Transit-oriented development (TOD) as a facilitator for urban development integration: Case study: Du Toit train station precinct, Stellenbosch

by
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Declaration

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Date: March 2017

Abstract

There is a need for academic research to focus on solving or contributing to solving real-world societal problems. Transdisciplinary research (TDR) provides a way to produce functional and applicable research findings, which can be used to advance developmental causes. This TDR study explores ways in which South Africa's spatial divide, entrenched through decades of discriminatory planning policies, can be restructured to bring about equitable access to places of employment, business, leisure and service for previously marginalised South Africans. It does by exploring the potential of the transit-orientated development (TOD) model to restructure and revitalise urban spaces in a collaborative model. The study focuses, through a case study, on the Du Toit station precinct in the town of Stellenbosch, on the peri-urban edge of the city of Cape Town, South Africa.

The TOD model is increasingly viewed as an effective strategy for creating sustainable urban redevelopment initiatives, and it has been deployed successfully in other parts of the world. The model, which emphasises development density, diversity of land-use and infrastructure and transformative design, is customisable to a variety of country contexts. The study aims to answer questions related to the extent that the diverse stakeholders with interests in the Du Toit station precinct (such as the municipality, researchers, business owners and community members) could collaborate and use TOD principles to redevelop the precinct; and could the redevelopment of the precinct using the TOD approach facilitate urban mobility and spatial development integration. The study explores the historical legislative framework that encouraged segregation, presents the correlations between public transport planning and land-use activities, and describes the steps taken to establish the Bird Street/Du Toit station precinct urban district infrastructure improvement forum. The forum hosted a series of collaborative discussions focused on a future vision for the precinct. These discussions combined with the findings of focus group discussions and one-on-one interviews formed the basis for the drafting of a long-term strategic plan for redeveloping the precinct.

TDR principles were used to design a case study approach that used mixed methods to collect and analyse data. Various research methods were used, including the above-mentioned focus group discussions and interviews, as well as observation, transect walks and three software programmes: QRS NVivo, Tableau and ArcGIS. The TDR approach enabled the emergence of a structured and practical approach to the setting up of the forum.

The outcomes are categorised as correlational findings on the relationship between public transport and infrastructure development, explorative findings that outline a detailed approach to establishing a multi-stakeholder discussion forum, and descriptive findings that provide the rationale for choosing the Du Toit station precinct as a suitable site for TOD implementation. In addition, the research presented detailed insights as to the process of collaborative vision creation. Research findings were triangulated using the software programmes to increase the validity and reliability of the findings. This research contributes to the professional development of TDR studies that are focused on urbanisation issues.

Key words: Transit-oriented development (TOD); Transdisciplinary research (TDR); Integrated urban development; Case study; land-use; transport; stakeholders; collaboration; documents study; Stellenbosch, South Africa.

Opsomming

Daar is 'n behoefte aan akademiese navorsing om met oplossings óf bydraes tot oplossings vir werklike samelewingsprobleme vorendag te kom. Transdissiplinêre navorsing lewer funksionele en toepaslike navorsingsbevindinge op wat aangewend kan word om ontwikkelingsake te bevorder. Hierdie transdissiplinêre navorsingstudie ondersoek maniere waarop die ruimtelike verdeeldheid van Suid-Afrika, wat deur dekades van diskriminerende beplanningsbeleide vasgelê is, herstruktureer kan word om billike toegang tot plekke van indiensneming, sake, ontspanning en dienslewering vir voorheen gemarginaliseerde Suid-Afrikaners te bewerkstellig. Dít word gedoen deur ondersoek in te stel na die potensiaal van die model vir vervoergerigte ontwikkeling ("TOD") om stedelike ruimtes op 'n samewerkende manier te herskik en te vernuwe. Deur middel van 'n gevallestudie konsentreer die navorsing op die Du Toit-stasiegebied op die dorp Stellenbosch, wat op die buitestedelike rand van Kaapstad, Suid-Afrika, geleë is.

Die TOD-model word al hoe meer beskou as 'n doeltreffende strategie vir die skep van inisiatiewe vir volhoubare stedelike herontwikkeling, en word met groot welslae in ander wêrelddele gebruik. Die model, wat klem lê op ontwikkelingsdigtheid, diverse grondgebruik en infrastruktuur, sowel as transformasiegerigte ontwerp, kan vir 'n verskeidenheid nasionale kontekste pasgemaak word. Die studie beoog om na antwoorde te soek op vrae oor die mate waarin die diverse belanghebbendes by die Du Toit-stasiegebied (soos die munisipaliteit, navorsers, sake-eienaars en gemeenskapslede) kan saamwerk om die gebied volgens TOD-beginsels te herontwikkel, en of die herontwikkeling van die gebied met behulp van die TOD-benadering stedelike mobiliteit en ruimtelike ontwikkelingsintegrasie sal kan fasiliteer. Hiervoor ondersoek die studie die historiese wetsraamwerk wat skeiding aangemoedig het, bied die korrelasies tussen openbare vervoerbeplanning en grondgebruikaktiwiteite aan, en beskryf die stappe om die forum vir infrastruktuurverbetering in stedelike distrikte met die oog op die Birdstraat/Du Toit-stasiegebied op die been te bring. Die forum het 'n reeks samewerkende gesprekke aangebied om 'n toekomsvisie vir die gebied te ontwikkel. Hierdie gesprekke, tesame met die bevindinge van fokusgroepgesprekke en individuele onderhoude, het die grondslag uitgemaak vir die skryf van 'n langtermyn- strategiese plan vir die herontwikkeling van die gebied.

Transdissiplinêre navorsingsbeginsels word gebruik om 'n gevallestudiebenadering te ontwerp wat met behulp van gemengde metodes data insamel en ontleed.

Verskillende navorsingsmetodes is gebruik, waaronder bogenoemde fokusgroepgesprekke en onderhoude, sowel as waarneming, deursneedatawandelings ("transect walks") en drie sagtewareprogramme, naamlik QRS NVivo, Tableau en ArcGIS. Met die transdissiplinêre navorsingsmetodologie kon 'n gestruktureerde en praktiese benadering tot die samestelling van die forum ontwikkel word. Die uitkomste word ingedeel in korrelasiebevindinge, wat die verwantskap tussen openbare vervoer en infrastruktuurontwikkeling toon; ondersoekende bevindinge, wat 'n omvattende benadering tot die skep van 'n gespreksforum met veelvuldige belanghebbendes bied, en beskrywende bevindinge, wat die beweegrede vir die keuse van die Du Toit-stasiegebied as 'n geskikte terrein vir die inwerkingstelling van TOD uiteensit. Daarbenewens bied die navorsing uitvoerige insigte in die proses van gesamentlike visieskepping. Navorsingsbevindinge is met behulp van die sagtewareprogramme getrianguleer om die geldigheid en betroubaarheid van die bevindinge te verhoog. Hierdie navorsing dra by tot die professionele ontwikkeling van transdissiplinêre navorsingstudies wat op verstedelikingskwessies konsentreer.

Trefwoorde: belanghebbendes; dokumentstudie; geïntegreerde stedelike ontwikkeling; gevallestudie; grondgebruik; samewerking; Stellenbosch, Suid-Afrika; transdissiplinêre navorsing; vervoer; vervoergerigte ontwikkeling ("TOD").

Tshipiḓa tsha maṅwalwa

Huna ṱhoḓea ya ṱhoḓisiso dza akhademiki ya u sedza kha u tandulula thaidzo kana u shela mulenzhe kha u tandulula thaidzo dza matshilisano dza vhukuma dza ḽifhasi. Ṱhoḓisiso ya Transdisciplinary (TDR) i ṋetshedza nḓila ya u bveledza zwine zwa shuma na mawanwa a ṱhoḓisiso o teaho, ane a nga shumiswa kha u engedza mvelaphanḓa ya zwivhangi. Ngudo iyi ya TDR i wanulusa nḓila dzine Afurika Tshipembe ḽa khethekanya masia, na u bveledza nga kha zwifhinga zwa u khethulula nzudzanyo dza mbekanyamaitele, zwi nga dzudzanyululwa hafhu u ḓisa u swikelela hu linganaho mishumoni, mabinduni, mbofholowo na tshumelo kha vhadzulapo vha Afurika Tshipembe vhe kale vha vha vho siwa nnḓa. I zwi ita nga u wanulusa ndeme ya tshiedziswa tsha transit-orientated development (mveledziso yo sedzaho tshanduko) (TOD) u dzudzanya hafhu na u bveledza hafhu fhethu vhuponi ha dziḓoroboni nga tshiedziswa tsho ṱanganelaho. Ngudo yo sedza kha tsenguloso ya nyimele, vhuponi ha tshiṱitshi tsha Du Toit ḓoroboni ya Stellenbosch, kha tshipiḓa tsha nnḓa ha ḓorobo tsha ḓorobo khulwane ya Cape Town, Afurika Tshipembe.

Tshiedziswa tsha TOD tshi khou sedzeswa nga maanḓa sa tshiṱirathedzi tshine tsha shuma kha u sika mvelaphanḓa ya tshifhinga tshilapfu vhuponi ha dziḓoroboni, tsho shumiswa zwavhuḓi kha zwiṅwe zwipiḓa zwa ḽifhasi. Tshiedziswa, tshi ombedzela mvelaphanḓa ya vhukwamani, u shumiswa ha mavu nga nḓila dzo fhambanaho na themamveledziso na nyolo i shandukisaho, u ita uri i fane kha zwithu zwo fhambanaho zwa shango. Ngudo yo livhiswa kha u fhindula mbudziso dzine dza elana na tshivhalo tsha vhadzhiamikovhe vho fhambanaho vha re na dzangalelo kha vhupo ha tshiṱitshi tsha Du Toit (u fana na masipala, vhaṱoḓisisi, vhoramabindu na miraḓo ya tshitshavha) vha nga shumisana na u shumisa milayo ya TOD u bveledza vhupo; u bveledzwa hafhu ha vhupo hu tshi shumiswa kuitele kwa TOD u thusa u bveledzisa vhuponi ha ḓoroboni na ṱhanganelano ya masia a mveledziso. Ngudo i wanulusa ḓivhazwakale ya furemiweke ya zwamulayo u ne wa ṱuṱuwedza khethululo, u ṋetshedza vhuṱumani vhukati ha nzudzanyo ya vhuendi ha nnyi na nnyi na mishumo ya kushumisele kwa mavu, na u ṱalutshedza maga e a dzhiwa u bveledza vhupo ha tshiṱitshi tsha Bird Street/Du Toit foramu ya u khwinisa themamveledziso ya tshiṱiriki tsha vhupo ha doroboni. Foramu yo tshimbidza therisano dzo fhambanaho dzo ṱanganelaho dzo sedzaho kha bono ḽa vhupo ḽa tshifhingani tshiḓaho. Therisano idzi dzo ṱanganela na mawanwa a therisano dza tshigwada tsho sedzwaho khatsho na u ithaviwa muthu nga muthihi muthihi zwa vhumba mutheo wa mvetomveto ya pulane ya tshiṱirathedzhi tsha tshifhinga tshilapfu dza u bveledzisa vhupo hafhu.

Milayo ya TDR yo shumiswa u dzudzanya maitele a tsedzuluso ya nyimele ine ya shumisa maitele o ṱanganelaho u kuvhanganya na u saukanya data. Maitele o fhambanaho a ṱhoḓisiso o shumiswa, hu tshi katelwa therisano dza tshigwada tsho sedzwaho khatsho tsho bulwaho afho nṱha na ithaviu, na u dovha wa sedza, na u khethekanya matshimbidzele na phurogireme tharu dza sofuthiwee: QRS NVivo, Tableau na ArcGIS. Kuitele kwa TDR ku tendela u vha hone ha maitele a u dzudzanya foramu. Mvelelo dzo khethekanya sa mawanwa a ndulamiso a vhushaka vhukati ha vhuendi ha nnyi na nnyi na mveledzo ya themamveledziso, mawanwa a ndingedzo ane a bvisela khagala maite o fhelelaho a u thoma foramu dza therisano dza vhashumisani vha zwa vhubindudzi vho vhalaho, na mawanwa a mbuletshedzo ane a ṋetshedza u nangwa ha vhupo ha tshiṱitshi tsha Du Toit sa fhethu ho teaho u shumiselwa TOD. U ḓadzisa kha izwo, ṱhoḓisiso yo ṋetshedza kupfesesele kwo fhelelaho kha kuitele kwa u sika bono ḽo ṱanganelaho. Mawanwa a ṱhoḓisiso o dzuzanyululwa hu tshi shumiswa phurogireme dza sofuthiwee u engedza u khwaṱhisedza na u tea ha mawanwa. Ṱhoḓisoso iyi i shela mulenzhe kha mveledzoso ya phurofeshinaḽa ya ngudo ya TDR yo sedzaho kha zwithu zwa mveledzedziso.

Maipfi mahulwane: Transit-oriented development (Mveledziso yo sedzaho tshanduko) (TOD); ṱhoḓisiso ya Transdisciplinary (TDR); Mveledziso yo ṱanganelaho ya vhuponi ha ḓoroboni; Tsenguluso ya nyimele; u shumiswa ha mavu; zwiendedzi; vhadzhiamikovhe; tshumisano; ngudo dza maṅwala; Stellenbosch, Afurika Tshipembe.

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I would like to extend my gratitude to the following people for their support and contribution to this thesis:

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List of acronyms and abbreviations

ADEC	African Development Economic Consultants
BRT	Bus rapid transit (systems)
GIS	Geographical Information System
CSIR	Council for Scientific and Industrial Research
IUDF	Integrated Urban Development Framework
MoCoGTA	Ministry of Cooperative Governance and Traditional Affairs
SDF	Spatial Development Framework
TDR	Transdisciplinary research
TOD	Transit-orientated development

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Chapter 1: Introduction

1.1 Background

Across the world cities are growing at a rapid rate, which is increasing levels of contestation for economic, social and environmental resources in urban centres. More than 60 percent of South Africans live in cities and the World Bank predicts that this figure will increase to more than 70 percent by 2030 (Suzuki, Cervero & Luchi, 2013). The country's urban spaces are characterised by a divide between traditional, informal (often illegal) settlements and township housing developments. Increasing urbanisation trends are intensifying this divide, which is caused by historical socioeconomic disparities entrenched during the apartheid era. It is often difficult for residents of informal settlements and townships to access public services and infrastructure. Because the divide is "compounded by historical separation of race groups into fragmented urban form through apartheid, re-envisioning transport systems also provides an opportunity to address the core physical mobility issues that confront those who remain marginalised in the urban divide" (Peter & Swilling, 2012:19). Transit-orientated development (TOD) is an approach that could realise multiple benefits within this context. For example, this approach could potentially play a significant role in enabling the emergence of new social integration behaviour, which is a required element for transitioning towards a peaceful and prosperous society. TOD is a United States-based concept that originated in the late 1970s (Southworth, 2003). It is known as an integrated 'smart growth' urban planning approach with the potential to attract spatial investments for diverse land-use activities centred on and around transport corridors and thus able to link previously segregated areas (Southworth, 2003).

This study focuses on how the TOD approach can be used in the South African context, particularly in the town of Stellenbosch. Stellenbosch is located in South Africa's Western Cape province and, like most of the country's urban centres, is characterised by historic spatial segregation. The town has been tasked with ensuring that its urban development pattern encourages spatial and social integration. South African development policies, such as the Integrated Urban Development Framework (IUDF), provide guidelines as to how towns can achieve this integration. The IUDF recommends using public transport systems as a way to link economic investment and social integration imperatives (Ministry of Cooperative Governance and Traditional Affairs [MoCoGTA], 2014a).

Stellenbosch Municipality created the Rector Mayor Forum, which, in turn, created the Integrated Planning Committee and the Infrastructure Innovation Committee (Davies & Swilling, 2015). These committees were tasked with helping to solve the town's infrastructure development challenges. The Infrastructure Innovation Committee comprised working groups and coordinators for finance, energy, water and sanitation, waste, transport and institutional aspects (Davies & Swilling, 2015). This study falls under the auspices of the Transport Working Group to determine how investments in public transport infrastructure can facilitate integration of Stellenbosch's segregated spaces. The working group recognised the TOD model as a future alternative model for Stellenbosch's urban infrastructure development. This study looks specifically at Stellenbosch's Du Toit station precinct as a potential location for implementing TOD. The station is located in a buffer zone between conventional housing settlements, the central business district and underdeveloped townships and informal settlements. Implementing this approach in this location could facilitate broader social integration, as well as ensure the safety and reliability of the public transportation infrastructure that encourages urban mobility.

The primary outputs of TOD are the creation of compact mixed-use development, urban biodiversity conservation, extended urban mobility, improved space liveability, infrastructure expansion, and efficient management and adaptive re-use of existing built infrastructure (Porter, 2002). Its implementation in various global contexts has contributed towards creating inclusive urban growth patterns. South Africa's urban landscape is somewhat different to that of other developing countries and how TOD is implemented here will need to be adapted accordingly.

1.2 The rationale of study

TOD models have the potential to facilitate integrated urban spatial development patterns that will help overcome the spatial and social segregation caused by apartheid-era policies.

1.3 The study's contribution to planning policy in South Africa

The study aims to contribute to development planning policy by outlining an alternative way in which South Africa can use public transport investments to shape its urban development path. The literature review highlights the link between public transport investments and land-use planning.

The former opens up the potential for those people who have been historically spatially marginalised to access urban centres of education and recreation, as well as economic areas and employment opportunities. The study therefore contributes to knowledge about how land infrastructure development using the TOD model can facilitate integrated urban development patterns.

1.4 The research questions and objectives

The study attempts to answer the following two research questions.

1. What are the most important elements of building a process for the diverse stakeholders in Stellenbosch, such as Stellenbosch Municipality, Stellenbosch University researchers, landowners, business owners, community members and interested parties to collaborate and use TOD principles to redevelop the Du Toit station precinct?

2. Which elements of the TOD approach can help facilitate urban mobility and spatial development integration of the Du Toit station precinct?

The objectives of this study are as follows:

a) To discuss the historical legislative framework that encouraged segregation and the urban restructuring strategies, with a specific focus on public transportation policies, which aim to reshape South Africa's urban areas.
b) To present the correlations between public transport planning and land-use activities, and how they are informed by TOD theory.
c) To establish the Bird Street/Du Toit Station Precinct Urban District Infrastructure Improvement Forum.
d) To facilitate diverse stakeholder collaboration conversations arising from this forum.
e) To develop a long-term strategic plan for redeveloping Du Toit station precinct.

In order to achieve the above objectives, the study uses a transdisciplinary research (TDR) approach, which is outlined below.

1.5 The research design

The TDR approach allows the researcher to explore the depth of the studied concept in a descriptive manner (Max-Neef, 2005). Further, it enables the emergence of balanced opinions because it uses an array of analytical tools, including literature

reviews, dialogues and case studies (Max-Neef, 2005; Haberman, Misganaw, Peloschek, Dessalegn & Selassie, 2013; Montuori, 2013).

Employing a TDR study design will enable the exploration of the correlations between the scientific frameworks of public transportation systems, the theoretical frameworks of TOD and the practical frameworks for land-use planning, public transport and integrated urban development patterns (Hirsch-Hadorn, Hoffmann-Riem, Gorssenbacher-Mansuy, Joye, Pohl & Hirsh-Hadorn, 2008; Haberman et al., 2013).

A TDR design enables integration of the different steps of the research process: identification of the problem, structuring of the research, analysis of the findings and production of the results (Hirsch-Hadorn et al., 2008). It also allows the research problem to be investigated at normative, descriptive and operational levels, while permitting a holistic view of the studied issue to emerge. This is because TDR is problem-orientated and involves participants from diverse backgrounds (Max-Neef, 2005; Hirsch-Hardon et al., 2008).

The findings of a TDR process are often practical in nature (Hirsch-Hadorn et al., 2008; Haberman et al., 2013; Montuori, 2013) making it a relevant choice for a study focused on issues of urban mobility, land-use activities and urban structural planning.

1.5.1   Data collection methods

This study is explorative in nature and uses a mixed-methods approach to collect and analyse data. Both primary (field research) and secondary data (literature review) were collected to develop a case study on the Du Toit station precinct. The case study approach was chosen to allow for the emergence of complex interpretations and the framing of a narrative analysis (Flyvbjerg, 2011). It drew on both qualitative and quantitative methods to collect and analyse data. Methods comprised focus group discussions, semi-structured interviews, observation, transect walks, key informants, documents study, and use of software programmes such as NVivo, Tableau and ArcGIS. These methods are described briefly below.

Focus group discussions: Aim to recreate a natural sense of interaction between the different actors participating in the research. They enable the gathering of data from participants' tacit knowledge and personal interpretations of the issue (Baxter & Jack, 2008; Denzin, 2008).

Semi-structured interviews: Used to reach out to less active participants who are more likely to open up in private conversation (Blatter, 2008; Wilson, 2013).

Observations: Enabled the collection of data about the participants involved in the study, including their informal perceptions, value and attitudes (Riessman, 2006; Pushor, 2008) towards re-development of the Du Toit station precinct.

Transect walks: Used to collect observations and elicit more casual, less guarded impressions from participants. These walks are planned systematic outings around the defined research location (Pretty, Gujit, Scoones & Thompson, 1995). For the purposes of this study, the defined research location encompassed Bird Street/Du Toit station precinct, the Plankenburg industrial area, Enkanini and parts of Khayamandi in Stellenbosch.

Key informants: Used to gain access to multiple data sources because they have unique backgrounds and skills, which enable them to access sometime difficult to obtain information (Mukhija, 2010; Jalil, 2013). This included quantitative data, such as statistical information, census data and historical spatial archives for this study.

Document study: Enabled an understanding of public sources of information, such as those listed above as gained from key informants, as well as spatial data files and statue information. The extensive review conducted for the study also focused on personal documents, such as daily planners, photographs, diary entries, scrap notes from focus group discussions, and notes. Invaluable information and insights are often found in documents of this nature (Flyvbjerg, 2011)

1.5.2 Data analysis approach

Various software programmes were used to analyse the data. NVivo 10 is an analysis tool designed to help researchers find new and deep patterns of relationships between elements when using mixed methods (Corbin, 2004; King, 2008; Smyth, 2008). It was used to enhance the validity, trustworthiness, integrity and robustness of the data. It was also used to analyse the relationship between the theory and the data. And it helps keep data results secure, as the information is stored through the software interface and protected by passwords (Smyth, 2008).

The study also made use of Tableau to increase the validity and integrity levels of the analysis. Tableau 9.3 is computer-assisted software that enables multiple information descriptions through visual representation (Tableau, 2016). For example, it was used to make a representation of pedestrian traffic flow through the Du Toit station precinct.

This software is not, however, able to analyse spatial patterns using maps and so ArcGIS 10.2 was used to analyse, manipulate, create, edit and query the statistical

data in visual maps. ArcGIS is the geospatial database that translates data into maps through the visualisation process using cartographic methods and techniques (Jung, 2009).

1.5.3   Ethical considerations

As TDR normally involves people and real social issues, the ethical obligations are strict. The study proposal was submitted and approved by the Stellenbosch University Research Ethics Committee: Humanities (see Appendix A) for the period from September 2015 to September 2016. All participants that took part in the study were briefed on its nature, procedure and intent.

Participation was on a voluntary basis and this was made clear at the outset of the study. The participants understood whether there were any potential benefits that could accrue from their involvement and made aware of their rights to access the research results. Processes were put in place to ensure that any issues that arose between the researcher and participants were identified and dealt with.

To ensure that the thesis remained as free from bias as possible, anonymity and confidentially were offered to participants and accurate references and source citations used at all times. The focus on ensuring that the study complied with ethical considerations is evident throughout this paper.

1.6   Definition of core terms

- **Apartheid spatial planning:** Refers to the spatial policy adopted in South Africa in 1948, which was used as a legislative framework to divide people living in the urban and rural areas according to class, race, gender or other such factors (Hindson, 1995).
- **Case study:** Is an empirical method of inquiry focused on an in-depth investigation approach of real societal phenomenon, using diverse data sources (Keddie, 2006; Zucker, 2009).
- **Integrated urban development:** Refers to inclusive urban development that encourages growth throughout urban locations in order to promote a more cohesive society and better living environment (MoCoGTA, 2014a). This type of development, therefore, unlocks the development synergy that results from coordinated investments in urban infrastructure, the people and spaces.
- **Key informants:** Are individuals that possess unique backgrounds and skills related to the research (Levy, 2008; Jalil, 2013). These individuals were relevant

for this study because they could access information that the main researcher could not

- **Land-use activities planning**: In the context of this thesis, this term refers to characterised arrangements, inputs and daily activities. These are categorised in terms of the purposes of the given land, the location or the considered spatial unit, the timing of specific activities, how such activities are managed, how much of the spatial area is suitable for specific activities, and the rationale behind the current land-use activities (Loures & Burley, 2001; GIZ, 2012; Negash, 2012; Stellenbosch Municipality, 2014a).

- **Main researcher:** Refers to the author of this thesis.

- **Non-motorised transport:** Is all modes of transport that are powered by humans, such as walking, bicycling, and using push scooters and hand carts (Stellenbosch Municipality, 2009).

- **Stakeholders:** In the context of this thesis, these have been the various individuals who had concerns in or were interested in the future upgrade of Du Toit station and the integrated development of Stellenbosch. This group included landowners around the Du Toit train station, developers, community representatives, researchers and business owners.

- **Train station precinct:** Is the defined space around the train station, including neighbouring communities (Mushongahande, Cloete & Venter, 2014). The precinct was the area within a 1 kilometre radius of Du Toit station in this study.

- **TDR:** Is a research approach with objectives that include collaboration between society and researchers to co-produce solutions for real-world societal problems (Max-Neef, 2005; Cilliers, du Toit, Cilliers, Drewes, & Retief, 2014; Swilling, 2014).

- **Transect walks:** Is a planned systematic walk around the defined path of the field research (Pretty et al., 1995). This type of walk requires the researcher to carefully observe, ask questions and listen.

- **TOD:** Is a development concept that promotes the integration of public transport services development and urban land-use activities. This integration is characterised by high density mixed land-use activities, improved urban mobility, improved liveable spaces and infrastructure redevelopment (Belzer & Autler, 2002; Porter, 2002; Southworth, 2003; Cervero & Sullivan, 2010; Bickford & Behrens, 2013).

- **Transport corridors:** Are the transport infrastructure organisational networks, such as roads and railway lines, that connect different areas (Mammon & Ewing, 2006).

- **Transport nodes:** Are the beginning and end interchange points of public transportation between the areas where the traveller can change routes. The nodes can be connected through a network of transport corridors (Bunting, 2004; Walters, 2013).

- **Urbanisation:** Is the shift in population from rural to urban areas, resulting in the most dramatic and permanent form of urban land-use, and leading to an increase in demand for public services (Pushkarev & Zupan, 1977; Berke, Godschalk, Kaiser & Rodriguez, 2006).

1.7 Thesis outline

This thesis is thematically divided into seven chapters, which are outlined below. Figure 1 provides a visual presentation of this thesis.

- Chapter 1: Introduces the study describing the aims, research questions, objectives and overall methodological approach.

- Chapter 2: Offers a literature review encompassing urban development strategies, TOD, urban renewal, stakeholder collaboration, and land-use and transport development.

- Chapter 3: Gives a detailed review of the proposed study area using visual representation tools and situational analysis.

- Chapter 4: Expands on the research design, methodologies and methods of the research study.

- Chapter 5: Outlines the main findings of the study.

- Chapter 6: Provides a detailed discussion of the findings.

- Chapter 7: Presents the study's conclusions and provides recommendations for further research.

Chapter 1
Introduction

Chapter 2: Literature Review

South African
Urban spatial realities
Urban development pattern

TOD
Land-use planning & public transport
Stakeholder collaboration

Chapter 3
Case description:
Du Toit station precinct

Chapter 4
Research methodology

Chapter 5
Research findings

Chapter 6
Discussions of the findings

Chapter 7
Conclusions and recommendations

Figure 1: Visual representation of the thesis chapter outline

Chapter 2: Literature review

2.1 Introduction

South Africa has undergone momentous social engineering strategies throughout the colonial and apartheid eras, followed by a shift to a democratic state in 1994, and entry into a globalised world economy. These shifts have had intense spatial implications, imprinting the urban physical landscape in particular. Following the rise to power of the white-led National Party in 1948, the land was carved along racial lines segregating whites, African blacks and coloureds into designated areas (Christopher, 2001a). This spatial segregation was enforced for more than 40 years under the apartheid regime. The democratic government has since 1994 tried to undo past spatial injustices (Christopher, 2001a), but it has struggled to reform the legacy of apartheid spatial planning, which has proven remarkably resilient to attempts to shift it towards a more integrated urban approach. This chapter reviews South Africa's history of urban development and highlights how the government's focus on developing effective public transport systems could function as an integration tool in the urban context.

2.2 South Africa's urban spatial realities

More than 60 percent of South Africans (more than 32 million people) live in town and cities, yet these urban cities are characterised by some of the world's lowest urban densities (Cilliers et al., 2014). The country's urban areas face a multitude of challenges: provision of basic services to a growing population, poverty, low levels of access to economic opportunities and a shortage of well-located land for development (MoCoGTA, 2014b). Their ability to address these challenges is limited because of weak spatial development and planning capabilities (MoCoGTA, 2014b).

Urbanisation is a global trend with the twenty-first century characterised as an urban one. South African cities are characterised by the legacy of past and existing spatial segregation, rapidly expanding populations, lack of urban housing, unemployment, and underserviced public transport services (Fischer-Kowalski & Swilling, 2011). The spatial, economic and social segregation found in the country's urban areas has resulted in a concentration of poverty, unemployment and inadequate access to basic services (Cilliers et al., 2014).

It is important to find strategies to combat these challenges and move the country's urban centres onto integrated and sustainable urban development pathways.

To expand on the realities of the South African urban structures, the following section reviews the policies that created the 'apartheid city' and the democratic state policies that aim to restructure them.

2.3 South Africa's urban development patterns: from the apartheid city to the democratic state

Urban development in South Africa has always been shaped by strong land policies. Land is a private commodity that can be used for profit and yet its development is subject to government intervention to ensure that it also benefits the wider community (Donaldson & Marais, 2002; Walters, 2013). Legislation such as the Native Urban Areas Act (1923) and the Group Areas Act (1950) set a particular development pathway in motion; the Reconstruction Development Programme (1994), the Development Facilitation Act (1995) and the Urban Development Framework (1997) hope to set a different course (Lemon, 1991; Christopher, 1992; Department of Housing, 1997; Donaldson, 2001).

2.3.1 The planning framework for the apartheid city

South Africa's apartheid cities are unique because they have undergone careful reorganisation to create mono-racial suburbs and mono-racial facilities, including recreational spaces and transport and public services (Lemon, 1991). This reorganisation of the urban structures to create the apartheid city is depicted in Figure 2. The Natives Urban Areas Act and Group Areas Act played a significant role in shaping the country's urban structures (Christopher, 1992). Black South Africans were evicted from their homes and moved to 'locations' – satellite townships on the urban fringes. This was an extension of the marginalisation that has been practiced in South Africa since the end of the nineteenth century. A series of acts and bodies have shaped the disempowerment of black landowners in South Africa.

The first was the Natives Land Act (1913), followed by the Natives Development Trust and Land Act (1936), the Urban Blacks Council formed in 1961 following forced removals in the apartheid era and the Black Communities Development Act (1988) (Lemon, 1991; Christopher, 2001b; Schensul & Heller, 2010; Research Unit, Parliament of South Africa, 2013).

The result is that the urban sociology of space in terms of reinforced inequalities is painfully apparent in South Africa's urban spaces (Schensul & Heller, 2010).
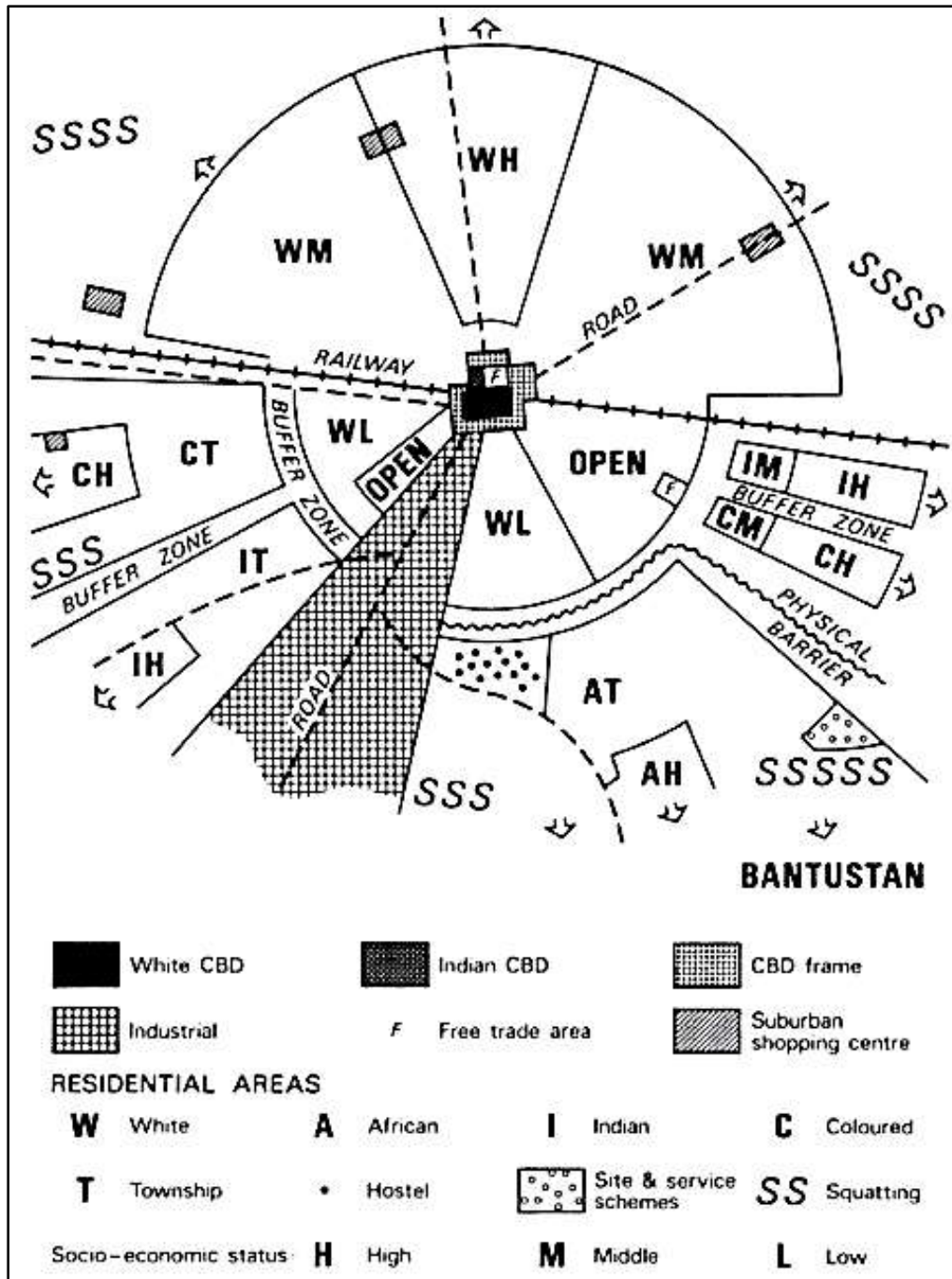
Figure 2: The South African apartheid city design model

Source: Davies, 1981:63

2.3.1.1   Natives Land Act (1913) and Natives Urban Areas Act (1923)

The 1913 Natives Land Act effectively facilitated socioeconomic injustice in South Africa because it legalised the dispossession of land from Africans (Modise & Mtshiselwa, 2013). It moved them onto 'reserves' and opened up additional agricultural land for white ownership. Africans could only leave the marginal lands they had been sentenced to (making up only 7 percent of the country's arable land) if they could prove employment elsewhere.

It was used to regulate the influx of Africans into the urban areas and to reduce their numbers in whites-only zoned areas in both rural and urban settings (Christopher, 2001b). Those who found their way to towns and cities found themselves living far away from economic activities and often unable to even access the central business districts, which had controlled access points (Modise & Mtshiselwa, 2013). Many were effectively caught in a poverty trap as a result (Modise & Mtshiselwa, 2013).

The Native Urban Areas Act further entrenched segregation in urban areas (Lemon, 1991; Modise & Mtshiselwa, 2013) and the notion that Africans were not permanent residents, but only there to serve the needs of the white population. These acts paved the way for the 1950 Group Areas Act, which set out controlled land-use and development practices; these acts still influence urban development patterns (Research Unit Parliament of RSA, 2013).

2.3.1.2   Group Areas Act (1950)

The Group Areas Act established and entrenched controls over the movement of Africans in and out of urban spaces by implementing a pass document system. The act noted that "everyone was to be officially classified into racial groups, and all would have to live in areas specifically set aside for the exclusive occupation of a legally defined group" (Christopher, 1992:571). This act had the most significant impact, effectively creating the apartheid city model with its distinctive characteristics of segregated living and services (Lemon, 1991).

2.3.1.3   Key insights

The effect of these acts and the resultant planning policies was the apartheid city model (see Figure 2) with its suburbs and urban centres segregated according to white, African, Indian, and coloured races. The suburbs and central business districts were separated by created buffer zones of roads, industrial areas, physical barriers, and railway lines (Davies, 1981; Donaldson, 2001). The results of the apartheid city model are fragmented development patterns because of mono-functional land-use activities, dispersed cities characterised by low-density urban sprawl, and racially divided urban growth patterns (Donaldson, 2001).

Any model wanting to address these challenges, therefore, has to comprehend the entrenched nature of apartheid spatial planning.

Since the 1990s, the government's approach has been characterised by reconciliation efforts, multiparty negotiations and a focus on rejuvenating underdeveloped and previously disadvantaged areas (Christopher, 2001a; Walters, 2013) in an attempt to undo the injustices perpetrated by apartheid spatial planning processes.

2.3.2 Post-apartheid urban restructuring policies

South Africa has undergone significant structural changes since the early 1990s in efforts to mitigate the social and economic injustices of the past and build an integrated democratic society (Christopher, 2001a). The government's Reconstruction Development Programme (1994) was its first attempt to lay a foundation for transformation in the country, including that of spatial planning. Later frameworks relevant to this study are the Urban Development Framework (1997) and the Development Facilitation Act (1995) (Donaldson & Marais, 2002).

2.3.2.1   Reconstruction Development Programme (1994)

The Reconstruction Development Programme was envisioned as the primary tool to address inherited challenges, such as inadequate access to housing, unemployment, inadequate education and health-care systems, a failing economy and a culture of violence (Presidency, 1994; Donaldson & Van Der Merwe, 2000). It was based on the ideals of sustainable and integrated development, being a people-driven and people-centred process, eradicating the country's economic inequalities, creating a link between development, reconstruction, redistribution and growth, and establishing a democratic society (Donaldson & Marais, 2002).

It laid the foundation for development legislation and policies such as the Development Facilitation Act, the Urban Development Framework and other urban-focused policies. It also, however, created an expectation that South Africa would achieve its development objectives within five years.

2.3.2.2   Development Facilitation Act (1995)

The Development Facilitation Act was introduced to facilitate and quicken the implementation of Reconstruction Development Programme projects, to fast track the release of land for development, and to establish the Development and Planning Commission (Department of Land Affairs, 1995). It aimed to "guide the administration of any physical plan, transport plan, guide plan, structure plan, zoning scheme or any like plan or scheme" (Department of Land Affairs, 1995:14).

It embraced the key principles of restructuring the country's spatial environment by encouraging compact city development, as opposed to encouraging urban sprawl, promoting the creation of sustainable urban structures, encouraging diverse stakeholder involvement in development processes, and building capacity for public participation processes (Department of Land Affairs, 1995; Donaldson & Marais, 2002).

In short, it aimed to promote integrated and efficient urban spatial development using a bottom-up, participatory approach. Two years later the Department of Housing drafted the Urban Development Framework to shift spatial planning to align with developmental objectives with the goal of facilitating "economic growth and employment creation within an urban area and contribute to the area's tax base" (Donaldson & Marais, 2002:190).

2.3.2.3   Urban Development Framework (1997)

This framework aimed to "promote a consistent urban development policy approach for effective urban reconstruction and development, to guide development policies, strategies and actions of all stakeholders in the urban development process and to steer them towards the achievement of a collective vision" (Donaldson & Marais, 2002:192). It focused on creating sustainable settlements through densification, mixed land-use activities, improved public transport systems and public-private partnerships to deliver services (Department of Housing, 1997).

What these post-1994 acts and policies have in common is the emphasis on integrating urban development patterns, upgrading existing infrastructure and promoting inclusive urban economic development. This is to be done by promoting high-density development serviced by public transportation systems. The framework has been amended over the years. The second generation framework was known as the National Urban Development Framework (2009) and the current third-generation framework is titled the Integrated Urban Development Framework (Department of Housing, 1997; Donaldson & Marais, 2002; DoCGTD, 2014a).

2.3.3   Integrated land-use development policies

A variety of policies, including the country's National Development Plan (2012) and the ones above, have been drafted in attempts to eliminate the results of colonial and apartheid-era structural planning practices and to achieve integrated urban regeneration patterns (Ndebele & Ogra, 2014). Figure 3 provides an example of such a city model.

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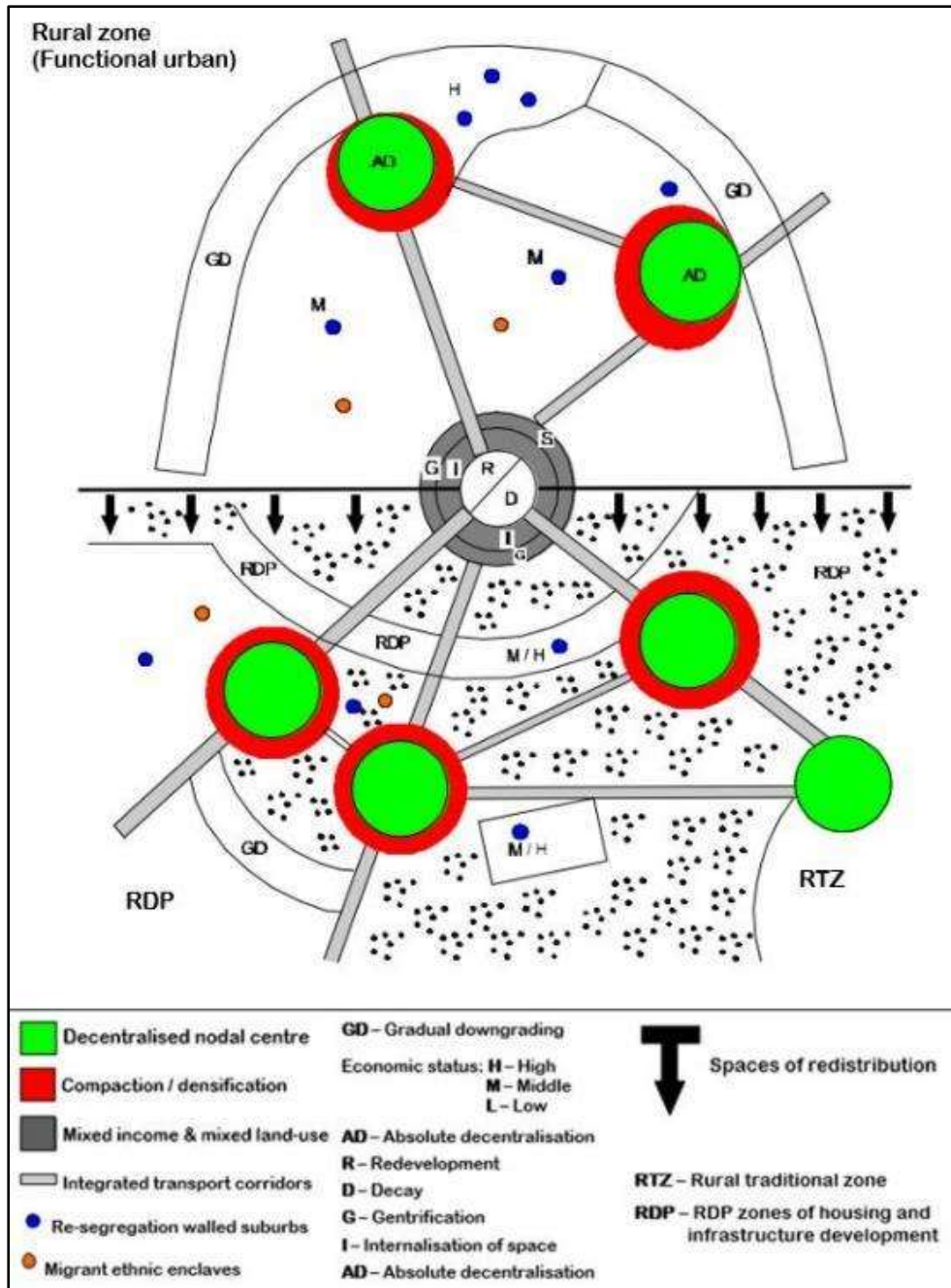
Figure 3: A model for a twenty-first century South African city structure
Source: Donaldson, 2001:12

2.3.3.1   National Development Plan (2012)

The National Development Plan sets out a long-term strategic vision that aims to reduce inequality levels in the country and eliminate poverty by 2030. It identifies the following elements of a sustainable and integrated South Africa: access to housing, an efficient public transportation system, improved education and health care, employment opportunities, a safe environment and adequate nutrition (National Planning Commission, 2012).

The plan emphasises the importance of improving public transport infrastructure to encourage social integration and improve access to facilities. It therefore encourages all levels of government to focus on spatial transformation to achieve the plan's objectives by 2030.

One of these goals is to create sustainable, integrated urban patterns, which means preventing further urban sprawl and encouraging densified urban spaces supported by efficient public transport services (National Planning Commission, 2012). The plan also encourages looking beyond transit systems when it comes to urban mobility and exploring the potential economic opportunities in and around the location. This requires incorporating elements of behavioural change into transport planning. It prioritises the development of feasible transit solutions, increased investments in public transport, attracting private-sector investments in transport services, offering incentives to users, improving road infrastructure and upgrading the commuter train fleet (National Planning Commission, 2012).

It emphasises that to achieve the vision of spatial transformation "the new urban development and infrastructure investments should be focused around corridors of mass transit and around existing and emergent economic nodes, applying internationally accepted principles of transit-oriented development" (National Planning Commission, 2012:285).

2.3.4   White papers supporting urban development

South Africa also has a variety of White Papers related to land-use planning and urban spatial development. The White Paper on Western Cape Provincial Transport Policy has been included in this review because the location of the case study is in this province, and the National Land Transport Transition Act (2000) because of its integrative objectives.

2.3.4.1   White Paper on National Transport Policy (1996)

The White Paper on National Transport Policy was initiated in a newly democratic South Africa to integrate the country's transport systems with economic and social development objectives.

It reviews government's commitment to provide efficient public transport services that support development objectives and promote economic sustainability (Department of Transport, 1996). It also encourages including a diverse group of stakeholders in decision-making processes (Presidency, 1994; Department of Transport, 1996).

2.3.4.2   White Paper on Western Cape Provincial Transport Policy (1997)

The Western Cape provincial government drafted this White Paper to address its transport needs and challenges. It notes the necessity for provincial planning policies to adopt densification, containment and mixed-land-use activities in planning activities to ensure a public transportation system that is efficient, affordable, viable and sustainable (Western Cape Government, 1997). Key principles outlined in the White Paper are ensuring that transport plays a role in creating jobs and increasing the potential for productivity increases in the sector, that prices are affordable and that the decision-making processes are participative and democratic (Western Cape Government, 1997). In addition, it notes that the effects of implemented transport programmes as regards spatial development should be assessed (Western Cape Government, 1997).

2.3.4.3   White Paper on Local Government (1998)

The South African Constitution (1996) gives local government a responsibility to help build a democratic state and promote socioeconomic development. The White Paper on Local Government notes the challenges that local government faces in creating sustainable settlements because of distorted settlement patterns, service provision backlogs, spatial separation between town centres and peripheral 'townships', and its inability to effectively leverage private-sector investments (Walters, 2013). It encourages local government to work towards achieving spatial integration (Department of the Presidency, 1998) and highlights public transport as an integration tool.

2.3.4.4   The National Land Transport Transition Act (2000)

The National Land Transport Transition Act aims to integrate land transport functions with land-use activities and economic development by creating development corridors with densified urban spaces serviced by decent public transport (Morojele, 2005). It established transport authorities and assigned the responsibility for public transport planning to regional and local government (Walters, 2013).

2.3.4.5   White Paper on Spatial Planning and Land-use Management (2001)

The Minister of Land Affairs introduced this paper in 2011 as a way to rationalise the many planning policies and focus them on creating more sustainable land-use patterns.

The paper intended to "to enable local government, to formulate policies, plans and strategies for land-use and land developments that address, confront, and resolve the spatial, economic, social and environmental problems of the country" (Morojele, 2005:7). It explored different approaches to land-use and encouraged improved development planning, management and monitoring of land-use projects and the development of polices that result in sustainable land-use and management (Ministry of Agriculture and Land Affairs, 2001). It also sought to address the issue of urban land conflicts.

2.3.5   Urban land-use and transport development policies

South Africa has an extensive array of urban development policies. The following sub-sections provide a selection of these that are closely related to integration of transport and mixed land-use activities.

2.3.5.1   National Land Transport Strategic Framework (2015)

The purpose of the National Land Transport Strategic Framework is to frame urban development plans that aim to integrate land-use and transport planning in alignment with sustainable development goals. The transport development goals are to support "incremental development; integrate land use and transport planning; promote social inclusion and accessibility; improve safety and security; reduce transport impact on the environment; promote sustainable transport modes" (Department of Transport, 2015:45). These goals were developed from the National Development Plan's sustainability section. The National Land Transport strategic framework focuses on "job creation; rural access and mobility; economic development; poverty alleviation; rail, road and aviation transport integration and planning; infrastructure development and maintenance; and public transport" (Department of Transport, 2015:20). Relevant documents, such as local government integrated transport plans, are created using the guidelines from this document.

2.3.5.2   Spatial Development Framework

Spatial development frameworks (SDFs) are by law required for the municipal planning processes. They are mandated by the Municipal Systems Act (2000) and the Local Government Municipal Planning and Performance Management Regulations (2001) (Morojele, 2005).

The function of a SDF is to "set out objectives that reflect the desired spatial form of the municipality; contain strategies and policies regarding the manner of the desirable land use patterns; set out basic guidelines for a land use management system in municipality; and further contains a strategic assessment of the environmental impact of the SDF" (Republic of South Africa, 2000:38). They also provide a visual representation of potential investment locations, desired spatial utilisation, areas that require strategic interventions and potential priority spending areas (Republic of South Africa, 2000; Morojele, 2005). Visual elements include cadastral or conceptual maps, diagrams, photographs or other visualised tools.

2.3.5.3   Moving South Africa Transport Policy (1998)

This strategic document focuses on developing the country's long-term transport vision (Council for Scientific and Industrial Research [CSIR], 1999). It highlights the "key strategic actions based on a need to focus investment and resources into high-density corridors and nodes, and by so doing, provide the necessary thresholds for public transport" (Morojele, 2005:9). The main foci are the provision of high-quality mass public transport corridors servicing densified mixed land-use activities and determining appropriate public transport infrastructure for specific development corridors (CSIR, 1999).

2.4 Land-use and transport planning for integrated urban development

South Africa faces the challenge of retrofitting public transportation in urban forms that have been designed for private motor vehicle use (Beg, Bickford, Denoon-Stevens, Harber, Jitsing, Moosajee & Schmidt, 2014). It must also do so in a way that offers social, political, economic and cultural benefits (Donaldson, 2001).

This means that planners, municipal managers and politicians have a responsibility to restructure and integrate urban spaces, although regenerating these spaces does pose developmental challenges.

2.4.1   Public transport and urban land-use development

Urbanisation is one of the most dramatic and permanent forms of land-use change in the world. South Africa, as with most developing countries, is experiencing rapid urbanisation – more than 60 percent of South Africans already live in urban areas (Berke et al., 2006).

The effects of rapid urbanisation include a higher demand for public services, particularly transportation because it connects people to employment, education, recreation and other facilities. To meet these needs, a conceptual land-use framework to guide proposed design is needed (Berke et al., 2006).

South Africa's urban land-use development frameworks aim to create integrated urban development patterns. For example, development policies, such as the National Urban Development Framework, the National Development Plan and the Integrated Urban Development Framework, have the common goal of using public transport services improvement as a tool to achieve more integrated urban development patterns (MoCoGTA, 2009, 2014a; National Planning Commission, 2012). This is because improving public transportation services has the potential to attract land-use development to previously underdeveloped and neglected areas. Most of the urban development literature points out that public transport investments have the potential to influence the amount and the quality of the future development (Pushkarev & Zupan, 1977; Boarnet & Crane, 2001; Belzer & Autler, 2002).

2.4.2   Transport corridor development concept

The corridor development concept offers a detailed framework for the development of the desired land-use patterns integrated with transport. Figure 3 visually presents this model of integrating land-use patterns using public transport corridors. Such a corridor is usually developed when there is an unusually high concentration of passengers who are demanding improved infrastructure services (Mammon & Ewing, 2006). The model (incorporating transport nodes and corridors) encourages high-density and mixed land-use development around public transport corridors (Morojele, 2005; Mammon & Ewing, 2006). These can serve as restructuring tools, and can limit dependencies on car transport (Newman & Kenworthy, 1991).

2.4.3   Land-use development around train stations

In a country like South Africa, shifting development towards the rail stations serves as a means to integrate development from the urban periphery where most of the poor reside towards the well-developed urban core. This kind of development can be done through high-density infill developments on vacant and under-utilised land surrounding identified rail stations, as a way to achieve socioeconomic benefits (Department of Transport, 1997).

Densifying mixed-use developments around the rail station results in shortened travelling distances and reduces the need for private modes of transportation. Thus, it

is evident that rail-based transport has the potential to shape land development, which can result in economic, social, and environmental benefits (Graham & van Niekerk, 2014). Land-use development close to public transportation nodes, such as railway stations, can thus act as a catalyst for spatial transformation and social integration (Wilkinson, 2006; Graham & van Niekerk, 2014).

2.5 TOD: An effective integrated urban development model

Apartheid's spatial legacy, particularly in South Africa's urban areas, is proving challenging to restructure. Any development model aiming undo this legacy must have the necessary vision to integrate previously segregated areas. In the South African context, TOD is not about only mitigating the dependency on private-car use, but rather about facilitating solutions to the country's particular socio-spatial challenges (Ndebele & Ogra, 2014).

Bickford and Behrens (2013:2) note that the "persistent apartheid spatial patterns where public transport captive communities live in detached single-unit housing on the fringes of cities" is at the root of the country's public transport challenges.

TOD can potentially help to integrate spaces and shift development and infrastructure investments to areas in need of them (Schensul & Heller, 2010; Bickford & Behrens, 2013). It is often used to refer to development around urban public transport stations and routes compatible with non-motorised transport options and a diversity of land-uses (residential, retail, offices and public open spaces) (Cervero, 2006; Lin & Gau, 2006; Carlton, 2009; EMBARQ Global, 2013). The National Development Plan calls for international development principles, such as this, to be deployed (National Planning Commission, 2012).

2.5.1 The history of TOD

The concept originated in the United States in the late 1970s (Southworth, 2003; Transit Cooperative Research Program, 2004). It gained popularity in the 1990s in response to the need to change the way in which cities were expanding and developing (Porter, 2002; Southworth, 2003). TOD promotes integrated development planning to create compact, mixed-use development that offers extended urban mobility and improvements in space liveability through infrastructure investments, redevelopment and adaptive reuse of the existing built infrastructure (Transit Cooperative Research Program, 2004).

It provides a viable model for integrating transport and land-use activities in urban spaces. It concentrates diverse, densified non-motorised development around public transport stations and aims to promote integration in the urban environment through mobility (Cervero, 2006; Cascetta & Pagliara, 2009). This model illustrates that it is possible to shape future and desired land-use patterns while solving urban development challenges in a sustainable way (Hrelja, 2015).

<u>2.5.1.1   Defining TOD</u>

There are different understandings of this model because it does not have a universal definition; definitions tend to shift depending on the context in which it is applied. Some varied understandings of TOD are outlined below.

- It creates mixed-use communities with a multiplicity of landowners around public transport stations, preferably the railway stations (Still, 2002; Fong, 2014).

- It promotes smart growth and integrated urban development, and it caters for changes in lifestyle as the urban population expands and the resultant changes in demand for services (Cervero & Sullivan, 2010, 2011).

- It is a form of development that uses the existing infrastructure to enhance the use of the public transport networks, create diverse mobility options for the surrounding community, and provide mixed land-use activities in high-density development zones (Bernick & Cervero, 1997; Belzer & Autler, 2002; Cervero et al., 2004).

- It can be "a new construction or redevelopment of one or more buildings whose design and orientation facilitate transit use, and general development of an area" (Mess, 2014:465).

- According to the Centre for Transit Oriented Development, it is "an approach to community development that leverages the unique approaches provided by access to high-quality public transportation, contributing to the creation of healthy walkable communities that provide residence with housing and transportation choices which support an affordable lifestyle" (Cervero et al., 2004; Austin, Belzer, Benedict, Esling, Haas, Miknaitis, Wampler, Wood, Young & Zimbabwe, 2010:4).

- At the local level, Stellenbosch's non-motorised transport policy document defines it "as a development pattern that is characterized by a mix of uses where buildings and uses cater to the pedestrian accessing the area via alternate modes of transportation.

  It typically incorporates compact development and dense activity centres within easy walking distance of transit stops" (Stellenbosch Municipality, 2014b:12).

2.5.2   Principles of TOD

The principles that distinguish this model from other urban development models are the focus on raising development density around the transport stations, facilitating the diversity of land-use activities, and use of spatial design orientated towards pedestrians (Calthorpe, 1993; Boarnet & Crane, 2001; African Development Economic Consultants [ADEC], 2009). Figure 4 illustrates the basic elements of every TOD model – the creation of compact cities through high-density development, which is connected by public transport services. Urban dwellers shift from car dependency to walking and cycling. Further, the urban activities become vibrant and multifunctional through the mix of available activities. Figure 4 illustrates how the TOD model can create a better urban life; these aspects are discussed in the following subsections.
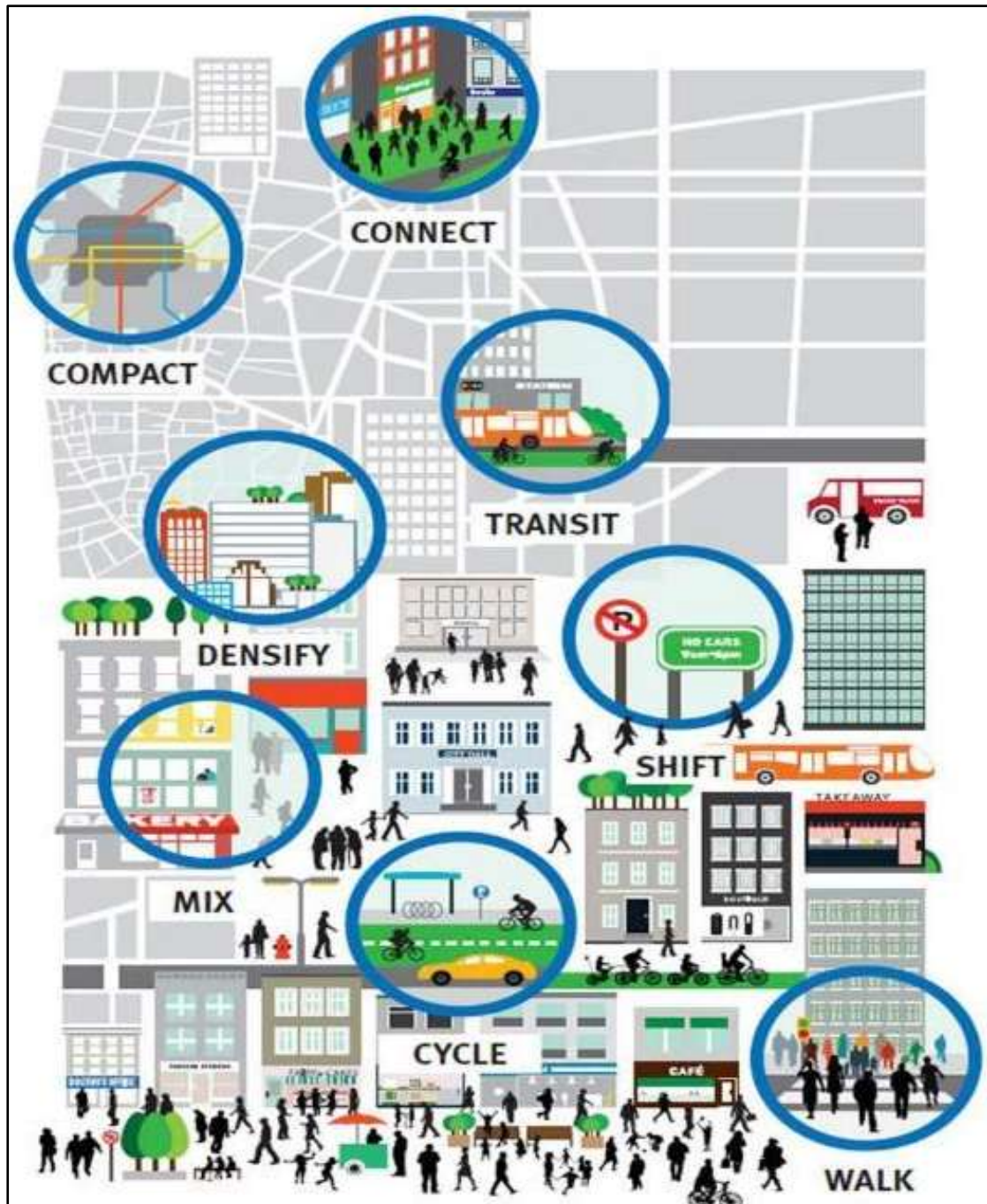
Figure 4: Basic principles of the TOD model

Source: Institute for Transportation and Development Policy, 2016

2.5.2.1   Enhancing density

Density is a key factor in the model, which encourages the clustering of activities around public transport interchange points by concentrating places, people and livelihoods in those spaces (Newman & Kenworthy, 1991; Cervero & Kockelman, 1997; Ndebele & Ogra, 2014). Cervero and Kockelman (1997) note that the higher the density of mixed-use spaces and activities, the higher the demand for transport.

Kenworth and Laube (1996:281) state that "high densities tend to be associated with lower average trip distances for all modes, improved public transport through higher potential patronage around each stop"; in particular, it enhances non-motorised transport options.

2.5.2.2   Facilitating diversity

A diversity of activities tends to make a space more vibrant and attractive. The model focuses on making public transportation hubs multi-functional to serve needs other than transport. Encouraging diversity, not only in activities, but also in land-use activities, can lead to the establishment of mixed-income communities and increased interaction between races, occupations and households with the ultimate objective of creating an integrated urban system (Dittmar & Poticha, 2004; Greenberg, 2004; Cozens & Hillier, 2008). Activities likely to facilitate this type of diversity include integrating recreational spaces, residences, places of learning and offices – all served by a well-functioning public transport system (Dittmar & Poticha, 2004; Parzen & Sigal, 2004; Papa & Bertolini, 2015).

2.5.2.3   Transformative design

Design is a key principle of the model encompassing design of the transport system and its accessibility, as well as the land-use patterns around it. There is a focus on supporting non-motorised transport because this increases accessibility and attracts pedestrian flows. The element of land-use design emphasises safe access to the transit stations and the surrounding area, including public amenities such as parks (Suzuki et al., 2013; Ogra & Ndebele, 2014). The model aims to reduce travel distances to the stations and thus promote urban form efficiency, which can result in environmental benefits such as low carbon emissions, contribute to building a competitive economy and boost social capital through regular interactions between residents of the city (Boarnet & Crane, 2001; Bunting, 2004). Mokhtarian & Pride-Wells (2007) illustrate how this approach also facilitates and deepens access to the city itself using examples such as bus-rapid transit (BRT) systems that combine light and heavy railways.

Suzuki et al. (2013) argue there is no better way to connect and integrate city spaces than public transport because it enables people to access spaces they previously could not.

Design can extend to the use of weather protection measures, street lights, trees and so on to ensure that the surrounding streets are safe and attractive to pedestrians.

2.6   Examples of objectives-based TOD

While all TOD models embrace the concepts of design, density and diversity, there are differences in application in different country contexts. Countries have different market factors at play, land development regulations, zoning ordinances, redevelopment opportunities, existing public transport systems and development resources. These aspects determine the scale at which this model can be implemented, as well as the location (vacant land or existing infrastructure), and the purpose for which it is employed. This affects the emphasis put on each of the principles expanded on above.

This section provides some illustrative examples of successful TOD implementation that was aligned with specific goals.

2.6.1   Upgrading urban public transport services

Most literature about the model focuses on how it is applied to improve public transportation services. Outcomes of this approach include improved services, lowered dependence on cars as a primary mode of transport and increased uptake of non-motorised transport infrastructure (Cervero, Murphy, Ferrel, Goguts & Tsai, 2004; Cervero, 2006; Cervero & Sullivan, 2010). Some examples of successful implementation in this regard are given below.

Washington D.C.'s metro system was the first modern rapid transit system built with the specific goal of reshaping regional growth patterns, reducing traffic congestion and improving public transport options (Cervero & Sullivan, 2010; Suzuki et al., 2013). The city brought in the private sector to take part in land-use planning activities and it followed a collaborative approach. Its success was based on the principles of "maximising the use of transit, linking landuse and transit, providing a diversity of housing types, emphasising mixed uses in high density developments, and creating special places" (Cervero et al., 2004:234). The city has one of the best, modern rail networks in the world (Reconnecting America, 2011).

The city of Denver customised the model's principles to serve its particular goal of reducing traffic congestion by focusing on densifying the area around stations, ensuring flexibility of land-use and reducing parking spaces (Denver, 2006). Its framework, the Blueprint Denver, emphasised that local governments need to develop plans for existing and future transport nodes that "further the region's goals and meet [the] needs of local communities" (Reconnecting America, 2011:17).

Portland took a more aggressive approach than other regions by upgrading almost all of its railway stations (Reconnecting America, 2011). It recognised train stations as special places for development and used the model as a growth management strategy and rezoned areas to allow transit-supportive developments. This model had strong support from officials, landowners and communities and it was nested in a long-term self-sustaining model for Portland's future (Cervero et al., 2004; Austin et al., 2010).

The city of Copenhagen in Denmark is often referred to as a model city because of its integration of land-use activities and transport planning (Tan, 2012). It has followed a 'transit first' planning approach and has created bike-friendly urban spaces, one of the longest car-free streets in Europe and casual outdoor relaxation spaces (Cervero, 2006; Olsen, 2008). Its celebrated 'finger plan' planning pattern is so named because of the corridors that feed into the urban centre (Suzuki et al., 2013) linking the harbour front, new areas and towns, including a fixed road and rail link to southern Sweden (Knowles, 2012).

Both Bogota and Curitiba are medium-sized cities that operate high performance and affordable BRT systems (Cervero, 2006). Curitiba is recognised as one of the world's most sustainably planned cities through using the TOD approach with radial axes that serve dedicated bus ways; the city has the world's first pedestrian mall (ICLEI Local Governments for Sustainability, 2011). The model is characterised by high-density development along bus corridors with extensive mixed land-use activities (Cervero, 2006). It also has environmental protection objectives (Lindau, Hidalgo & Facchini, 2010). Bogota encouraged adoption of the system by implementing car-free zones, limiting parking spaces and rationing licence plates – it reputedly has the longest cycling network of 250 kilometres in Latin America and the world's longest pedestrian corridor at 17 kilometres (Cervero, 2006). The city boasts the planet's largest car-free day with residents only using public transport, walking or bicycling around the city – an area encompassing 35 000 hectares (Cervero, 2006).

The car-free day sets an example of smart growth based on the belief that "quality of life distribution is more important than the income distribution" (Suzuki et al., 2013:27).

Curitiba is often referred to as the world's most well-managed sustainable metropolitan area, that has over the years carefully integrated urbanisation and transportation development (Gwilliam, 2002). Both demonstrate the spatial sustainability benefits of integrated land-use and public transport system planning. They also emphasise investments in bus infrastructure (Rodriguez & Tovar, 2013). Some Latin American

cities moving to adopt the TOD model include Sao Paulo (Brazil), Guatemala City (Guatemala) and Quito (Ecuador) (Salvador & Jimena, 2014).

Hong Kong's public transport system ranges from "high-capacity railway networks, [to] surface-street trams, ferries, and assortment of buses and minibuses" (Suzuki et al., 2013:61). The city is known for the high quality of its public transportation systems, which have significantly decreased the numbers of personal cars on the road (Bukowski, Boatman, Kmramirez & Du, 2013). It serves as a Chinese implementation model due to its value-capturing approach (Bruce, 2012; Hung, 2014).

2.6.2   Integrating segregated urban settlements

Historical segregation patterns can be found in cities and towns across the world. The reasons might differ, ranging from socioeconomic status, political eminence, religion, culture and race. Segregation in urban spaces creates a concurrent segregation in development imperatives, which distorts urban development patterns. Public transport is recognised as a tool to facilitate urban integration by increasing mobility (Todes, 2008; Carlton, 2009; Hutchings, 2013). The following examples indicate how TOD was used an integrating mechanism.

The city of Helsinki in Finland used new tram lines to facilitate the development of housing estates with a focus on establishing mixed-income housing (Papa & Trifiletti, 2006). In the Netherlands, the planning approach used in Amsterdam focused on encouraging new developments towards public transportation lines and railway stations (Papa & Bertolini, 2015). The TOD model was seen by city officials as a suitable tool to enhance liveability and accessibility to the urban lifestyle (Lee, 2006; Pojani & Stead, 2014).

Shanghai, one of China's largest cities, has made significant investments in TOD in efforts to undo a legacy of spatial planning that separated people from their work places and recreational activities (Cervero & Day, 2008). Beijing is following the same approach with an emphasis on providing quality and safe transport connections (Papa & Trifiletti, 2006; Hutchings, 2013).

Poverty, political eminencies, culture and religious differences are some of the factors that have led to the segregation of urban communities in Mexico (Rodriguez & Tovar, 2013).

Implementation of the model in this context was first targeted at low-income urban communities to connect them to higher-income ones. The goal was to create

sustainable urban communities integrated with open road networks, pedestrian and cycling networks (EMBARQ Global, 2013; Rodriguez & Tovar, 2013). Besides achieving increased integration, a further benefit was the revitalisation of low-income neighbourhoods through the redevelopment of abandoned urban spaces.

2.6.3   Urban redevelopments and neighbourhood revitalisation

The implementation of the TOD model also benefits infrastructure development, leading potentially to a revival of urban spaces. Various cities have used the model to specifically redevelop and revitalise old neighbourhoods (Cervero, 2006). Some examples are provided below.

In Boston, which already had embraced TOD principles in its urban design (Breakthrough Technologies Institute, 2008), implementation aimed to "… take back its old neighbourhood character without sacrificing modernity and mobility" (Cervero et al., 2004:203). The initiative revitalised older neighbourhoods stimulating economic development and increasing uptake of public transportation. The Boston approach is closely related to that of the city of Stockholm. In Stockholm, Sweden, the model was used to reduce traffic and encourage the use of public transportation (rail and BRT system) by creating a balance between work spaces and mixed-income housing set along axial rail-served corridors (Suzuki et al. 2013). This approach is part of a greater transformation agenda that promotes using transport to shape development patterns and this type of TOD is often referred to as a 'planetary cluster plan' (Cervero, 2006).

The system was implemented in Chicago using existing transport infrastructure (Austin et al., 2010; Reconnecting America, 2011). It comprises both heavy and light rail systems, which are operated by the Chicago Transit Authority.

The city uses a variety of incentives to encourage uptake, including "development bonuses, eminent domain, open market purchases, site assembly, reduced parking standards, and rezoning" (Cervero et al., 2004:283). This kind of development made it possible for the city of Chicago to capture property value within the train stations' precincts.

This approach was also followed in Dallas where the main objective was to capture value and create the place-making activities around the public transport stations (Austin et al., 2010:47). Seoul uses a BRT approach to TOD with an additional focus on reclaiming urban land used for highways and roads.

It removed a 6 kilometre, elevated freeway to restore the river and create pedestrian greenways (Suzuki et al., 2013). This forms part of the effort to make Seoul a sustainable, liveable city with reduced traffic congestion, a low carbon footprint and a restored natural environment (Kang, 2009).

2.6.4   Urban infrastructure investments

TOD has also been used to encourage investments in infrastructure development. New Jersey, Singapore and Taipei are some example of cities that have used this model as a way to develop their urban infrastructure.

A strong and committed political leadership in New Jersey enhanced implementation of the model because it was committed to revitalising small towns and redeveloping abandoned urban infrastructure (Renne, 2008). The focus was on creating transit villages by refurbishing old railway towns. The transit village initiative is defined as "a municipality that is committed to redeveloping the area around its train station into compact, mixed use neighbourhood with a strong residential component" (Cervero et al., 2004:212). State policies aimed to make New Jersey a leader of the smart growth movement by curbing urban sprawl and stimulating economic growth (Cervero et al., 2004).

Alternatively, in Taipei, it was used to support a sustainable urban development patterns perspective (Li & Lai, 2005) to encourage investments in high-density infrastructure along public transport corridors. Investment was supported if it was economically efficient, facilitated environmental protection and social equity, was serviced by public transport, and incorporated multi-activity planning (Lin & Gau, 2006; Papa & Trifiletti, 2006).

The island state of Singapore is renowned for its success in integrating public transport and sustainable environmental and economic regional development initiatives (Cervero, 2009). Its 'constellation plan' has radial rail corridors connecting the central city district to protective greenbelts and high-capacity buildings (Cervero, 2006). Successful implementation in this context was supported by urban development policies that emphasised diversity in developments around train stations. It also has stable 'transit first' policies in place (Suzuki et al., 2013). Singapore increased vehicle purchase costs and registration fees, as well as fuel taxes and parking fees, and it implemented 'real-time electronic road pricing' for those motorists using their cars in peak hours (Cervero, 2006; Suzuki et al., 2013). As a result, there has been a radical decrease in the number of cars on the road in Singapore.

2.7   Approaches to implementing TOD

As illustrated above, cities have different objectives for their TOD models. They also have different approaches when it comes to implementation. Below find examples of relevance to the South Africa context.

2.7.1   Diverse stakeholder collaboration

Arlington County in Virginia, United States, undertook a multi-actor collaborative process to achieve its objective and today there is "no place in the United States [that] has witnessed more high-rise, mixed-use development along a rail corridor over the past three decades than Arlington County, Virginia" (Cervero, 2006). Stakeholders included the city mayor, developers, business owners, public transport institutions and local community members (Cervero, 2006). The collaboration led to the creation of a customised model, known as the 'Bulls Eye' TOD concept (Suzuki et al., 2013).

Philadelphia also followed a multi-stakeholder approach that was facilitated through the NGO NeighborhoodNow, which worked with the community and public institutions to assess the impact an improved transportation system would have, identified the barriers to implementation, provided comprehensive solutions and helped develop a common vision for the city (Voith & Huang, 2007). The result has been that previously abandoned urban spaces were rebuilt and occupied (Voith & Huang, 2007). In Miami the federal government encouraged the creation of a joint partnership between the public and private institutions (Bailey, Mokhtarian & Pride-Wells, 2007). The objective was to create (Cervero et al., 2004:264):

> *… development of a wide variety of residential and non-residential land uses and activities in nodes around rapid transit stations to produce short trips, minimise transfers, attract transit ridership, and promote travel patterns on the transit line that are balanced directionally and temporally to promote transit operational and financial efficiencies…*

In Sydney, Australia, the model was implemented collaboratively by the Committee of Transport Infrastructure to concentrate "urban development around stations in order to support transit use, and developing transit systems to connect existing and planned concentrations of development" (Talbot, 2012:4).

There is also an emphasis on mitigation measures within this model. Brisbane's approach to TOD was embedded in urban management and regional planning programmes (Hale & Charles, 2007; Breakthrough Technologies Institute, 2008). The

city also nested the model within its policy documents. These included the Translink Network Plan, Integrated Transport Planning Framework, City Centre Master Plan and the Local Growth Management Strategies (Hale & Charles, 2007). The result has been a reduction in the number of cars on the road (Shatu & Kamruzzaman, 2014).

Perth pursued a strong cross-agency partnership to implement the model focusing on raising awareness, encouraging community participation in visioning processes and promoting local and state government partnerships, as well as developing financing strategies and affordable housing plans (Renne, 2008). The resultant rail corridor redeveloped the abandoned railway station and re-orientated the urban pattern towards stations (Olaru, Smith & Taplin, 2011).

In London, United Kingdom, while there was minimal involvement of community members, TOD was undertaken collaboratively by public and private institutions. The result was the City Together Strategy Vision for Transport (Papa & Bertolini, 2015), which aimed to create a sustainable urban transport system based on diversity design and density.

In Japan, Tokyo's railway is one of few in the world that is owned and operated by both private and public service providers (PADECO Co. LtD, 2000). Implementation of TOD in this context is viewed as an implementation model for developing countries because it was done with restricted finances, used both existing and/or underdeveloped rail infrastructure, and it harnessed the private sector to ensure economic efficiency of the operating system (PADECO Co. LtD, 2000).

2.7.2   Successful implementation within funding constraints

It is possible to implement the TOD model within budgetary constraints. For example, Bangkok, Thailand, is characterised by high levels of poverty and limited government budget. It used private funding to invest in efficient rail systems and other TOD infrastructure (PADECO Co. LtD, 2000). In Manila, the system was implemented using mostly borrowed funding and it is operated by private entities (PADECO Co. LtD, 2000).

Ahmedabad in India is using TOD to enhance the link between informal and formal housing areas, restore polluted rivers and capture value through infrastructure investments (Suzuki et al., 2013).

Guangzhou in China has a 23 kilometre BRT corridor surrounded by green areas and operates a bike-sharing system from the transit stations – the model aims to improve the quality of public spaces (Gwilliam, 2002; Suzuki et al., 2013).

Some African countries have begun to explore the various aspects and benefits of TOD. Nigeria has identified the importance of using this model as a tool to enhance human interaction and communication (Akwara, Udaw & Azirim, 2014) and to transform infrastructure development as part of a national empowerment and economic strategy (Oni & Okanlawon, 2005). The BRT-LITE system has already started functioning (Orekoya, 2010). Nairobi in Kenya aims to create a hybrid BRT system in its urban centres (Chitere, Mccormick, Orero, Mitullah & Ommeh, 2012). The Kenyan government has also developed a Non-Motorised Transport Policy (Nairobi City County Government, 2015).

There have been many studies conducted in South Africa exploring ways in which to pursue TOD. The South African Cities Network identifies the need for bold leadership, use of public transport funds to create inclusive green spaces, incorporation of the existing minibus taxi system into a comprehensive TOD system, the development of integrated and equitable ticketing systems, and enforcement of land-use management strategies (Beg et al., 2014). An example of advanced thinking about this model in South Africa is Johannesburg's 'corridors of freedom', which involved a multitude of stakeholders in the visioning process (Bickford & Behrens, 2013; Ndebele & Ogra, 2014). This strategy aims to give "our residents increased freedom of movement as well as economic freedom, while liberating the residents from apartheid spatial legacy characterised by informal settlements, poor schooling and limited recreational spaces" (City of Johannesburg, 2014:3).

It also fits into a vision of a low-carbon future for the city. The strategy emphasises the need to create and maintain safe neighbourhoods and streets with calm traffic patterns, residential-based mix-use development, mixed-race residential areas and convenient public transport stations and stops (City of Johannesburg, 2014).

2.7.3   The potential benefits for South Africa

It is evident that the placement of public transport infrastructure does influence development patterns. In South Africa, investments in suburban development have increased levels of car dependency and exacerbated spatial segregation, further marginalising the urban poor (Mammon & Ewing, 2006; Lin & Gau, 2010; Ndebele & Ogra, 2014).

Most South African urbanites live on the edges of cities and towns facing long travelling distances to get to work, places of learning and recreational facilities. They also face higher travelling costs as a percentage of the household budget. Implementing a relevant and effective TOD approach in South Africa would provide these people and the wider community with a range of benefits (Morojele, 2005; Tan, 2012).

The need for such an approach will become increasingly critical given the country's high urbanisation rates of 1.4 percent a year with more than 60 percent of the population already residing in the urban areas (United Nations, 2015).

The rapid rate of urbanisation puts pressure on existing systems and creates new service delivery demands (Gwilliam, 2002). A detailed explanation of South Africa's urbanisation rates can be found in Appendix B and a visual representation is provided in Figure 25.

A primary benefit that TOD would provide South Africa is the integration of people through improved mobility to spaces that were previously inaccessible (Mammon & Ewing, 2006; Ndebele & Ogra, 2014). This model also facilitates improved access to health, education and social services. In addition, it provides benefits to the wider society. Bagley and Mokhtarian (2002), based on the results of implementation of the model in California, note that it provides diverse choices of mobility and enhances public safety because streets are designed for both motorised and pedestrian traffic. It also reduces traffic congestion through increased uptake of public transport (Boarnet & Crane, 2001; Cervero, 2006). Household's disposable income is likely to rise as the percentage of household income spent on transport decreases – transit rides are cheaper than personal motorised transport.

And shifting to rail or bus systems also helps to reduce air pollution and energy usage, which contributes to resource savings and can help preserve biodiversity (Bagley & Mokhtarian, 2002; Bailey et al., 2007). A further benefit is that this model can help grow the economy as new developments attract private investment, which can increase tax revenues (Pushkarev & Zupan, 1977; Calthorpe, 1993).

TOD in South Africa must aim to enhance mobility while increasing connectivity and integration of urban activities (City of Johannesburg, 2014). The model could help to create integrated urban development patterns (Parzen & Sigal, 2004; Maginn, 2007; Lin & Gau, 2010) with economic, socio-political and environmental benefits.

2.8   The stakeholder collaboration process in TOD vision creation

It is important to go further than looking at how TOD can support integrated infrastructure development to discuss why the multi-stakeholder collaboration process is important for TOD implementation in the South African context. Cervero (2006) emphasises how public participation in the planning process aids in successful implementation.

International examples of successful TOD implementation had strong leadership with forward-looking urban planning visions, which enabled TOD to become a sustainable urban development model (see section 2.7 and its sub-sections).

Some authors argue that "TOD success is dependent on the ability of stakeholders with diverse interests to collaborate in building a shared vision and understanding the roles various stakeholders will play in making decisions to realise such vision" (Bickford & Behrens, 2013:379).

This stakeholder collaboration can be defined as pro-growth collaboration where developers, landowners and the building industry share a common vision of developing the land, which in the future will also generate a profit (Berke et al., 2006).

2.8.1   Planning support system: Diverse stakeholders

A good development plan needs to be influential, must fit the needs of the community and be of high quality. It is thus important for the planner or the facilitator of the plan to understand the physical, social and economic systems of the location. This study hopefully contributes to sound design of such a planning support system that focuses on railway stations as pivotal locations for regenerating urban spaces, and thus contributing to the transition to integration of urban spaces.

Any planning support system should aim "to generate knowledge and support discourse and decisions about the public interest issues springing from linkages among the area's population, economy, environment, land use, transportation and infrastructure" (Berke et al., 2006:89). It should involve a diverse profile of stakeholders.

A planning system should "facilitate collective design, social interaction, interpersonal communication, and community debate, which attempt to achieve collective goals to deal with common concerns" (GIZ, 2012:32). It should facilitate the reconciliation of land-use conflicts and guide changes in the urban development process to bring about a more integrated sustainable urban system.

The technologies to support the design of a planning system consist of the most accessible basic types: Geographical Information System (GIS), visualisation and communication, analytic models and the Internet (Martin, 2009).

A planning support system describes (Berke et al., 2006:103):

> … the history, current state, policies and decision rules about development; it monitors, records, and interpret development changes; its forecasts the future status of development; it diagnoses its planning and development problems; it assess its supply and demand balance; it models its changes, relationships, impacts and contingencies; and it communicates clear and credible information to decision makers and stakeholders.

Information about the contextual economy and population are driving forces that shape land-use plans in that detailed analysis of these aspects provides the necessary data for a needs analysis. This analysis identifies suitable land, infrastructure needs and available natural resources and enables the estimation of land-use activities and available land. Using information about the economy and population helps the modelling process to determine the past and present conditions and estimate future needs (Liversage & Mangiafico, 2014).

2.8.2   The importance of key stakeholder integration and participation

Urban development planning processes need to follow a systematic approach in identifying relevant stakeholders for a particular project to ensure effective collaboration. Stakeholders can include key agencies, landowners, developers and government entities (Bourgoin, Castella, Pullar, Lestrelin & Bouahom, 2012; Negash, 2012).

It can also include, depending on the particular country context (culture, history, location, organisational structures, decision-making processes, etc.), organisations, institutions, infrastructure and even natural resources. This study used collaborative forum discussions to engage different stakeholders in the vision creation process.

2.9   Summary

This chapter has addressed the study's first objective of discussing the historical legislative framework and more recent urban restructuring strategies with a particular focus on public transportation. It also addressed the second objective to outline the correlations between public transport planning and land-use activities, and describe how TOD theory informs these.

The review of the literature has provided insights into how development frameworks affect broader socioeconomic structures and how integrating land-use planning and public transport systems can help to bring about more integrated urban development patterns. Most post-apartheid urban development policies have attempted to dismantle this structure and implement integrated development planning principles. The TOD model provides a practical implementation model for restructuring South Africa's urban areas, but it does require a different planning approach because of the country's unique context. The review helped to identify stakeholder collaboration as an important tool in creating planning support systems for TOD implementation (see section 2.8).

Chapter 3 expands on the TOD model and its application in South Africa. It does by providing a practical case study on Du Toit train station in Stellenbosch, Western Cape province.

Chapter 3: Case Study: Du Toit train station, Stellenbosch

3.1 Background

Stellenbosch, located in South Africa's Western Cape province, is the country's oldest town. It is well known for its wine industry, university, tourism routes and Cape Dutch architecture (Western Cape Government, 2014). The development of the town has shaped its spatial layout and transport routes. As with most other South African towns and cities, the central business district is surrounded by relatively affluent suburbs that have well-developed infrastructure and public facilities, and then townships and informal settlements located on the urban edges that do not. Stellenbosch has two train stations that served different communities based on this historical development pattern. The main Stellenbosch station serves the more affluent communities and the central business district, while the Du Toit station set on the northern side of the town serves the informal settlement and township communities of Cloetesville, Enkanini and Khayamandi (location of the stations can be found in Figure 5). Stellenbosch's SDF, among other urban development policies, has identified Du Toit station as a potential TOD site with the aim of integrated mixed land-use activities and making infrastructure investments around the public transport nodes. It is for this reason that Du Toit station precinct was chosen as the focal case study for this study. This is because implementing TOD in this area will benefit most of the Stellenbosch population and also work towards integrating the infrastructure development pattern and shifting development to the north of Stellenbosch.

This chapter aims to review the spatial planning history of Du Toit station as well as explore its potential for TOD implementation. A brief historic background is presented to provide a context for the case study. Relevant municipal policies are reviewed to identify the emphasis placed on integrating public transport development and mixed land-use activities. The chapter then outlines a theoretical suggested vision for TOD of the precinct against the municipality policy framework, which has never been activated. The concluding section offers a brief discussion on how to move towards the vision of a spatially integrated Stellenbosch using the collaborative stakeholder approach for the redevelopment of Du Toit station precinct.

3.2 The history of train transport in Stellenbosch

Designed by David Aitken McCubbin in the early 1800s, the main Stellenbosch train station was built to complement the town's Dutch and Victorian architecture (Rock, 2011).

It is located to the south of the town (see Figure 5) and was developed to serve the transit needs of the mainly white population residing in the central areas. In 1913, Du Toit train station was built to serve the poorer communities comprising Africans and coloureds (Christopher, 1992). Images detailing the difference in design approach to these two stations can be found in Photo 1 for Du Toit train station and Photo 2 for the Stellenbosch train station, illustrating the physical layout of both. The creation of the stations to serve different racial and economic groups – segregated by racially discriminatory policies – further entrenched social and economic inequities in terms of access to economic opportunities and social and recreational facilities. It solidified and continues to entrench distorted urban patterns.
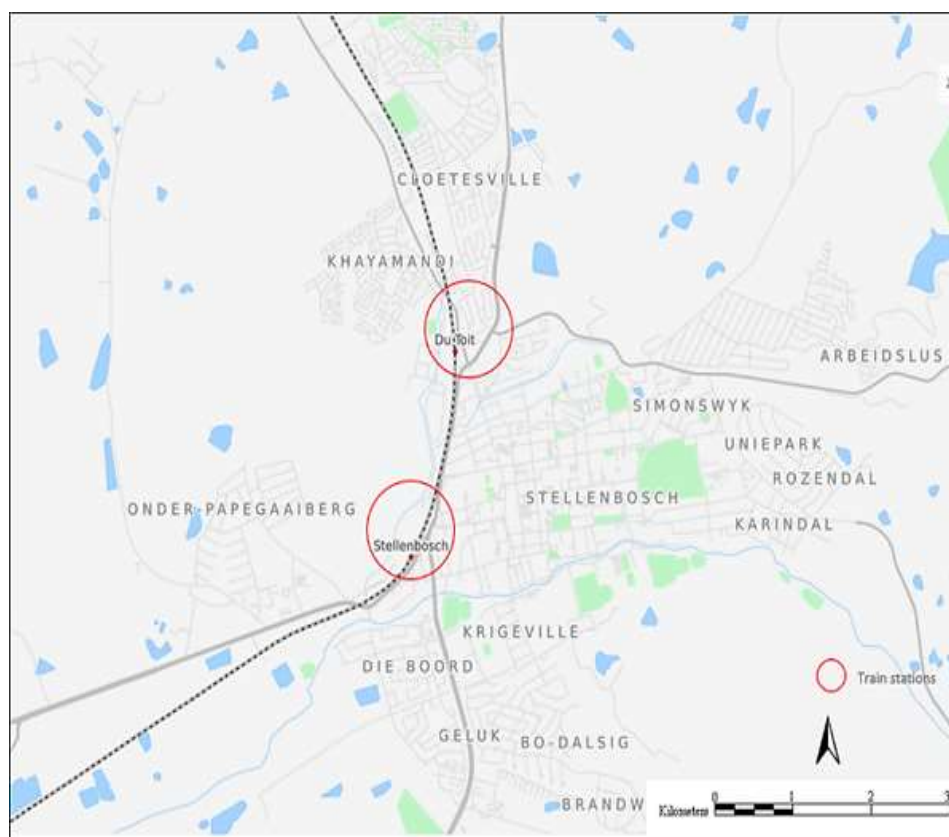
Figure 5: Map of Stellenbosch indicating suburbs and location of train stations
Source: Author using data from Centre for Geographical Analysis

Photo 1: Du Toit train station (2016)
Author

Source:

Photo 2: Stellenbosch train station (2016)
Source: Author

3.2.1　Du Toit station and the historical urban racial segregation

As with all South African towns and cities in the early 1900s, Stellenbosch underwent spatial reorganisation to accommodate apartheid-era segregation policies (Lemon, 1991; Rock, 2011). The town's development patterns have further entrenched this process. The choice of location for Du Toit station is evidence of this. Following the passing of the Black Land Act and the Native Urban Areas Act, the suburb known as Du Toitville was separated into what is now known as Khayamandi to serve the African population and Cloetesville to serve the coloured and Indian population (Lemon, 1991; Christopher, 1992, 2001a; Rock, 2011).

The proclamation of the Group Areas Act in 1950 led to further spatial segregation in Stellenbosch as the remaining non-white population living in the central business district was forcibly removed to land designated for their use (Christopher, 2001a; Schensul & Heller, 2010). This legacy is difficult to undo, particularly because of the historical lack of infrastructure and development investments made into poorer areas (Christopher, 1992, 2001a; Schensul & Heller, 2010). Today, Cloetesville, Khayamandi and Enkanini (a relatively new informal and illegal settlement on the outskirts of the town) are characterised by high population densities, low levels of infrastructure development and high levels of crime and poverty, as well as limited access to basic services (Western Cape Government, 2014). Du Toit station, situated next to the low-income townships of Khayamandi and Cloetesville, serves as an ideal site to implement TOD because of these characteristics.

3.2.2　The role of Bird Street/Du Toit station precinct

The station precinct performs multiple functions. It is located in the middle of a light industrial zone and so provides access to a number of industries and businesses that manufacture goods, provide agricultural and construction materials, and render professional services, such as accounting offerings. It serves as a place of work for mostly unskilled and semi-skilled labour and thus provides both formal and informal (mostly trading) employment opportunities.

It is a mobility node and provides a gateway into the town itself connecting the surrounding communities with different urban spaces. Khayamandi is home to about 25 000 people and Cloetesville to about 16 000 (Stellenbosch Municipality, 2014b).

About 5 600 people enter Du Toit station every day during morning peak hours and about 4 200 leave (City Of Cape Town, 2014).

Access to areas around the stations is by mini-bus taxis, private car or by foot. Redevelopment of this precinct could enhance access to different urban spaces and facilitate increased urban mobility. In addition, there is ample underused or vacant land in close proximity making it an ideal location for investment in mixed land-use activities. Examples of successful TOD (see section 2.6.3) indicate that implementation of this approach can increase property values (Reconnecting America, 2011; Darchen & Huston, 2012; Hutchings, 2013).

The following section offers a brief overview of the legislative framework that is conducive to implementing TOD in Stellenbosch, with a particular focus on the Du Toit precinct.

3.3 Integrated transport and land-use planning policy

Since 1994, the democratic government has prioritised the restructuring of the spatial organisation of South African towns and cities in attempts to undo the inequities entrenched during the apartheid era. It drafted strategies to facilitate infrastructure development in historically underserved communities, alleviate poverty and increase access to economic opportunities for marginalised groups. These strategies were implemented at the national, provincial and local government levels (see Chapter 2).

While national level initiatives, such as the Reconstruction Development Programme, the Development Facilitation Act and the Urban Development Framework (Presidency, 1994; Department of Land Affairs, 1995; Department of Housing, 1997), provided a framework for action, the impacts of apartheid-era spatial development policies is felt mostly at the municipal level. The White Paper on Local Government provided guidance on developing initiatives that would help integrate previously separated urban populations; for example, it set out definitions of settlements.

Stellenbosch is defined as being on the urban fringe because it is on the periphery of the Cape Town metropolitan area and comprises various high- and low-income groups (Department of the Presidency, 1998). Stellenbosch Municipality has created varied development strategies to foster integration. These include the Municipal Land-use Planning Policy, the Municipal SDF, the Stellenbosch Non-Motorised Planning Policy and the Comprehensive Integrated Transport Plan. These are briefly outlined in the following subsections.

3.3.1   Municipal Land-use Planning Policy

This policy aims to help municipalities establish collaborative working groups or project committees to create or amend local government SDFs. The groups are responsible for identifying existing levels of development and relevant challenges at the municipal level (Stellenbosch Municipality, 2014a). The policy mandates local government with the responsibility for land-use planning and integrating urban development. The Development Facilitation Act and Urban Development Framework also give local government a responsibility to focus on infrastructure investment (Department of Land Affairs, 1995; Department of Housing, 1997). The Municipal Land-use Planning Policy focuses on zoning decisions (Stellenbosch Municipality, 2014a). To fulfil its responsibilities as outlined above, Stellenbosch is in the process of drafting its municipal SDF.

3.3.2   Municipal SDF

The framework enables municipalities to focus on developmental issues that are of relevance to them. However, as Stellenbosch was still in the process of drafting its framework during the period of this study, it is not possible to evaluate this framework and its alignment with TOD. However, according to the National Spatial Development Framework, the municipal framework should provide detailed spatial planning proposals and guidelines relevant to the town's needs; it should address specific land-use planning needs and it must outline its development priorities with a focus on integrating land-use planning, biodiversity and environmental concerns (Department of Rural Development and Land Reform, 2010). It is therefore assumed that the Stellenbosch framework will align with these guidelines. In its drafting process, the municipality has created some frameworks that focus on integrating public transportation and land-use planning.

3.3.3   Stellenbosch Comprehensive Integrated Transport Plan

Stellenbosch's Comprehensive Integrated Transport Plan aligns with the mandate to use investment in public transport infrastructure to enhance the overall functioning of the town (Stellenbosch Municipality, 2011).

Stellenbosch's plan aims to make the train stations and their precincts places of high-density development characterised by mixed land-use activities that provide direct employment opportunities (Stellenbosch Municipality, 2011).

Higher priority is given to public transport to stimulate and support economic development and growth. The plan encourages the development of safe public transport with nodes set in mixed-use high-density developed precincts.

3.3.4 Stellenbosch Municipality Non-motorised Transport Policy

Stellenbosch created its non-motorised transport policy to facilitate urban mobility within the town and it is encouraging the promotion and use of this as a way to make the town a "preferred destination" with the "greenest municipality" and "safest valley" where people live a dignified life" (Stellenbosch Municipality, 2009:2).

3.4 The vision of implementing TOD at Du Toit station precinct

Stellenbosch, in alignment with national urban development policies, is looking to develop a more integrated urban development plan. The municipality has identified Du Toit station precinct as a medium potential urban improvement district (see Figure 6).

3.4.1 The benefits of implementing TOD at Du Toit station precinct

Implementing TOD at Du Toit station precinct would provide quality, safe and secure, convenient and attractive high-density infrastructure, serviced by public transport. Properly designed and implemented, the precinct could improve the quality of life for residents of the surrounding communities. It would do this by providing access to improved mobility options and by facilitating interaction and integration of previously segregated communities through creating shared residential, working and recreational spaces (Stellenbosch Municipality, 2014b).

TOD, according to most of the literature, has the capacity to provide inclusive growth in spaces that have been degraded or underdeveloped, while preserving heritage infrastructure (Cervero & Sullivan, 2011; Mess, 2014; Ogra & Ndebele, 2014). It could certainly do this at the Du Toit station precinct. TOD development at this location would also act to restrict urban sprawl by emphasising densification, and thus reducing the impacts of uncoordinated growth.
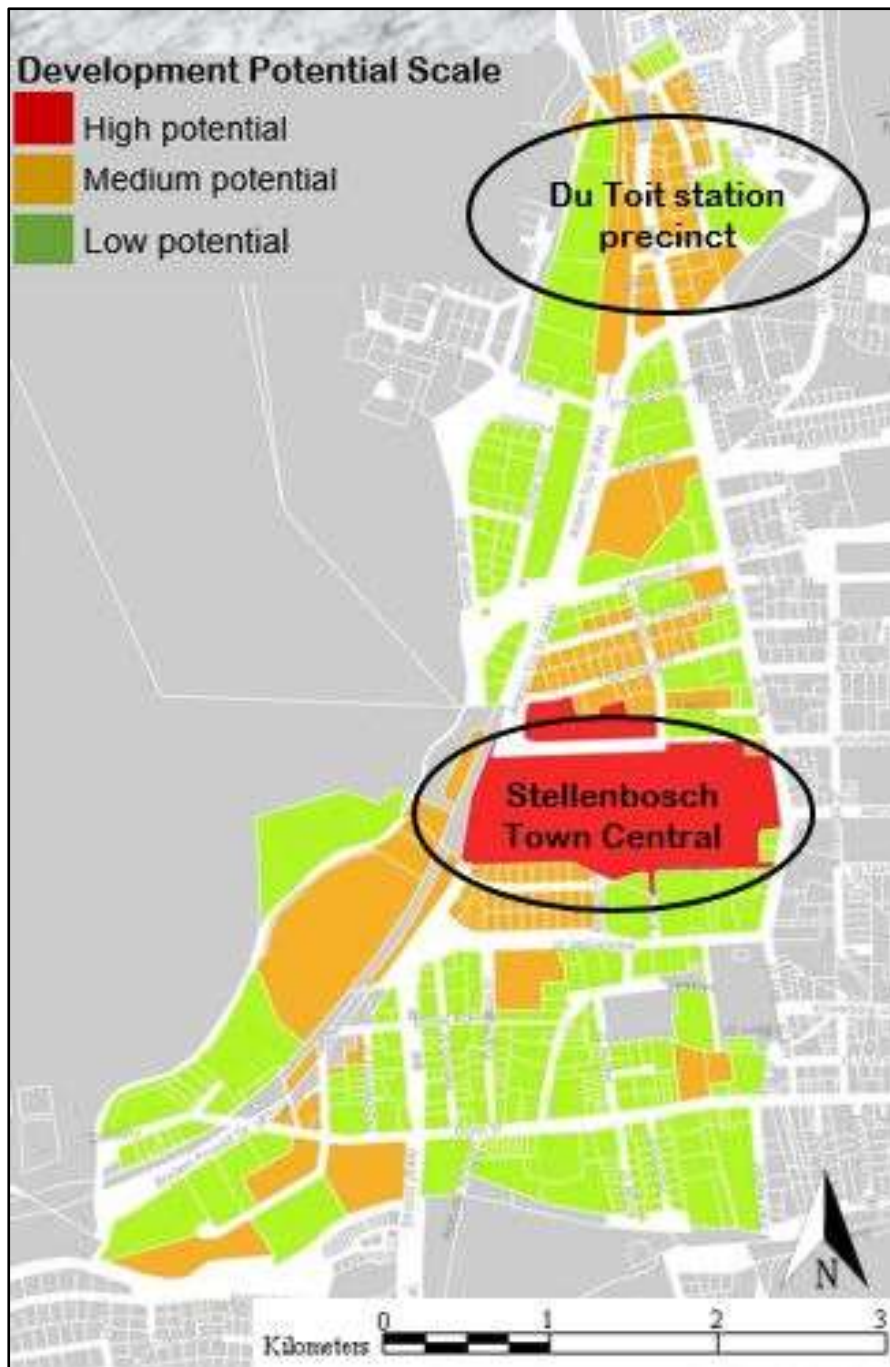
Figure 6: Location redevelopment potential scale of Stellenbosch town

Source: Stellenbosch Municipality, 2014b

The aim of TOD is to establish high-density infrastructure development serviced by a multimodal public transport system on the identified potential development locations. This would involve upgrading rail, road and non-motorised transport options to accommodate regional growth, while improving mobility between different town locations and neighbouring regions (Shin, 2014; Stellenbosch Municipality, 2014b). This can add immediate value to the areas surrounding the Du Toit precinct, which is currently underused, underdeveloped and undervalued.

3.4.1 The vision for TOD at the Du Toit station precinct

The Du Toit station is located in the ideal place to develop an integrated transport network close to central Stellenbosch. It is at the entrance to the central business district, which is accessible by rail, road or non-motorised transport routes. Other studies (see Chapter 2) illustrate how all successful examples of implementation are serviced by diverse public transport infrastructure that functions on a circular interchange motion (Donaldson, 2006; Shichun & Xing, 2008; Republic of Kenya, 2013). Figure 6 presents a suggested Du Toit intermodal plaza with areas for non-motorised transport infrastructure and linkages to roads leading into and out of Stellenbosch (Stellenbosch Municipality, 2014b).

Figure 6 also indicates the various changes to infrastructure that will need to be made to make public transport services more efficient. For example, the Stellenbosch Municipality's TOD model suggests that the station be moved 500 metres to the north from its current location. This shift will provide residents of Cloetesville, Enkanini and Khayamandi convenient access to public transport and other facilities (Stellenbosch Municipality, 2014b). The relocation of the station would also facilitate mobility options, make space for mini-bus taxi routes and open up the opportunity for the station plaza to provide commercial opportunities.

3.4.2 A diversity of land-use activities

TOD theory suggests that diversity in terms of land-use activities is an important component of adapting and implementing the model. The more diverse the activities offered in a location, the more that users will be drawn to the space (Dittmar & Poticha, 2004). Stellenbosch envisions a mix of commercial, residential and industrial activities taking place (Stellenbosch Municipality, 2014b). Figure 7 indicates areas potentially earmarked for mixed land-use development activities. Creating spaces for mixed land-use activities could help create reconciliatory spaces in Stellenbosch.

Thus, implementing TOD at Du Toit station precinct has the potential to elicit many personal, community and regional benefits (Cervero & Sullivan, 2011; Reconnecting America, 2011; Mess, 2014; Ogra & Ndebele, 2014).

Implementation at this location could also increase regional connectivity between Stellenbosch and neighbouring towns, reduce traffic congestion, reduce energy consumption and air pollution, and increase the choices of living spaces available.
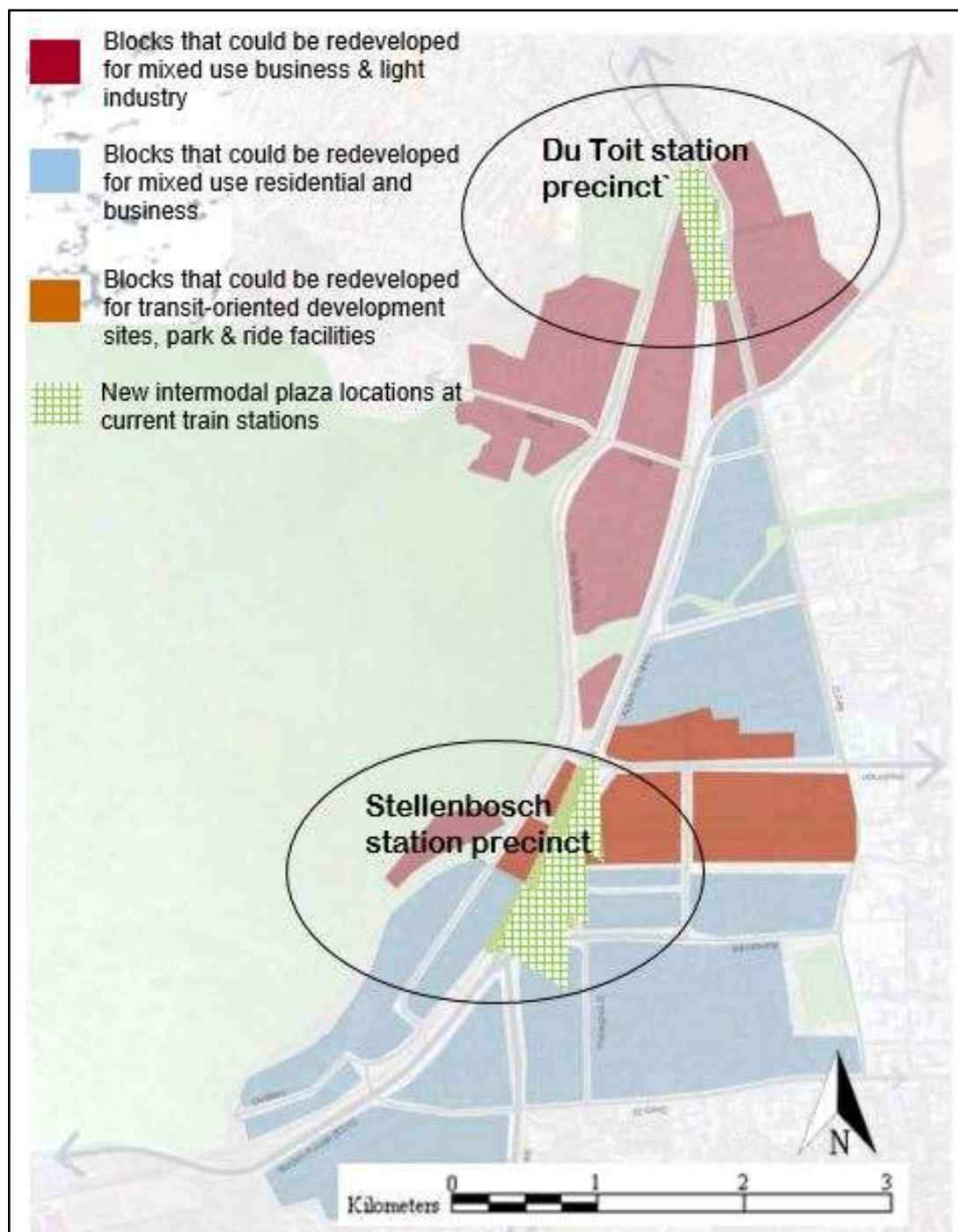
Figure 7: Proposed locations for mixed land-use and station intermodal plaza
Source: Stellenbosch Municipality, 2014b

3.4.3 Densifying Du Toit station precinct

High-density development helps to increase urban activity thresholds (Cervero & Kockelman, 1997) providing benefits to neighbouring communities. Densifying the Du Toit station precinct will create better connections between employment spaces and transport routes and bring in new urban activities, such as the public plaza, retail spaces and cafes connecting the Du Toit precinct with the central town.
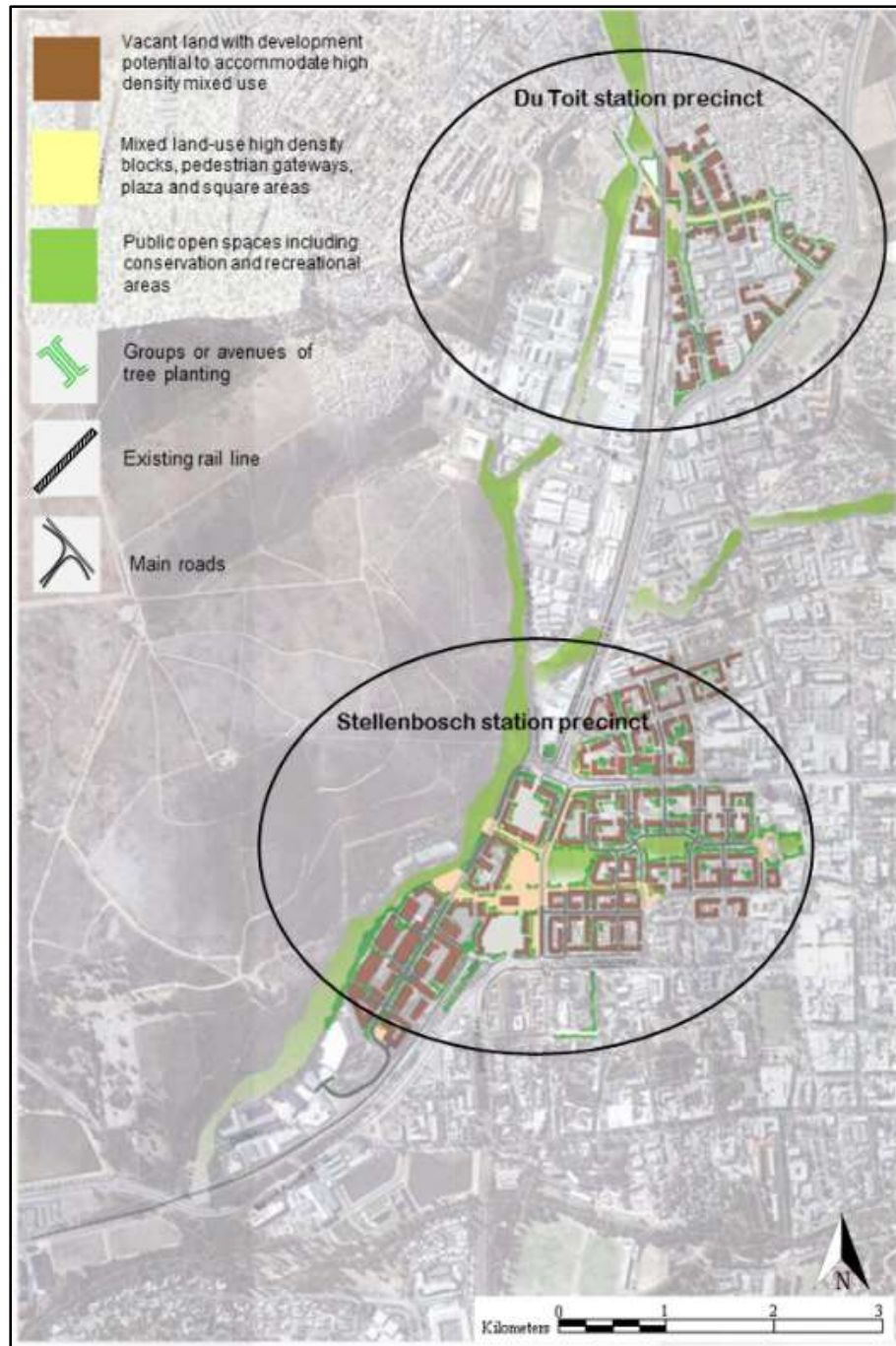
The high-density development at Du Toit station precinct has the potential to also function as a catalyst for the urban regeneration of Stellenbosch because, as presented in Figure 8, there is plenty of vacant land at the Du Toit station precinct that can be used for high density development. However, in the case of Stellenbosch where the town is characterised by the historic Dutch and Victorian architecture, it is important that the newly created high-density design matches the standards of the historical architecture.

The TOD model encourages investment in physical infrastructure and also offers an array of social, economic and ecological benefits that affect a diversity of stakeholders. Given this, Berke et al. (2006), in their theory of urban land-use planning, note the importance of diverse stakeholder engagement to develop a collective vision for inclusive development and to minimise potential conflict over access and use of resources. The stakeholder profile is outlined in section 3.5.

Photo 3 is a visual representation of the high density mixed-use buildings that could be developed at Du Toit station precinct. This illustrates how the precinct can be redeveloped to create an integrated urban development pattern that encompasses residential, work and recreation spaces.

The potential benefits would include a 'lively' space that provides environmental, convenience, social, and economic benefits in that people can walk around, be less dependent on private car use, and enjoy access to urban activities that are close to their communities (Kenworthy & Laube, 1996; Ogra & Ndebele, 2014). The high-density design at the Du Toit precinct shows how the TOD model allows for land-use activities to be concentrated in one space.

Figure 8: Vacant land with the potential for high-density development
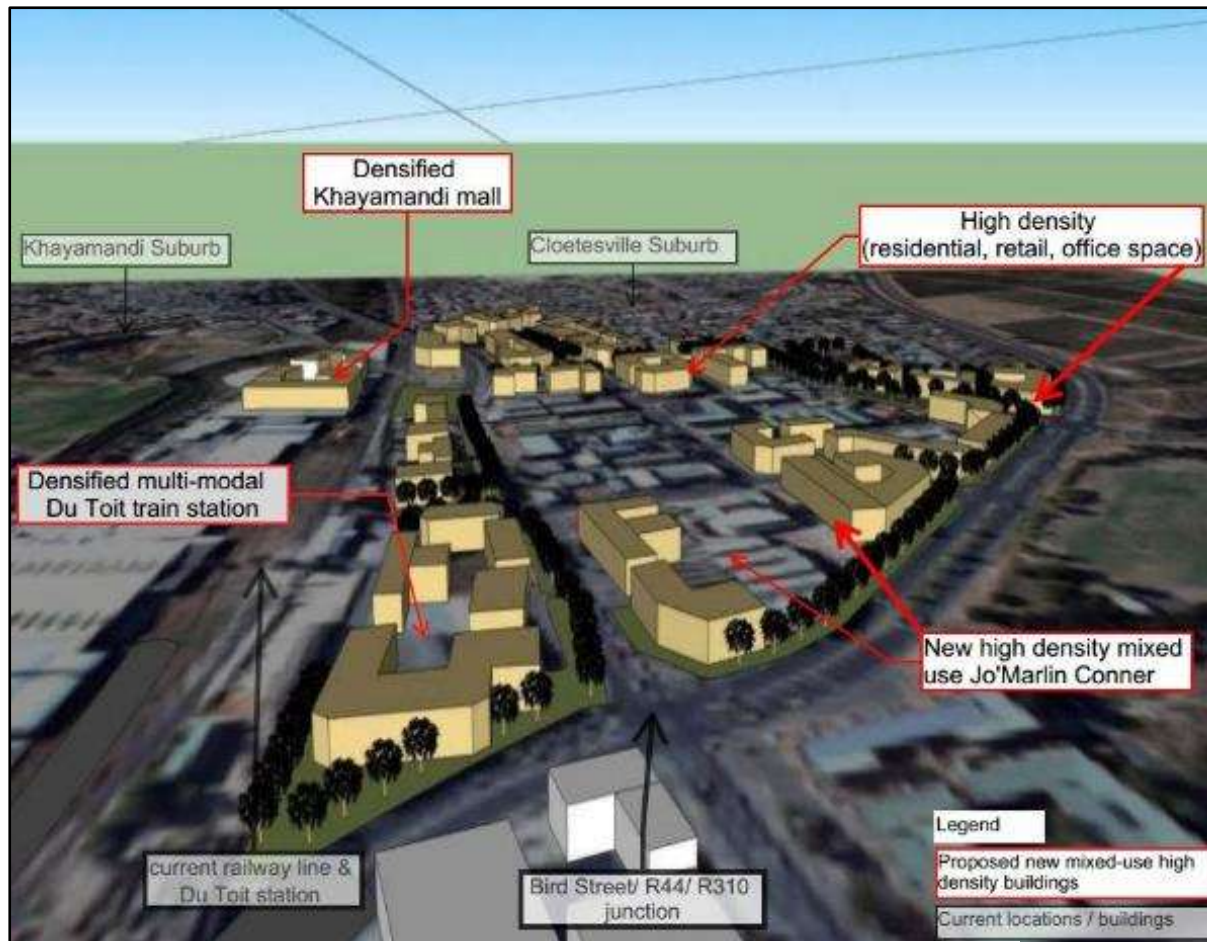
Source: (Stellenbosch Municipality, 2014b)

Photo 3: High-density options for Du Toit station precinct

Source: Stellenbosch Municipality, 2014b

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3.5   Diverse stakeholder profile

The success or the failure of implementing TOD is subject to buy-in from various stakeholders (Bickford & Behrens, 2013). There is a diversity of stakeholders connected to the Du Toit station precinct that need to be consulted to ensure successful implementation. These include developers, landowners, government, local communities, academic researchers and intermediary institutions.

All play different roles, have diverse needs and interests and may view the benefits from conflicting perspectives (Darchen & Huston, 2012; Bickford & Behrens, 2013). For example, the railway operator agencies may look at this development as a means to increase train use. The developers look at the potential return on their infrastructure investments. The landowners wish to see how this will affect the value of their land. The local communities may be interested in seeing how this can provide reliable, efficient and safe public transport services, create employment opportunities or uplift their standard of living (Cervero & Day, 2008; Darchen & Huston, 2012).

Thus, for this research it was imperative that the different stakeholders' views were obtained. A safe space needed to be created where the different stakeholders could share their visions for the Du Toit station precinct and discuss the potential benefits they thought the infrastructure investment would bring.

The primary stakeholder is the Stellenbosch Municipality. Its Integrated Development Plan 2012–2017 motivated for investment into the town's public transportation services and the adoption of the TOD model (Stellenbosch Municipality, 2012). However, without buy-in from developers and landowners the municipality cannot achieve its goals. The landowners in Du Toit and Bird Street are also identified as key stakeholders, as were urban infrastructure developers because they often function as intermediaries between local government (who create development strategies) and landowners who have the power to support or reject these strategies.

The stakeholder groupings include tenants of buildings within the precinct, train commuters and general road users entering the central business district. For the purposes of this study, those who owned businesses in the suggested precinct and those who used the train on a daily basis and those who worked in the area (including vendors and 'illegal' taxi services) were identified as key to successful implementation, particularly because their livelihoods could be affected by infrastructural changes, including the demolition of certain buildings. The Cloetesville and Khayamandi communities are also important stakeholders.

Given the population count of about 40 000 people, ward councillors and community leaders served as their representatives (Western Cape Government, 2014). Their inputs were considered most important because these residents will be the prime users of the space following implementation. The project design needed to take into account their needs and it needed to keep them informed on a regular basis as to project developments. Subsidiary stakeholders included Stellenbosch University and researchers, such as me, that provided input, thus influencing the process. This grouping, which will not benefit directly from implementation, helped to facilitate neutral and safe spaces for the sharing of ideas and relationship building.

One of the study's objectives was to establish such a forum in order to communicate the infrastructure needs of the precinct; to encourage the collaboration among the diverse stakeholders; and to explore the development potential of the precinct. As most urban development theories indicate the collaborative process supports co-learning, cooperation, consultation and information sharing among stakeholders; this is a vital prerequisite to developing a collective vision for any TOD (Freilich, 1998; Berke et al., 2006; Negash, 2012). The Bird Street/Du Toit Precinct Urban Improvement District Forum was established on 1 March 2016. This forum aimed to facilitate the discussion between stakeholders and ensure that everyone's voice could be heard in terms of the vision they have for the Du Toit station precinct.

3.6 Summary

This chapter reviewed the history of spatial planning regarding Du Toit train station, with the purpose of presenting an explorative theoretical and policy framework for redeveloping the station precinct using TOD model principles. An exploratory aim was to discover if such a model could bring abour more integrated development patterns. It is clear from Chapter 2 and 3 that the legislative and policy framework in South Africa and in Stellenbosch is conducive to TOD implementation. The vision for high-density development at Du Toit station precinct was presented in Photo 3; with the precinct identified as a favoured location for such development, which could concentrate urban activities in a space that is accessible by public transport.

The preceding chapters attempt to portray the potential of TOD for reshaping Stellenbosch in a more inclusive way. This chapter provided a theoretical investigation of the site's potential and the opportunity provided by national and local legislative and policy frameworks. Chapter 4 presents the methodology and practical research methods used and Chapters 5 and 6 outline the empirical research findings and outcomes.

Chapter 4: Research design and methods used

4.1 Introduction

This study was conducted to identify strategies that would create integrated urban development patterns using public transportation investment, which makes it applied research. The identified urban development strategy is the TOD model. The objectives were designed using descriptive, correlational and exploratory techniques (Jenkins, 2004; Baxter & Jack, 2008; Rosaline, 2008). It is descriptive as the study tries to accurately describe the origins of South Africa's segregated spatial development patterns that are still entrenched despite the end of the apartheid era (Lemon, 1991; Jenkins, 2004). It is correlational in that it attempts to establish the existing connections between transport and land-use development (Baxter & Jack, 2008; Ogra & Ndebele, 2014). It is exploratory as it investigates the possibilities of using a collaborative, multi-actor stakeholder approach to create a long-term vision for the redevelopment of the Du Toit station precinct (Rosaline, 2008; Calland & Nakhooda, 2012).

Given these multi-layered aspects, the study demands a TDR mode of inquiry, which allows for a mixed-methods approach to answering the research questions and attaining the study's objectives. A mixed-methods approach is able to articulate the connection between conceptual research questions and the practical, empirical research journey. This chapter discusses how the transdisciplinary study was designed using such an approach. Methods used comprise a case study, focus group discussions, interviews, observation, transect walks, key informants, documentation study and the use of software programmes: NVivo 10 (http://www.qsrinternational.com/), Tableau 9.3 (http://www.tableau.com/) and the ArcGIS 10.2 toolkit (https://www.arcgis.com/features/features.html). This chapter also explores triangulation of data using these methods. The ethical considerations, important in a study of this nature, are also outlined, as well as the researcher's positionality while conducting the study.

4.2 TDR strategy

The TDR approach offers several benefits. It aligns with the intentions of this study because it has the ability to investigate descriptive, operational and normative real-life problems (Hirsch-Hadorn et al., 2008; Lotrecchiano, 2013).

It does this by creating a space for sharing knowledge and co-creating solutions for a focal issue. According to Swilling (2014), it also functions to legitimise researchers as

active urban development change agents. In other words, when using this approach in the context of the study, the researcher is able to become an active part of finding the solutions to specific problems (Hirsch-Hadorn et al., 2008) in collaboration with societal actors; solutions to real social problems are thus co-produced (Max-Neef, 2005; Cilliers et al., 2014; Swilling, 2014). Because TDR thus rests on a variety of methodological approaches it is able to move beyond a disciplinary approach to establish an action-orientated and reflexive research design (Bergmann, Bettina, Hoffmann, Loibl, Rehaag, Schramm & Vob, 2005).

Figure 9 below visually represents the basic principles of TDR and how it differs from interdisciplinary and multidisciplinary research approaches. The multidisciplinary and the interdisciplinary approaches are represented in the bigger circle as they share common elements. The TDR approach is visually represented with a square inside the two circles. This is because TDR continuously oscillates between the interdisciplinary and multidisciplinary research approaches (Lotrecchiano, 2013).
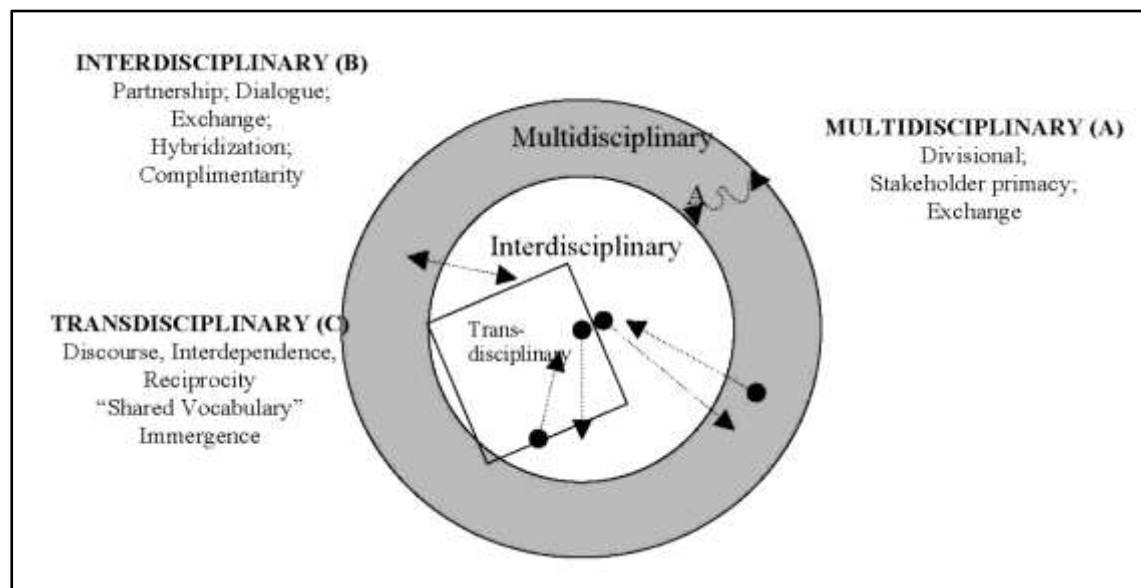
Figure 9: Positionality of TDR within various disciplines

Source: Lotrecchiano, 2013:4

The theoretical aims of the TDR approach are to identify, analyse and cope with real-world problems so that a study is able (Pohl & Hirsch-Hadorn, 2008:4):

> *(a) To grasp the relevant complexity of the problem. (b) To take into account the diversity of life-world and scientific perceptions of problems.*

> *(c) To link abstract and case-specific knowledge. (d) in addition* [to] *develop knowledge and practices that promote what is perceived to be common good.*

It thus requires use of mixed methods.

4.2.1   The benefits of the TDR approach

The use of the TDR approach enables researchers to analyse real-world problems in detail from a diversity of perspectives (Haberman et al., 2013; Montuori, 2013), including those from academic and non-academic participants (Haberman et al., 2013). It facilitates the sharing of knowledge and acknowledges that all participants have knowledge worth sharing (Bergmann et al., 2005; Max-Neef, 2005; Hirsch-Hadorn et al., 2008; Pohl & Hirsch-Hadorn, 2008; Haberman et al., 2013; Montuori, 2013). Its main advantage, therefore, is to bridge the gap between academic research and practice through reciprocity and constant emergent of themes as visually presented in Figure 9.

4.2.2   The shortfalls of the TDR approach

The TDR approach is often critiqued for the process through which participants are chosen, as well as the choice of who interprets and applies the research findings. There is a danger that processes of this nature "may turn out to be largely superficial or driven by power-constellations representing underlying values" (Pohl & Hirsch-Hadorn, 2008:438). Researchers may struggle to find a balance when working across the academic boundaries of natural sciences and humanities (Max-Neef, 2005). This has implications in terms of the way in which stakeholders are engaged, the problem is framed and the study outputs viewed (Max-Neef, 2005; Cronin, 2008). It can also be difficult to incorporate the views of all participants' ideas and inputs.

A mixed methods approach can help to balance the above-mentioned benefits and disadvantages.

4.3   Undertaking mixed methods research

Undertaking mixed methods research implies the use of more than one method and type of data set to gather and analyse data. This study collected, interpreted and analysed the data in alignment with Luce-Kapler's definition of mixed-methods research as a process that "collects and analyses data, integrates the findings, and draws inferences using both qualitative and quantitative methods" in the same study (2008:486).

A difference between qualitative and quantitative research is that qualitative studies can sometimes describe characteristics and events without providing comparative data, while quantitative studies focus on statistical measurements of subjects (Yin,

2011). A more detailed view of the differences between the two approaches is provided below.

Qualitative methods allow the researcher to interpret the collected data through the research subject's understanding of it; i.e. it is a naturalistic approach. Methods for collecting empirical data include personal experiences, case studies, interviews, focus groups, transect walks and visualisation tools (Flyvbjerg, 2011). Quantitative methods seeks to produce generalised results through use of the collected measurements and produce statistical data (Thomas, 2003; Sumner, 2006). Qualitative methods are able to produce an interpretation that portrays the socially constructed world reality that changes over time, as opposed to the quantitative focus on measurable facts (Berg, 2001). However, both approaches are guided by the same set of values: "[the] belief in the value-leadenness of inquiry, belief in the theory-leadenness of facts, belief that reality is multiple and constructed, and belief in the fallibility of knowledge" (Tashakkori & Teddlie, 1998:13). They can therefore be used within the same study in a complementary manner.

This study used mixed methods to enable a deeper understanding of the research objectives. Both set of data were collected concurrently and merged during the analysis process. The mixed methods approach allowed this study to investigate different social processes and phenomenon regarding the use of TOD to redevelop and regenerate the urban space of the Du Toit station precinct.

There are challenges to using a mixed methods approach. It can lead to particular methods dominating regarding particular concepts and discourses (Yin, 2009; Flyvbjerg, 2011) or according to the researcher's familiarity and preference for one over the other thus negating any complementary benefit. It can also be difficult to assure confidentiality when descriptions of participants are both qualitative and quantitative in nature (Bazeley, 2007). Integrating incompatible views is also a concern (Luce-Kapler, 2008). In attempts to mitigate these challenges, the study used the QSR NVivo software programme to coordinate the two approaches (Smyth, 2008) and enhance the researcher's understanding of both the theoretical and statistical approaches undertaken in the study. Other supporting toolkits include ArcGIS and Tableau. The various methods used in the TDR mixed methods study design are discussed below.

4.3.1 The case study

The case study is an empirical method of inquiry, which investigates an existing phenomenon to create a deeper understanding. The goal is to highlight the unique features of the chosen example (Zucker, 2009). Keddie (2006:21) defines a case study as "an in-depth investigation approach of the real-life societal phenomenon, using diverse data sources." The case study was used in this instance to gain insight into the physical, social and economic context of Stellenbosch as related to the Du Toit station precinct. It enabled a detailed description of the study areas and highlighted the potential integrated infrastructure development options.

The use of this method provided the study with strong, in-depth analysis of the context (Blatter, 2008); constructed the internal validity of the case, and allowed both a theoretical and practical representation (Blatter, 2008; Zucker, 2009; Bryman & Bell, 2014). The case study method permits "a researcher to reveal the way [in which a] multiplicity of factors have interacted to produce unique character of the entity" (Thomas, 2003:72). It enabled a clear contextual picture through the lenses of many individual stakeholders to emerge, and enabled a thorough exploration of the interaction between the spatial dynamics of Stellenbosch and participants' mobility, facilitated by public transport. It also elicited insights into spatial changes and the nature of entrenched spatial segregation and enabled a deep, rich understanding that would not have been gained through a primary review of publicly available literature.

While case studies require thorough data-collection and analysis methods, which enhance objectivity, they are demanding in terms of time and resources, can be biased because of the extensive exposure of the researcher to study participants (Bryman, 2008; Bryman & Bell, 2014), and do not provide generalised findings. The data gathered can also be over-interpreted. The various methods used to overcome these shortcomings are outlined below.

4.3.2 Focus group discussions

As a TDR study requiring multi-stakeholder participation, focus groups were an important tool for gathering and interpreting data. Focus group discussions bring a diversity of stakeholders/research participants into a space to facilitate discussion on a particular topic (Montuori, 2013). The aim in this study was to gather collective opinions on a future vision for the Du Toit station precinct.

The focus group discussions enabled the collection of a diversity of views and some insight into the differential power structures at play.

In the empirical process of this study the focus groups comprised the landowners around the Du Toit station precinct, the Stellenbosch University academics and the representatives of Cloetesville, Enkanini, and Khayamandi communities.

Following the establishment of the Bird Street/Du Toit Precinct Urban Improvement District Forum on 1 March 2016, members met twice a month to discuss the future of Du Toit station and other matters important to the precinct and communities around (see Appendix C for two samples of the forum discussion invitations). The proposed topics of discussion consisted of the role and future of Du Toit station, the safety and security of the area, the future of public transport in Stellenbosch, and other matters concerning the forum members relevant to infrastructure improvement.

The disadvantages to using this method include that the researcher cannot control the type of information discussed or produced by participants, which can lead to the production of chaotic data that makes analysis more difficult (Maginn, 2007). It also cannot be used to produce generalised findings as the sample number is necessarily limited (Maginn, 2007; Montuori, 2013). There is also the danger that the researcher might have domineering perceptions of certain concepts. However, the natural interaction between participants stimulated a productive discussion and allowed the gathering of data in a timely manner, saving on this and other resources (Bergmann et al., 2005).

It also enabled direct interaction with participants, the clarification of certain issues and the formulation of follow-up questions for the next discussion – as opposed to the limitations posed by survey methods. Data was gained from opening up and reaching deeper levels of meaning through flexible discussions and connections made with participants (Bergmann et al., 2005; Maginn, 2007; Montuori, 2013).

Some participants, however, were hesitant to open up in this type of forum and interviews were held to ensure that everyone's views were included.

4.3.3   Interviews

Interviews are used to gather information and insights by working through a series of questions with study subjects either in person or through correspondence. Personal interviews can follow structured, semi-structured or unstructured formats. This study made extensive use of semi-structured interviews using open-ended questions.

This enabled participants to answer questions freely and provide much greater detail (Gubrium & Holstein, 2002). The more informal environment encouraged them to be open and honest (Warren, 2004; Davies, 2006).

The interviews allowed the researcher to follow up on questions with participants and explore their motivations for joining the forum. This process has therefore allowed the researcher to possess more control over what matters are discussed, as opposed to the lack of control in the focus group discussions. The use of interviews theoretically enables a deeper understanding of contextualised information, which is important for the research (Gubrium & Holstein, 2002; Lewis-Beck, 2004; Warren, 2004; Davies, 2006).

It is important to note, however, that interviews are time-consuming as they require prior organisation regarding appointments and take time to conduct, including the necessary travelling time to meet participants at a location of their choice (Davies, 2006). They can also open up space for participants to manipulate their opinions; for example, to garner approval from the researcher (Lewis-Beck, 2004; Warren, 2004; Rosaline, 2008).

It was challenging in this study to produce comparative data from use of this method because each participant had a different background and level of interest in the redevelopment of the Du Toit station precinct.

For the purpose of this study, however, the people who were formally interviewed are the landowners, the ward councillors, municipality representatives and the business operators at Du Toit station precinct. The reason for individually interviewing the landowners was to try gather opinions in terms of their interest in developing Du Toit station precinct. As landowners at the precinct they have the power to either support or oppose any suggested development concept (the list of the interviewees can be found in 0).

The data collected in this way is also not generalisable to the entire Stellenbosch population, because only the landowners, municipality representative, and ward councillors were formally interviewed.

Observation was used to bring myself into the process, in addition to my playing the role of facilitator.

4.3.4   Observations

The fieldwork process for the study consisted of informal interviewing, active looking, detailed note taking, and patience. The process of observing was used to collect data about the people involved in the research process, their perceptions, value and attitudes – through the focus groups and interviews. Observation is understood as "the systematic description of events, behaviours, and artefacts in the setting of the chosen study" (Pushor, 2008:93). Observation often "exists in a natural, unstructured, and flexible setting" making it an ideal method for a mixed methods research approach (Riessman, 2006:190). Observations provide direct information on the topic. For example, it allowed the dominance of certain voices to be noted, as well as interaction between participants. It includes observing non-verbal expressions. It established a deeper connection between me and the study participants, which eased facilitation of the focus group, for example, and it enhanced the quality of the data produced. The observation process improved the collection and interpretation of the overall research data (Warren, 2004; Pushor, 2008). It is, however, a time-consuming process requiring researchers to stay longer in the field, which can then affect participant's behaviour (Markham, 2008; Pushor, 2008). It may also result in the researcher assuming that certain events or behaviours are common, as opposed to time-related and incidental (Riessman, 2006; Markham, 2008; Pushor, 2008).

Transect walks provided a way to get to know the people, activities and functions of Du Toit station precinct in an informal environment.

4.3.5   Transect walks

Transect walks are planned systematic walks around a defined path of field research. The process requires researchers to carefully observe, listen and ask questions to gather pertinent questions (Pretty et al., 1995). This method is an important part of any strategy seeking to understand the real-life actuality of a study area (Negash, 2012). It is important that participants actively engage in discussions about their observations and experiences during the walk.

For this study the transect walk was along Bird Street/Du Toit station precinct, the Plankenburg industrial area and through Enkanini and parts of Khayamandi (see Figure 10). The group undertaking the walk comprised the departmental research assistant, the community-based co-researchers and myself.
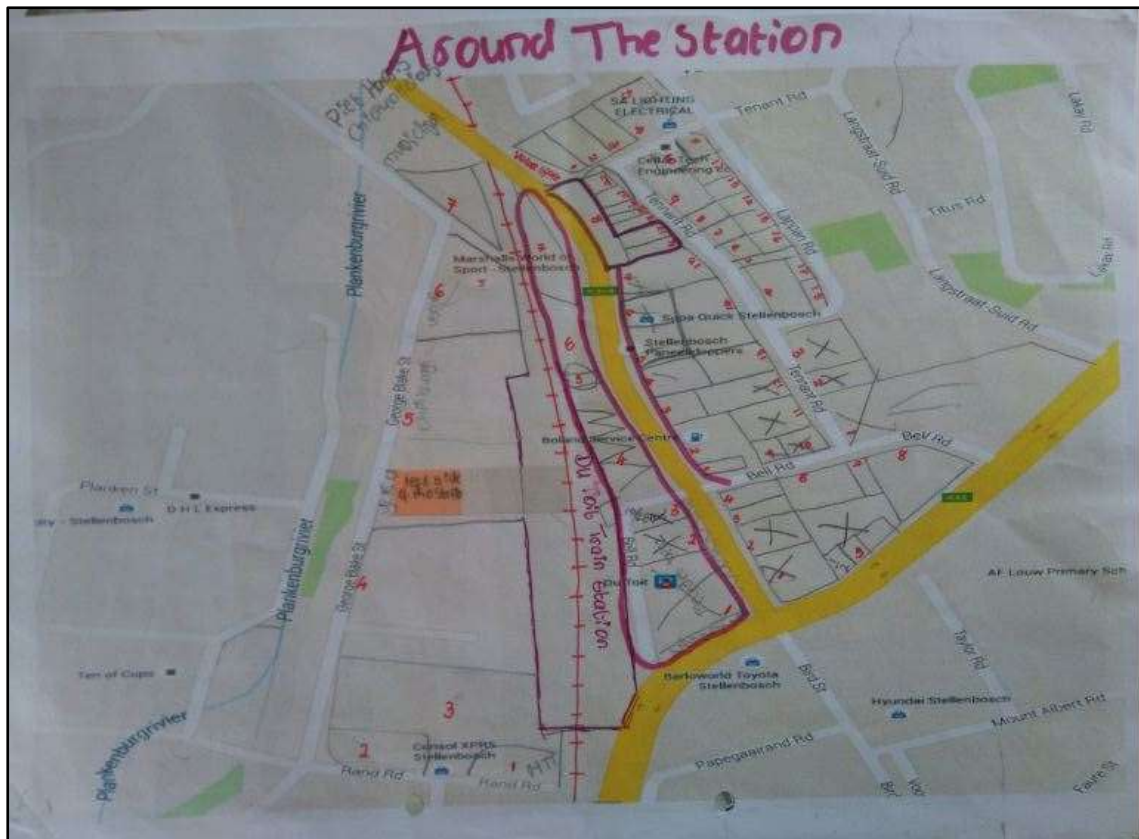
Figure 10: The field research transect walks journey

Source: Author using Google Maps (2016)

The walks were used to collect information about the context of the participants of the focus groups and to identify infrastructure problems and development opportunities.

This is a good choice of tool to gather information on distribution of infrastructure resources, existing landmark features, the social and physical landscapes, and land-use activities along the transect. The walks enable other social issues to emerge, such as the high levels of crime experienced by those residents that the group engaged with in conversation (Pretty et al., 1995).

While transect walks can help to identify problems, the effects and possible solutions (Pretty et al., 1995; Mukherjee, 2002; Negash, 2012), it is not possible for all research participants to walk together for a variety of reasons – some personal, some time-related, etc. As with observation, there is a danger that researchers determine conclusions based on what could be accidental situations or experiences (Negash, 2012). However, the benefits for this study were that the transect walk helped to identify key informants and to develop visualisation tools, such as photographs and maps.

4.3.6   Key informants

Key informants are those individuals with unique backgrounds and skills related to the research topic (Keddie, 2006; Levy, 2008; Mukhija, 2010; Jalil, 2013). They can usually access information that a researcher cannot access on her/his own and they can either play a role as key research participants or identify potential research participants and encourage them to join in the study.

In this study, key informants did all of the above and helped organise discussion venues and equipment. This study had four key informants. These were the representative from the University of Stellenbosch Community-based Research division; Rose Jordaan, a representative of landowners at Du Toit station precinct; the owner of the Nuts and Bolts shop owner at 135 Bird Street; and the Stellenbosch municipal ward councillor 14. Communication with these key stakeholders was on a one-to-one basis; the only time where the key informants shared opinions with each other was during the focus groups and forum discussions.

One of the advantages of having key informants for this study was their promotion of the research, thus bolstering the legitimacy of my involvement in the improvement of Du Toit precinct to other stakeholders. In addition, the key informants also help with specific research tasks, and are able to provide 'inside' information and guidance as to the research process.

In this regard, they helped the researcher to understand and interpret information gathered from other stakeholders, thus deepening contextual understanding (Keddie, 2006; Levy, 2008). The use of key informants also helped the researcher establish and build relationships with other stakeholders and research participants (Keddie, 2006).

It is, however, time consuming to build relationships with this group of stakeholders in the research journey. And the relationship itself can influence the data that is collected and how it is analysed because key informants could influence the study through their own bias and impressions. There can also be disagreements between them, which could be hard to resolve without jeopardising relationships and the study itself (Keddie, 2006; Mukhija, 2010; Jalil, 2013). An evident disadvantage in this study is that key informants tended to dominate focus group discussions.

It was necessary to conduct a document study to verify information gained this way.

4.3.7   Documents study

This research made extensive use of a document study – both of public records and personal documents. Vital insights and valuable information are often buried in existing records in documented form. Public records are useful as they describe institutional characteristics providing a historical background to a study – these include demographics, economic activities and development patterns over set periods. Public records, reviewed for this study, consisted of vital municipality statistics, census, past structural patterns, and some other business records.

Personal documents help the researcher review the way in which s/he engaged with the overall research process (Flyvbjerg, 2011). Information collected in this way is useful in identifying observation events and to generate additional interview questions (Zucker, 2009; Flyvbjerg, 2011). For this study, personal documents included daily planners, photographs, diary entries, letters of invitation for focus group participation, notes, scrapbooks from the focus groups, and some artworks (the sample pieces of the personal documents can be found in Appendix E).

Public records provide the opportunity to study historical trends. It is also easy and inexpensive to access information using this method as the material is locally available.

This method enabled important information about infrastructure development patterns in Stellenbosch to emerge, particularly that drawn from the municipal infrastructure development plans. Disadvantages to this method include that documents may be incomplete, inaccurate or have questionable authenticity. It can also be challenging to locate documents, making it sometimes a time-consuming process. In addition, access to some documents may be restricted (Flyvbjerg, 2006). For the purposes of this study, the quality of data was assessed by a quick scan and only public records with verifiable sources of origin were used. Personal records were used to add value where needed.

NVivo was used to manage data from the documents study, as well as that gathered through focus group discussions, observations, interviews and the transect walk. This was in efforts to ensure that the data was not tainted by my own personal perspectives and bias as NVivo automatically generates the most relevant information from the uploaded sources.

4.3.8   QSR NVivo 10

The validity, trustworthiness, integrity and robustness of research data must be enhanced when using the mixed-methods approach. NVivo is a computer-assisted data analysis tool that is designed to help researchers elicit deep-level analysis of rich

text-based data (Corbin, 2004; King, 2008; Smyth, 2008). This study used a variety of NVivo functions, which include the ability to manage data and ideas, handle data queries, provide visual modelling and reporting (Bazeley, 2007). It helped with the storage, search and retrieval of data using the in-built coding methods. It also provided flexibility in that I could easily analyse the relationship between theory and practical data, explore and discover new patterns of relationships, and safeguard data analysis results (King, 2008; Smyth, 2008). I was also able to code my personal experiences and thoughts.

It is time consuming to use the software and as most of the research participants were not familiar with the software, I had to produce the visualised data, such as the word clouds, to make the information easy to understand by all stakeholders. Figure 11 is a sample diagram of how NVivo was used to communicate urban development to stakeholders during forum discussion. This was done by storing urban development literature, videos, transcripts, maps and other sources, into the NVivo file and running a query by automatically generating words that represent what urban development is and different principles that it entails.

For example, if the reader now looks at Figure 11 the boldest and visible words are *urban, development, city, populous, areas, transitions, and transport*. What these represent is the brief word overview of what urban development is, and the least visible words are the supporting word characteristics of what the urban development concept in the context of this study is.
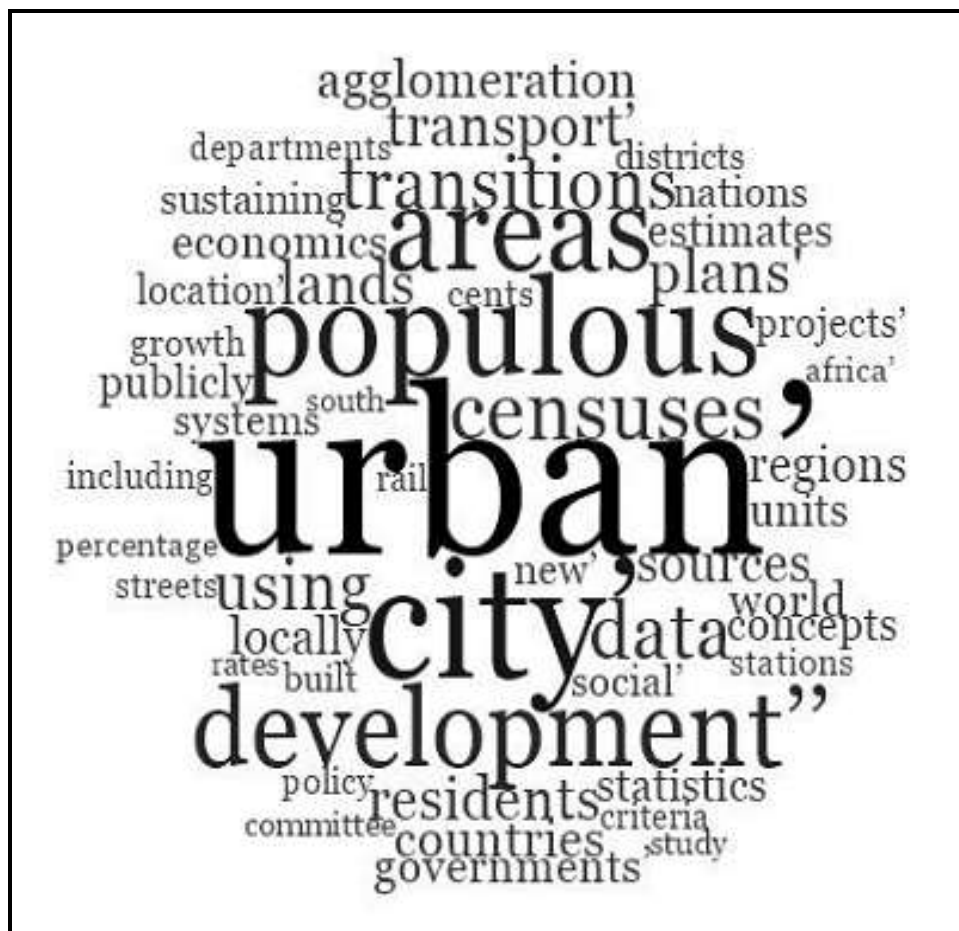
Figure 11: NVivo generated word cloud on urban development theory
*Source: QSR International Softwares, 2015*

The NVivo-generated word trees were used as a simplified mode of communication to the stakeholders. See Appendix F for other samples of word clouds representing concepts such as the apartheid city theory; urban land-use planning concept; the TOD strategies from other countries; the TOD potential for South African cities; the transport development supporting policies; and this study's research methodology.

NVivo proved to be the most compatible tool to be able to communicate the academic concepts to stakeholders not familiar with academic development theories. Within the forum, members were able to grasp the concept of integrated urban development and how the TOD concept could facilitate this integration in the context of Stellenbosch. Nevertheless, in terms of the NVivo compatibility, the toolkit is often criticised for the validity of its generated words cloud and words trees. This is because the person who select the sources is often the main researcher, and might possibly be biased towards certain theorists (Corbin, 2004).

Thus, Tableau, an innovative data-blending toolkit, was used to enhance the data descriptions generated through NVivo.

4.3.9   Tableau 9.3

Tableau is a data visualisation toolkit that is able to blend data from disparate sources (Tableau, 2016). It is designed for users with divergent skill sets to create and interpret data visualisation products. It was thus ideal for this study as a decision-making tool. Tableau does not have the formatting issues of NVivo and can instantly transform data into interactive visual forms (Tableau, 2016), including representations of data factors into maps, decision trees, and graphic visualisation form. As an example, Figure 12 represents the rate at which infrastructure investment has changed between 1994 and 2014 in South Africa. The rate at which South Africa has been investing in infrastructure since 1994 is compared to other African countries using World Bank statistics (The World Bank, 2015). The relevance of this comparison to the study is to highlight the importance of focused urban development integration in South African cities.
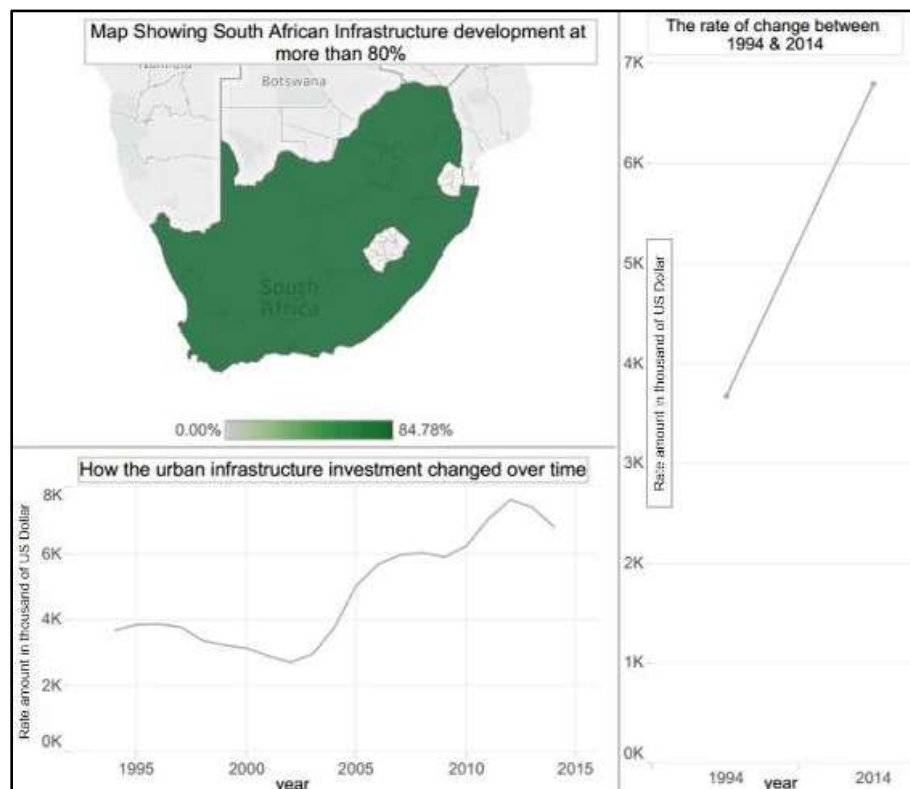
Figure 12: Example of Tableau dashboard representing the rate of change of infrastructure development in South Africa (1994–2014)

Source: Tableau, 2016

Tableau does not, however, support the transcription of audio data sources, outputs can be of low quality and they can appear incomplete because the software does not support maps, legends and scale information. It must be used in conjunction with other software, such as ArcGIS's ArcMap, to produce robust data analysis.

4.3.10 ArcGIS 10.2

ArcGIS is a geospatial database that translates geospatial data into maps through a visualisation process that uses cartographic methods and techniques (Jung, 2009). It uses different interfaces, such as ArcCatalog, ArcMap, and ArcToolbox, to create visual representations of various spatial contents and land-use activities (Steinberg & Steinberg, 2006). The ArcGIS maps can be used to visually display the location of the study area. Using the ArcMap toolkit illustrated in Figure 13 the author was able to visually locate the study area using the map layers starting with the world, then Africa, South Africa, the Western Cape province to Stellenbosch.

The ArcGIS maps have the ability to display and analyse the country's demographic information, such as population density, racial distribution and income (Jung, 2009). The visual layout of the South African population density can be found in Figure 14 The lighter shade of the colour represents less populated areas, where less than one inhabitant occupies 1 square kilometre of land. The areas with darker red and orange shades represent the highly populated areas where there are more than 1 000 inhabitants on 1 square kilometre of land. The figure indicates that in the Western Cape province of which Stellenbosch is the main study location, the area around the coastal line is highly populated. Figure 14 is an example of a choropleth map. A choropleth map has the ability to thematically represent the aerial units in proportion to the measured variables (Goodchild, 2009). The shading and the layers of the choropleth map were created using the 2016 mid-year population statistical release from the Statistics South Africa database. ArcMap obviously cannot document people's real life experiences, which are often documented using other forms such as text, videos, audio and other images (Jung, 2009). And there is some dispute as to the accuracy of the information with Goodchild (2009:467) noting that "GIS designers failed to ground their products in sound theory, preferring intuitive terms and explanations" of the toolkit. Generalisation of the data can also result in inaccuracies. Every effort was made to reduce errors and bias in the data collection process using the multiple methods described above.

Besides the desire to generate valid research results, there was also an ethical onus to ensure that study participants were not in any way compromised.
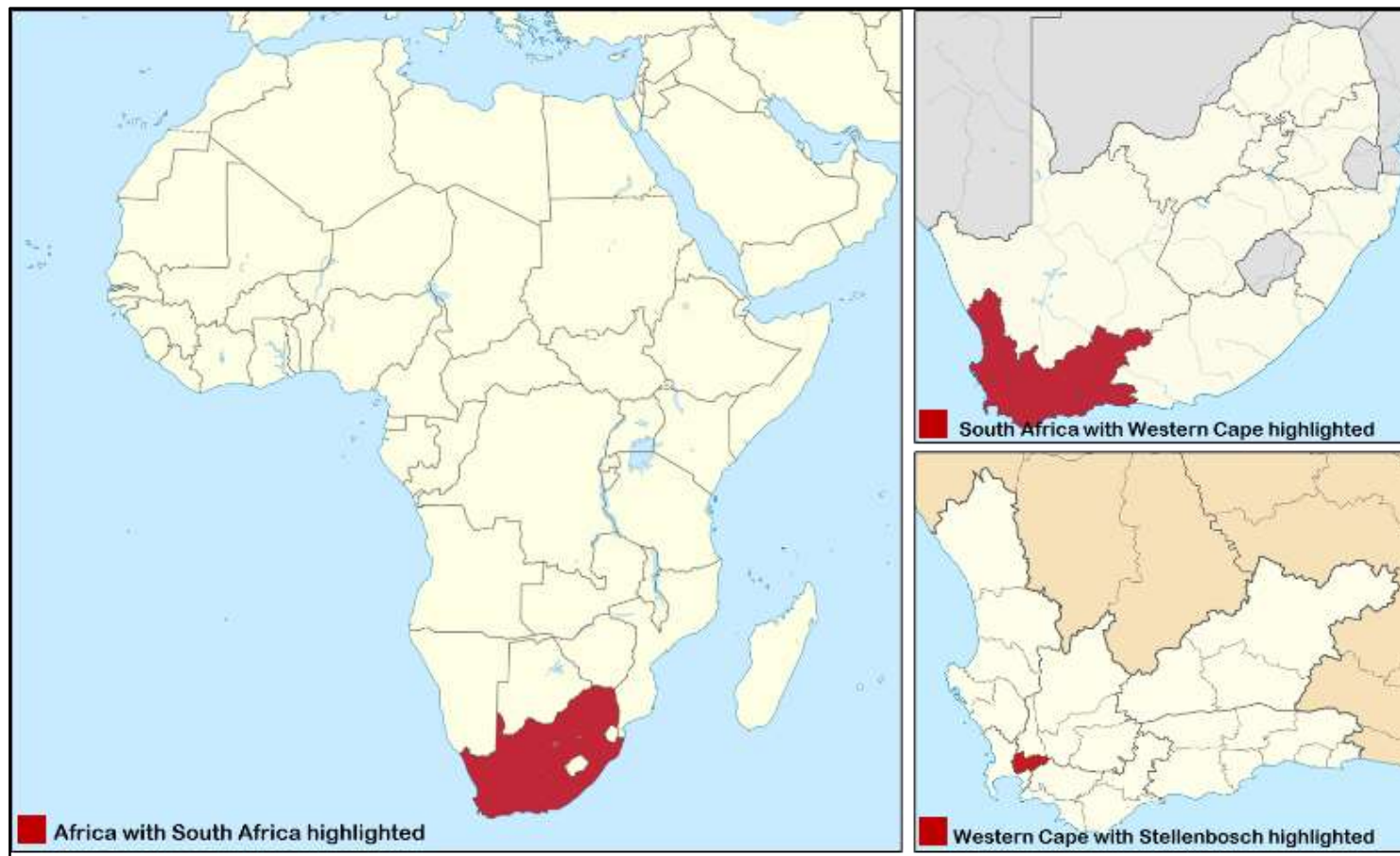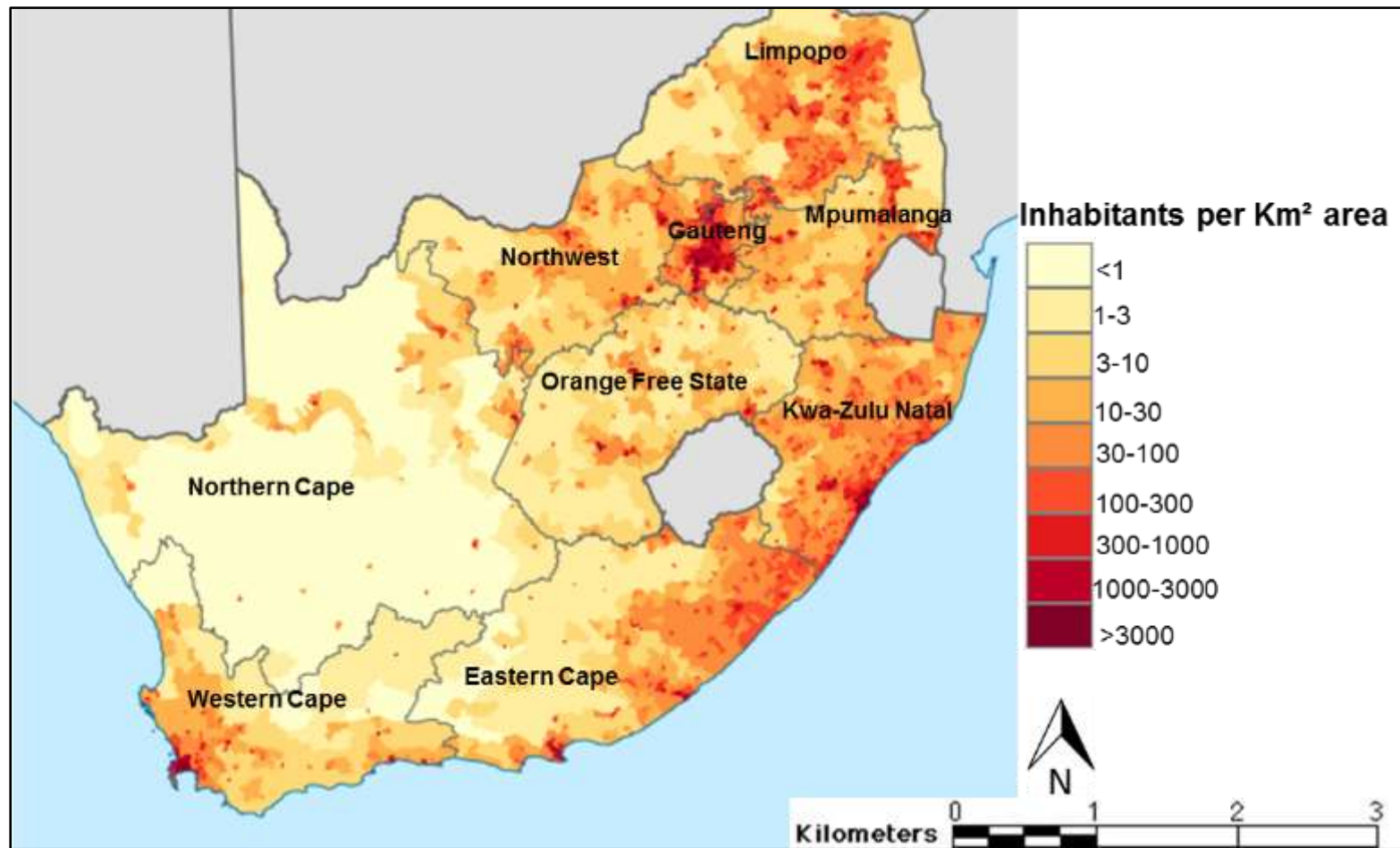
Figure 13: Geospatial data maps with Africa, South Africa, the Western Cape province and Stellenbosch highlighted

Source: Esri, 2016

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Figure 14: The South African population density (mid-2016 estimate)

Source: Esri, 2016; Statistics South Africa, 2016

4.4   Triangulation

The TDR nature of the study and use of mixed methods meant that triangulation of the collected data was an important aspect. Triangulation is defined as a strategy to improve the validity of the research findings in order to eliminate bias (Mathison, 2011). Triangulation is used to maximise the strength of the weaknesses between used methods and theoretical explanations. The basic principles of triangulation consists of data triangulation, investigator triangulation, theoretical triangulation and methodological triangulation as explained by Denzin (1978), expanded by Mathison (2011) and visually presented in Figure 15.

Triangulation was used in this research because conducting a TDR study in particular requires that the collected and analysed data is verified and tested for reliability as explained by Rothbauer (2008). Rothbauer (2008) makes use of triangulation as a way to explore, identify and understand different dimension of the research, in order to strengthen the interpretation of the research findings. Figure 15 visually presents how the researcher achieved a deeper understanding of the importance of using public transport to integrate the previously segregated South African urban spaces.
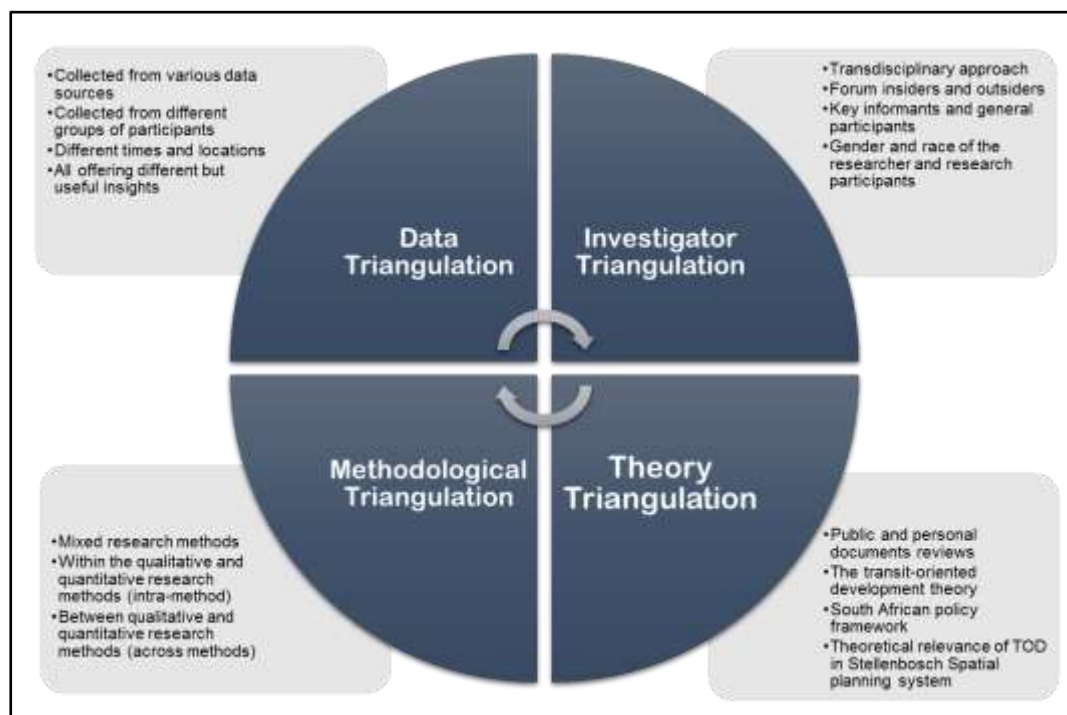
Figure 15: Visual representation of triangulation types

Source: Denzin, 1978; Rothbauer, 2008; Mathison, 2011

4.4.1 Data triangulation

Evidence was drawn from various data sources throughout the research process to increase the credibility of this study. These sources included academic journals, books, policy documents, archives and historical documents, public records, interviews, videos, photographs, and participant observation processes. The motivation behind the use of various data sources for the data triangulation was that "each type of source of data will yield different evidence that in turns provides different insights regarding the phenomena under study" (Rothbauer, 2008:894).

4.4.2 Investigator triangulation

The investigator triangulation process was done by incorporating the additional insights about the study gathered from the field research participants, the focus group members, key informants and co-researchers. These participants were active members of the research process. Furthermore, these investigators were given opportunities to triangulate the main researcher's conflicts and biases using sometimes competitive theories. Authors such as Rothbauer (2008) suggest that it is important to use the research participants and co-researchers for the data validation process and for commenting on the overall research findings.

4.4.3 Theory triangulation

Theoretical triangulation refers to the examination of the findings through the use of different theoretical lenses to overcome the biases that the researcher might have (Rothbauer, 2008). The use of theoretical triangulation for this study has allowed the researcher to attain deeper insights regarding the use of the TOD approach to integrating segregated urban spaces.

4.4.4 Methodological triangulation

Methodological triangulation often refers to different methods used to gather the data for the research (Denzin, 1978; Mathison, 2011). Following the principles of TDR, this study made use of mixed methods for the data collection and analysis process.

These range from the case study, focus group discussions, interviews, observations, transect walks, key informants, documents study, NVivo, Tableau and ArcMap. The mixed methods were used to provide diverse perspectives regarding the concept of using a TOD model to facilitate the integration of urban development patterns.

Therefore, the data collected using qualitative methods was triangulated using the quantitative and visualisation methods.

This research has used triangulation on the assumption that the weaknesses of each research method would be compensated by the strength of another. However, the triangulation approach also provides its own tension in that verification of multiple data sources is tricky and can result in inconsistent findings. Hence, it was important for this research to abide with the Stellenbosch University Research Ethics Committee.

4.5   Ethical considerations of the research

Because of the TDR nature of the study, which involved people, ethical clearance was an important first step. The Stellenbosch University Research Ethics Committee approved the request for ethical clearance. Standard ethics rules are the use of voluntary participation, confidentiality, privacy, and informed consent (Hammersley & Traianou, 2012). The following steps were taken to abide by the study's ethical obligations.

- Participation in the study was voluntary.
- Participants gave their informed consent, which enabled them to have "access to full and accurate information that enables them to know how best to act by their own lights in the circumstances they face" (Hammersley & Traianou, 2012:80).
- Information gathered from participants was protected and their names and personal details were kept confidential. This was important given the controversial nature of land and infrastructure development in South Africa.

All of these steps helped to ensure that the study was conducted with honesty, integrity and respect, and took into consideration the views of the research subject (Davies, 2006; Hammersley & Traianou, 2012).

There are some challenges regarding informed consent in that it can be impossible for researchers to develop or elicit consent that is fully informed, and participants sometimes choose to participate, but do not want to sign official forms. For example, the participants in the focus group discussion did not want to sign the consent form as most of them needed their legal representatives to look at the details of the consent form first. However, all gave vocal consent to participate in the study.

4.6   Positionality of the researcher on the methods used

Positionality of the researcher is defined as (Gregory, Johnston, Pratt, Watts & Whatmore, 2009:556):

> … the researcher's social, cultural, and subject positions [that] affect the questions they ask and how they frame them.

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> *Their relation with the field research participants and interpretations they place on empirical evidence. The access to data, institutions and outlets of research dissemination. In addition, the likelihood that they would be listened to and heard.*

According to Reinharz (2011), it is important for the researcher to offer a reflexive positionality in terms of what influenced the choice of specific research methods. My choice of research topic, methods and overall process was influenced by my culture and personal background. This section reports on my process of self-examination of the relationship between myself and the study participants.

I am a black South African woman born in the late 1980s. I grew up in a democratic South Africa and went to school in the northern part of the country. I moved to the southern part to attend university and am currently still living in this region. Prior to embarking on this study, I undertook a post-graduate diploma at the Sustainability Institute outside of Stellenbosch where the classes comprise students from a multiplicity of cultural, working and academic backgrounds. My main mode of transport during this period was the train where I would hear a diversity of stories – both from other students about ways in which to change the world and from commuters about the struggles they had in their daily lives because of spatial division in Stellenbosch, the poor train services and lack of reliable, safe and affordable public transport. Their story was sometimes one of a loss of hope in the vision of an integrated and peaceful South Africa.

I started this research journey in the hope of finding strategies that would help bring that vision into being with a focus on integrating segregated urban spaces and improving public transport services. TOD seemed a viable strategy in this regard.

Following the preliminary completion of this research, I started to reflect more deeply on the experiences I had during the process and my choice of research methods.

My personal 'story' could have influenced the way in which I created the purpose and objectives of the study, as well as the choice of methods. I reflected on the following aspects in particular:

- The influence of my positionality as an African woman conducting research on issues involving urban land.
- The ways in which I used my positionality in different field settings.
- The ways in which my positionality influenced my interaction with research participants.

These aspects are briefly explored below.

4.6.1   Black female positionality in this TDR project

What does it mean as an African woman to critically examine issues of urban land, such as segregation, underdevelopment, poverty and lack of access to basic services? I did not want to appear as a representative of or as doing research on behalf of African communities. There were advantages and disadvantages to being an African woman conducting this type of research. A disadvantage is that I found it sometimes difficult to connect to male participants who were more forthcoming if a male research assistant accompanied me, on the transect walks, for example. Landowners, in particular, seemed to trust my intentions regarding the project and perceive them as more valid if I was accompanied by a man. While this is not ideal, it is important to note that in these circumstances, it could be worth using a male spokesperson to enable faster data collection.

The advantage of my positionality was, however, that being African and a woman I was able to leverage support for the successful completion of this study. Participants and fellow academics displayed a genuine interest in seeing me successfully complete my degree. I felt that they automatically gave me a certain level of respect, which was manifested in the focus group discussions, my relationships with key informants, and the more formal interviews. I also after a while received a security escort from participating landowners for field observations and transect walks to ensure my personal safety. I was able to effectively facilitate the focus group discussions as most participants knew me and understood my intentions. I also received free technical assistance regarding the software.

This kind of support, however, might originate from participants feeling "white guilt"[1]. It is not possibly to determine whether this is what it was. It was thus important to understand my positionality and how it could influence the research, and, according to Reinharz (2011), maintain that particular position throughout the process in the different field settings.

A further aspect of my positionality that influenced my interaction with participants was my level of education, which provided me with a certain authority regarding issues such as Stellenbosch's development patterns and how they could be changed. I could exert this influence in the interviews through the types of questions I asked and the focus group discussions, where I also had control of the duration of the sessions.

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[1] White guilt is defined as "the individual or collective guilt felt by some white people for harm resulting from the racist treatment of ethnic majority, by other white people both historically and currently, which becomes the psychosocial cost of racism for white individuals along with empathy for victims of racism" *(Spanierman & Heppner, 2004:251)*

4.7 Summary

This chapter offered a detailed description of the methods used in this study. The research was designed in a descriptive, correlational and explorative manner. The use of a TDR strategy made provision for studying real-world problems in the specific location of Stellenbosch and identifying ways in which they could be solved. The use of a case study made it possible to generate a rich description of the study area and highlight its importance for land-use activities and transport development. It enabled the investigation of existing phenomenon of urban development segregation and the various factors that have brought this phenomenon about. Various methods were used to supplement this description: focus group discussions, interviews, observation, transect walks and key informants. These allowed the evaluation of the correlational relationship between land-use development and public transport services. The document study and use of the NVivo, Tableau and ArcGIS software programmes were used to more objectively explore the various data sets.

The use of mixed methods in the study allowed data to be triangulated to increase the validity and reliability of the study. This triangulation was applied on the assumption that the strengths of one method would compensate for the weakness in another.

The ethical considerations for the study were outlined along with the researcher's positionality as an African woman researching issues around urban land use.

Chapter 5 presents the findings generated by the methods described in this chapter. These are categorised in a descriptive, correlational and exploratory manner. Chapter 6 follows with an overall discussion of the study.

Chapter 5: Findings

5.1 Background

This study set out to answer the following two research questions.

1. To what extent can the diverse stakeholders in Stellenbosch, such as Stellenbosch Municipality, Stellenbosch University researchers, landowners, business owners, community members and interested parties collaborate and use TOD principles to redevelop the Du Toit station precinct?
2. Can the re-development of Du Toit station precinct using the TOD approach facilitate urban mobility and spatial development integration?

The study objectives (discuss the historical and current legislative framework, present the correlations between public transport planning and land-use activities, establish the forum, facilitate stakeholder collaboration and develop a long-term plan for redeveloping Du Toit station precinct) helped to guide the research process and answer the questions above. These objectives were designed in a descriptive, correlational and exploratory manner, which has framed the way in which the research findings are presented in this chapter.

The descriptive findings present the motivation for redeveloping Du Toit station precinct. The correlational findings present the results of the Bird Street/Du Toit station urban district improvement forum discussions. The exploratory findings speak to the creation of the Bird Street/Du Toit station urban district infrastructure improvement forum itself.

This chapter only reports on findings and the overall study outcomes. Chapter 6 focuses on a discussion of these findings.

## 5.2 Descriptive findings: The choice of Du Toit station precinct for TOD

This section outlines the descriptive findings that provide a rationale for choosing Du Toit station precinct as a suitable site for TOD implementation, as opposed to other station precincts in the town. These findings are an extension of the detailed overview of the precinct supplied in Chapter 3. There were three motivating factors driving the choice of Du Toit station as the location. These were the spatial design of Stellenbosch (shaped by historical forces), the current state of infrastructure at the location, and the socioeconomic profile of the precinct.

5.2.1   The historic spatial layout of Stellenbosch

The documents study illuminated a variety of factors that have shaped Stellenbosch's spatial segregation. Records found in the historical archives indicate that Stellenbosch had been spatially organised in a segregated way prior to the apartheid era. The earliest aerial image of Stellenbosch taken in 1679 is presented in Figure 16 (Van Zyl, Morkel, Smart, Carstens & Vos, 2016). It is clear from the image that people started to develop infrastructure in the area that is today the central business district. Dorp Street had already been built by 1679; it is one of the oldest urban streets in the country. Today it is a world-renowned infrastructural heritage site. Development then spread across to the south of Stellenbosch, the R44 area marked on the image, which leads towards Somerset West and Gordon's Bay. The area to the north, which today is home to the Du Toit station serving the local communities of Khayamandi, Cloetesville and Enkanini, was designated as farm land.

Figure 17 presents the second-oldest image of Stellenbosch found in this research process, depicting the town in 1710. Development continued to spread in a southerly direction from the central business district to Dorp Street, and new suburb known today as Die Boord. The area towards the modern-day Khayamandi and Cloetesville was slightly developed as a farm workers' settlement area, close to the farms. In essence, development served to provide labour for farms and the town.

These images and those following provide the motivation for channelling infrastructure investment into these traditionally marginalised areas, including the Du Toit station precinct.
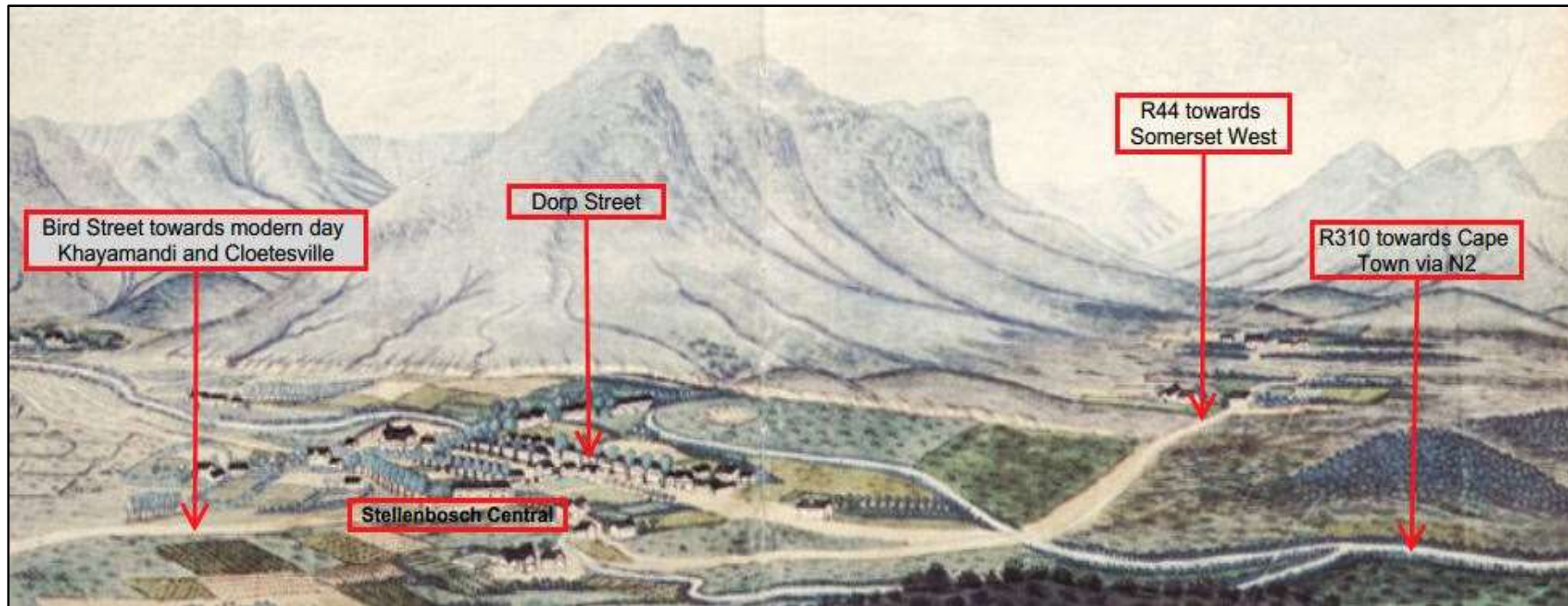
Figure 16: Print of a painting depicting the spatial lay-out of Stellenbosch in 1679

Source: Van Zyl et al., 2016
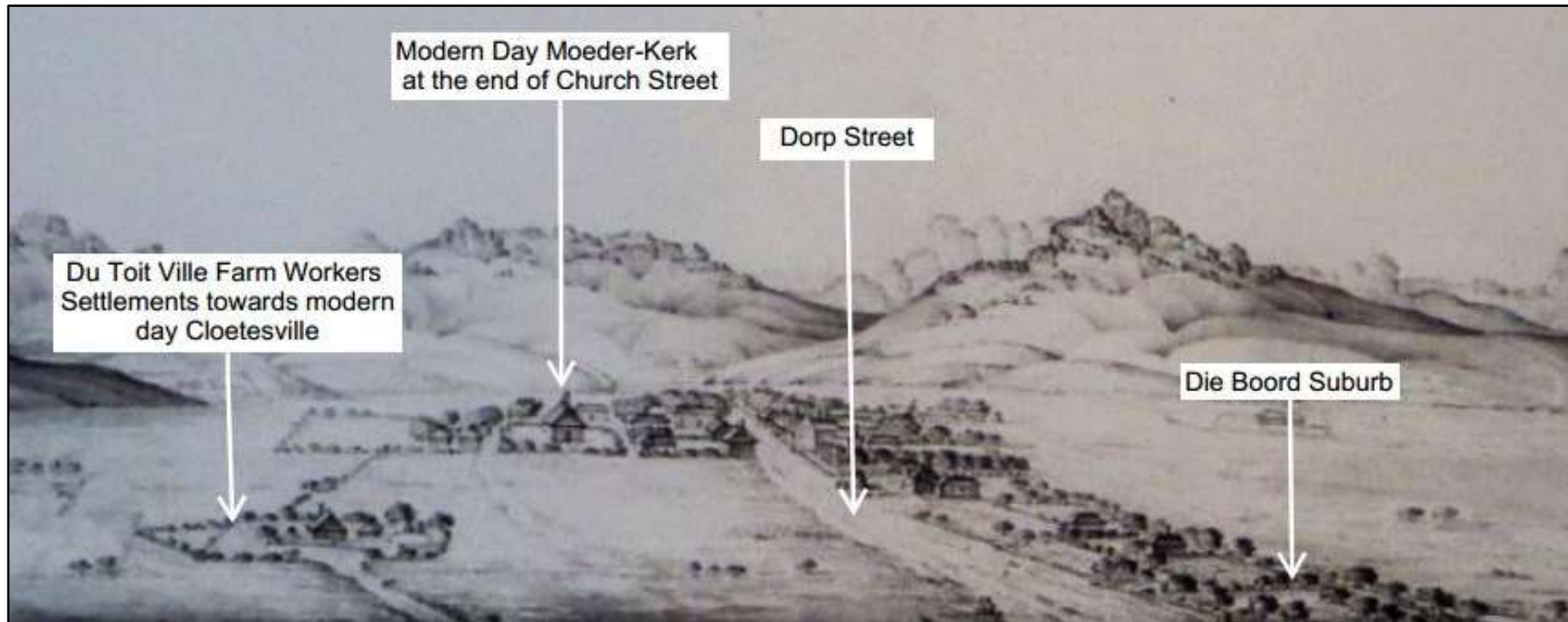
Figure 17: Print of a painting depicting the spatial lay-out of Stellenbosch in 1710

Source: Van Zyl et al., 2016

5.2.2   The current state of infrastructure at Du Toit station precinct

The photograph below provides a visual description of the Du Toit station precinct. The area is characterised by low-density development and infrastructure in an advanced state of degradation. This is one of the least attractive areas in the town and it experiences high levels of crime.

Photo 4: The structural condition of Du Toit station precinct
Source: Author

The Du Toit train station is, however, functional and it serves as a primary mode of transport for the majority of the population that resides in the surrounding communities. The road and transport infrastructure is represented in Photo 5. Mini-bus taxis serve to connect the train station and places of employment, study and recreation. There is, however, no proper infrastructure in terms of a taxi rank or any other public transport interchange. Mini-bus taxis use an open area under the bridge as a rank; this area has been deemed an illegal stopping point for this purpose by the municipality. There is a clear need for an extensive overhaul of this node by investing in multi-functional infrastructure, which is serviced by efficient public transport services.

Photo 5: The current road and public transport infrastructure (2016)
Source: Author

5.2.3   The racial and socioeconomic spatial division of Stellenbosch

<u>The racial division</u>

The racial divide is still clearly apparent in Stellenbosch. Figure 18 provides an illustration of this divide in 2013 using a race map to highlight that residential areas are highly concentrated according to race. The density of the dots depicts population density. The red circle indicates the Du Toit station precinct.

For the most part, the white population resides in the relatively low-density areas, including the central business district and the southerly suburbs of Die Boord and Brandwacht. Most of the African and coloured residents live to the north of the central business district in Khayamandi, Idas Valley and Cloetesville and are served by the Du Toit station. These areas are traditionally high-density in terms of population. The outlier community to the north is the gated community of Welgevonden, home to mainly white residents. This image indicates the lack of integration between races in Stellenbosch. Infrastructure development in previously marginalised areas can help to do this.
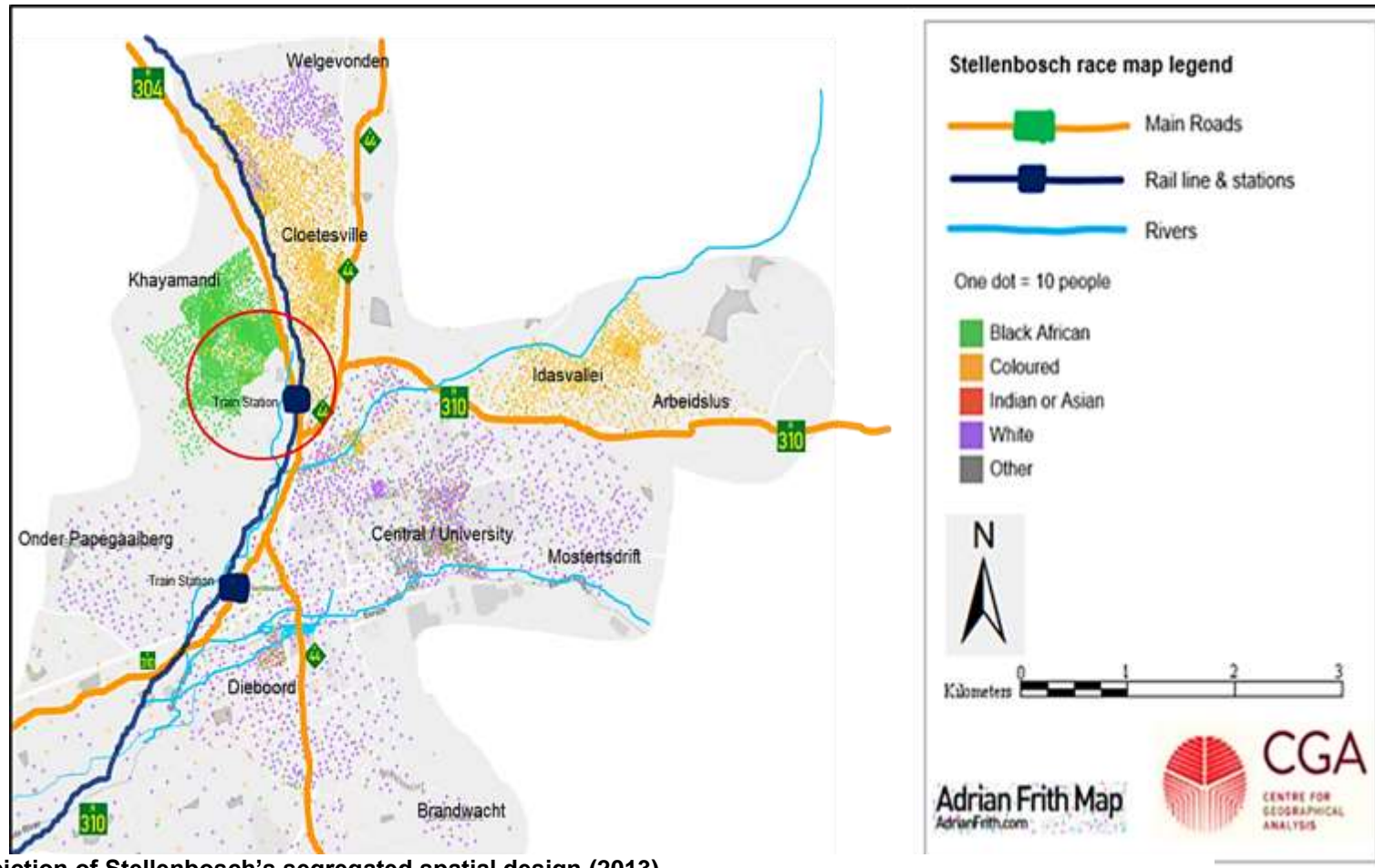
Figure 18: Depiction of Stellenbosch's segregated spatial design (2013)

Source: Western Cape Government, 2014; Statistics South Africa, 2016

Household income

Figure 19 illustrates the differences in average household incomes for the town. These statistics were drawn from South Africa's census data and then plotted on the map using the physical address provided in the census data. Those households with the lowest average incomes reside in the Du Toit station precinct and are mostly African and coloured. Those with higher incomes are concentrated in the central business district and the more southerly suburbs. The racial divide echoes a socioeconomic one. The historic lack of or underinvestment in the communities residing to the north of the town has resulted in the marginalisation of these residents.

Correlational assumptions: the apartheid structure of Stellenbosch

Looking at these two images, one can make the assumption that the residents of Stellenbosch are still divided along the race and socioeconomic divisions entrenched during the apartheid era as according to Figure 20. In short, it remains an apartheid city more than 20 years after apartheid has been abolished. Stellenbosch needs visionary, yet realistic, strategies to reshape the town. This study has been motivated by the possibilities of using the TOD model to facilitate spatial integration through a redevelopment of the Du Toit station precinct. For this reason, the study set as an objective the establishing of a forum to focus on redeveloping the precinct.
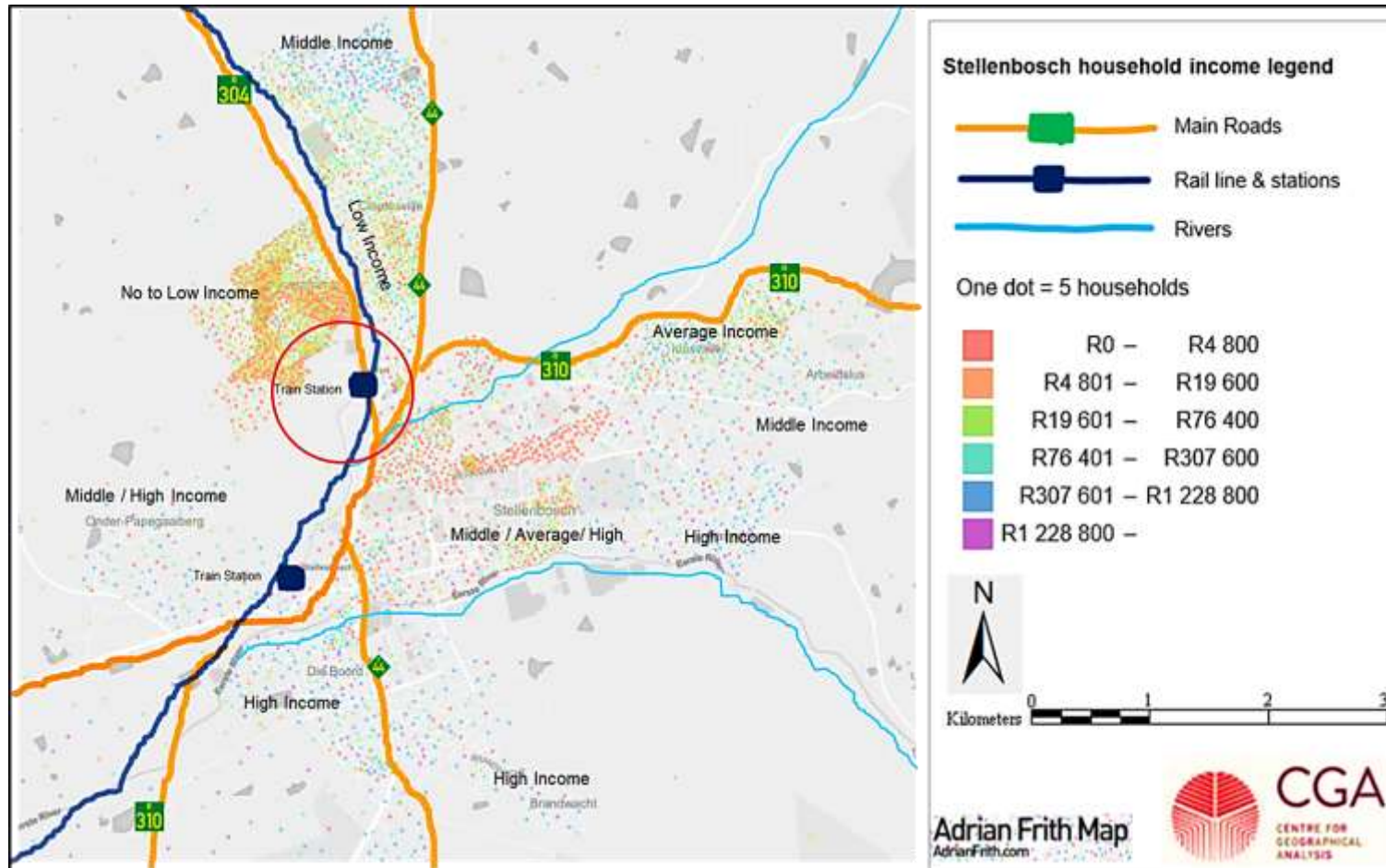
Figure 19: The average household income in Stellenbosch (2013)

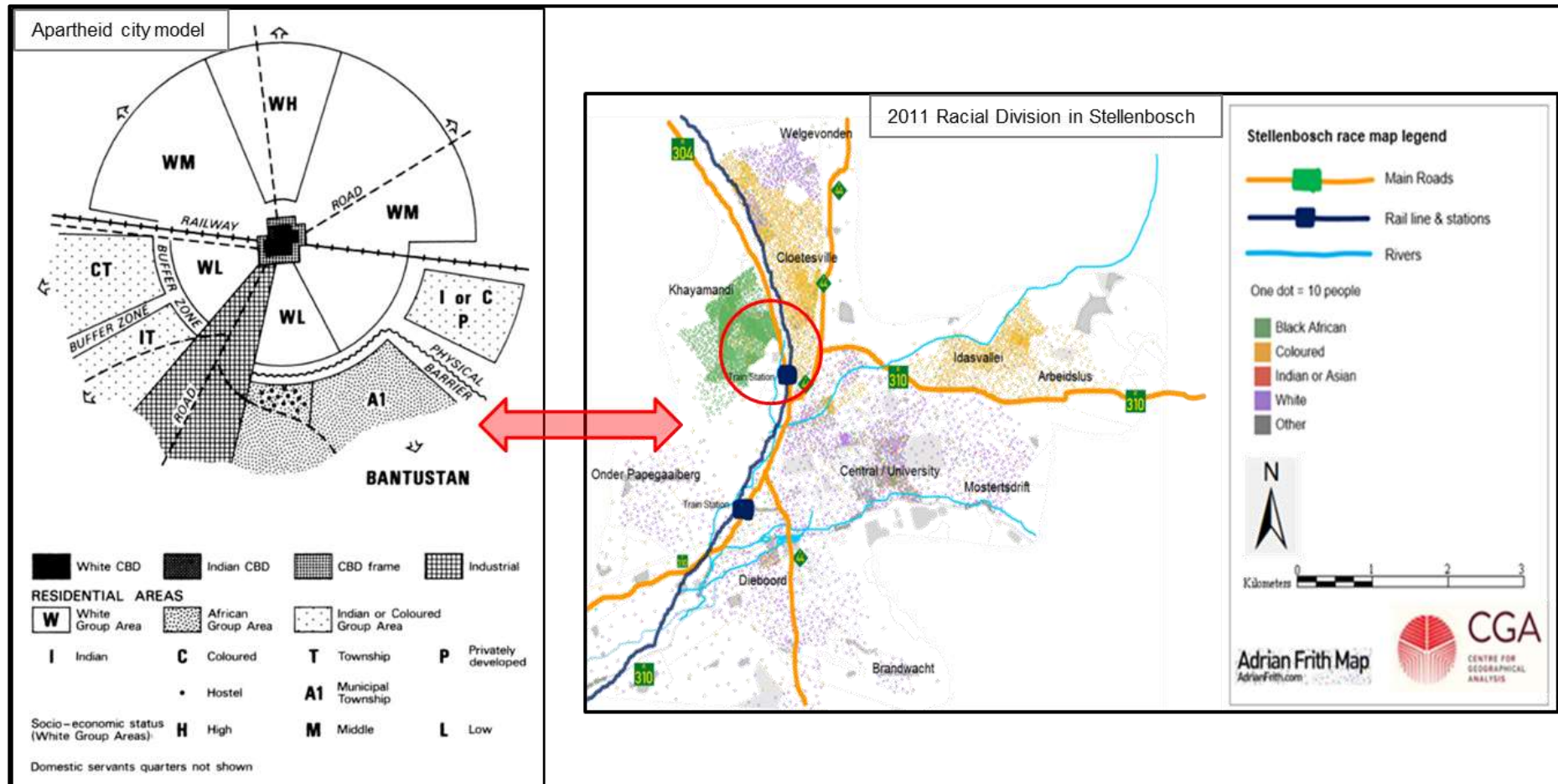*Source: Western Cape Government, 2014; Statistics South Africa, 2016*

Figure 20: The resemblance of Stellenbosch racial division to the apartheid city model

Source: Davies, 1981; Western Cape Government, 2014; Statistics South Africa, 2016

The following section provides an overview of the correlational findings and provides a visualisation of a potential redeveloped future for the Du Toit station precinct.

5.3 Correlational findings: The Bird Street/Du Toit Station Precinct Urban District Improvement Forum

5.3.1 Overview

There is an urgent need to find alternative strategies to solve the issues arising from the rapid rate of urbanisation. A most pressing issue is the lack of sufficient infrastructure. Addressing such issues requires the collaboration of a diverse range of stakeholders, including researchers, community members, business owners, and private institutions.

5.3.2 Procedures and participants

The collaborative partnership between the diverse stakeholder participants, such as the university, landowners, developers, public institution, and surrounding Stellenbosch community members held a first explorative meeting with the purpose of improving the Du Toit train station precinct. The initial purpose of the first collaborative discussion was to learn more about the functions, development potential ideas, and the precinct's important needs. This collaborative partnership led to the formal creation of the Bird Street/Du Toit Station Precinct Collaboration forum, in March 2016.

The forum participants met once a month and engaged in the facilitated infrastructure improvement discussions for the precinct. During the forum discussions, participants were encouraged to share their personal ideas on how to improve the Du Toit station precinct. They were asked, to contribute to a planning effort designed to identify and address precinct challenges and opportunities, which affect the landowners, surrounding community, business, and the wider public. I maintained regular and reasonable contact with participants and engaged in discussions regarding the personal ideas they had for improving the precinct. These discussions contributed to a planning effort designed to identify and address precinct challenges and opportunities that affect the landowners, surrounding community, businesses, and the wider public.

5.3.3 The objectives of the forum

The forum used the objectives of the research study to guide discussions. The purpose behind its establishment was to learn more about the function, development potential, and community needs for the precinct, and to consider the first steps to establishing collaboration among landowners to improve the area.

This collaborative partnership spoke about the following issues at meetings:

- The infrastructure needs of the train station and the precinct.

- The needs of the businesses in the station and the precinct.

- Ways in which to encourage landowners to work together to keep the area attractive and safe.

- How to initiate improvements to the street and precinct.

Forum members were encouraged to also think about short-term strategies to improve the precinct, including finding systematic solutions to the issues of traffic congestion, crime and degrading property values. They also explored how the TOD model could help to facilitate urban development and the various funding opportunities for investment in public infrastructure.

The following sections provide a brief overview of the various research findings and emergent findings from the forum discussions. These findings are the importance of infrastructure diversity, the validity of development density at the precinct, and also the creation of the transformative design for the Du Toit station precinct.

5.3.4 The main findings

Infrastructure diversity

TOD principles suggest that establishing diverse activities in an area designated for development will attract a diversity of users and, thus, encourage integration. Through discussions, the forum identified that there was a lack of vibrant urban activities in the Du Toit station precinct. Figure 21 indicates some potential urban activities that could be implemented to encourage a diversity of users to visit. These included modern office spaces, student accommodation and local restaurants.
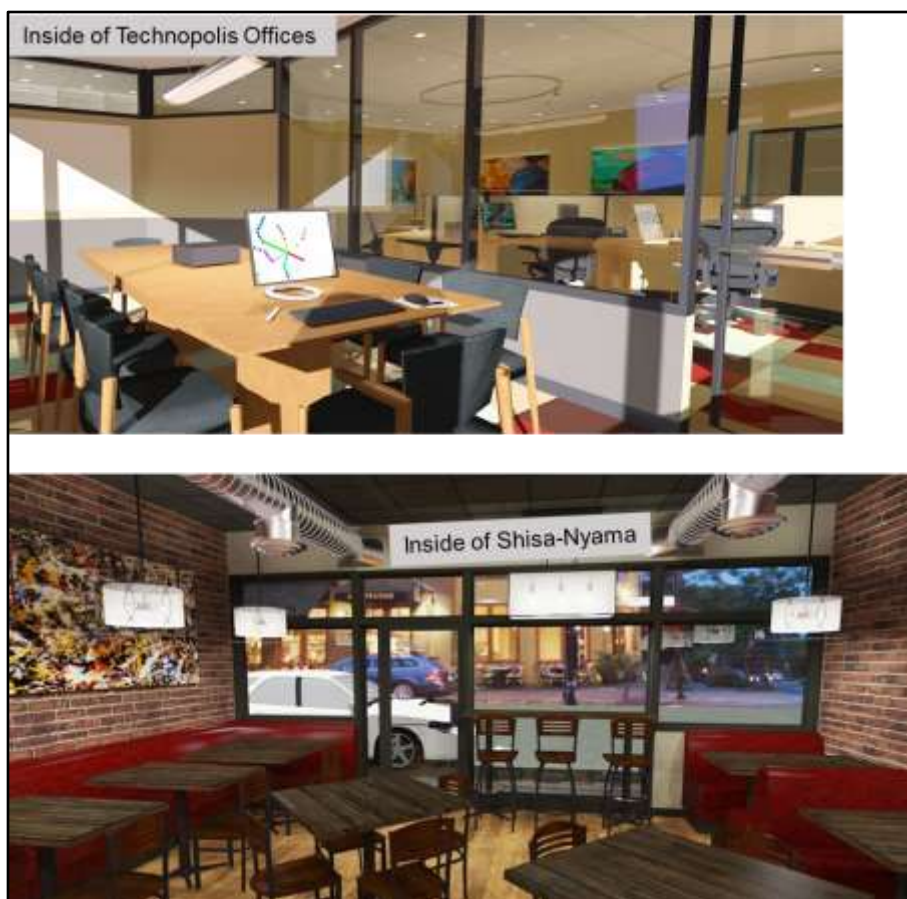
Figure 21: Potential indoor office and restaurant design for Du Toit station precinct

Source: Collaborative Stakeholders, 2016

Development density

Density is a key factor in the TOD model, which encourages the clustering of activities around public transport interchange points by concentrating places, people and livelihoods in those spaces (Newman & Kenworthy, 1991; Cervero & Kockelman, 1997; Ndebele & Ogra, 2014). Du Toit station precinct would need to be densified to accommodate a diverse range of activities, as currently there is not enough space. The forum identified a location that could be densified, see Figure 22.

Transformative design

The forum designed a prototype model for an infrastructural transformation of the precinct. Photo 6 provides an example of buildings that could be demolished to make space for apartments for youth and student accommodation. It was noted that mixing student and youth accommodation could aid the integration process. Photo 7 depicts a vision for redevelopment of the precinct. I designed the model based on the ideas that emerged from the forum discussions. The model was then revised following its presentation to the forum.

Figure 22: Potential locations for density development at Du Toit station precinct

Source: Stellenbosch Municipality, 2014; Collaborative Stakeholders, 2016

Photo 6: A depiction of the potential transformation of the Du Toit station precinct

Source: Collaborative Stakeholders, 2016

Photo 7: The vision layout of the multi-functional integrated Du Toit station precinct

Source: Collaborative Stakeholders, 2016; Author

5.3.5 The emergent forum findings

There were a variety of discussions undertaken at the forum. One such discussion led to the creation of the Ghetto Art Gallery. This was done as a short-term initiative to beautify the precinct and encourage residents of other parts of Stellenbosch to visit the precinct area. The gallery was established in a vacant building. The Ghetto Art Gallery is still in existence and has run a series of events. Photo 8 illustrates what the venue looked like before the gallery was opened. Photo 9 shows a multicultural event held on 24 September 2016, Heritage Day, indicating how the space acts as one of integration.

Another short-term initiative was the design of a road-expansion model, see Figure 23. The design was created with scaled details and is implementable if the budget is found. The figure indicates the expanded streets, a new parking lot and a formalised taxi rank, which could serve as a multimodal connection between the station and surrounding suburbs.

Photo 8: Creating the Ghetto Art Gallery
Source: Collaborative Stakeholders, 2016

Photo 9: Heritage Day event at the Ghetto Art Gallery 2016
Source: Author

Source: Collaborative Stakeholders, 2016

Figure 23: The design for expanding the road in the Du Toit station precinct

5.4 Exploratory findings: The creation of a multi-actor collaborative discussion forum

5.4.1 Background

A series of steps were followed to create the forum, including consulting with stakeholders and building the necessary relationships. As a contribution to the science of TDR, this section outlines the different stages that I undertook to establish the Bird Street/Du Toit Station Precinct Urban District Improvement Forum. These findings are exploratory in nature because they outline possible guidelines for using the multi-actor collaborative forum approach in the vision-creation stage of the TOD model. The document study (encompassing personal journals and photographs as well as public documents) was a vital part of this exploratory process. In particular, the personal documents helped me to review the way in which I engaged with the research process, as noted by Flyvbjerg (2011). The following subsections outline the six stages of stakeholder engagement undertaken.

5.4.2 Stages of stakeholder engagement

Discussion issue specifications

The researcher must specify the issues that the forum will focus on. The study's first research question provided the primary topic for engagement with prospective stakeholders. The question asked to what extent a diversity of stakeholders can collaborate and use TOD to facilitate the redevelopment of the Du Toit station precinct. The primary topic was therefore identified as the future development of Du Toit station precinct. The research question also provided broad guidance as to the prospective stakeholder groups, including government, civil society, business owners and community residents. The second step was consultation with prospective stakeholders to initiate the building of strong relationships.

Consultation

Understanding the behaviour, attitudes and beliefs of stakeholders is important in a TDR study. Consultation is a strategic way to start building long-term constructive relationships with prospective stakeholders. Useful methods for consultation with this objective are focus group discussions, transect walks, interviews and observation.

Using my own reflexive positionality through the consultation process I was able to track and identify the needs, expectations, perceptions, and attitudes from the various stakeholders.

This enabled me to understand the way in which they communicated, their level of interest in the topic and their biases prior to inviting them for further discussions; i.e. through the interview process.

The context of a study determines the form of the consultation process. Consultation in this study became an ongoing engagement process between myself as the researcher and the stakeholders. This process was time consuming, particularly when done on a one-to-one basis as these meetings required focused attention on the stakeholder's comments, as well as the monitoring of her/his perceptions regarding urban spatial integration and the improvement of public transport. This ongoing type of engagement does, however, ensure that stakeholders buy into the project and become actively engaged, making informed decisions. Literature points out that the efficiency of the consultation process is a key element of successful project implementation because when stakeholders are consulted they tend to feel a greater sense of responsibility to and ownership of the project (Maginn, 2007; Marthu, Price, Austin & Moobela, 2007; Pushor, 2008; Xing et al., 2009; Houghton & Stevens, 2011).

Consultation is a necessary step prior to building relationships with stakeholders; these relationships are pivotal to the success of a study.

5.4.3   Relationship building

Relationships need to provide both parties with benefits to generate successful results. There are different ways of building relationships with people. Some general aspects to building the necessary beneficial relationships in this study are outlined below.

- **Assessing the strength of the relationship:** It is important to realise whether a connection has been made or not to support a decision to invest time into deepening the relationship.
- **Building trust:** Trust is the most important factor of the TDR study approach because most of the methods used in TDR rely on the successful building of relationships. Participants need to trust the integrity of the researcher's positionality.
- **Paying attention and responding:** It is very important to pay attention to what the stakeholders say and do and then promptly responding to their requests, in a neutral manner. By paying close attention, a researcher displays a belief in the legitimacy of a stakeholder's opinion.
- **Being committed:** The demonstration of commitment by the researcher to the stakeholder helps to build long-term relationships.

This is because it indicates that the researcher is loyal to the process. A researcher must make it clear to stakeholders that s/he is willing to commit to building long-term relationships.

- **Ensure stakeholder satisfaction:** Inform stakeholders from the start of the process about the benefits of participation for them, and how their contributions can benefit the larger group. It is important that they feel that they are an important element in the process and are therefore keen to participate on an ongoing basis.

- **Keep a balance between personal and communal relationships:** The researcher will have two levels of relationship with stakeholders: personal relationships stemming from onto-to-one consultation and communal relationships, stemming from focus group discussions, for example. The researcher must maintain a careful balance between these two so as to not provide stakeholders with false expectations about the dominance of their opinions.

This stage of building relationships enables the researcher to identify emerging trends and challenges that might impact stakeholders' participation in platforms, such as the focus group discussions and the forum. Building strong relationships with the stakeholders also allows the researcher a valuable opportunity to access information that can shape the study design and outcomes. This study relied heavily on the relationships built between the researcher and stakeholders. The researcher was able to build exclusive and collaborative relationships by focusing on the aspects outlined above.

5.4.5   Strategic planning

The successful design of a multi-stakeholder discussion forum rests on strategic planning. The research study must have clearly identified goals, discussion timelines, identified stakeholders, an outline of involvement activities, and a budget. The points below illustrate the strategic planning process for this study, which led to the establishment of the forum.

- **Create a stakeholder engagement strategy:** Outline the purpose of engagement, relevant stakeholders and suitable methods of engagement. In this study the researcher, in collaboration with the supervisors, drafted the stakeholder engagement strategy. Thus informal meetings were held with various participants to see if they would be interested in taking part in the research brainstorming sessions.

- **Set objectives for desired post-engagement outcomes:** Identify the kind of information desired from the engagement process, which will provide the outputs of the research study.

Before the creation of the forum the stakeholders where informed about the purpose of the research, that it is was an initiative with the potential to transform the infrastructure at the Du Toit precinct and benefit both the users and the owners of the buildings.

- **Invite only relevant stakeholders:** Only invite relevant stakeholders who have an interest in the topic under discussion. The consulted stakeholders who did not show enthusiasm and interest in the development of Du Toit were not invited to be part of the forum.

- **Identify the method of engagement:** Clarify the method of engagement; for example, this study used focus group discussions for the early stages of engagement and then used facilitated consensus-building forums to create the joint planning process.

- **Plan the logistics:** The chosen method of engagement influences the logistics of the project, including timelines, venues, tools, resources, ways of documenting outcomes, and the budget. This study used venues such as boutique hotels, museums, art galleries and boardrooms. Conversations were tape recorded; participants did not give their permission to be videotaped or photographed.

- **Communicate consistently about the process with the study supervisors:** Consistent communication with one's study leaders can help to support the researcher through the stakeholder engagement process.

- **Determine ways in which to manage risk:** The process of engaging with stakeholders is complex and therefore does present some level of risk. The researcher should attempt to predetermine potential risk. In this study, risks included creating expectations about the proposed development, possibly rupturing political agendas, and personal safety issues. These risks were mitigated throughout the research process by avoiding persons with known political affiliations and agendas.

The strategic planning process is an important step in the design of the involvement activities.

5.4.6 Involvement activities

There is a wide array of involvement activities possible. This study followed two approaches. First, it used a collaborative approach focused on methods such as the stakeholder visioning process and the co-design workshops. Second, it used an in-depth consultation process, which used facilitated workshops and brainstorming sessions with a panel of experts.

The collaborative approach

Stakeholders were first asked to visualise the future infrastructural design of the Du Toit station precinct (see the previous section for a selection of computer-generated architectural designs). This process was used to build a communal relationship between stakeholders and identify their skill sets. These skills were then used in the co-design workshops where stakeholders developed a long-term plan to develop Du Toit station precinct. The diversity of ideas contributed by stakeholders helped to create a suitable infrastructure model, which would contribute to integrating Stellenbosch at a spatial level.

<u>The in-depth consultation process</u>

The facilitated workshops comprised a series of brainstorming activities focused on drawing up a plan to redevelop the station precinct. Stakeholders also discussed issues such as crime, the lack of municipal services and the poor condition of the area. They also generated ideas as to how the place could quickly be made clean and safe. Stakeholders collaborated on the issues and possible solutions. The panel of experts was more exclusive with the landowners, architects, graphic sketchers and myself, as a semi-skilled urban designer, in attendance. These meetings were used to produce the detailed plans and designs for the redevelopment.

All of the ideas generated through these discussions were reviewed with the co-researchers and study leaders and a series of follow-up discussions with some stakeholders was scheduled.

5.4.7   Follow-up discussion

The follow-up discussion can be used as a tool to gain further feedback from stakeholders, particularly from those who were not particularly comfortable in sharing their ideas with other participants. I met with stakeholders who wished to rather meet privately and with those unable to make the meetings. Semi-structured interviews were used to gather information and expand on the discussions. These stakeholders were informed of the outcomes of the workshops and brainstorming sessions, and reassured that their inputs had been taken into consideration.

5.5   Conclusion

This chapter present the overall findings of this research in a thematic manner. The descriptive findings presented the findings in terms of why the Du Toit station precinct was chosen as an ideal location to conduct this study.

Motivating factors varied from Stellenbosch's spatial planning history, the evident racial segregation, and the infrastructural condition of the Du Toit station precinct. The correlational findings offered an overview of findings that emerged from the Bird Street/Du Toit station

precinct forum discussions. These included different visual models created for the redevelopment of the precinct and also some implemented initiatives. The exploratory findings provide practical guidelines to establishing this type of forum. These exploratory findings also cover the different stages followed to create the stakeholder engagement forum and different engagement activities used for the discussions. The discussion of these findings follows in Chapter 6, which also gives the in-depth reflection of the overall research process.

Chapter 6: Discussion of the findings

6.1 Background

Chapter 5 presented the various outcomes of the study thematically. The research was correlational in nature because it illustrated the relationship between public transport and infrastructure development; it was explorative as it aimed to create a multi-stakeholder forum and facilitate discussions to explore the future of Du Toit station precinct, and it was descriptive in that it outlined the forces that created the current discriminatory land-use patterns found in South Africa's urban centres. The study was designed using these three themes, which then functioned as thematic outlines for presenting the findings.

This chapter presented a more detailed discussion of each theme. It aims to present an overview of how the TDR was constructed to the point where it informed the TOD-facilitated discussions. This chapter analyses the theoretical underpinnings (drawn from the literature review) of the establishment of the urban district improvement forum, including a focus on the importance of stakeholder collaboration, as well as the elements of the study that improve the validity and reliability of the findings. It presents in-depth reflections regarding the validity of interaction with supervisors, among other elements, such as the level of detail required in answering research questions and achieving the objectives of the study, the needed and demonstrated skills important for this research, and the potential contribution that the study makes to global urban development debates and the field of TDR. The chapter also provides an acknowledgement of the methodological and practical limitations to this research, which could affect the findings.

6.2 The areas of discussion

There is emerging agreement that solving societal problems needs new ways of approaching these problems, making decisions about them and producing knowledge (Bergmann et al., 2005; Max-Neef, 2005; Lotrecchiano, 2013). Problems arising from urbanisation are no exception.

An important aspect of this 'new' way is ensuring the involvement of non-academics in the process of solving problems and producing knowledge. The TDR approach is identified as a methodological approach that provides an opportunity for integrating knowledge and ideas from different groups to solve real-world societal problems. Figure 24 presents a visual overview of a TDR process of designing a collaborative team to tackle such problems.
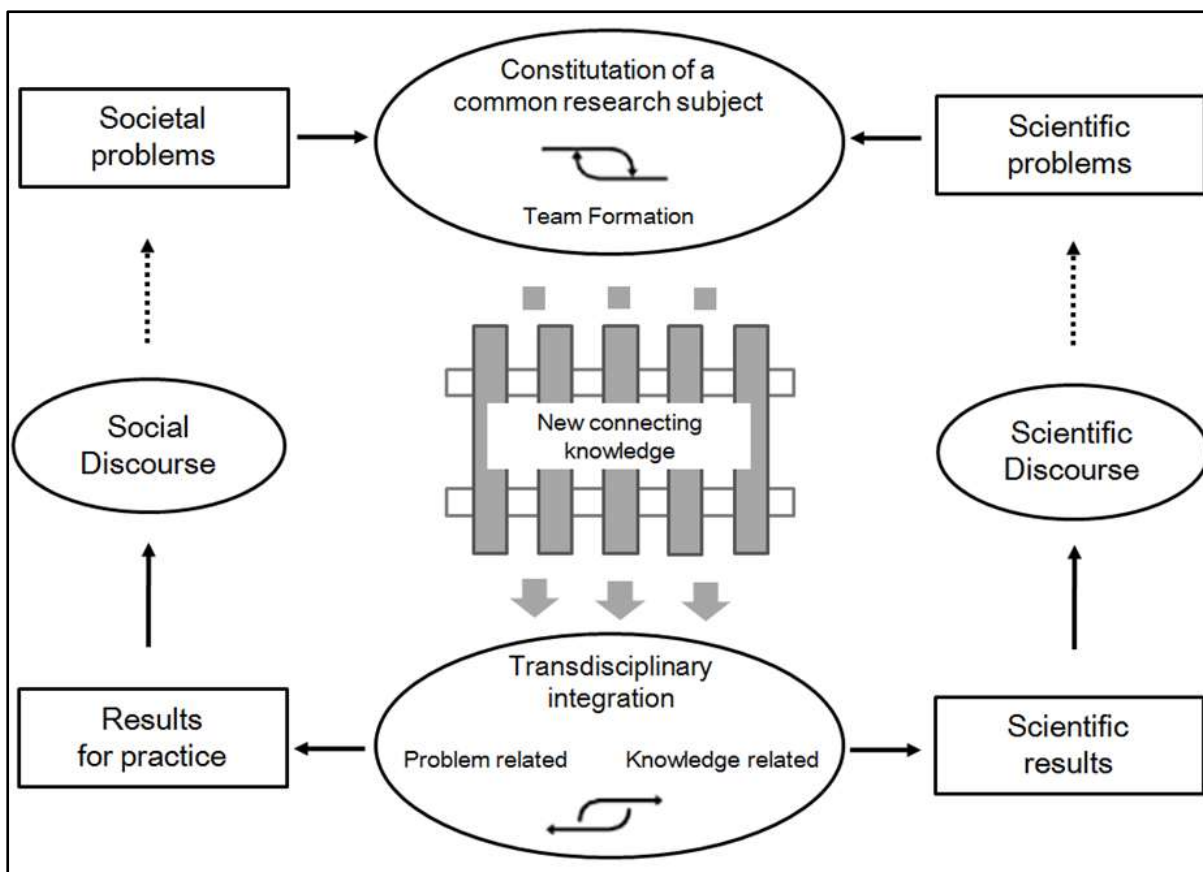
Figure 24: The scientific and practical TDR process analysis
Source: Bergmann & Jahn, 2008:98

The figure illustrates how the TDR process can be designed as a circular one to ensure successive stages of knowledge production.

6.2.1   The TDR approach

As per Figure 24, the TDR process begins with the formation of a team focused on an agreed common research subject. This phase is followed by a 'new knowledge connection' phase, in which participants share ideas; this is known as transdisciplinary integration. This integrative phase separates discussions in the problem-related theme (a societal approach) and the knowledge-related theme (a scientific approach) (Bergmann et al., 2005; Bergmann & Jahn, 2008).

This section analyses how the research findings aligned with TDR application regarding the societal problem formulation strategy (the urban spatial division in South Africa). It then focuses on the created social discourse – the forum's brainstorming sessions. It also provides a critical analysis of the relevance of the societal problem to an area such as the Du Toit station precinct. The scientific approach is covered in the third sub-section.

<u>The societal problem formulation strategy</u>

In this phase of the research, the forum members met to formulate the problems of the Du Toit precinct. Once the most pressing problems were agreed upon, the forum was established as a formal space to discuss these problems and possible solutions to them. It is important to note that the research questions and objectives did frame the initial objectives of the forum. This phase led to the creation of a collaborative research team.

<u>Created societal discourses</u>

TDR theory notes that effective long-term strategising rests on the creation of organisations that will later function as facilitators of discourse (Winston & Maheshri, 2007; Amin, 2013; Kamruzzaman et al., 2014). A variety of methods were used to facilitate this phase, including focus group discussions, interviews and observations (Warren, 2004; Reinharz, 2011; Montuori, 2013).

The created social discourse was actor-specific institutional forum, with various emergent discussion themes. TDR theory notes that collaborative discussions focused on solving societal issues creates an opportunity to develop a structure of roles and responsibilities. The different skill sets of participants became increasingly apparent during this study. Chapter 5 outlines the various processes that the researcher undertook to facilitate discussions and create the forum. The accumulated knowledge of all forum participants was integrated and applied in practice, resulting in the visual models of the future station precinct development.

<u>The relevance of the societal problems regarding Du Toit station precinct</u>

The forum discussed issues of poverty, crime, poor infrastructure and lack of efficient public transport in the Du Toit station precinct. The forum aimed to find ways to redevelop the precinct into an attractive area with a focus on using public transport to encourage integration between previously segregated areas. Chapter 2 provided an overview of different strategies that the government has employed to reshape urban land-use patterns. The discussions in Chapter 3 provide theoretical support for the relevance of the forum's discussions regarding Du Toit station.

The 1998 White Paper on Local Government, for example, provides guidance on finding development strategies to help integrate previously separated urban populations. Du Toit station is a prime example of apartheid-style planning as it was designed to serve the African and coloured populations of Stellenbosch (Christopher, 1992). It also functions, however, as a mobility node providing accessing to the central business district and it connects different spatial locations (Stellenbosch Municipality, 2014a).

The redevelopment of Du Toit station precinct potentially could enhance access to different urban activities, thus potentially increasing urban mobility. The use of a TDR approach in this study enabled the opportunity to identify relevant models for such redevelopment, such as TOD.

6.2.2   The TOD model

This section outlines how forum discussions focused on the importance of public transport in Stellenbosch, the role and future of Du Toit station, and the opportunities for expansion onto Bird Street aligned with TOD principles. Information gathered at the forum discussions was triangulated with the relevant academic theory; principles such as infrastructure diversity, urban density and transformative design (Calthorpe, 1993; Boarnet & Crane, 2001; Cervero, 2006) are discussed in detail in Chapter 2. Their emergence in forum discussions is outlined below.

Infrastructure diversity

TOD theory notes that creating a diverse range of urban activities around public transport nodes increases the 'livelihood' of an area by making the space more vibrant and attractive (Newman & Kenworthy, 1991). Further, it notes that having diverse land-use activities can lead to the creation of mixed-income communities and increased levels of interaction between races, occupations and households with the ultimate objective of creating an integrated urban system (Dittmar & Poticha, 2004; Greenberg, 2004; Cozens & Hillier, 2008). Forum discussions noted that to make the precinct more attractive to people it would need to support a diversity of activities; that the area would need to 'be alive for 24 hours a day' meaning that activities would need to extend beyond working hours.

It was noted this diversification of activities might need to rely on densification of infrastructure, such as buildings.

Development density

TOD theory notes that densifying urban activities increases the demand for public transport, which, in turn, make it necessary to densify development in close proximity to train stations (Newman & Kenworthy, 1991; Cervero & Kockelman, 1997; Ndebele & Ogra, 2014). Examples of development include recreational spaces, residential areas, learning spaces and offices. Stellenbosch's Integrated Development Plan and SDF both support the redevelopment of Du Toit station precinct because both acknowledge that to develop underdeveloped areas will rest on clustering various urban activities in a high-density manner (Stellenbosch Municipality, 2014a, b).

Forum discussions noted the necessity of this, but highlighted that such redevelopment would need to be done in a transformative way to ensure integration of previously segregated urban spaces.

<u>Transformative design</u>
TOD theory notes that design is a key principle for enabling a transformation of urban spaces in that designed land-use activities have specific objectives, such as unifying societal actors or improving the physical condition of the space (Bailey et al., 2007; Suzuki et al., 2013; Ogra & Ndebele, 2014).

In this case, the design element aimed to undo segregation of urban spaces by using modern infrastructural design. Forum discussions noted that improving public transport services would benefit not just the local communities around the precinct, but Stellenbosch as a whole. Investments in public transport and a diversity of land-use activities would enable people to experience more urban mobility and enhance integration (Suzuki et al., 2013). It is using transformative design processes that enable TOD interventions to bring about real societal change.

6.2.3 The potential contribution of this research to the professional development of TDR studies focused on urbanisation issues

This thesis potentially makes a contribution to the professional development of TDR studies because the process used bridged the boundaries between academic discipline and practical application. The research was motivated by the need to deal with societal problems brought about by rapid urbanisation, segregated urban development patterns and underdeveloped urban infrastructure, such as public transport. It facilitated collaborative discussions among stakeholders resulting in the generation of new knowledge, which was brought to bear on the particular societal challenge represented by Du Toit station precinct.

This thesis also makes a contribution to the TDR field because it deals with the ambiguities and tensions of conducting TDR (the researcher has to determine which methods are relevant and for which purpose, undertakes complex negotiations with stakeholders with a focus on building strong relationships, has to understand power relations, and must practice self-reflection). It presents an array of engagement techniques, such as focus group discussions and brainstorming workshops that were successfully employed during the course of the study. And it supports the role of creating knowledge in urban development initiatives. A space for co-learning was opened up through the forums and the practical redesign of the precinct, which enabled a shift in thinking from traditional planning approaches to a transformative, integrative urban development approach.

In this sense this research process has produced transformative knowledge that supported this shift. According to Hirsch-Hadorn et al. (2008:30-31) transformative knowledge "is about how to make the transition to the target status, which includes technical, social, legal, cultural, institutional and other changes." Lastly, the outputs of the study are presented in answer to the research question and associated objectives, and have gained the approval of the study supervisors, research participants and funders of the research.

6.3 Successful elements of the urban district improvement forum

6.3.1 The importance of stakeholder collaboration

The literature that focuses on strategies to implement TOD as part of collaborative urban development strategies emphasises the need for a diversity of stakeholders to collaboratively create a redevelopment vision. Arlington County in Virginia, United States, is a good example in this regard. Discussions included the city mayor, developers, business owners, public institutions and local community members (Cervero, 2006).

The study was successful in its attempt to generate innovation, co-design and development initiatives through stakeholder collaborative processes.

Urban development innovation
This thesis presents how TOD can facilitate the integration of urban development patterns (Bickford & Behrens, 2013; Ndebele & Ogra, 2014). Envisioning innovative solutions, however, rests on the vision-creation process.

This study used the open innovation approach to arrive at the research outcomes. It supported a collaborative knowledge-sharing process that opened up the space for the emergence of innovative ideas (Marthu et al., 2007; Pushor, 2008; Calland & Nakhooda, 2012) regarding redevelopment of the Du Toit station precinct. This participatory approach enabled the co-design of the precinct.

Co-design
The process through which various stakeholders collaboratively design a 'solution' is known as co-designing. The participants of the forum effectively took part in a co-design process by sharing their visions for a redeveloped Du Toit station precinct. The co-design approach provides an opportunity to find solutions to real-world complex problems (Papa & Trifiletti, 2006). The co-design approach is considered theoretically important for TOD implementation.

As a collaborative process, it ensures that the co-designed reality is a transformative one through an exchange of development-related information, a balancing of power dynamics

through ensuring inclusive participation, and a bringing into reality of the collaborative vision. This is an important step to ensuring the sustainability of an urban development initiative.

<u>The sustainability of the development initiative</u>

Blake et al. (2006) argue that the way in which a TOD initiative is implemented influences its sustainability. Government-led development, for example, is often not suited to particular contexts and does not always take into account the needs of the particular community. When involved from the start of a development process, stakeholders actually function as a planning support system, which can "generate knowledge and support discourse and decisions about the public interest issues springing from linkages among the area's population, economy, environment, land use, transportation and infrastructure" (Berke et al., 2006: 89). This thesis illustrates alternative and sustainable ways in which development plans can be implemented to bring about spatial integration in South Africa's cities, with a particular focus on TOD.

The co-designed urban development approach, outlined in this study, was tested for validity and reliability.

6.4   Validity and reliability of the findings

Research must meet certain methodological requirements to produce valid outcomes and findings (Rothbauer, 2008). The findings of this study meet both internal and external validity requirements.

It followed scientific methodological guidelines to produce valid results internally; for example, the transect walks were used to identify potential forum participants, which were then selected according to their relevant skills and possible contribution to the research – either by being a key informant or co-researcher.

The external validity of the research findings theoretically evaluates the way in which the research findings can be applied in real life (Hammersley & Traianou, 2012). This study followed a case study approach, in which the findings could be practically applied beyond the theoretical setting of the forum. It did not, however, produce generalisable results because the findings are specific to Du Toit station precinct.

The data sources must be reliable to ensure the validity of the research findings.

For this reason, the study through a document study drew on documents such as published sources, the public archives, statute documents, census statistics and other public records. These sources were deemed reliable and in the public domain.

The research findings of this study are valid and reliable; they are consistent and meet the requirements of scientific research methods. Further, the researcher engaged in in-depth reflection as to her role in the study and the possible implications thereof.

6.5   In-depth reflection of the study

As the primary researcher, I have been actively involved in every activity related to the study. My positionality regarding the study was therefore subjective. This section provides an overview of the personal reflection undertaken during the study, including my interactions with study leaders, my ability to answer the research questions, the interpersonal and communication skills that I developed and the potential contribution of this research to the TDR field.

I present these reflections in the knowledge that I take a risk of exposing my subjectivity, which could be interpreted as a limitation to the research. Most TDR literature, however, notes the importance of acknowledging these reflections on the research process (Bergmann et al., 2005; Hirsch-Hadorn et al., 2008). Myerhoff an Ruby (1982:26), for example, state that "the more the researcher attempts to fulfil scientific obligation to report on methods, the more he or she must acknowledge that his or her own behaviour and personality in the field are data."

6.5.1   Experiences of interactions with the supervisors

Two dedicated supervisors provided practical support for this research project. Both had different backgrounds. The main supervisor is an expert in the TDR field and the co-supervisor is proficient in the urban planning, logistics and urban transport economics fields. Both provided extensive support and guidance. I met with both on a regular basis and took part in brainstorming sessions regarding the project. They also provided feedback on multiple drafts of this thesis. They both effectively fulfilled their duties as supervisors for the purposes of this thesis.

6.5.2   Answering the research questions and meeting the study objectives

The answering of the research questions was reliant on the collected data of the study. This thesis was able to answer the research questions and meet the study objectives as outlined in Chapter one.

The review of literature in Chapter 2 and case study presented in Chapter 3 fulfil the requirements of objective a) and b) because they offered theoretical descriptions and an overview of the study area. This theoretical overview helped to determine the empirical research methods, which were used to meet objective c) and d); the practical sessions were

used to collect the data necessary to meet objective e) – the development of a long-term strategy to redevelop the Du Toit station precinct.

The secondary data for this research was collected from reliable sources, such as books, government publications, peer-reviewed journals, and other academic publications. The reliability of the information gathered through the field research was triangulated using these secondary sources and software programmes, such as NVivo and Tableau. Chapter 5 presents only the relevant information pertaining to the research questions and objectives as not all of the data gathered during the forum discussions was relevant to the study.

In short, the data used for this study was extracted from reliable sources, relevant methods were selected for the fieldwork and this data was triangulated with secondary data sources. This thesis successfully answers the research questions and meets the objectives of the study. The findings were critically presented and the research was conducted in an ethical manner in accordance with the guidelines and approval granted by the ethics committee.

There were, however, some challenges and limitations faced during the research process. These are discussed in Section 6.6. below. The following section outlines the demonstration of my skills throughout the research process, an important aspect of my positionality.

6.5.3 Demonstrated skills throughout the research

Undertaking TDR requires researchers to hold and demonstrate a variety of skills. It can be challenging in this particular study context to incorporate theoretical and practical frameworks into one's thinking; for example, the study encompassed development policy, urban design features, participatory processes, and so on. The researcher has to decide what is important and what is not. This requires social skills, creativity and good judgement, an analytic intellect, writing skills and reflexivity.

Social skills were needed to gain access to stakeholders, and then build relationships of trust with them to gain access to information. These skills were needed throughout the study. The vast amount of data generated in a TDR study requires a researcher to exercise creativity and good judgement to select what is relevant. These skills are also necessary to construct a conceptual framework, identify significant themes, decide on what data is relevant, transform these into usable formats, and build this into a theoretical framework.

My intellect has been shaped by my academic experiences, which were enhanced by the research dissemination and colloquium training provided at the Sustainability Institute. It was here that I received insights into the kind of data analysis skills needed to conduct this research. My ability in this regard has allowed me to 'weave' a rich story, create a link between

themes and elements, and go beyond providing a description of collected information to providing a critical evaluation of it.

The ability to write well is important to bring the data unearthed in the study to life. This study has presented a convincing argument I hope that supports the notion that the successful 'breaking' of apartheid structural planning rests on collaborative action between varied stakeholders, a supporting policy framework, and use of international urban development models, such as TOD.

Another important skill that this thesis present is the researcher's reflective skills. Reflective skills are theoretically defined "as an active, dynamic action based and ethical set of skills, placed in real time and dealing with real, complex and difficult situations" (Rosaline, 2008: 12). I was able to maintain my positionality throughout this research, listen to the research participants respectfully, reinterpret their stories clearly, be non-judgemental and present my subjectively honestly.

The skill of reflexivity demonstrated in this process illustrate how my interactions with research participants were an explicit part of the production of knowledge about how the redevelopment of the precinct could contribute to social integration in Stellenbosch. I was able to describe my positionality using the data recorded in my field diaries.

This collective set of skills allowed me to apply the chosen methods of this research in a consistent way and one that aligned with the study objectives. Thank to the study, I have improved certain personal skills, such as listening, which has helped improve my communication skills. This study therefore also contributed to my personal development. It has taught me how to balance being a student, a researcher, a facilitator and potentially a change maker. It has also increased my levels of motivation to bring about change in South Africa's urban structures.

There were limitations to this study, as with all research studies. The following section outlines the theoretical, methodological and practical limitations of the study.

6.6   Limitations of this study

This section outlines the limitations of the study, as well as providing some insights as to how these limitations can be overcome in future studies.

6.6.1   Theoretical limitations

There were some challenges in trying to shape the TOD concept, which is an international one, to the South African urban context. The concept of TOD is still relatively young, and there

is a dearth of literature on its application in the South African context. The use of international implementation examples is a theoretical limitation, as those examples may not be applicable in the local context. There is also a lack of literature focused on the use of TDR in the urban development integration space. The literature used in this study might therefore not be enough to provide full support to the argument. This study was further limited in terms of available theory to support a balance between the reductionist approach to urban development and the holistic approach of a TDR study. These limitations may have, to some extent, influenced the interpretation of the research outcomes.

6.6.2   Methodological limitations

The researcher needs to have some basic knowledge of both qualitative and quantitative research methods when choosing to use a mixed methods approach. I have a social science background and, as such, was more familiar with qualitative methods. I had to learn quantitative methods within a short period of time, as well as how to mix these methods to suit the objectives of the study.

A further limitation was the limited number of people comprising the stakeholder group; the result is that effectively an exclusive group determined the future design of the precinct. The lack of literature on similar interventions in the South African context with a specific aim of integrating urban spaces presented a further limitation. For this reason, the initial results of the study were presented in a correlational and exploratory manner.

While this thesis perhaps proves that TOD principles can facilitate the implementation of integrative urban development patterns, it does not provide a detailed plan for how to do this at the Du Toit station precinct; the last objective of the study was thus not met. Forum discussions had only reached a point of focusing on how to redevelop the precinct. It is therefore not clearly proven that redevelopment of the precinct would result in spatial integration in Stellenbosch. The study did not systematically examine other possible ways of facilitating integrated urban spaces. This presents as another possible limitation.

6.6.3   Practical limitations

Undertaking TDR is expensive and time consuming. Both of these factors were practical limitations to the study, which has a limited budget; for example, the need to secure neutral venues, such as hotel conference rooms and rented boardrooms, to conduct workshops and brainstorming sessions is expensive. In addition, getting all of the stakeholders together at a determined time and place is time consuming.

The ethics committee approved this research for the period September 2015 to September 2016, which meant that all activities in which stakeholders were involved had to happen within the 12-month period. This served as a limitation in that I could not engage with stakeholders after 21 September to facilitate the forum discussions, organise the workshops, conduct interviews or follow-up discussions. This could possibly have a long-term negative effect on the momentum needed to move the forum to a more formalised body, as desired by stakeholders.

The methods, resources and budget for the research were, however, relevant and served their purpose in that the study generated sufficient outcomes to meet the objectives.

Chapter 7: Conclusion and recommendations

7.1 Introduction

South Africa's policies aiming to solve various urbanisation issues in the country focus on infrastructure development as a tool. Government structures at all levels need to understand how to engage stakeholders, such as community members, developers and landowners, in infrastructure development processes. A motivation for this study was the concern that some areas are left underdeveloped, and are even degrading. These areas are mostly found in formal and informal settlements and townships, where the majority of the urban population live. Residents of these areas tend to earn low incomes and experience the effects of poverty, while contributing the bulk of the labour force used in the well-developed urban centres.

This study aimed to explore to what extent the diverse stakeholders in Stellenbosch, Western Cape province (including Stellenbosch Municipality, Stellenbosch University researchers, landowners, business owners, community members and interested parties) could collaborate using TOD principles to redevelop the Du Toit station precinct. This led to the generation of further research questions and objectives, which aimed to provide a clear understanding of how TOD could act as a facilitating tool to redevelop urban spaces and create more integrated urban development patterns. This was done following a TDR approach.

One of the research objectives was to establish an infrastructure improvement discussion form and another to create a long-term strategic plan for redeveloping the Du Toit station precinct. Policy documents were analysed to gain an understanding of the legislative framework that had resulted in segregated urban spaces. Discussions with various stakeholders were held to identify the correlation between public transport planning and land-use activities, and understand how these correlations are informed by the TOD theory.

This chapter presents the main conclusions derived from the overall research findings. The following sections present brief reflections of whether the study achieved its aims and answered the questions. Practical recommendations are provided and the possibility of expanding this study explored before concluding the thesis.

7.2 Summary of findings and conclusion

A primary outcome of this study is the support it provides to the notion that using multi-stakeholder collaborative platforms to envision the redevelopment of segregated urban spaces using public transport as a facilitating mechanism is effective.

Discussion on how to use TOD to facilitate urban redevelopment was divided into various phases: secondary data was gathered through a comprehensive review of the literature, which was used as a framework to decide on methods for collecting primary data; which then resulted in findings, structured as correlational, explorative and descriptive results.

A structured approach to the study, guided by the research questions and objectives, helped to provide relevant and valid results. The literature review, focused on South Africa's urban spatial realities and urban development patterns, enabled an understanding of historical drivers of segregation and the current attempts to shift these to bring about a more integrated urban environment. It is clear from this theoretical perspective that public transport services play a prominent role in urban development segregation. In the apartheid era, for example, roads and railway lines often acted as buffer zones between white areas and that of Africans and coloured (Davies, 1981). Through a review of this literature, it was possible to identify that the TOD model could potentially act as a facilitating mechanism to integrate urban spaces in the country.

The objectives-based TOD literature presents various ways in which cities can use transport development to create interactive and inclusive urban activities, and thus spaces. For the purposes of this research, the diverse stakeholder collaboration approach was selected to initiate an envisioning process for the chosen case study: Du Toit station precinct. A significant amount of time was spent in the field gathering stakeholders for brainstorming sessions on how the precinct could best be redeveloped.

Conclusions of the study are outlined below: the creation of the stakeholder forum, the usability of the discussion from the forum, and the validity of the outcomes from those discussions, with reference to the research questions and objectives.

7.2.1   Development of the collaborative stakeholder discussion forum

A primary objective of the study was to determine if the discussions arising from a multi-stakeholder forum could use TOD principles to co-create a vision of a redeveloped Du Toit station precinct. The forum was established and comprised representatives of the municipality and Stellenbosch University, affected landowners and business owners, community members, and other interested parties. Chapter 5 outlines the way in which the forum was created and stakeholders chosen. Chapter 6 outlines how using a TDR approach enabled the development of a context-relevant TOD model with the potential to contribute to the debate on urban development in the global South.

Further to this, the forum was able to provide a predictive view regarding the information produced through it and the validity of these discussions on issues of urban space integration through infrastructure investments.

The research questions have been successfully answered. Visual models of a redeveloped Du Toit station are provided in Section 5.3, as part of the long-term strategic plan to redevelop the precinct. The following subsections explore whether the model for such redevelopment can be successfully implemented.

7.2.2   The usability of the forum discussions

All forum stakeholders contributed their ideas to the vision of a redeveloped Du Toit station precinct. These are captured in the visual models. Stakeholders also discussed the viability of ideas and how these could be implemented. Redevelopment 'goals' were divided into short- and long-term initiatives.

In the short term, several initiatives were launched. The precinct area was cleaned up and in efforts to encourage integration of the various Stellenbosch communities, I, with friends, launched the Ghetto Art Gallery. This experimental initiative is related to the research question regarding whether the redevelopment of the precinct could facilitate urban mobility and spatial development integration. The establishment of the gallery did encourage mobility to some extent in that it encouraged those living in other parts of Stellenbosch to enter the precinct area.

The long-term vision is that of extensive infrastructure redevelopment of the precinct to make it an inclusive space in terms of race and class, and one serviced by an efficient public transport system. The forum thus played a role by contributing to the finding of valid alternative urban integration strategies.

7.2.3   The validity of the forum discussion outcomes

Chapter 2 provides the motivation for reshaping South African urban development patterns and the need for integrated urban spaces that are effectively serviced by efficient public transportation services. More than 60 percent of South Africans live in urban centres, making it even more urgent that inclusive urban spatial development is supported and implemented. The outcomes from forum discussions are valid in this regard; they produced realistic results that are achievable in the short and long term. The validity of the discussions is further supported by the literature focused on land-use and transport planning for integrated urban development, which aligns with TOD principles.

It emerged through the empirical research process of this study that various stakeholders are keen to contribute to restructuring South Africa's urban spaces into more inclusive and diverse spaces. Forum discussions focused on what could be done about settlement segregation. The outcomes of these discussions were further triangulated using literature to outline the benefits that TOD application could have in South African cities. The outcomes of the discussions were found to be valid, which, in turn, validifies the assumption that implementation of a TOD model using a multi-stakeholder approach does have potential to act as a facilitating mechanism for restructuring the country's urban spaces and ushering in more sustainable and integrated communities.

7.2.4   Remarks on TOD implementation at Du Toit station precinct

While this study focused on TOD implementation at Du Toit station precinct, the findings indicate that this multi-stakeholder approach could work in other South African cities and towns. Regarding its application to the Stellenbosch context, the findings indicate that Du Toit station precinct is a viable location for implementation because it has vacant land suitable for infrastructure development and degraded buildings that could be redeveloped. Investing in infrastructure at this location would make the area more attractive, which would boost the usefulness of the station itself as people will access the station while engaging in other activities. Implementation of the TOD model at this location could also provide a real-life South African model for implementation in other cities and towns.

7.3   Recommendations for future studies of this nature

This section provides recommendations for future studies of this nature, based on issues of data quality and availability, the tenure of the created forum, management and support of the researcher, and required amendments to further expand the forum.

7.3.1   Availability and quality of data

It was evident throughout this study that the quality and availability of data would significantly influence the data outputs. The ability to produce high-quality data relies on the accuracy of the data collected and the ability to select what is relevant to the study. Establishing a clear-cut method of standardising data could help to ensure that only relevant data is collected, save time in the data-collection phase and ensure that future studies need not duplicate previous work. It is recommended that researchers start the empirical data-collection process early in the study for work of this nature, and that enough co-researchers are hired to assist.

7.3.2   Tenure of the forum

There is a danger in studies of this nature that once the researcher has completed her/his fieldwork that the forum or organisation created dissolves due to lack of leadership and motivation. This Bird Street/Du Toit Station Precinct Urban District Infrastructure Improvement Forum stopped meeting once I disengaged from the process because of the lack of a dedicated person to keep it running, including the updating of forum members on ongoing initiatives. This person would need to function as the director of the forum and have the right to make individual decisions related to the forum, administrative duties and acting as a contact person. This would help formalisation processes, applications for funding, etc.

7.3.3   Management and implementation support

The forum needs ongoing support to enable it to bring the co-created vision into reality. As discussed in previous sections, I was not able to engage with the forum once my ethics clearance had expired and there was no ongoing support provided by the department or outside parties to ensure a smooth handover process. Finding strategies to provide such handover and implementation support once the research is complete should be an integral part of the research design, with mandated support from the department or an identified role player.

7.3.4   Amendments to the redevelopment models

The visual models of a redeveloped Du Toit station precinct presented in this thesis are not based on the detailed calculation of land spaces and necessary budget. They are an initial envisioning tool and will require amendment as the vision is aligned with the reality of what is available in terms of resources. This need for models that can be adapted also reaffirms the necessity of a dedicated forum head that can serve as a keeper of generated knowledge, the plans and the models.

7.4   Concluding remarks

The TDR approach was used in this study to enable an innovative take on using the internationally based concept of TOD to find ways to integrate South Africa's historically segregated urban spaces. While several South African urban development policies do suggest using an adaptation of TOD, there is no clear guidance on how to do this in the South African urban context. This study thus contributes to knowledge about urban infrastructure development initiatives and provides guidance as to how TOD can be implemented in South Africa using a TDR approach.

It proves that multi-stakeholder collaborative processes can be used to create TOD visions, encompassing both short and long-term goals.

The focus of the research approach was on generating infrastructural development ideas from those who would use or be affected by the facilities. The research produced a visualised model of a collaborative vision of the redevelopment of the Du Toit station precinct. The study followed a well-structured methodological approach, which was supported by various literature sources. This enabled the generation of valid and reliable results.

A visible benefit of the study is the forum itself, as well as the Ghetto Art Gallery, which continues to contribute to integrating the Stellenbosch community through an arts-based exchange of ideas. Its location in the precinct has encouraged Stellenbosch residents from other parts of the town to visit and perhaps shift their perceptions of this somewhat derelict area. Separating aspects of the vision into short- and long-term goals has helped to control expectations about the speed of development, in that some benefits are realisable and visible now, while others will require time and a budget.

The use of Du Toit station precinct as a case study in this research contributes to Stellenbosch's strategic planning framework, through, for example, the road design, which could be developed given a budget. Forum participants were positive about the process and the resultant models, painting an encouraging picture for how this collaborative process, based on TOD principles and rolled out using a TDR approach, could help to transform South Africa's urban spaces.

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Appendix A: Notice of ethical clearance

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Approval Notice

New Application

01-Oct-2015

Mafame, Thendo T

Proposal #: DESC/Mafame/June2015/13

Title: **Using transit-oriented development (TOD) model as a facilitator for urban development integration: Case Study Du Toit Train Station, Stellenbosch**

Dear Miss Thendo Mafame,

Your **New Application** received on **16-Jun-2015**, was reviewed

Please note the following information about your approved research proposal:

 Proposal Approval Period: **22-Sep-2015 -21-Sep-2016**

Please take note of the general Investigator Responsibilities attached to this letter. You may commence with your research after complying fully with these guidelines.

Please remember to use your **proposal number** (DESC/Mafame/June2015/13) on any documents or correspondence with the REC concerning your research proposal.

Please note that the REC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

Also note that a progress report should be submitted to the Committee before the approval period has expired if a continuation is required. The Committee will then consider the continuation of the project for a further year (if necessary).

This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki and the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health). Annually a number of projects may be selected randomly for an external audit.

National Health Research Ethics Committee (NHREC) registration number
REC-050411-032. We wish you the best as you conduct your research.

If you have any questions or need further help, please contact the REC office at 021 808 9183.

Included Documents:
DESC Checklist Form
Informed Consent
Form Research
Proposal

Sincerely,

Clarissa Graham REC Coordinator
Research Ethics Committee: Human Research (Humanities)

Appendix B: South Africa's urbanisation profile

Notes:

(1) **Proportions of urban and rural population** in the current country or area in per cent of the total population, 1950 to 2050.

(2) **Proportions of urban population** in the current country as compared to the major area and region in which this country is located. The proportion is expressed in per cent of the population between 1950 and 2050.

(3) **Proportion of urban population** in the current country (blue line), major area (red line) and region (green line) as compared to the ranked urban proportions of all countries of the world (Gray area). The figure illustrates, what level of urbanization a country has compared to its major area and region, as well as compared to all other countries of the world.

(4) **Urban and rural population** in the current country.

(5) **Urban population of the current country by size class** of its urban agglomerations in 2014. The light blue area is a residual category, which includes all cities and urban agglomerations with a population of less than 300,000 inhabitants. The size classes correspond to the

	<300TH
	300-500TH
	500TH-1M
	1-5M
	5-10M
	>10M

following legend:

(6) **Average annual growth rate of the urban population** of the current country between 1950 and 2014 (blue line), as compared with the average annual growth rates of the urban population of all countries of the world (Gray area). The figure illustrates that urban growth rates between 1950 and 2014 were positive in the great majority of the countries of the world. Only a few countries had negative urban growth rates - indicating that their urban proportion was declining between 1950 and 2014. Due to limitations of space official country names had to be abbreviated in the figure legends.

Source: United Nations, 2014
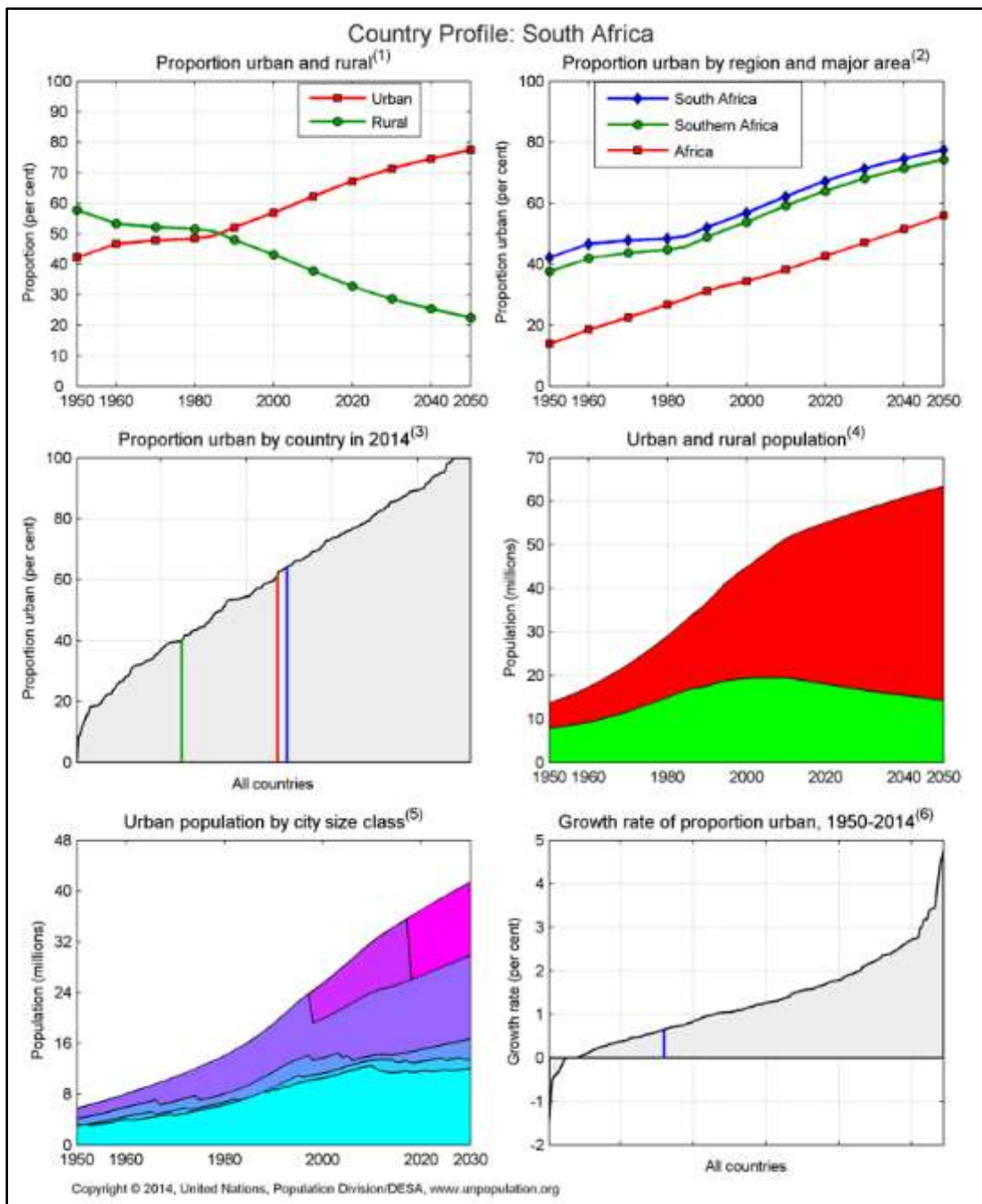
Figure 25: Urbanisation profile South Africa

Source: United Nations, 2014

Appendix C: The forum discussion invitations

18 February 2016

Dear Bird Street Landowner

Bird Street/Du Toit Station Precinct Landowners Meeting

This letter serves as an invitation to explore the idea to establish an urban precinct improvement district for the Bird Street/Du Toit Station Precinct, Stellenbosch.

The collaborative partnership between Stellenbosch Municipality, Stellenbosch University, and some landowners around Du Toit Station (such as Rose Jordaan), would like to invite you to an initial explorative meeting for the Bird Street Precinct landowners. The purpose of this meeting is to learn more about the function, development potential, needs and ideas for the precinct and to consider the first steps to establish collaboration among the landowners with the ultimate aim to improve the area.

This landowner collaboration initiative is strictly voluntary. It will be designed to create a forum for landowners in Bird Street to:
- communicate the needs of the businesses in the streets;
- encourage landowners to work together to keep the area attractive and safe;
- initiate improvements to the street and precinct.

The Bird Street/Du Toit Station Precinct Collaboration will include everyone who owns or rents properties and/or who conducts business there, or anyone with an interest in the precinct. Landowners, business owners and/or any interested public members will be eligible to participate in the forum discussion, and have the opportunity to address the issues that directly affect them.

Proposed agenda:
1. Introduction and purpose of the meeting
2. State of Infrastructure:
    2.1. Road upgrade requirements
    2.2. Public transport
    2.3. Role and future of Du Toit Station
3. Safety and Security
4. Other matters

Details:
Date: 1 March 2016
Time: 18:00 – 19:30
Venue: Coopmanshuijs Boutique Hotel board room, 33 Church Street, Stellenbosch

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10 March 2016

Dear Bird Street Landowners

THE BIRD STREET / DU TOIT STATION PRECINCT DISCUSSION MEETING

The collaborative partnership between Stellenbosch Municipality, Stellenbosch University, Researchers, Transnet, and some landowners around Du Toit Station, is requesting for your presence, at an upcoming discussion meeting regarding the infrastructure development vision for the Bird Street / Du Toit Precinct. The meeting will take place on 16 March 2016, at Sasol Museum, in Ryneveld Street.

This meeting will be facilitated, and is designed to take everyone through the assessment, with respect to the potential infrastructure development in and around Du Toit station. We therefore request for your participation, in terms of personal ideas you have for the precinct improvement, to contribute to a planning effort designed to identify and address precinct challenges and opportunities, which affect the landowners, surrounding community, business, and the wider public. Please commit to lending your expertise to this meeting, in terms of the infrastructure development vision you have for the precinct.

PROPOSED AGENDA
1. Collaboration potential between landowners for future infrastructure development visions;
2. Personal ideas you have for the improvement of the precinct;
3. Current infrastructure needs;
4. Anything related to infrastructure investment around Du Toit Station you would like to discuss.

The Bird Street/Du Toit Station Precinct Collaboration will include everyone who owns or rents properties and/or who conducts business there, or anyone with an interest in the precinct. Landowners, business owners and/or any interested public members will be eligible to participate in the forum discussion, and have the opportunity to address the issues that directly affect them.

DETAILS
Date: 16 March 2016
Time: 17:45 – 19:30
Venue: Sasol Museum, Ryneveld Street

Appendix D: List of interviewed landowners

Bird Street Building numbers	Building Representative interviewed person	Current Activity	ERF Value
Conner Adam Tas & Bird 113	Garage Manager	Mercedes-Benz car dealership	5 062 000
127 Bird	Bell House Trust Barney Jordaan	Cash and carry shop	4 000 000
135 Bird	Rose & Dr Michael Jordaan	Speed fit Motor Spares Nuts & Bolts Hardware Chines Clothing shop	6 009 000
139 Bird	Trever Townsend	Independent Supermarket Hardware Fish & Chips Tab Gambling Centre DC butchery Battery Spares	9 000 320
141 Bird	Bernabie De la Bat (municipality representative)	Hawkers Space Illegal taxi rank	
228-232 Conner of Bird & Adam Tas	Pandero Investments 103 cc (unnamed representative)	Jo' Marlins fisheries Bottle store Butchery	7 080 000
246 Bird	Ibizo Property Investments CC (unnamed representative)	Medical Surgery	1 310 000
234-236 Bird	Schoonwinkel Marleen Nuwerhoudt Martin	Motor Spares and Panelbeaters	4 640 000
238 Bird	Osman Family House (Fazwah Osman)	Residential house	1 300 000
248 Bird	Basil Hinks	Caltex Garage	6 100 000
250 Bird	Ozman Investments (representatives)	Build-it Hardware	6 100 000
254 Bird	Dawie Joubert & Jannie Joubert	Joubert Implemente	2 280 000
252 Bird	Felan cc	Engineering garage	6 100 000
256 Bird	Dale Richard	Super Quick Tyre workshop Stellenbosch Panelbeaters	2 880 000
258 Bird	Nick Furness	Wine machinery	3 030 000
5 Bell	Van der Spy GJP	Upholstery business	1 185 000
7 Bell	Esterhuizen GP+E	Panelbeaters	1 690 000
Bell	Niemsco Eiendomme	Cash and Carry	3 500 000
10 Bell	Baladam Eiendomme	Bottle store	780 000

Appendix E: Personal documents (journal entries, scrap pages, photographs, informal interactions)
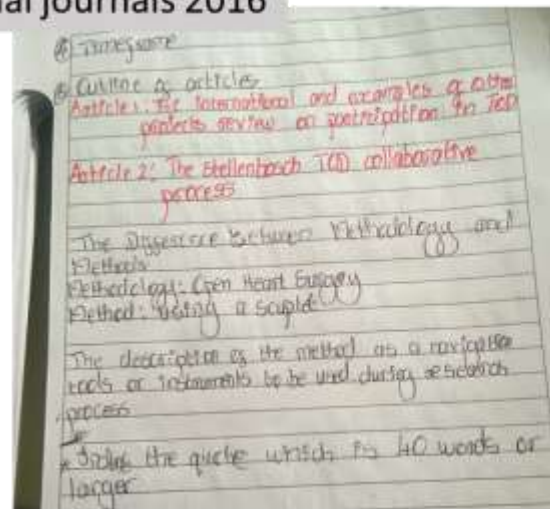

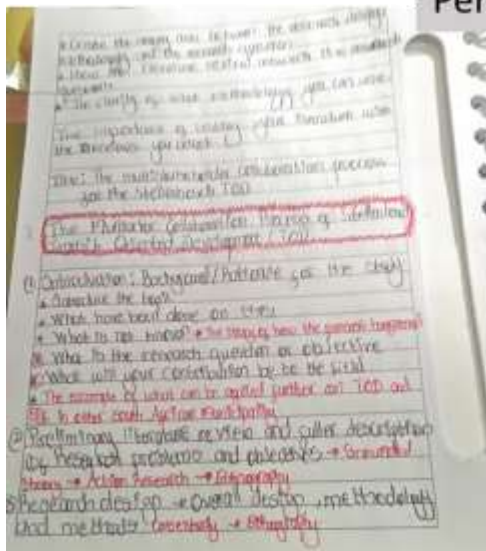Personal journals 2014

Personal journals 2015

Personal journals 2016
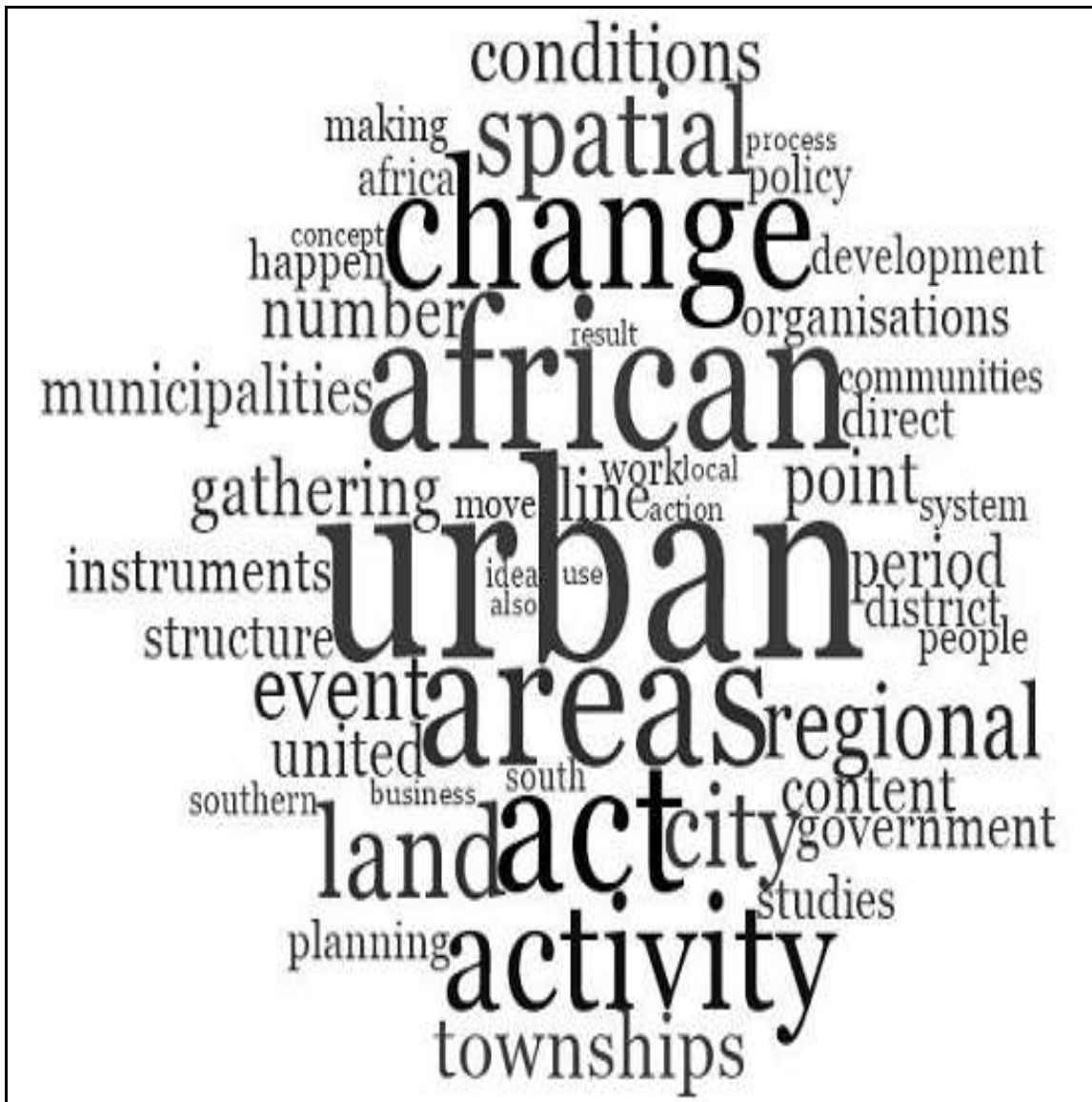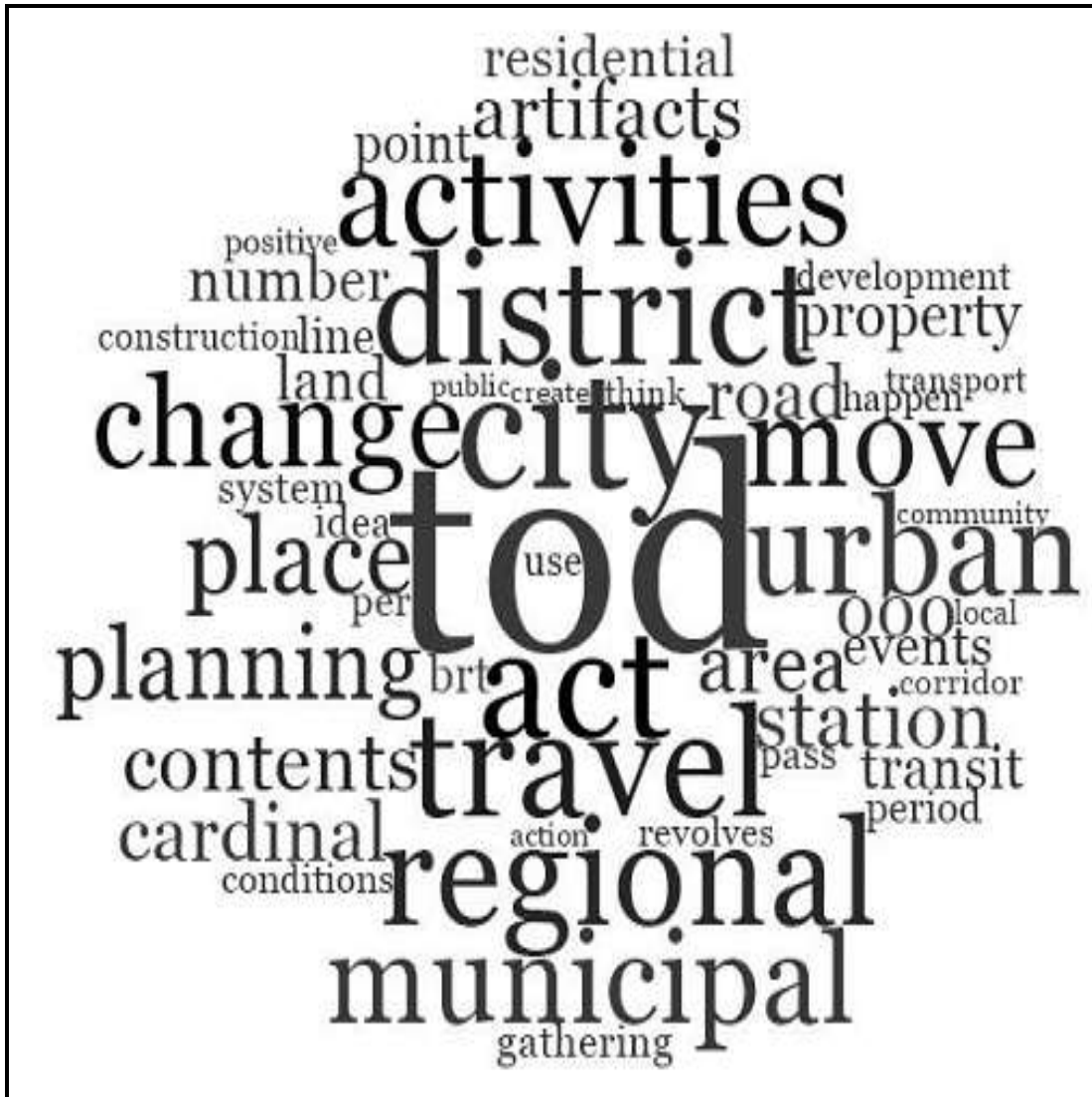
Appendix F: NVivo-generated word clouds

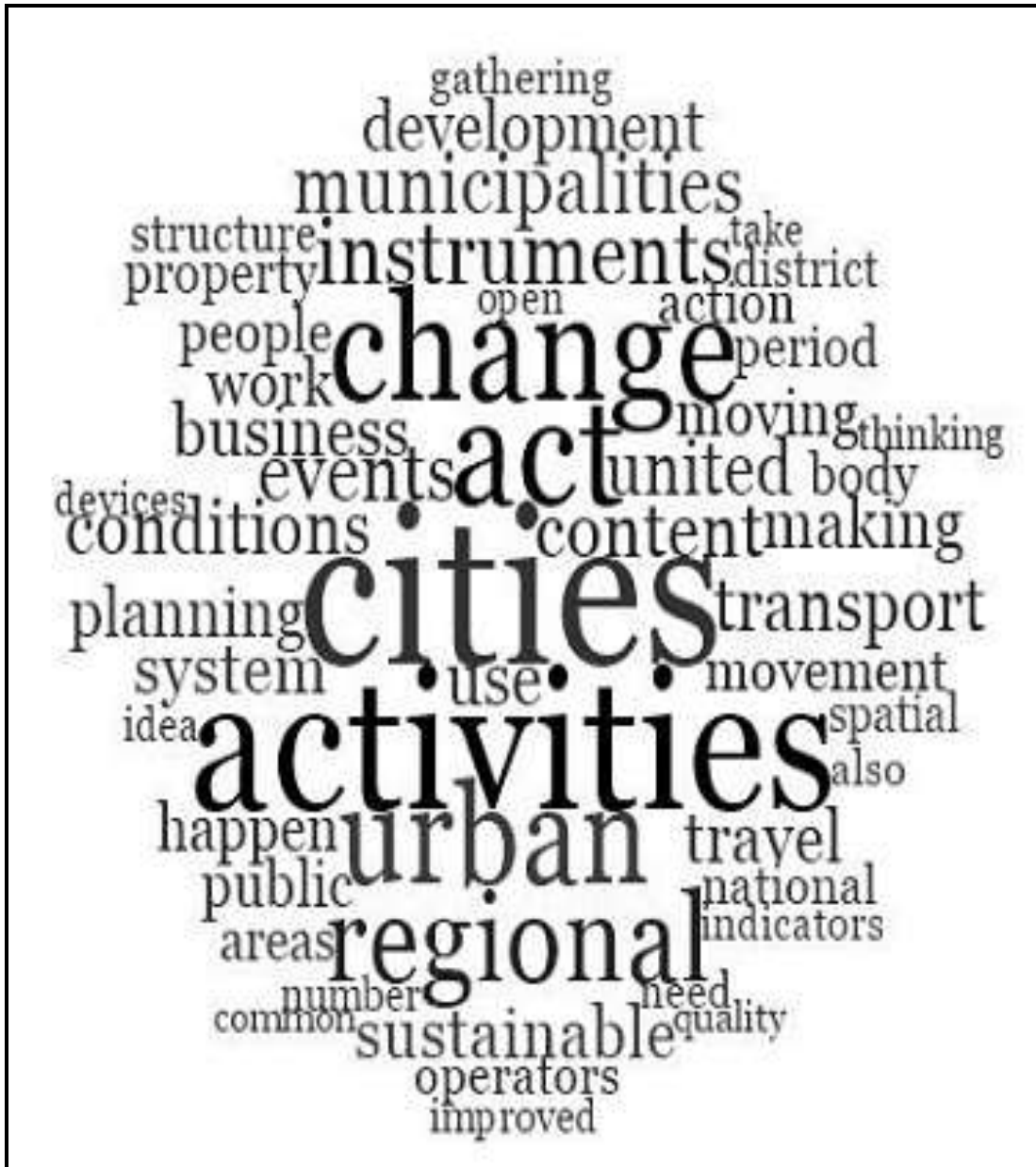**Figure 26: Apartheid city theory**

Source: Author

Figure 27: Land-use planning principles theory

Source: Author

Figure 28: The TOD concept

Source: Author

Figure 29: Transport development in South African cities

Source: Author

Figure 30: Public transport development policy framework in South Africa

Source: Author

Figure 31: TDR methods used for this study

Source: Author