ACCOUNTNG FOR ECONOMIC DISPARITIES IN FINANCING MUNICIPAL INFRASTRUCTURE IN SOUTH AFRICA: A CASE STUDY USING DATA FROM THE CAPE WINELANDS DISTRICT MUNICIPALITY

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A thesis submitted in fulfillment of the requirements for the degree of Doctor Philosophiae (PhD), Public Administration in the School of Government, University of the Western Cape.

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KEYWORDS

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Cape Winelands District Municipality

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Municipal infrastructure grants

South Africa

ABSTRACT

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In this thesis I argue that by taking account of economic disparities and backlogs in intergovernmental infrastructure grants to municipalities in South Africa, government will effectively meet its constitutional obligation to equitably allocate infrastructure grants to local government according to the principles of parity, proportionality and priority (Young, 1994). Municipalities will thus be able to provide basic services to households in keeping with the Bill of Rights of the Constitution of South Africa (1996). Adapting the Petchey et al (2004) provincial capital expenditure grant model to the provision of municipal services using secondary data and information from local municipalities in the Cape Winelands District, I evaluate whether government's existing municipal grants are allocated equitably and, whether they account for disparities that differentiate municipalities from each other.

The findings from my analysis show that the current approach to financing municipal infrastructure does not sufficiently account for disparities and thus, undermines the requirement for equitability, adequacy and efficiency of intergovernmental allocations. Consequently, the right of citizens to basic municipal services is compromised and the macroeconomic structure is weakened. Furthermore the institutional arrangements for local government autonomy is undermined because municipalities cannot ensure stability, predictability, flexibility and economic efficiency of infrastructure budgets.

As municipalities receive part of their finance from national government through infrastructure grants, I used data from five local municipalities to examine the extent to which there is equitability and efficiency in the way this finance is allocated. To this end I constructed and applied a composite disparity index for each municipality to my adapted municipal infrastructure grant model to analyze and observe the impact of economic disparities in grant allocations. The findings show that a grant model that accounts for economic disparities satisfies the constitutional, economic and institutional considerations that should inform municipal grant allocation decisions. I conclude the thesis by highlighting the limitations and possibilities of using a municipal infrastructure grant model that accounts for economic disparities and, I propose some recommendations for applying such a model in South Africa.

May 2011

DECLARATION

I declare that this PhD thesis, *Accounting for Economic Disparities in Financing Municipal Infrastructure in South Africa: A Case Study using Data from the Cape Winelands District Municipality,* is the outcome of my own research study and, that it has not been submitted before for any degree or examination in any other university, and that all sources I have used or quoted have been duly noted and acknowledged as complete references.

Mervyn Jayaprakash Josie May 2011

Signed:……………………

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The research project that culminated with the writing up of this thesis was inspired by a strong conviction that unless we address the root causes of structural socio-economic inequality and disparity in South Africa we will not be able to eradicate poverty and promote growth and development. However, the thesis would not have been completed without the encouragement, support and assistance of many individuals and institutions along the way. In particular, I am grateful to my supervisors Prof. John Bardill and Prof. Stefaan Marysse. They provided guidance and encouragement that very often went beyond the call of academic duty.

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… in South Africa there is such an ill distribution of wealth that any form of political freedom which does not touch on the proper distribution of wealth will be meaningless. … So for meaningful change to appear there needs to be an attempt at reorganizing the whole economic pattern and economic policies … *Steve Biko, 1977*

… as long as poverty, injustice and gross inequality persist in our world, none of us can truly rest. *Nelson Mandela, (2005 speech, Make Poverty History*)

Everyone is equal before the law and has the right to equal protection and benefit of the law…Equality includes the full and equal enjoyment of all rights and freedoms. To promote the achievement of equality, legislation and other measures designed to protect or advance persons, or categories of persons, disadvantaged by unfair discrimination may be taken. *The Bill of Rights, (Constitution of South Africa, 1996, Section 9 clauses 1 and 2*

An Act of Parliament must provide for the equitable division of revenue raised nationally among the national, provincial and local spheres of government…and any other allocations to provinces, local government or municipalities from the national government's share of that revenue, and any conditions on which those allocations may be made. The Act… must take into account: the need to ensure that the provinces and municipalities are able to provide basic services and perform the functions allocated to them; the fiscal capacity and efficiency of the provinces and municipalities; developmental and other needs of provinces, local government and municipalities; economic disparities among and within the provinces; … the desirability of stable and predictable allocations of revenue shares; and the need for flexibility in responding to emergencies or other temporary needs, and other factors based on similar objective criteria. *The Constitution of South Africa,* [*Section 214 (1) and (2)*].

DEDICATION

To the memory of my mother Elisabeth, my aunt Flora and, my sister Margaret – my symbols of the struggle of working women against inequality, disparity and poverty.

CONTENTS

Chapter 1:

Introduction[1]

The purpose of the research for this thesis was to study the implications of taking account of socio-economic capital cost disparities and historical capital backlogs in infrastructure grant transfers to municipalities with communities historically disadvantaged by apartheid[2] in South Africa.

The Bill of Rights in the South African Constitution (Chapter 2, 1996) prescribes that the state must provide certain socio-economic rights to all citizens. The provision of certain of these rights falls within the ambit of municipal responsibility for sanitation and water. Among others these rights include an environment that is not harmful to health and wellbeing; access to adequate housing and basic shelter, access to health care services and, sufficient food. The Constitution also enjoins government at the national, provincial and municipal spheres to take reasonable legislative and other measures within available resources to achieve the progressive realization of these rights.

The Constitution, in Chapter 13, prescribes a set of guidelines for reasonable legislative and other measures to be taken within available financial resources. The principles for legislative and other measures are based on important clauses in the Preamble and Founding Provisions of the Constitution.

The Preamble principles (The Constitution, 1996: 1) for deciding on legislative and other measures for determining available resources include the recognition of "*the injustices of the past*"; healing "*the divisions of the past and establish(ing) a society based on democratic values, social justice and fundamental human*

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[1] *All definitions and explanations of terms are presented in footnotes. Quotations in this thesis are in italics with quotation marks when part of the text and, larger quotations are indented in italics without quotation marks.*

[2] *Apartheid was the official state policy in pre - 1994 South Africa and was characterized by the systematic political, economic, social and judicial oppression and discrimination of the black (African, Coloured and Indian) majority by a government representing a white minority. It has its genesis in the history of European colonialism and the subsequent discovery of diamonds and gold in South Africa. (See Lundhal and Ndlela, 1980, Marks and Rathbone, 1982; Crankshaw, 1997, Terreblanche, 2002, Feinstein, 2005, Seeking and Natrass 2006)*

rights"; and, improving "*the quality of life of all citizens and free(ing) the potential of each person*".

The Founding Provisions (Ibid: 3) suggest that legislative and other measures for determining available resources should include such values as "*Human dignity, the achievement of equality and the advancement of human rights and freedoms*" and, equal entitlement to "*the rights, privileges and benefits of citizenship*". The notion of equal entitlement is further bolstered in the Bill of Rights (Ibid: 7) where equality is meant to include "*the full and equal enjoyment of all rights and freedoms*" and, where the state is required to "*promote the achievement of equality*" through "*legislative and other measures designed to protect or advance persons, or categories of persons, disadvantaged by unfair discrimination*" of past apartheid policies.

According to Chapter 13 (Ibid: 124-125) all three spheres of government are expected to finance the progressive realization of basic services from available financial resources generated by own tax revenues and, equitable shares of nationally collected revenue transferred to provinces and municipalities by National Government through the legislative instruments of the national budget (Annual Division of Revenue Act) and the Intergovernmental Fiscal Relations Act (1996). Chapter 13 also stipulates that before the division of revenue bill is enacted it must take account of a list of public finance considerations [Ibid, Section 214 (2) a-j: 125]. These considerations underpin the priorities, limits and constraints for government policy in implementing the principles and values written into the Preamble, the Founding Provisions and the Bill of Rights.

It is clear from the foregoing that all three spheres of government are therefore confronted with the constitutional mandate of prioritizing the progressive realization of basic services in the face of prescribed limits and, constraints on available resources. With limited available own resources poorer municipalities with disadvantaged communities are faced with the enormous problem of providing the necessary infrastructure to access basic public services. This is particularly so if these municipalities are characterized by a range of socio-economic disparities and inequalities inherited from the past. Given this problem the study for my thesis asked:

> *How can municipal infrastructure grants take account of historical backlogs and disparities that differentiate municipalities from each other?*

To address this question and, following from my preliminary analysis of the current situation in which municipalities find themselves, I proposed two arguments that guided my empirical research. In the first argument I suggested that structure of the existing conditional infrastructure grant formulae does not take account of regional capital cost disparities that differentiate municipalities from each other in the provision of basic services. This omission compromises the right of citizens to basic services as enshrined in the Bill of Rights. Furthermore the omission compromises the principle of the equitability and efficiency of allocations within and between municipalities as required in Section 214(1) (a) to (c) and Section 214(2) (d), (e), (f), (g) and (h) of the Constitution. My second argument suggested that national government's existing project approach to financing municipal infrastructure based on the unit costs of inputs is flawed. This flawed approach compromises the intergovernmental fiscal relations (IGFR) principle of municipal autonomy and, the requirement for stability, predictability and flexibility of municipal budgets required by section 214 (2) (i) and (j) of the Constitution.

My arguments raise two secondary questions about the structure of the existing conditional grant scheme for allocating nationally collected revenues to local municipalities. The first sub-question is what are the likely impacts on grant shares of including cost disparities in an intergovernmental infrastructure grant scheme intended to equitably allocate funding to municipalities? Secondly, can equitability, stability, predictability and flexibility of municipal budgets be enhanced by the inclusion of cost disparities and economic efficiency considerations in a municipal infrastructure grant scheme.

Given the main question and two sub-questions the ultimate aim of the research was to explore and test the possibility of taking account of capital cost disparities in an intergovernmental infrastructure grant model for equitably allocating finance to municipalities within the constraints of a limited available pool of funds. To achieve this aim I set myself three objectives that also defined my approach to the study.

The first objective of the study was to analytically review the way in which municipal infrastructure grants are currently allocated to local municipalities for redressing socio-economic disparities, infrastructure backlogs and inequalities in historically disadvantaged communities in South Africa. The second objective was to examine and evaluate the Financial and Fiscal Commission (FFC) Provincial Capital Expenditure Grant Scheme (Petchey et al, 2004) for allocating targeted municipal infrastructure grants and to assess whether this approach may be appropriate for addressing disparities and inequalities within and between municipalities in South Africa. The third objective was to assess the trade-off between economic efficiency considerations and the equitability of allocations that take account of capital cost disparities within and between municipalities in achieving their targets with specific reference to the requirements listed in clauses (e), (f) and (g) in Section 214(2) of the Constitution.

The questions and objectives that informed the study for this thesis presupposed an analytical understanding of the political economy structure in which infrastructure grants are determined and allocated to municipalities in South Africa's intergovernmental fiscal relations context. In this sense intergovernmental fiscal relations decisions that affect municipalities are determined by both macroeconomic and microeconomic structural constraints. This is particularly so with respect to the roles, decision-making behaviour and linkages of economic agents and institutions within municipal boundaries with large communities which have been disadvantaged by apartheid. My approach can be defined as *structural* because it seeks to model the way policy-makers should behave and impact upon intergovernmental fiscal relations and institutions in allocating infrastructure grants to municipalities. The theoretical and conceptual basis of the structural approach is discussed in the literature review in Chapter 2 of this thesis.

The relevance of a structural premise for the thesis is that infrastructure investment decisions of local municipalities are influenced by state intervention and institutional arrangements in the allocation of resources, income distribution and class relationships among households, investment decisions by firms, the technology costs of producing a service and, the macroeconomic impacts of debt, interest rates, prices and inflation and, foreign trade. In turn the microeconomic nature of infrastructure investment decisions by municipalities will have significant macroeconomic impacts for employment, income distribution, demand for goods and services and, domestic saving and investment opportunities.

As local municipalities in South Africa receive much of their infrastructure investment finance from national government it is important to interrogate the extent to which there is equitability and efficiency in the way this finance is allocated. Municipalities are faced with varying degrees of historical disadvantage, socio-economic inequalities and geo-spatial disparities. They also have to deal with past and present institutional arrangements and transaction costs, and macroeconomic constraints that impede their ability to finance their infrastructure investments.

Through the process of interviewing government officials and analyzing official data from the five local municipalities in the Western Cape Winelands District, my study for the thesis evaluated the approaches that maybe adopted for the equitable and efficient allocation of existing municipal infrastructure grants such that they take into account the cost of structural socio-economic disparities that differentiate local municipalities from each other. Appraising the equitable sharing models proposed by Petchey, MacDonald, Josie and Nthite (2004), Josie, MacDonald and Petchey (2008); Petchey, MacDonald, Josie, Mabugu, Kallis (2007) the thesis evaluates the FFC provincial capital grant scheme model (Petchey et al, 2004) for application to municipalities with economic disparities that differentiate them from each other.

All three objectives of the thesis will be achieved by using infrastructure data and other information from the Cape Winelands District local municipalities to examine whether National Government's municipal infrastructure grants are equitably allocated. Thus, the study examines the notion of equitability in South Africa's intergovernmental fiscal relations system against government's constitutional obligations to provide certain basic municipal services to all citizens (Bill of Rights, Chapter 2 of the Constitution). This obligation falls within the notion of socio-economic rights (Liebenberg, 2010; Stytler, N. and De Visser, J., 2007; Metha, L., 2005).

Context And Background

Over the past five years South African local municipalities have been plagued by many protests and demonstrations against local authorities. Municipal IQ, an organization that monitors developments at local government level, tracked reports of these protests and the findings have been published extensively in the South African media. The Business Day newspaper (22 July 2009) reported from a Municipal IQ statement that:

> *...halfway through the year, 13% of the major service delivery protests recorded since 2004 took place last year (2008). It suggests that should the trend continue, the number of protests this year (2009) will exceed those of 2007 and last year and come close to the 2005 peak when 35 protests were recorded countrywide.*

The Business Day report indicated that according to Municipal IQ protests related to poor public service delivery increased in 2009 with 24 major protests organized compared to 27 in the whole of 2008. Allan and Heese of Municipal IQ (Internet briefing paper, www.municipaliq.co.za, accessed 17. 11. 2009) on reporting data from Municipal IQ's Hotspots Monitor confirmed that there have been more major protests in 2009 (up to October) than any previous period since protests started in 2004.

On the 18 November 2009 The Voice of the Cape (www.vocfm.co.za 18 November 2009) radio station broadcast a statement from the Municipal IQ Hot Spot Monitor reporting that by the end of August 2009 83 major protests were recorded. This accounts for 44% of major protests recorded between 2004 and the end of October 2009.

An executive summary of research undertaken by the South African Parliament Research Unit and published on the Internet by the Parliamentary Monitoring Group (www.pmg.org.za/node/18556, August 2009) reported that between January and June 2009 a total of 26 protests were recorded. This was one less than in 2008. The Municipal IQ statement and the South African Parliamentary Research Unit (August, 2009) attribute the protests to the inadequate provision of social infrastructure such as housing, water and sanitation; the concomitant lack of delivery of public services and, corruption amongst public officials and politicians.

In their analysis however, Alan and Heese (2009), also add that:

> *...a sense of relative deprivation, and inequality within an urban context, is key to understanding why protests take place. People will wait for service delivery, but not if it seems that everyone else in their municipality is getting services before them. Add to this the marginalization and exclusion felt by communities in informal settlements and the general desperation for services in these areas, and top it all up with a lack of information from the municipality.*

The authors conclude that contrary to popular arguments that protests are an indication of municipal government failures statistical analyses suggest a significant link between the service delivery protests and high levels of migration and informal settlement patterns in relatively successful and productive municipalities. Recently, the authors suggest, some of these protests have turned destructive and are mixed with dangerous overtones of xenophobic and tribal violence against political and economic migrants and refugees from other poorer provinces and African countries. The new entrants set up in existing informal settlements swelling the ranks of these communities and adding further to the demand pressure for municipal services.

The Western Cape Province has not escaped such protests. Over the past five years the Western Cape Province has witnessed service delivery protests in townships and informal settlements (Khayalitsha, Langa, Phillippi and Delft) around the Cape Town metropolitan area and in De Doorns and Stellenbosch areas of the Cape Winelands District and, in Piketberg, in the adjacent Berg River Municipality. In 2005, The Cape Argus newspaper (7 July 2005), reported violent service delivery protests in the De Doorns area of the Cape Winelands District. From the 17 to 18 November 2009 protests again erupted in De Doorn. The November 2009 protests in De Doorn were openly xenophobic with local residents from informal settlements nearby attacking foreign seasonal labourers being hired by the local farmers. According to news reports on the News24 Internet news service (www.news24.com accessed on 17 and 18 November 2009) these protests are regular events at harvest time.

The Cape Winelands District is semi-rural and essentially based on the wine and agricultural industries. Historically the wine estates depended on slave labour. With the advent of democracy and the introduction of labour regulations in the agricultural sector in South Africa there have been massive evictions of farm labour from the estates (see my summary in the Appendix of interviews conducted in the Cape Winelands District). The consequence of these evictions has seen an increase in informal settlements and higher unemployment around towns and relatively more affluent centers thus creating added pressure on municipalities to provide accommodation and services. (See Western Cape Anti-Eviction Campaign website www.anti-eveiction.org.za).

Targeting disparities in municipalities through intergovernmental fiscal transfers

In the context of growing inequality in South Africa the service delivery protests are not surprising. The relationship between inequalities in regional patterns of disparity and deprivation and intergovernmental fiscal relations (IGFR) will be discussed further in Chapter 2 and Chapter 3 of this thesis. The next few paragraphs briefly puts into perspective the impact of inequality trends in South Africa.

After Gauteng the Western Cape province reveals the second highest level of inequality (Development Indicators Report, 2009) among provinces in South Africa. Amongst the many factors underlying the causes, constraints and challenges of service delivery protests are the past and present structures and institutions that determine the political economies of inequality and poverty in municipalities. To address some of these constraints and challenges government needs to assess and restructure the intergovernmental fiscal relations arrangements that govern the financial transfers and grant schemes that finance municipal infrastructure and service delivery. Such an assessment must take cognizance of the relationship between increasing trends in inequality and growing protests in the country.

n a long list of fourteen constraints and challenges that hamper service delivery presented in the executive summary of the Parliamentary Research Unit Report (2009), the first five have direct and indirect implications for intergovernmental infrastructure finance allocations. These implications are discussed briefly below.

Firstly, the Report suggests that lack of capacity in engineering and project management skills has impacted negatively on the implementation and management ability of municipalities to provide adequate access to clean water and sanitation services to disadvantaged communities. As a consequence, the Report suggests that urgent projects necessary to address inequality and poverty are left incomplete with funds unspent because many municipalities are unable to manage their projects. However, it has been argued by municipal officials (see Summary of Interviews, Appendix) that projects are left incomplete and funds unspent also because municipalities are unable to plan and budget with certainty and predictability. Addressing this challenge is one of the aims of my thesis.

While metropolitan and larger municipalities are able to finance such capacity needs from their own revenue sources, many smaller local municipalities, in which a large proportion of poor people reside, depend almost entirely on discretionary local government equitable shares and conditional infrastructure grant transfers from the national government share. The local government equitable share is meant to finance municipal operational and maintenance costs. On the other hand the conditional grants for municipal infrastructure, housing and roads are specifically meant for building these physical and social infrastructure needs.

The way in which the conditional grants are determined, allocated, disbursed, implemented and monitored is a cause of much consternation and anxiety amongst municipal officials given the lack of technical capacity in disadvantaged municipalities. The relevant municipal, provincial and national government officials who were interviewed for my study expressed this consternation and anxiety very emphatically (See interview questionnaire and summary in the Appendix). The concerns of the officials relate to the fact there is no equitable, stable and predictable allocation mechanism in place for conditional infrastructure grants.

Equitability, stability and predictability are key requirements of Section 214(2) (i) and (g) of the Constitution. The grants are currently allocated as per project application and have very serious consequences if municipalities without the requisite technical skills capacity cannot access and/or manage the implementation of projects. The situation is further exacerbated by the uncoordinated way in which grants are allocated and disbursed for the same integrated development plan (IDP) project. For example, a municipality with an IDP programme that requires project funds for housing, roads, water and sanitation has to submit different project proposals to the different government departments. Each department has a different set of conditions; time delays and, takes account of different considerations with respect to implementation and performance criteria. Clearly this does not make for equitability, stability, predictability and certainty in allocations. Aggravating this problem further is that consequent delays compromise the planned time lines for the delivery of services and are likely to precipitate angry responses from disadvantaged communities.

The second challenge in the Parliamentary Report (2009) suggests that widespread and growing unemployment and poverty levels are increasing the dependency of households on municipalities to provide free basic services thus fuelling frustrations in disadvantaged communities. The Allan and Heese Municipal IQ paper (2009) cited earlier adds that the influx of political and economic refugees from other African countries into informal settlements and townships only serves to inflame such frustrations as both groups compete for scarce jobs and, municipal services under pressure from high demand, lack of capacity, uncoordinated and, inadequately and inappropriately funded budgets. This frustration was dramatically illustrated in the second week of November 2009 when the media reported one such violent protest against so-called foreign farm workers in the De Doorn area of the Cape Winelands district of the Western Cape.

The Parliamentary Report (2009) goes on to list the third, fourth and fifth levels of constraints and challenges faced by provincial and local government as follows: the negative impact of the economic recession on the cost of services for disadvantaged communities already reeling under the weight of poverty and deprivation; the under-spending by municipalities due to poor project planning, poor management and/or lack of capacity; outstanding debt payments for services from residents, businesses and government departments. All three of these challenges place constraints on the determination of infrastructure grants and the way in which they are allocated. The inability of municipalities to accurately plan and spend their budgets was subsequently confirmed in the official government report on the *State of Local Government in South Africa* published in November 2009 (Cooperative Governance and Traditional Affairs, COGTA). This Report is reviewed in Chapter 3 of this thesis.

Considering the background presented in the foregoing discussion this thesis questions whether the current approach to financing municipal infrastructure is appropriate. It also questions whether it may be necessary for an alternative approach to be adopted. Such an alternative approach should take account of disparities and efficiencies in ensuring equitable and adequate shares of all allocations and, support stability, certainty and predictability in planning and budgeting. Such an approach should also make it relatively easier for municipalities to plan, coordinate, manage and deliver infrastructure dependent public services.

The Challenge of Economic Disparity and Intergovernmental Fiscal Relations

Municipalities, legally responsible for local service delivery and development, are faced with many challenges, not the least of which is the poverty and deprivation consequent on structural inequalities inherited from the apartheid past. To this challenge one can add the legal obligation for municipalities to progressively realize the rights of all citizens to basic services enshrined in the Bill of Rights in Chapter 2 of the Constitution. The Bill of Rights affirms the rights of basic public services for all South Africans and proposes that it may be provided within reason and progressively over time, taking into account the availability of financial resources.

Over the recent past, in their attempts to claim such rights, citizens have individually and collectively sought redress in the South African judicial system. The Grootboom Constitutional Court case ruling in September 2000 (See Southern African Legal Information Institute, 2000, www.saflii.org.za/za/cases) is typical of such court cases and the litigious environment in which all spheres of government have to function.

Mrs. Grootboom and other applicants who lived in an informal slum settlement of Wallacedene near Cape Town brought such a case to the Constitutional Court. The applicants argued that in terms of Section 28 (1) (c) of the Bill of Rights their children had a right to "*basic nutrition, shelter, basic health care services and social services"* (The Constitution, 1996) and therefore government had a responsibility to provide them and the community with decent shelter and related water and sanitation services. The Constitutional Court ruled in favour of Mrs. Grootboom and other applicants. The Constitutional Court ruling has subsequently been used as a precedent in other claims of this nature. The socio-economic mandates in the Bill of Rights and their various interpretations will be discussed in greater detail in the literature review (Chapter 2) of this thesis.

Given the current local government context of intergovernmental fiscal relations discussed above it is no wonder that Government in South Africa is presented with a basic public finance dilemma: how to balance the mandates in the Bill of

Rights and equitably finance the provision of municipal infrastructure services while simultaneously ensuring economic equity and efficiency. National, provincial and local government spheres are each constitutionally entitled to an equitable share of nationally raised revenues for the provision of services to communities (See Constitution of the Republic of South Africa (SA), 1996, Chapters 2 and 13). The dilemma resides in how this revenue should be equitably shared such that each sphere of government may fulfill its constitutional obligations.

The South African Constitution (1996) is very explicit in its prescription that not only must nationally collected revenue be allocated equitably to all spheres of government but it must also take into account disparities and other considerations that distinguish communities from each other [See Chapter 13 Section 214(2) (d), (e), (f), (g), (h), (i), (j)]. This constitutional injunction implies that municipal infrastructure grants should also be allocated equitably and take account of certain considerations such as: (d) the need to ensure that provinces and municipalities are able to provide basic services and perform the functions allocated to them; (e) the fiscal capacity and efficiency of the provinces and municipalities; (f) the development and other needs of provinces, local government and municipalities; (g) the economic disparities within and among the provinces; (h) the obligations of the provinces and municipalities in terms of national legislation; (i) the need for desirability of stable and predictable allocations of revenue shares; (j) the need for flexibility in responding to emergencies or other temporary needs, and other factors based on similar objective criteria.

Such an allocative responsibility requires taking into account the legacy of inequality and disparity of the apartheid past and the immediate socio-economic needs of the present. The Bill of Rights provides the constitutional foundation for this responsibility. In this respect financing municipal infrastructure presents a very specific dilemma.

The spatial and demographic configuration of the current municipal boundary dispensation bears the legacy of apartheid policy. To protect the privileges and interests of the white minority population apartheid policy institutionalized (under the Group Areas Act of 1955)[3] the targeted location of the African, Coloured and Indian (Hereafter referred to as *Black*) population groups in designated areas with limited social and physical infrastructure and considerable distance from centers of employment (See Lundhal and Ndlela, 1980; Marks and Rathbone, 1982; Crankshaw, 1997; Terreblanche, 2002; Feinstein, 2005; Seeking and Natrass 2006). The net result was that communities found themselves in conditions of unemployment, extreme poverty and deprivation.

The Group Areas Act left a devastating legacy of institutionalized inequality and discrimination in land distribution; discriminatory employment, labour and wage remuneration policies; unequal education and health facilities and, restrictions on social mobility and access to services for black people (*The Urban Foundation Group Areas Policy Document, 1990*). Many municipalities in South Africa still carry the responsibility of providing social and physical infrastructure and basic services to disadvantaged black communities. Most of these communities were victims of institutionalized inequality and are still burdened by exponentially growing infrastructure backlogs and, suffer the consequences of the negative impact of backlogs on the delivery of basic services.

The 2009 Development Indicators Report published by the Presidency, Government of South Africa (25 September 2009), confirms that despite fifteen years of post-apartheid democracy persistent income inequality remains the single most important challenge facing all levels of government.

> *Income inequality in South Africa was not reduced even during the years of economic growth: while income of all sectors has improved, that of the richer segment of the society seems to have improved at a faster rate.* (Development Indicators Report, 2009: Executive Summary).

[3] *The Group Areas Act was written into law by the white minority National Party Government in 1950 soon after coming to power in 1948 and stated that South Africans must live in separate residential areas designated for the use of different race groups in terms of the Population Registration Act of 1950. These two Acts constituted the formal legal foundation on which apartheid was built.*

The report shows that the Gini coefficient[4] based on data from the national Income and Expenditure Surveys (IES) has not improved significantly and, was in fact 0.640 for 1995; 0.680 for 2000; 0.690 for 2005 and, 0.679 for 2008. (Development Indicator Report, 2009: 25). One reason for the persistence of such inequality may be the structural disjuncture between the intended constitutionally based policy objectives of the post-apartheid state and the continued existence of socio-economic, political and institutional arrangements that have their roots in the political economy of colonialism and apartheid. Recent literature from the *New Institutional Economics* school of thought argues strongly for taking into account institutional arrangements and configurations in economic development policy. (Platteau, 1994 and 2000; Young, 1994 and 1998). The relevance of the *New Institutional Economics* approach for the thesis will be discussed in greater detail in the next chapter (Chapter Two: Literature Review).

In addition to taking account of disparities and inequalities between and within communities the Constitution also requires that government consider the fiscal capacity and efficiency of provinces and municipalities in their endeavor to provide services (See Constitution, 1996, Section 214 (2) d, e, and g). The study for the thesis analyzed how government may balance the requirement to simultaneously take account of disparities and economic efficiency so that municipalities may reduce infrastructure backlogs and effectively provide basic services. The next section of this introduction discusses some of the pertinent conceptual foundations and principles that underpin the notions of inequality and efficiency and, the ways in which it impacts on individuals and communities. In this thesis disparity is used as a synonym for inequality.

The Cost of Disparity in the Intergovernmental Fiscal Relations Dilemma

There is broad agreement amongst economists of differing persuasions that socio-economic disparities and inequalities impact on the material, physical and psychological quality of life and capabilities of individuals and the communities

[4] *The Gini Coefficient is an index that measures the level of inequality in society between 0 for no inequality, and 1 for complete inequality.*

in which they live. The literature on these issues by Alfred Marshall and Amartya Sen is reviewed in Chapter 2.

The importance of the principles and considerations raised by Marshall, Sen and others were important in defining the fundamental objective of the thesis as it applies to municipalities in South Africa in general and the five local municipalities in the Cape Winelands District of the Western Cape Province in particular.

In South Africa the legacy of the structural inequalities inherited from the apartheid past inhibits the ability of local governments to deliver the concomitant services as mandated by the Bill of Rights. Among the key challenges facing local governments are disparities in the quality, availability and adequacy of public infrastructure across local municipalities. Associated with this challenge is the requirement for government to allocate adequate and equitable levels of capital grants to local governments to eradicate capital backlogs and to eliminate the socio-economic disparities that limit their infrastructural capacity to promote growth and development in the quest to eradicate inequality and poverty. Following from this argument the thesis examines the relationship between economic disparity, infrastructure and capital stock in achieving equitability and economic efficiency.

Economic disparity, infrastructure and capital Stock

In macroeconomic analyses and, in the context of national accounts, public infrastructure is aggregated and classified together with privately provided infrastructure as the capital stock of a nation or sub-region. The level of public infrastructure investment in the overall capital stock is an important variable in determining national and sub-regional economic growth and development. For instance, Bhaduri (1986) and Taylor (1991), among others, discussed the importance of the capital stock variable in macroeconomic theory and, Hulten (1990) and Diewert (2006) discussed the measurement of capital stock for microeconomic applications. These concepts are explored further in Chapter 2. Despite the many difficulties associated with the measurement of capital discussed in the literature, from the accounting perspective of fixed assets and land, capital stock estimates are an important indicator for measuring wealth and analyzing the role of capital stock in production of goods and services. It is in the context of the production of public services by municipalities that capital stock estimates will be used in this thesis to gauge the required level of public infrastructure investment necessary to meet the demand of communities disadvantaged by past disadvantages and current socio-economic disparities.

The Problem: Balancing the Costs of Economic Disparity and Efficiency

In the light of the preceding discussion and given the fundamental questions and sub-questions the problem posed by the thesis can be expressed as finding an effective way of balancing the costs of addressing economic disparity while also addressing the costs of economic efficiency in equitably allocating infrastructure grants to local municipalities.

In 2005 I was part of a Financial and Fiscal Commission (FFC)[5] research team that presented a report (FFC, 2005) recommending to National Government a capital grant model for allocating infrastructure grants to provinces. The report was based on a paper (Petchey et al, 2004) prepared for the 2004 Tenth Anniversary Conference of the FFC. The model incorporated the principle of taking account of disparities (called disabilities in the Report) in developing a capital grant scheme formula. A generic version of the model was later published in the Journal of Development Studies (Josie et al, 2008). In 2007 I led an FFC research team that developed a macro-model extending the principles of the provincial capital grant model to include all equitable share allocations to national, provincial and local governments (See Petchey et al, 2007). The latter was an attempt to show how it could be possible to progressively provide basic services taking into account disparities and the availability of financial resources in balancing the cost of disparity with the constitutional requirement for economic efficiency.

[5] *The Financial and Fiscal Commission (FFC) is an institution set up in terms of the Chapter 13, Section 220, of the Constitution (1996) to make intergovernmental fiscal relations recommendations to government. It reports to Parliament.*

In arguing for an alternative approach to equitably sharing national revenue the Petchey et al (2007) report suggested that the current formulaic approach does not adequately cater for three policy issues. Firstly, it does not consider the need to balance the provision of constitutionally mandated basic services within macroeconomic constraints that limit available resources. Secondly, it is unable to objectively determine the equitable revenue shares for the three spheres of government. Thirdly, the current formulaic approach is unable to allocate infrastructure and capital grant funds in a way that is consistent with responses to the first two policy issues. These issues reflect the same challenges faced by policy makers in applying the existing formula for allocating infrastructure grants to municipalities. The empirical case study for this thesis was an attempt to examine the challenges with a view to providing an alternative model for allocating infrastructure grants to municipalities. In other words the study focused on the most appropriate policy instrument for equitably and efficiently balancing the allocation of government's municipal infrastructure grants such that they meet all the requirements of the Constitution.

Thus, to answer the questions identified earlier in this chapter I undertook the case study using secondary data on socio-economic disparity indicators from five local municipalities falling within the jurisdiction of the Cape Winelands District Municipality of the Western Cape Province. The five local municipalities studied were Breede River, Breede Valley, Drakenstein, Stellenbosch and Witzenberg. To complement the use of secondary data I also conducted a series of semi-structured interviews with officials from the District and local municipalities and, with officials from related provincial and national government departments. The aim of these interviews was to understand the extent to which including disparities in the grant model would imply a change in the intergovernmental institutional arrangements that governed infrastructure grant transfers to municipalities. The results of the interviews were supplemented by analyses and reviews of official government and private sector reports on the issue of municipal finance, governance and the delivery of infrastructure-based public services. The interview questionnaires and a summary of the responses are presented in the Appendix to this thesis.

Equitability, in the sense used in the thesis, means the equitable allocation of nationally collected revenue to all spheres of government as prescribed in Section 213 of the Constitution of South Africa (1996). While in general the equitability of allocations is the aim of Section 214, sub-sections (2) (a) to (j) represent the constraints that have to be considered when making the equitable allocations. In particular sub-section (e) lists *the fiscal capacity and efficiency of the provinces and municipalities* as a key constraining consideration. To the extent to which this constraint applies to the public finance context of the allocation and distribution of nationally collected taxes one can assume that *efficiency* here carries the same meaning as the notion of *economic efficiency* often used in the tradition of the neo-classical economic school of thought.

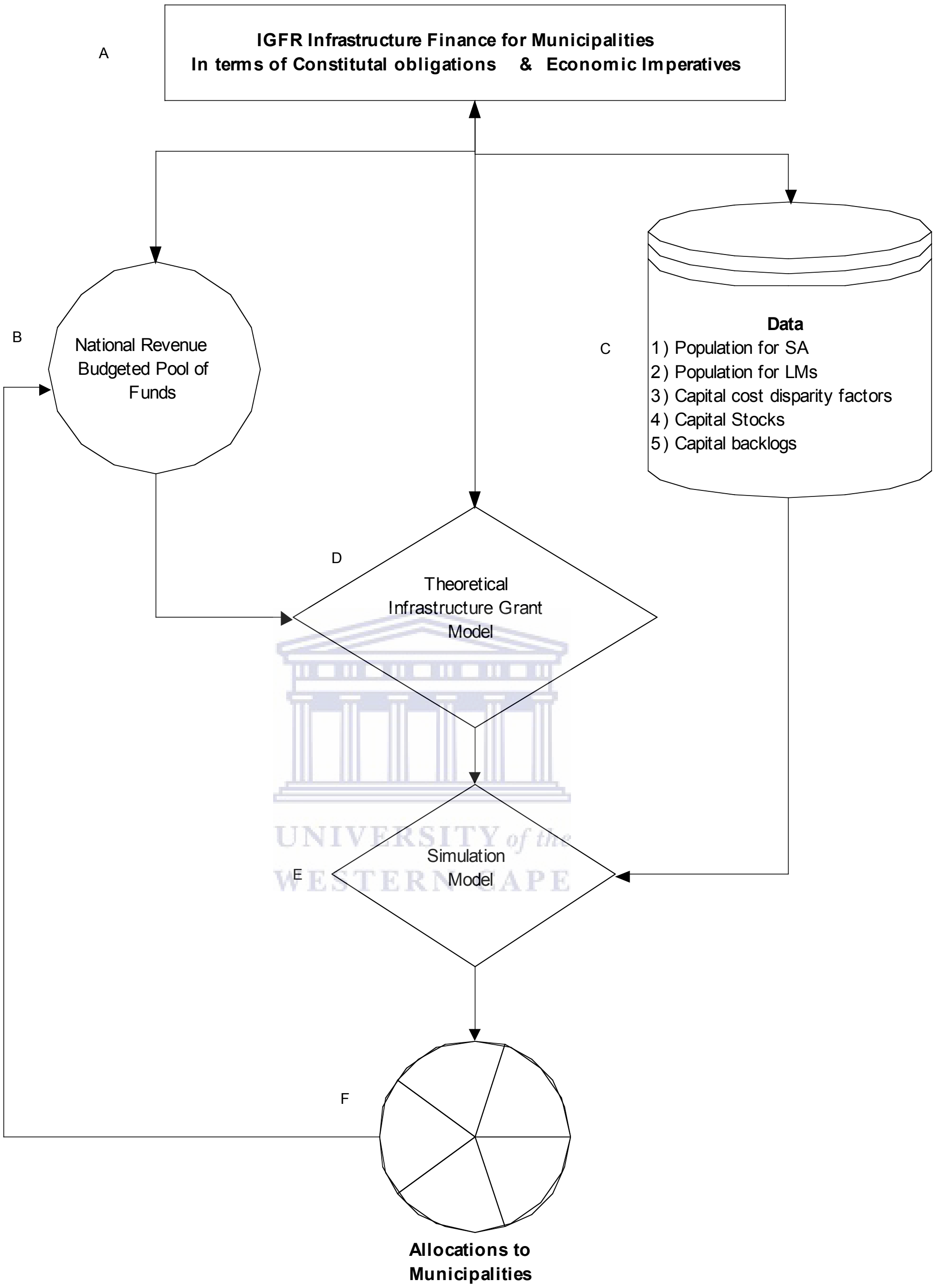
The *Penguin Dictionary of Economics* (Bannock, Baxter and Davis, 1992) captures the essence of the neo-classical definition of efficiency as follows:

> *The state of an economy within which no one can be made better off without someone being made worse off. For this to be the case, three types of efficiency must hold. The first is **productive efficiency**, in which the output of the economy is being produced at the lowest cost. The second is **allocative efficiency**, in which resources are being allocated to the production of the goods and services the society requires. The third is **distributional efficiency**, in which output is distributed in such a way that consumers would not wish, given their disposable income and market prices, to spend these incomes in any different way.*

Research Design and Methodology

The research design for the study was based on the integration of five inter-related components of analyses each of which applied a specific empirical methodology to the financing of infrastructure in the local municipalities in the Cape Winelands District. The thesis design is illustrated in Figure 1.1 and explained in the paragraphs that follow.

Figure 1.1: Schematic representation of the thesis design and components



Legend: *IGFR = Intergovernmental fiscal relations; LM = Local municipalities; SA=South Africa*

The first component (Box A) of analysis is a critical assessment of the existing intergovernmental fiscal relations institutional and governance frameworks within which the state allocates finance for municipal infrastructure. The second component (Box B) requires the estimation of the pool of funds available for financing local municipality infrastructure needs. The third component (Box C) specifies the data requirements for an assessment and construction of a reasonable estimate of public infrastructure backlogs as a function of the desired per capita level of public capital stock[6] and the capital cost disparities for estimating the composite disparity indices.

The fourth component provides the analytical incorporation of estimates of infrastructure backlogs and, the disparity indices into a coherent model that will lend itself to providing an alternative approach to allocating infrastructure finance that takes into account equitability, economic disparity and economic efficiency.

The fifth and final, component converts the theoretical model into a computer simulation model capable of simulating and generating alternative allocation scenarios that are consistent with the general equitability principles of *parity, proportionality,* and *priority* suggested by Young (1994: 8-9) and discussed in the literature review (Chapter 2) of the thesis.

The assessment of the statutory, institutional and governance policy objectives, targets, instruments and budgetary arrangements for infrastructure grant allocations used information from official documents and interviews with officials from municipalities and relevant national and provincial government departments. Estimating the value of the actual capital stock for the particular service for a specified period for municipalities in the Cape Winelands District was based on actual public expenditure data. Estimating the value of the actual capital stock for the particular service for an identified municipality in the specified period used

[6] *For the purpose of this study capital stock refers to the stock of all physical durable and tangible production factors. In the United Nations System of National Accounts 1993 (SNA93) in practice this corresponds to fixed capital, and in business accounts, it corresponds to tangible fixed assets.*

data derived from national and provincial estimates based on generally accepted accounting inventory methodologies (perpetual inventory method[7]).

The required population data of the identified municipality in the specified period were sourced from officially published government statistics. The required population data forecasts of South Africa for the specified period were sourced from the official government statistical agency, Statistics South Africa (StatsSA).

For determining the pool of funds available for municipal infrastructure for the specified period data from the National Treasury macroeconomic projections were used, assuming that Nationally Treasury took account of macroeconomic considerations listed in Section 214(2) of the Constitution. The study for the thesis used public infrastructure backlogs data from officially published sources.

Aggregated or composite capital cost disparity indices were estimated to show how the costs of historical backlogs and other disparity factors would impact on municipal budgets. The relevant disparity indices and their weights in a model can also be identified using statistical econometric regression analysis techniques (Petchey et al, 2000) or it may be assumed that the factors and actual weights are policy choices of decision makers. The latter point is discussed in detail in the literature review (Chapter 2).

I evaluated the Petchey et al (2004) model for allocating infrastructure grants to local municipalities using a methodology for analyzing and comparing the results of including and excluding cost disparities in the model. To do this I used a municipal specific disparity indicator derived from data from the five local municipalities in the Cape Winelands District. Through this process I defined a set of disparity indices and weights and then, assessed the effect of the disparity indices on municipal capital stock and population data by carrying out simulations of the infrastructure grant model adapted for allocating grants to municipalities. Using the results of model simulations that first excluded and then included disparities in the calculations, I compared the results with respect to:

[7] *The Perpetual Inventory Method (PIM) is a technique for estimating capital stocks. The technique entails adding gross fixed capital to an initial estimate of the capital stock and then by applying a rate of depreciation, calculates the net capital stock. (UN SNA93).*

- The positive or negative effects of disparities on infrastructure backlogs;
- The impact of disparities on the municipalities' share of the grant pool for backlogs;
- The impact of disparities on the speed with which municipal backlogs are reduced;
- How disparities affect the per capita economic efficiency portion of the infrastructure grant;
- How the inclusion of disparities impact on the equitability, stability, predictability and flexibility of municipal budgets.

The methodology used for adapting the Petchey et al model for allocating infrastructure grants to local municipalities is fully developed in Chapter 4. One key limitation to this thesis is the unavailability of capital stock data at municipal level. This is exacerbated by difficulties in accessing the capital expenditure data requirements and the information from official sources. Expenditure data is essential for estimating capital stock levels using the perpetual inventory method. Another limitation is the assumption that official data is a true indicator of reality in municipalities. Despite these limitations the data was used for illustrative purposes and to demonstrate the feasibility of the model proposed in this thesis.

The Context of Disparities in Municipalities in the Cape Winelands District

It is argued in the literature (see Chapter 2) that socio-economic inequality and disparities within and between communities in South Africa have their roots in the history of slavery, colonialism and apartheid (Terreblanche, 2002; Lundhal, M. and Ndlela, D. B., 1980; Seeking and Natrass, 2005). Andries du Toit (2004) argues that this is particularly true of the Western Cape in general and the Cape Winelands District more specifically.

Recent studies on municipal infrastructure and development in South Africa reveal serious shortcomings by municipalities in the delivery of social infrastructure services such as housing and related services. The studies in a collection edited by van Donk et al (2008) cover a range of local government issues that include the intent and impact of policy; evolving human settlements;

urban passenger transport; social development and the implications of HIV/AIDS; institutional arrangements for economic development and finance; intergovernmental delivery and, electricity distribution and industry reform. An official study commissioned by the Department of Provincial and Local Government [The Department of Provincial and Local Government (DPLG), 2007] raised specific concerns about the municipal infrastructure grant system and the possibility of a review of the Municipal Infrastructure Grant (MIG) in particular.

While these studies deal with a wide range of local government issues they do not adequately address the systemic link between equitability, efficiency and economic disparities in the infrastructure grant allocation system. Of particular concern to policy makers is that despite increases in infrastructure finance to municipalities the gap between rich and poor within and between the historically advantaged and historically disadvantaged communities seems to be widening at an alarming rate and, with negative socio-economic consequences. This trend was reflected quite sharply in the recently published (2008) Community Household Survey by Statistics South Africa. Of relevance for this thesis (Western Cape Provincial Treasury, 2006) the Cape Winelands District local municipalities reveal a similar trend.

In the Cape Winelands District the problems of historical inequalities and disparities within and between municipalities were starkly raised at a Cape Winelands District Municipality (CWDM) Poverty Conference, 27 May 2005, where a study entitled "Measuring the Vulnerability of the Poor" (CWDM, Conference Presentation, 2005) presented some key findings about local municipalities in the Cape Winelands District. These include in-migration into the district by work-seekers; expansion of informal settlements; 43.4% increase in numbers of people earning less than R9600 per annum between 1996 and 2001; the gap between rich and poor widening; three local municipalities in the district (Witzenberg, Drakenstein and Breede Valley) have the highest concentration of low income earners; unemployment being extremely severe in regional centers;

slow economic growth in the district and, informal settlements clustered around highest economic activity.

With respect to infrastructure and access to municipal services the study showed that housing, water, sanitation and electricity backlogs were severe across the district but especially so in Witzenberg and Breede River Winelands local municipalities. A recent study (Burgoyne, 2007: 17-18) on the factors impacting on the housing delivery in the Western Cape revealed that the Cape Winelands District Municipality had the second highest housing backlogs estimate in the province for 2007/08 after the City of Cape Town. Of a total provincial housing backlog of 410 000 units, the Cape Town estimate was 300 100 units and the Cape Winelands was 38 522 units compared to 35 380 for the Eden; 15 876 for the West Coast; 17 427 for the Overberg and, 2 522 units for the Central Karoo districts respectively.

International trends in health and social indicators are strongly correlated with inequality, poverty and infrastructure provision (Glyn A. and Miliband D., 1994). Data from the local municipalities in the Cape Winelands District (Western Cape Provincial Treasury, 2006) reveal increased incidence of TB in Breede River, Witzenberg and Stellenbosch; higher teenage pregnancy in Drakenstein; low birth weight figures, malnutrition and increases in cases of Feotal Alcohol Syndrome (FAS); increasing HIV cases, and a decreasing use of access to primary health care services. Trends in crime show that Drakenstein has one of the highest incidences of general crime and, crimes against women and children and, unacceptably high rates of drug and alcohol related crime compared to the national norm.

The Cape Winelands District Municipality Conference presentation (2005) identified several emerging issues and made some important recommendations with respect to infrastructure provision and accessibility to public services. Of particular significance for financing municipal infrastructure were: the strong correlations between settlement type and poverty; the growing gap between rich and poor; the worsening depth and scope of poverty; the limited access by disadvantaged communities to services and assets; minimal informal sector activity and, the multi-dimensional character of poverty and vulnerability. The most important recommendations made that are relevant for the thesis is the urgent need to address specific infrastructure backlogs and integrated interventions in certain sectors and, the need to review existing government instruments to assess the impact on poverty.

In South Africa all three spheres of government are bound by constitutional (Constitution of the Republic of South Africa, 1996) and legal considerations to try and achieve equitability without compromising efficiency in achieving economic growth and development. Finding the most appropriate financial resource allocation mechanism to fund municipal infrastructure investment will contribute to addressing this challenge.

Given the above background and the three objectives of the thesis (listed on page 4) my study was multi-dimensional in depth and scope of analysis. It assessed how the integration and provision of different infrastructure services impact on the interrelationships that cut across the political, economic, institutional, spatial and social groups and classes within the Cape Winelands District in the context of historical disparities and socio-economic inequalities.

A multi-dimensional approach required a theoretical and analytical framework that is equally multi-dimensional in character. For this reason the study adopted a structuralist theoretical framework for the analysis of the equitability and efficiency of the allocations of infrastructure grants to municipalities. This framework and approach is discussed in greater detail in the literature review (Chapter 2) of the thesis.

Summary

In this chapter, following the University of the Western Cape (UWC) Thesis Guide and, Mouton (2001), I developed the idea for the thesis and provided a motivation as to why the study for the thesis was necessary and relevant. I discussed the relevance of the study and the thesis conclusions in the context of the unfolding problems bedeviling the delivery of basic municipal services and the financing of municipal infrastructure within the institutional and legal parameters defined by the South African Constitution. I also demonstrated in the chapter how the general literature helped to refine the thesis topic and informed the definition and articulation of the research problem that guided the case study. The chapter also presented the main research question and sub-questions and fundamental aims and objectives of the research. The chapter provided a brief description of the theoretical framework for the research and the underlying assumptions on which the study was based. Following from the theoretical framework the chapter presented the research design and methodology used to conduct the empirical study on which the thesis conclusions and recommendations are based. The rest of the thesis is divided into six other chapters and a concluding chapter.

Chapter 2 reviews the literature dealing with a structural approach to analyzing the intergovernmental financing of municipal infrastructure. The primary aim of this chapter is to demarcate and evaluate the scholarship and show how the specific theories, concepts and approaches constitute a relevant theoretical framework for the development of the thesis through its different stages.

Chapter 3 provides the background to the problem of local government infrastructure grant allocations in South Africa's intergovernmental fiscal relations (IGFR) context. This chapter critically assesses the statutory, institutional and governance policy objectives, targets, instruments and budgetary arrangements of local government infrastructure finance in South Africa's intergovernmental fiscal relations system. These elements are discussed against the need for government to address equitability, efficiency and the socio-economic rights framework within which the state should allocate municipal infrastructure grants.

Chapter 4 discusses and documents the various research methodologies and data used for analysis.

Chapter 5 presents data and statistical disparity profiles of the five local municipalities in the Cape Winelands District. In this context the chapter discusses the main characteristics of each municipality incorporating data and information from secondary and primary quantitative and qualitative sources including interviews, surveys and published reports.

In Chapter 6 I develop an adapted theoretical version of a disparity weighted municipal infrastructure grant model based on the Petchey, et al (2004)[8] provincial capital grant model developed for the Financial and Fiscal Commission (FFC, 2005). The municipal infrastructure grant model is intended for the equitable allocation of infrastructure grants to municipalities.

In Chapter 7 I present the results and findings of the Excel Simulation Model estimations from my adapted version of a municipal infrastructure grant model. To produce the results and findings the simulation used official government data and information to construct capital cost disparity indices for the five local municipalities. Using the constructed capital cost disparity indices to test and evaluate the impacts of including capital cost disparities in the model the simulation produced results for the evaluation of the impacts on grant shares under three alternative scenarios. The chapter also presents findings on the effects of accounting for capital cost disparities with specific reference to the trade-off between equitably funding disparities in infrastructure backlogs against funding economic efficiency.

Chapter 8 concludes the thesis. The chapter summarizes and discusses the salient points of the main findings by drawing together the results from the preceding chapters. In particular the chapter discusses the results in the context of the literature and theories reviewed and identifies the data gaps, limitations and anomalies that require further investigation. Based on the results of the model simulations the chapter discusses the broader significance of the results and proposes some recommendations for applying the model for allocating municipal infrastructure grants. The chapter also makes recommendations for further research to address the limitations identified in the study.

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[8] *The model was first presented as a paper by Petchey, Josie, MacDonald and Nthite at the Financial and Fiscal Commission (FFC) Tenth Anniversary Conference in August 2004 and later, published by the FFC as a set of recommendations and operational manual for the South African Government and Parliament in 2005.*

An Appendix with the questionnaires and summary of interviews follows the conclusion and bibliographical references. The Excel Simulation Model and an electronic version of the thesis on compact disc are attached to the hard copy of the thesis.

Chapter 2

A Structural Approach To Intergovernmental Financing Of Municipal Infrastructure: A Review Of The Literature

The South African Constitution (1996) recognizes implicitly in its Preamble that the history of colonialism and apartheid in South Africa has left a legacy of structural inequality and poverty (Liebenberg, 2010). The legacy of this structural inequality and poverty is characterized by widening socio-economic disparities between rich and poor communities in local municipalities. The Founding Provisions of the Constitution (Chapter 1) affirms that South Africa is founded on the values of "*1(a) Human dignity, the achievement of equality and the advancement of human rights and freedoms.*" The Bill of Rights (Chapter 2) enshrines the rights of all citizens to human dignity, equality and freedom. In the literature Liebenberg (2005) analyzes the way human dignity may be used to interpret the socio-economic rights in the Bill of Rights. The author argues that the Bill of Rights imposes obligations on the State to ensure that citizens have access to socio-economic goods and services. However, such second-generation rights are subject to resource availability and, the state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realization of each of these rights.

In the rest of the thesis I refer to socio-economic rights as constitutionally mandated basic services (CMBS). The provision of many of these rights is the responsibility of local governments acting on behalf of the State. Furthermore, the delivery of, and access to these basic services require public infrastructure investment by local municipalities. If municipalities lack the necessary finance to provide public infrastructure it becomes the responsibility of national government to provide funds to municipalities from nationally collected revenues. In Chapter 13 Section 214(g) the Constitution further requires that Government take economic disparities into account in equitably allocating funds to local municipalities. Given this background I adopt a structural approach for analyzing and evaluating the intergovernmental financing of municipal infrastructure to achieve the objectives of the thesis.

In this chapter I will critically review the theories, concepts and methods that form the basis for the theoretical framework for a structural approach to assessing and analyzing the impact of economic disparities on intergovernmental fiscal relations between local municipalities and national government. A structural approach provides the most appropriate framework for analyzing and evaluating the systemic economic, social and institutional interrelationships of the intergovernmental financing of municipal infrastructure. In Chapter 4 I discuss in detail why the structural approach is appropriate for developing, analyzing and evaluating models for allocating infrastructure grants. In particular it provides a firm foundation for understanding the linkages between the microeconomic decisions taken at municipal level and macroeconomic decisions taken at the level of national government. The overall economic interrelationships and linkages are schematically summarized in Figure 4.1 in Chapter 4. A stylized view of the structural approach to understanding local government's institutional arrangements in South Africa's intergovernmental fiscal relations system is captured in Tables 4.1, 4.2 and 4.3 in Chapter 4. In the rest of the chapter I will define and review some of the key concepts of the structural approach as it was used in the study for this thesis.

Structural Definitions and Concepts used in the Theoretical Framework

Structuralist theories and approaches to economic analysis were largely influenced by the works of Michal Kalecki (See Osiatynski 1990; Taylor 1991; Fitzgerald and Vos 1989, and O' Hara, 2001) and were extensively used to analyze the political economy problems associated with post-colonial reconstruction and economic growth in Latin America and in other parts of the developing world.

A structuralist theory of development focuses on specific structures of a given political economy and has its roots in development economic theory. It places greater emphasis on the interactions between economic agents, socio-economic and political groups, classes and institutions and other economic components in the economy and their impact on the macroeconomic structure and its performance (O'Hara, 2001). It draws on stylized facts based on micro-economic empirical analysis of the behaviour of economic agents and social groups and from this builds a foundation for the construction of macroeconomic development models.

Modern day applications of a structural approach to political economy analyses are explained in detail in the works of Lance Taylor (1991: 2-10) and E. V. K. Fitzgerald and Rob Vos (1989: 27-33). The use of stylized facts hinges upon a set of premises about the structure of the political economy of a country and assumptions about the behaviour of and inter-actions between all the economic agents and the existential context[9] of their social class, production organization and institutional relationships.

Taylor (1991: 10-12) argues that a key generalization about the behaviour of economic agents and social classes can be drawn from macro level information that defines and limits the boundaries within which they interact. Depending on how much freedom they enjoy, economic agents and social classes will make decisions and behave according to the limits set by macroeconomic constraints. In many instances (such as the prices determined by foreign trade) these limits are beyond the control of individual agents. Thus an economy is said to have a determinate structure if the interactions and inter-relationships of all economic agents are pre-determined by institutions, production technologies and distribution of incomes, resources and other factors of production. Fitzgerald and Vos, (1989:28) elaborate:

> *The institutional framework refers above all to ownership, but also to the institutional form of enterprise, social group organization and state intervention. The concrete setting of these characteristics condition the way resources are allocated and markets eventually clear. Macroeconomics is built up from the microeconomic level by studying the precise features of the*

[9] *This is the boundary within which individuals exist as free agents and are responsible for their own actions and decisions.*

agents and the markets in which they operate, such as oligopolistic[10] *firms or household selling labour. This then leads on to a macroeconomic structure, which includes government, foreign trade, and so on. Production structures are seen as relatively inflexible in the short run as they embody a determinate technology, which can only be changed over time by investment.*

Following Taylor, (1991) and, Fitzgerald and Vos (1989), stylized facts[11] in structural economic theory, may be defined as empirical and generalized representations of various facts and components of an economic system used to model the roles, decision-making behaviour and linkages of economic agents and institutions within the production relationships that characterize the political economy of a country. The link between the micro decision-making behaviour of individual agents and the aggregate behaviour of whole population groups are a key theme in explaining the role of institutions in economic phenomena. This link is developed in the lectures of Bastiaensen (2007/08) and the works of Platteau (1994 and 2000) and Young (1994 and 1998). To explain institutional impacts on economic policy I retain, for the purpose of the thesis, the approach advocated by Young (1998: xi) that:

Institutions emerge over time from the cumulative experience of many individuals. Once their interactions coalesce into a settled pattern of expectations and behaviours, an 'institution' has come into being. The theory makes qualitative predictions about the evolutionary paths that such processes tend to follow and the diversity of institutional forms that they produce.

In addition to the emphasis of income distribution in determining welfare and demand Fitzgerald and Vos (1989: 29) propose two other areas of analysis where the structural approach will be important.

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[10] *Oligopolistic behaviour of firms is characterized by perceptions of interdependence, retaliation and, sometimes collusion, in decisions on pricing, investment and advertising policies especially in markets where there are few sellers of goods and services.*

[11] *Taylor (1991: 5) suggests that " realistic macroeconomics has to be based upon 'stylized facts'" and describes these as "…empirical generalizations drawn hierarchically at the macro, sectoral, and micro levels, about the economy at hand; …"*

Firstly, structural analysis will be useful in the area of governance and accountability in countries in transition and undergoing structural transformation. In this instance such an approach is required for instituting, managing and monitoring prescribed policies of transformation and institutional restructuring of arrangements and transaction costs. Secondly, with relevance for infrastructure investment, the structural approach focuses attention on the extent to which the availability of infrastructure, skilled labour, markets, resource allocation mechanisms, production costs and imported inputs determine whether businesses invest in a particular area or not. Both these emphases take on greater significance within the context of the constitutional requirement for equitable financial resource allocation mechanisms to municipalities to provide basic services to citizens and promote developmental and sustainable local government. Mr. Trevor Manuel, the former South African Minister of Finance, underscored the need for state intervention to be founded on equitable financial resource allocation mechanisms *(Sunday Times, 25 May 2008)*:

> *Ensuring that national revenue is used equitably is the most important thing any government can do to promote the trust, confidence and inclusion central to the stability required for long-term economic growth.*

Following the arguments of Fitzgerald and Vos (1989:28-29) what then constitutes a structural perspective for modeling the equitable sharing of infrastructure grants to South African municipalities? To answer this question I construct and present in Figure 4.1 and Tables 4.1, 4.2 and 4.3 (Chapter 4) summarized representations of the interactions between economic agents, socio-economic and political factors, institutions and other economic components in the economy and their impact on the macroeconomic structure and its performance. The summarized representations show in stylized form the linkages and flows between the allocations of municipal infrastructure grants and the possible macroeconomic and microeconomic impacts on growth and development.

In the rest of this chapter I sequentially and critically review what the literature says about the key components that constitute the structural approach represented by Figure 4.1 and Tables 4.1, 4.2 and 4.3 (Chapter 4). . In particular I l review the literature on how economic inequality and disparity can become structurally entrenched because labour market relationships and behaviours between economic agents are defined and institutionalized by political power and control. From this discussion I review the literature on the nature and impact of accounting for structural economic disparity in intergovernmental financing of local government. I also review the literature on the constitutional and institutional intergovernmental arrangements that govern the allocations of infrastructure grants in South Africa, and that can be used to progressively eradicate the structural inequality and disparity. Finally, I will discuss the literature on infrastructure and capital stock in macroeconomic aggregates and, on the role and measurement of capital stock in infrastructure grant models that may be used to equitably allocate infrastructure grants to local municipalities so that they may address the negative social and economic effects of economic disparity.

Perspectives on Disparities and Socio-economic Inequality

Making the provision of certain public services a right is based on the recognition by the Constitution of the historical legacy of socio-economic disparity consequent on centuries of colonialism and apartheid oppression suffered by millions of South Africans (Liebenberg, 2010; Lundhal, M. and Ndlela, D. B., 1980) from 1652 to 1994. For the purpose of the thesis economic disparity in South Africa is defined as an economic inequality, gap or difference in some economic respect. In South Africa the requirement for taking account of economic disparities in grant allocations is a constitutional obligation [The Constitution, 1996, Section 214 (2) (g): 125] that must be considered amongst other obligations. The growing levels of household and regional economic inequality that characterizes disadvantaged communities in South Africa (see Chapter 5) places a burden on national government to take account of these inequalities in grant allocations. Throughout the thesis I use the term disparity to be consistent with the constitutional requirement [Section 214(2) g] for government to take account of disparities in grant allocations. In the context of the thesis the use of the term disparity also means socio-economic inequality between and within municipalities.

One reason for the persistence of such inequality in South Africa is the structural disjuncture between the intended constitutionally based policy objectives of the post-apartheid state and the continued existence of socio-economic, political and institutional arrangements that have their roots in the political economy of colonialism and apartheid. Recent literature from the New Institutional Economics school of thought argues strongly for taking into account institutional arrangements and configurations in economic development policy12 (Platteau 2000; Young, 1998; Young, 1994).

The notion that economic inequality and disparity can become a permanent structure of the political economy of society is fairly well established in the literature and predates the 1789 French Revolution. Inequality features prominently in the seminal works of Jean Jacques Rousseau such as the Discourses on the Origins of Inequality (1755), Discourse on Political Economy (1758) and The Social Contract (1761). Among others these writings had a significant influence on the events that led up to 1789 revolution in France. (See Mason, 1979 for a discussion on Rousseau). It was in The Social Contract that Rousseau famously declared; “Man was born free; and everywhere he is in chains” (Mason, 1979: 154). To paraphrase Rousseau, in 1994 South Africans broke the shackles of colonialism and apartheid and attained freedom and yet, everywhere inequality still keeps the vast majority chained to relative deprivation and poverty.

Inequality and disparity in society has been a concern for political economists going back to the writings of Adam Smith in his famous treatise entitled the “Wealth of Nations” published in 1776[13]. For Adam Smith inequality and poverty posed a serious threat to the economy and the interests of the wealthy. He noted in the “Wealth of Nations” that for every rich person there were about five hundred

[12] *The Shorter Oxford English Dictionary defines institution as an “established law, custom, usage, practice, organization.” The term is used in this sense in the thesis.*

[13] The full title of the book is *An Inquiry into the Nature and Causes of the Wealth of Nations.* The 5th edition was published in 1904 in London and is available on line on (http//www.econlib.org/library/smithWN.html)

poor and that affluence for a few presupposes the poverty of the many. Such poverty, he implies, may provoke conflict between the rich and poor.

A current perspective on inequality by Dugger (in O'Hara, 2001: 505-508) defines inequality as a social pathology characterized by limiting opportunities, freedom and capabilities on the consumption of food, clothing, housing standards, health care and education for one social group so that another social group benefits from the economic surplus thus generated. Dugger argues that such limitations can be costly as "the direct cost of maintaining structured inequality is usually high" because of the requirement of a multi-faceted state apparatus for maintaining control and hegemony (O'Hara, 2001:505).

According to Dugger other features that characterize structured inequality include its circular and cumulative processes; its manifestation as gender, racial, national and class inequalities; its formal incorporation in the broad institutional control and distributive roles of the state; and its promotion of enabling myths that justify the maintenance and persistence of inequality in a vicious cycle of consciousness and practice among victims and perpetrators alike (O'Hara, 2001: 505-508).

The circular and cumulative processes of the different manifestations of structured inequality is reinforced by formal institutional control of the state and through its promotion of a plethora of enabling myths that keep it in place. The circular and cumulative process generates a cycle of evolving consciousness and practice reflecting attitudes and roles of inferiority and superiority among victims and perpetrators respectively.

On the other hand for Sen, Adam Smith's notion of 'necessity' means that the necessities that matter in society are a bundle of capabilities that enhance the functioning of human beings in their quest "to generate some minimally required freedoms such as the ability to appear in public without shame." (Sen 1999: 73).

The relationship between functionings, capability and freedom in the context of inequality, poverty and deprivation in South Africa has its origins in the history of colonialism and apartheid. It is important to recall that during the years of colonialism and apartheid in South Africa the "broad institutional control and distributive role" (Dugger in O'Hara, 2001) of the state was geared towards promoting enabling myths of the inferiority, of the majority black population and legally, and sometimes violently, denying them the bundle of capabilities that would enhance their functioning as human beings in society (Sen, 1999: 73).

To reinforce his argument that inequality follows a circular cumulative process Dugger proposes a corollary that suggests that in subjecting their victims to material and social deprivation the perpetrators of inequality make it easier to look down on their victims as:

> *…Inferior beings, and…undermine …(their)… self-confidence and self-worth with invidious distinctions…(and)…find it easy to take further advantage …without feeling guilty." The victims often react by "accepting their fate and by blaming themselves for their own shortcomings. Their even lower condition makes it easier still for the upper classes to ignore or despise them. All these processes increase the cumulative relative inequality between classes. (in O'Hara, 200: 506).*

The cumulative process of inequality is reinforced and underpinned by enabling myths of the superiority of the perpetrators and the sense of inferiority of the victims.

The arguments put forward by Dugger apply equally to situations of slavery, colonialism, racial segregation and apartheid. These propositions have been well documented in the anti-colonial literature (Fanon, 1961); anti-racist literature (Myrdal, 1944, in O'Hara, 2001: 776; Sen, 1999), and anti-apartheid literature (Biko, 1978).

Fanon (1961), the French psychiatrist, in particular addressed the devastating long-term impact of French colonialism and inequality on the psyche of the colonized in Algeria. More recently economists such as Heckman and Cunha (2009) have presented a study investigating the impact of the economics and psychology of inequality and human development on capabilities. The Heckman and Cunha paper was first presented as the Marshall Lecture at the European Economics Association, 2008 to commemorate the pioneering works of the nineteenth and early twentieth century economist Alfred Marshall. Marshall is often considered to have laid many of the foundations of modern microeconomic theory. What is less known is that Marshall also considered inequality and poverty key variables in undermining economic growth and development.

Reflecting on Marshall's most important work it is not difficult to find references to his thoughts on the impact of inequality in generating poverty, dysfunctional behaviour and socio-economic ills in society. In the introduction to his *Principles of Economics* first published in 1890 Marshall writes eloquently about the role and impact of income inequality on household poverty.

> *But the conditions which surround extreme poverty, especially crowded places, tend to deaden the higher faculties. Those who have been called the Residuum of our large towns have little opportunity for friendship; they know nothing of the decencies and the quiet, and very little even of the unity of family life; and religion often fails to reach them. No doubt their physical, mental, and the moral ill health is partly due to other causes than poverty: but this is the chief cause. (*Marshall, 1920*, Principles of Economics*, Book I*)*

It is important to note that Marshall did not stop at only analyzing the economic impact of wealth, inequality, injustice and poverty. In Chapter V, Book IV of *Principles of Economics* he went further to consider the impact of these variables on the health, strength, psychology and the evolution of consciousness[14] and, efficiency of human beings in society.

More recently, apart from Heckman and Cunha, other economists have studied the nefarious and insidious psychological effects of inequality and poverty on human capital as it relates to economic efficiency, growth and development. See in particular the studies by Bowles, Gintis and Osborne, 2001.

Sen (1979) discussed the relationship between human capabilities and equality and traces the evolution of the different concepts of equality as it applies to the welfare and utility disadvantage of individuals and concludes that these traditional concepts have serious limitations. He argues that what is missing in these

[14] *Marshall's reference (See Note 63 to Chapter V) to "nervous strength" and "vigour" may be considered important attributes in the evolution of human psyche and consciousness.*

conventional economic frameworks to equality and inequality is an understanding and, a recognition of the urgency related to the individual's ability to do or perform certain basic functions that would make him or her a fuller human being in society. Traditional notions of equality focus on how welfare is enhanced by utility or primary goods or a combination of both. However, even though these notions of goods and/or their utility may include income, wealth, rights, liberties, opportunities and the social basis of self-respect the focus is still on ***the possession*** of these goods and rights rather than what they ***do*** to and for human beings. For Sen, a person's ability to do certain things and be truly human depends on whether the person possesses some ***basic capabilities*** to move about; to meet nutritional needs; to be clothed and sheltered; and, to have the power and freedom to participate fully in the social life of the community. An alternative approach to the conventional understanding of equality according to Sen is the interpretation of needs as basic capabilities. Because Sen believes that the understanding of needs and interests is implicit in the demand for equality he calls this type of equality "basic capability equality" (Sen, 1979). The application of the capability approach to policy to deal with disparity and disadvantage in various countries is captured in a collection of essays edited by Comim, Qizilbash and Alkire (2008).

Sen[15], in 1999, alluded to the relationship between the evolution of consciousness, inequality and, its consequent impact on capabilities in achieving valuable functionings by the disadvantaged.

> *The relevance of these different types of achievements in understanding a person's advantages and disadvantages is not hard to establish. It is easily seen that people have reason to value living healthy and comfortable lives,* ***with self-respect and social participation, and other functions of this kind.*** *(My emphasis) ... This is not merely because of the basic heterogeneity of*

[15] *Sen's argument that the development of a person's capabilities can also be a function of economic disparity is explored in a collection of essays on the concepts, measures and applications of the capability approach edited by Comim et al (2008).*

> *pleasure… but also because of the adaptation of mental attitudes to chronic deprivation (the persistently deprived learns to take pleasure in small achievements, but that does not make her deprivation disappear)* (Sen, 1999: 31*).*

While Sen and many modern day economists only address the systemic relationship between inequality, poverty, the provision of public infrastructure and its impact on labour in production, Marshall was keenly aware of the role played by physical infrastructure and public capital stock in the creation and distribution of wealth. In a sense he recognized much earlier the importance of unequal access to public infrastructure services as a key determinant in defining capabilities in the creation of wealth and, how its unequal distribution and inadequacy generates poverty. Discussing physical public goods which are common to all members of a community Marshall noted in Books II and IV the right of citizens to security, roads, energy, water and sanitation and housing (Marshall, 1920. *Principles of Economics,* Book II). In Book IV he recognizes that poor drainage can cause diseases and overcrowding and, slum conditions can lead to poor health and low self-esteem (Book IV, Chapter V, Marshall (1920). He advocated for government to provide public infrastructure facilities in the interests of the greater good of society and to promote economic growth.

Marshall's view on public capital underscores the importance of physical and social infrastructure in the lives of people. This view also highlights the role played by public infrastructure as a catalyst for economic growth and development in the structure of the economy.

It is through the processes highlighted in the literature discussed above that inequality and disparity become structurally entrenched as part of the political economy of a country.

Perspectives on Economic Disparity in South Africa and the Western Cape Province

In South Africa effective governance for local government is constantly presented with the question of how to equitably finance the provision of public services while ensuring economic efficiency in the pursuit of growth and development. At first sight this question seems to present as the perennial dilemma faced by development economists in the debates on the trade-off between equity and economic efficiency in the quest for long-term growth (Glyn and Miliband, 1994: 2-12; Kanbur and Lustig, 1999). For South Africa all three spheres of government are bound by legal considerations to try and achieve equity without compromising on efficient economic growth and development. The Bill of Rights (Chapter 2) of the South African Constitution mandates the provision of basic services by all three spheres. Chapter 13 (Sections 213 and 214) of the Constitution also stipulates that the provision of such services be financed equitably taking into account certain considerations such as debt, deficit, economic efficiency, fiscal capacity and development among others. This section of the chapter reviews the literature with respect to inequalities and disparities that differentiate poorer local municipalities from their richer counterparts in the Western Cape province of South Africa.

In the literature the relationship between the provision of public infrastructure and the geographical location of local communities is inextricably linked with the history of colonialism, slavery and apartheid in the Western Cape in particular and South Africa in general.

Terreblanche, (2002), provides an in-depth analysis of the transition from slavery and indentured labour to legal and institutional inequality in South Africa under apartheid. The analysis argues that because of the history of slavery and apartheid the different forms of inequality have become systemically entrenched and will not be eradicated overnight. Terreblanche (2002: 11-13) traces eight patterns of labour relations in the transition from slavery (since 1652) to modern forms of inequality in South Africa. The eight patterns include direct legally forced labour; indentured and bonded labour; compulsory indentured labour; forced contract labour; migrant labour system; protected white labour system; balkanization of African labour in tribal reserves; and, a reserve army of impoverished and unemployed African workers. According to the author (Terreblanche 2002: 13) the evolving patterns of unequal labour and socio-economic relations has been characterized, since the 1960s, by the increasing unemployment and poverty of black workers in general and African workers in particular.

Terreblanche (2002) argues that the systemic exclusion of black people from the mainstream of the economy combined with low levels of direct investment and low levels of skills have marginalized African workers in particular, and made them ineligible for employment in the formal sectors of the economy. Data presented in Chapter 5 of this thesis suggest that many of the consequences of the patterns of labour relations presented by Terreblanche (2002) seem to persist in the economic, labour, property and social relations of the political economy of the Western Cape to in general and the Cape Winelands District in particular.

The history of inequality from its genesis of colonialism, slavery and apartheid has received attention in other recent studies. Of particular significance is the study by Seeking and Natrass (2005) and, with specific reference to the Cape Winelands District of the Western Cape, the study by Andries du Toit (2004) is important and is discussed in Chapter 5 to identify some of the more salient features of economic disparity in the Cape Wineands District Municipality.

Seeking and Natrass (2005) seem to confirm Terreblanche's (2002) argument that the structural nature of inequality distinguishes South Africa from countries such as Brazil and India. Unlike in the latter the unemployed and those without incomes in South Africa do not have access to subsistence forms of livelihood. Disparities in the patterns of land and asset ownership, public infrastructure and access to basic services, especially for the rural poor in South Africa, have not changed significantly. The patterns of unequal labour relationships have become structurally entrenched as a result of the laws that forcibly relegated African and Coloured workers to remote rural areas far from the cities and access to infrastructure and public services. A detailed discussion of these features of economic disparity is presented in Chapter 5. The relationship between disparities, capability, public infrastructure and access to services is discussed in the next section on this chapter.

Disparity, capability, public infrastructure and access to services

Sen (1997) argues that needs of individuals and communities for the attainment of basic capabilities are heterogeneous and, as such, are derived from a whole range of utility, welfare and value opportunities offered by environmental, economic, private and public agencies in the form of incomes, goods and services. Possessing basic capabilities to function as a human being in society depends on whether individuals and communities have access to incomes, goods and services offered by the environment, the state or the private sector. For individuals the primary services offered by the public sector and environment provide access to basic capability equality through education, health, housing, roads, transport, energy, and water and sanitation services. Such services create opportunities for individual incomes and resources and the attainment of basic capabilities through a chain of heterogeneous links made up of personal well being, environmental well being, access to public goods, community relational cohesion and solidarity, and household level welfare.

For communities and individuals to access the primary services offered by the public, private and environmental sectors there must be adequate levels of investment in public infrastructure. Accessibility to primary services and the attainment of basic capability equality is dependent on the availability of adequate and appropriate public infrastructure. In as much as income and resource relationships to heterogeneous factors enhance individual capabilities, so too does investment in public infrastructure enhance capabilities in communities or municipalities.

For Sen (1999), individual freedom is inextricably linked to the endowment of abilities and capabilities necessary for every human being in the quest for true humanity. A model for applying Sen's capability approach developed by Dubois and Rousseau (Comim et al, 2008) demonstrates that a person's vulnerability is determined by a set of capabilities. Vulnerability increases in the face of higher risk and decreases with enhanced capability such that:

$$Vulnerability = R/C \text{ where, } R = risk \qquad (2.1)$$

The authors imply that by combining assets and access to services individuals and households can protect themselves from a pattern of various social risks and associated shocks when capability is a function of public capital investment, infrastructure services and accessibility to socio-economic opportunity such that:

$$C = f(pki, pis, aeo) \qquad (2.2)$$

Where
C = capability
pki = public capital investment
pis = public infrastructure services
aeo = accessibility to socio-economic opportunities

Following from this relationship the authors argue that:

> *Since everyone in daily life faces a pattern of various risks (social and idiosyncratic), it is the assets owned which prevents them from falling into poverty. According to their capacity of combining various assets, they will more or less (be) protected from the consequences of any corresponding shocks (*Dubois and Rousseau in Comim et al, 2008: 429*)*

This conclusion is an important linchpin principle in the development of the idea for my study for the thesis. Following the model let us assume in a local municipality there is a person *i* at date *t* with the ability to do things to deal with disparity and, who has the potential to be truly human. The ability to deal with disparity is used in the sense of the 'doings' of the person and the potential to be truly human is used in the sense of a person having endowments to avoid vulnerability (Sen, 1987). In this case the ability to confront disparity and the potential to be truly human are two components of person *i*'s level of capability. The level of capability is, therefore, a function of these two components such that:

$$C_{i,t} = f(A_{i,t}),(P_{i,t}) \qquad (2.3)$$

Where:
$C_{i,t}$ = *level of capability*
$A_{i,t}$ =*ability to deal with disparity*
$P_{i,t}$ =*potential to be truly human*

Also relevant for my analysis is the essay in Comim *et al* by Unterhalter (2008) on the capability approach in relation to state policy on gender, HIV/Aids and education in South Africa. Based on empirical evidence from a study of HIV/Aids intervention policies in schools in Durban, South Africa, the author found that the application of the capability approach requires a keen understanding and acknowledgement of the importance of social theories of inequality *“that allow us to understand what happens in the socially constructed spaces, in which the capability approach is applied…”* (Unterhalter, in Comim et al, 2008: 504-505). Without such an understanding the author concludes that the application of the approach will be limited. In the study for the thesis I attempted to discuss and analyze the importance of inequality and disparity in the context of the Cape Winelands District as the socially constructed space in which the capability approach may be applied in order to give meaning to policies for equitably financing municipal infrastructure.

The capabilities and functionings of the people of the Cape Winelands District can best be understood in the context of the lifecycle effects of the colonial and apartheid legacy of disparity and inequality in these disadvantaged communities. In an attempt to give practical meaning to Sen’s notion of ‘basic capability equality’ Yaquib (2008, in Comim et al: 438) refers to this as understanding capabilities and functionings over the lifecourse of a person as opposed to an ahistorical understanding of a person only as an adult. According to Yaquib to expand peoples’ capabilities to overcome poverty, policy interventions should best be made at childhood, when they are more likely to succeed. By lifecourse Yaquib (Comim et al: 437) means the process of growing up from childhood to adulthood. In this sense growing up is not only the essence of human development it is also a function of several factors amongst which childhood poverty and unequal opportunities to develop in childhood are key variables. The author presents data evidence that tracks individuals over several decades to show the links between “childhood deprivation and low adult attainments in health, education, income and psychosocial well-being.” Yaquib (Ibid: 439-440) makes a strong case for applying the lifecourse approach to understanding the evolution of capabilities and functionings as the ability of individuals to make choices about and, have command over the use of a set of commodities that enhance their development over a long period of time. Citing Sen (1987: 26) the author argues that the reason for this is because the set of choices made by an individual is invariably dependent on 'personal and social factors' affected by time in three ways.

Firstly, command over income to access commodities that enhance functionings evolves over time according to the age effects determined by biological and social factors; the shared cohort effects; the serially dependent effects such as past anti-poverty interventions and, random events in the life of the individual. Secondly, the individual's ability to effectively utilize commodities is also dependent on the experience an individual has gained over a period of time. Thirdly, choices that enhance functionings may depend on when poor individuals make decisions to invest in physical, human or social capital.

Adequate and equitably targeted investment in public infrastructure across different regions enhances personal and environmental capabilities and also addresses inequalities in regional per capita incomes. It also strengthens community relational cohesion; affords individuals accessibility to services and, reduces intra-regional inequality. The role of public infrastructure in providing communities access to basic capabilities can only be understood in the context of the relationship between interpersonal inequalities and spatial inequalities and disparities that distinguish communities or local municipalities from each other.

The relationship between interpersonal and spatial dimensions of inequalities has received attention in a United Nations University-World Institute for Development Economic Research (UNU-WIDER) study project on spatial inequality and development directed by Ravi Kanbur and Anthony J. Venables (September, 2005). The objective of the study project was to try and explain why, in developing and transition economies, spatial and regional disparities in economic activity, incomes and social indicators, are increasing.

The key findings of the Kanbur and Venables study project address three fundamental issues. The first is the extent of spatial disparities and their consequences. The second explains the levels and trends in spatial inequality. The third addresses the appropriate policy responses to spatial inequality. The study project was undertaken across a wide range of countries in Africa, Asia, Eastern

Europe and Latin America. The study concludes that despite the country heterogeneity spatial inequality is high and increasing. In assessing the diverse countrywide data the authors attribute the rise in spatial disparities to two key determinants. Firstly, certain regions are favoured by natural resource endowments such as proximity to rivers, ports and borders. These factors obviously account for the advantages enjoyed by such regions. Areas lacking in such endowments are, by implication, disadvantaged. The second determinant is infrastructure and openness to international trade. These factors are closely linked to benefits that may be derived from urban and industrial agglomeration and interactions that generate sustainable development and growth cycles. The authors assert that most of the empirical studies in the project show that public infrastructure is a key explanatory factor in rising spatial inequality in developing countries.

The UNU-WIDER study project (Kanbur and Venables, 2005) highlights two reasons why policy makers should be concerned about rising spatial inequality. Firstly, inter-regional inequality within a country is but a spatial manifestation of overall national inequality across individuals. Policy makers should be concerned because when spatial inequality rises, national inequality also rises. Secondly, in situations where regional socio-economic disparities coincide with political, ethnic, language or religious divisions resulting from historical and institutional roots then spatial inequality should be of concern to policy makers governed by considerations of inter-regional equity enshrined in their constitutions. The latter consideration is of particular relevance for South Africa and, given the history of Western Cape, of sub-regions within the Western Cape Province. The study project argued for targeted spatially equitable public infrastructure and public service allocations to address inequalities between and within regions.

In South Africa Havemann and Kearney (2006) analyze the relationship of spatial inequality to labour market outcomes. The paper reports the results of an empirical study that uses econometric regression analyses to show that, given the apartheid political legacy of irrational spatial planning, location is a key determinant for labour market outcomes. The authors introduce a new urbanization index as an input into their econometric analysis.

The study found that there was a positive relationship between the probability of being employed and the degree of urbanization. While this is true for most local municipalities in South Africa there are exceptions to the rule for six smaller municipalities. In these municipalities it was found that factors such as location near to a national highway or rail linkage to a metropolitan area, or a relatively well educated or highly skilled workforce played an important role in making these municipalities more successful despite their location. It is interesting to note that four of the six municipalities studied are located in the Western Cape Province and one of the four, namely Stellenbosch, falls within the Cape Winelands District, the focus area of the research for my thesis. From the results of their study the authors argue that while urbanization offers investment opportunities that may determine labour market outcomes, policy makers should not ignore or underestimate the investment potential of smaller municipalities to influence labour market outcomes. Drawing on the recommendations of the UNU-WIDER study project the authors strongly advocate higher levels of public investment in public transport infrastructure for railways and roads to reduce the structural spatial inequalities that separate the rural poor from the urban rich. The study argues that such investment will create opportunities for more positive labour market outcomes and an improvement in household incomes.

Another international study on child labour and access to basic services (Guarcello, Lyon and Rosati, 2004) comes very close to showing a possible causal link between infrastructure provision and basic capabilities.[16] The study sets out to show how the availability of certain basic services can affect the value of children's time and, consequently, household decisions on how this time may be allocated between school and work. If education is a key input into developing basic capabilities then household decisions on allocations of time between school

[16] *The International Labour Organization (ILO), UNICEF and World Bank initiated the study jointly in 2000 under a programme called Understanding Children's Work (UCW).*

and work is bound to influence the capability outcomes of households and the levels of basic capability inequality between households.

The Guarcello et al study investigates the availability and access of infrastructure services such as water and electricity as a determining factor in household decisions about children's time spent between work and school. The study also applies an econometric methodology to data from five developing countries to investigate the impact that the access to water and electricity has on children's activities. Using several advanced econometric techniques and sensitivity analyses the authors are able to make conclusions about the causal relationship between water and electricity access and children's activities. The study concludes that households with access to water and electricity are more likely to send their children to school and less likely to send them to work or keep them at home. The study also shows that the availability of water and electricity encourages early school enrolment and reduces dropout rates at later ages. For policy makers the findings of the study mean that the provision of access to infrastructure based services such as water and electricity is crucial for areas where school attendance is low and child labour is high.

All three studies reviewed above demonstrate that the inadequate provision of basic services and the lack of physical access to these services seriously handicap disadvantaged communities in the attainment of basic capability equality. Given the evidence from the literature discussed in the preceding sections of this chapter it is clear that the national government has a responsibility and obligation to ensure that local municipalities provide the necessary public infrastructure for their citizens in general and, more specifically, for those communities that still suffer the consequences of an apartheid legacy of structural economic disparity. National government fulfils this obligation through the allocation of intergovernmental infrastructure grant transfers to local municipalities. In the following sections of this chapter I review some literature on how government can effectively use a municipal infrastructure grant model to equitably and efficiently allocate such grants so that disadvantaged communities may benefit from such transfers.

Resource Allocation, Institutions and Social Justice

The grant model developed in this thesis is a tool for resolving the allocation problem that arises when the State is confronted with having to serve the interests of justice at both the microeconomic and macroeconomic level with respect to the provision of basic public infrastructure. Generically, the allocation problem, Young (1994: 6) notes, is about how institutions distribute "*specific benefits and burdens*" within the framework of the principles of social justice and the legitimacy of different forms of government. However, he notes further that theories of social justice are not specifically concerned with distributive problems at the microeconomic level. Young (1994: 7) argues strongly that as gross disparities and inequities are the result of the cumulative effects of local decisions, they should be rectified through redistributive policies at the societal or national level and "*not by trying to coordinate the decisions of local allocative institutions*". This condition is in South Africa satisfied because national government has a constitutional obligation to strengthen the legitimacy of sub-national forms of governments to achieve social justice by equitably distributing nationally collected revenue to provinces and municipalities.

In South Africa, addressing gross disparities and inequities of the apartheid past and achieving social justice through redistributive policies at the level of local government is prescribed in the Constitution and legislation. In this regard Liebenberg (2010) affirms:

> *The Constitution seeks to create an enabling legal framework for redressing the injustices of the past and creating a transformed society 'based on democratic values, social justice and fundamental human rights'. A fundamental feature of this Constitution is a holistic Bill of Rights, which integrates civil and political rights with socio-economic and cultural rights. All of these rights are enforceable by the courts, which have a broad discretion to grant just and equitable remedies. (Preface: xxi).*

However, in terms of local government responsibility Steytler and De Visser (2007: 7-9), argue that the socio-economic rights in the Constitution only translate into a requirement for local municipalities to provide services to all individuals where these rights intersect with the functional responsibilities of local governments to provide basic municipal services. Amongst the rights that may be associated with the provision of municipal services the authors include access to housing, health care services, sufficient food and water, social security and social assistance. While these rights fall within the ambit of municipal competence there are other rights such as the access to sufficient water and housing that are the concurrent functional responsibility of all three spheres of government. In the former the obligation is on the municipality and in the latter the municipality plays a crucial complementary and supplementary role.

The institutional dilemma and difficulty for local municipalities is how to achieve redistributive justice through the allocation of scarce own resources. Thus, with respect to redistributive justice the cumulative effect of local municipal decisions about the *allocation problem* of scarce own resources may be rectified through redistributive policies at the national level. Through this process the municipal allocation problem becomes an issue of how the institution of national government distributes "*specific benefits and burdens*" Young (1994: 6) within the framework of the principles of social justice and gives credence to the legitimacy of local government. It is for this reason that the thesis proposes a municipal infrastructure grant model for national government to fulfill its responsibility for the equitable sharing of municipal infrastructure grants.

For the construction of the municipal infrastructure grant model in this thesis I retain Young's specific principles and definition of the *allocation problem*. (Young, 1994: 7-8). Young defines the *allocation problem* as follows:

> *An **allocation problem** arises whenever a bundle of resources, rights, burdens, or costs is temporarily held in common by a group of individuals and must be allotted to them individually. An **allocation** or **distribution** is an assignment of the objects to specific individuals…An allocation is a decision about who gets a good or who bears a burden, and is usually decided by a group or by an institution acting on behalf of the group"*

From Young's definition of the *allocation problem,* and his subsequent discussion I retain several foundational principles for the construction of the infrastructure grant model. Young discusses eight factors give rise to allocation decisions. Allocation decisions are taken when a set of resources, rights, burdens or costs are temporarily and collectively controlled by a group of individuals who also have individual entitlements to the resources, rights, burdens or costs. Secondly, an allocation means an assignment to specific individuals by a group or institution acting on behalf of the group about who gets the good or who bears the burden. This principle is captured in the tables presented in Chapter 4 in the sense that the tables identify the government institutions as the groups, acting on behalf of the nation as a whole, that determine who gets the goods and services and who bears the tax burden.

Thirdly, a decision may be about allocating a good, a service or a burden. Fourthly, a good, service or burden may be homogeneous and divisible such as money or water. Fifthly, a good or service may be inhomogeneous and divisible like land. Sixthly, a good or service may be homogeneous and indivisible like seats in parliament or exemptions from obligations. Seventhly, they may be heterogeneous and indivisible such as in allocating kidneys for transplant or places in universities or jobs for designated groups. Eighth, the goods may be fixed (by law) or variable in the sense that the required resources may not be readily available at a given time.

According to Young (1994: 8) the allocation is *effective* if it results from three different types and levels of institutional decisions. These types are the *supply decision* about the quantity of goods or services to be distributed; the *distributive decision* about the formula, principle or instrument according to which goods or services are allocated to beneficiaries; and, a *reactive decision* made by individuals in response to the institutional choices made. Young's study focuses specifically on the rules of distribution applicable to distributive decision-making and the principles on which these rules are founded. Young (1994: 8) defines the *allocation rule* as follows:

> *In general an* ***allocation rule*** *is a method, process, or formula that allocates any given* ***supply*** *of goods among any potential* ***group*** *of claimants according to the salient* ***characteristics*** *of those claimants.*

The equity principles of *Parity, Proportionality,* and *Priority* describe the general *structure* of an allocation rule and are the foundations of theories of distributive justice discussed by Sen (1997) and Young (1994). *Parity* means that all claimants should be treated equally; *Proportionality* recognizes that goods and services must be divided according to the established differences amongst claimants; and, *Priority* affirms that the person with the greatest need is entitled to a first claim on the goods or services. The content of an allocation rule, however, is more complicated in practice and, according to Young (1994: 9), requires normative principles that emerge from empirical rules-based institutional choices, judgments and compromises between competing principles. In the thesis I attempt to incorporate the equity principles of *parity, proportionality and priority* by using a composite disparity index in a formula that allocates the supply of infrastructure funds for the benefit of disadvantaged communities living in local municipalities.

Constructing a composite disparity index is a complex proposition and is beset with many difficulties. In the following section I review some of the literature on constructing composites indices and the difficulties associated with such attempts. The literature is reviewed in the context of approaches to grant allocations based on the equity principles of *parity, proportionality and priority*.

Approaches to Grant Allocations Accounting for Capital Cost Disparities

Following from the equity principles discussed by Young (1994) an important component in the design of grant systems is accounting for cost differences in the resources required to achieve comparable service levels. These differences arise due to variations in demography, geography and socio-economic disparities among sub-regions. However, determining normative principles of *parity, proportionality and priority* to account for cost disparities in grant formulae from institutional choices remains the biggest challenge. As discussed in the literature structural inequality in levels of development, including critical capital backlogs is a major determinant of regional disparities. Even though a country's constitutional and legislative framework may provide a firm foundation for making rules based institutional choices regional disparities are difficult to prioritize and measure and very few countries attempt to do so in a detailed way. Reschovsky (2007) makes the point that estimating the differences in sub-regional input costs that should be incorporated in a grant model can be controversial and highly political because parochial considerations play a crucial role in determining what sub-regional features, characteristics and indicators are prioritized and taken into account. In the absence of clear normative principles based on institutional choices any judgments and compromises between competing principles will be perceived as less than objective. Explanations as to how the parameters in grant allocations were estimated would most likely raise suspicions that the weights were chosen on the basis of political and/or parochial considerations.

Despite the challenges and difficulties of doing so there is general agreement amongst public finance practitioners that, in principle, differences in fiscal requirements ought to be included in equalization grants targeting disadvantaged communities. This is especially true in systems where sub-regions have little revenue-raising capacity of their own. Any attempts to incorporate disparity cost indicators in grant formulae would contribute to the economic stability, fiscal equity and efficiency of the intergovernmental system. More particularly taking account of disparity cost indicators would ensure compliance with the equity rules of parity, proportionality and priority in allocation formulae. Some perspectives on the inclusion of disparity cost indicators for ensuring parity, proportionality and priority in grant allocations are reviewed in the following section. Particular attention is focused on how disparity indicators can be used for prioritizing the person with the greatest need being entitled to a first claim on the goods or services provided by the state because such claimants have been the victims of established structural inequalities.

Perspectives on constructing disparity cost indicators for grant allocations

To more effectively take account of municipal disparities in a capital grant model several composite cost disparity indices for disadvantage and socio-economic inequality may be constructed from sets of sub-indicators. International best practice shows how other countries have captured the disparity costs in formulae for delivering services to regions with varying degrees of disparities.

In Switzerland and Japan for example (Petchey et al, 2004; Reschovsky, 2007), residential location in remote and inaccessible geographical areas is used as a factor to calculate grant subsidies to these sub-regions. The first such sub-indicator may be population dispersion. Consider, for example, a geographically large municipality with a dispersed population. The cost of providing a school or hospital in the remote regions of such a municipality is higher than the cost of providing the same school or hospital in an urban metropolitan municipality with a predominately city-based population. This is so because, to provide a school or hospital in a remote location, it is also necessary to incur the cost of providing access roads, extending electricity and water systems and other infrastructure. As a result of such 'population dispersion disparity' the *per capita unit* cost of the flow of capital services in such a municipality may be relatively high. However, Reschovsky (2007) argues that that the key problem in estimating the costs of such inputs in the provision of public services is "identifying which factors are likely to play a role in influencing the costs of services and then determining the quantitative importance of those factors." (Reschovsky, 2007: 404). (Italics)

A second example of a composite capital cost disparity measure that may be relevant in South Africa relates to debilitating diseases. If a municipality has a relatively high incidence of debilitating diseases such as HIV/Aids or TB in its population, then the cost of each unit of health service may be high compared to a municipality with a relatively lower incidence of such diseases. This is because HIV/Aids and TB require more social infrastructure resources to manage services.

Although there is no conclusive evidence (Lienhardt, 2001) to suggest a causal link between debilitating diseases such as TB and HIV/AIDS and environmental or socio-economic conditions some studies (David et al, 2007) suggest that socio-economic and environmental conditions such as overcrowding and informal slum settlements are closely associated with a higher incidence of TB and HIV/AIDS. From this observation one can assume that the cost of providing a given unit of public service output may be higher in municipalities with structural disadvantages resulting from the injustices of policies of the apartheid past. For example, the cost of achieving given educational and health outcomes for people from poor families may be higher than the cost of achieving the same educational or health outcomes for people from richer backgrounds. Municipalities with more poor people (unemployed, lower incomes) and victims of past socio-economic discrimination might, therefore, be expected to incur higher costs in achieving given health and educational outcomes. Thus, some aggregated measure of socio-economic inequality and debilitating disease sub-indicators may be included in a composite capital cost disparity index.

As it is cumbersome to use a broad array of capital cost disparity indicators in a model for infrastructure grants to municipalities, one way of incorporating several sub-indicators into a model is to aggregate all the sub-indicators into a single composite capital cost disparity indicator. One such approach was used to construct the Financial and Fiscal Commission's (FFC) *Capital Grant Scheme Model with Provincial Disabilities* (Petchey et al 2004). In the FFC model the incorporation of multiple disparity indicators (called disabilities) began with the identification of a capital cost disparity indicator and the definition of its capital cost disparity function. Following this procedure used for provinces a capital cost disparity for a given municipality can be defined in order to arrive at a capital cost disparity function. In Chapter 4 of the thesis I present a method adapted from the Petchey et al paper (2004) for constructing disparity indices for the five Cape Winelands District local municipalities. The actual values for the disparity indices are calculated in the simulation model and presented in Chapter 7 of this thesis.

Australia is an example where the equalization grants formula attempts to incorporate needs and disparity factors (called disabilities) in a sophisticated way to determine the horizontal allocation of grants among states. Petchey, Shapiro, MacDonald and Koshy (2000) developed a model demonstrating how to capture differences within fiscal equalization formulae in capital costs across Australian states. However, in a later study completed for the Australian Commonwealth Grants Commission, Chan, MacDonald and Petchey (2007) made an important finding that highlighted the difficulty with incorporating disparity costs in grant formulae. The authors found that while they were able to identify and estimate the statistical significance of the main indicators that influence the cost of providing services they were unable to produce econometric results because of data limitations related to sample size and imprecise demand and supply definitions of disparity related proxies. The authors concluded that unless reliable data became available the study offered the best alternative for identifying disparity indicators in Australia.

In South Africa, in addition to the models developed by Petchey et al (2004) and Josie, MacDonald and Petchey (2008), another attempt was made to construct a grant model that incorporates disparities. In October 2007 Petchey et al constructed, for the FFC, a model that attempts to capture inequality and poverty disparities within provinces and municipalities in South Africa. In all the FFC allocation models composite capital cost disparity indicators were constructed and incorporated into the model.

Identifying proxies for disparity indicators in South Africa is not new and has in fact been the subject of other studies with particular focus on constructing health and deprivation indices. Of significance are two studies on regional trends of deprivation and health disparities for informing public funding allocation strategies in South Africa by Di McIntyre et al (2000) and, Di McIntyre and Okore Okorafor (2003).

The first study by McIntyre et al (2000) constructed four specific alternative deprivation indices to achieve vertical equity goals in the allocation of limited government resources. The aim of the study was to evaluate the significance of small spatial units in developing deprivation indices for prioritizing need in the allocation of state financial resources. To ensure that disparities for deprivation are not assumed to be of equal importance the variables were given differential weightings. The deprivation index developed in this study represents a state of social and material disadvantage experienced by an individual, household, group or community relative to the general norm in society as a whole. In this sense McIntyre et al (2000) assert that deprivation is closely related to Sen's human capabilities in that deprivation may be seen as the inability to achieve an adequate level of basic capability relative to the societal norm. The second study by McIntyre and Okore (2003) was an attempt to construct multiple deprivation indices from the 2001 South African census data at the level of the local municipality. From this study I incorporate the deprivation indices developed for the five Cape Winelands District Municipalities as sub-indicators for constructing a capital cost disparity indicator for the municipal infrastructure grant model proposed in this thesis.

Several difficulties are associated with attaching differential weightings to disparities. In some instances this is related to the paucity of data and information in transitional economies like South Africa. In the weighting schemes adopted in the studies by Petchey et al (2004) and McIntyre et al (2000) the approaches do not offer the possibility of reasonable bounds within which the weights may be specified. Nevertheless, the usefulness of such indicative tools in intergovernmental systems is that, compared to arbitrary decisions based on prevailing political interests, they provide a more objective mechanism for equitably allocating a limited pool of available funds. Given these shortcomings it is prudent to explore other weighting schemes that may go towards resolving some of these difficulties.

In the literature on disparity indices reviewed thus far the issue of attributing differential weights to disparity indicators to distinguish their varying degrees of importance in the scale of priorities is perceived as a fundamental challenge in grant allocation models (Chan et al, 2007). Without clearly identifying and defining the most important variables for disparity measuring the parity, proportionality and priority normative indicators will be very difficult. As is the case with the McIntyre et al (2000) study this difficulty can be overcome through an arbitrary normative policy decision by attributing differential weightings to avoid the assumption that disparities are equally important. This is not an ideal alternative although I adopt this principle in developing composite disparity indices for this thesis. Chan et al (2007) argue that econometrically defining and estimating proxy disparity weights can be achieved if reliable sample size data is available and, if demand and supply disparity related proxies are more precisely defined. However, in the literature on constructing composite indicators there are alternative methods for constructing and identifying weights that can determine the varying degrees of importance of a variable in a model. In the next few paragraphs I will explore one such alternative proposed by Cherchye et al (2006).

The composite indicator (CI) in Cherchye *et al* (2006) is presented as a weighted average of individual sub-indicators and defined as:

$$CI_c = \sum_{i=1}^{m} w_{c,i} . y_{c,i}^{n} \tag{2.4}$$

Where:

I_c : composite index for country j,

$y_{c,i}^{n}$: the (possibly normalized) value for country j for sub-indicator i (i=1,...m),

w_i : *the weight* assigned to indicator i.

Weights are bounded such that $0 \leq w_{c,i} \leq 1$ and $\sum_{i=1}^{m} w_{c,i} = 1$

In the paper composite indicators are used to summarize a set of diverse sub-indicators for the purpose of comparing countries with each other or, to assess their evolution over time. In general the ultimate goal of a composite indicator is to compare an entity relative to other entities in the set as a function of some benchmark policy objective determined from within the set of entities.

In proposing an alternative approach to constructing composite indicators the authors argue that the standard approach has two important shortcomings that have raised criticism against the use of composite indicators. Firstly, the standard approach is overly dependent on preliminary normalization aggregation techniques for ranking countries. The main purpose of normalization aggregation techniques is to ensure that sub-indicator data sets are comparable and use measurements that are consistent across the sub-sets of data to be aggregated and weighted. However, in the process normalization aggregation techniques transform original data and this may result in changes in the ranking of the variable. Such changes resulting from normalization techniques make the composite indicator meaningless and raise disputes and disagreements amongst stakeholders with respect to the credibility of the selected composite indicator. The authors suggest that a method that does not require normalization would eliminate this dependency and the basis of the criticism.

The second shortcoming and source of criticism against the use of composite indicators is associated with the weighting scheme for aggregating sub-indicators. Very often there are stakeholder disagreements about the selection process and choice of sub-indicators to be aggregated into a composite indicator. To resolve such disagreements some experts propose the equal weighting of all sub-indicators as a compromise (See McIntyre et al, 2000 and Petchey et al, 2004). However, equal weighting will be misleading because it does not reveal any specific knowledge about the importance of true weights in the scale of priorities. Equal weighting will be meaningless and a useless exercise as the initial purpose of the weighting procedure is to reveal the relative significance of the sub-indicators being aggregated. This poses the same problem encountered with normalization techniques where ranking scores depend on the weighting scheme. Fixed or equal weighting schemes will invariably be an advantage for some countries while being a disadvantage for others. Inherently such a scheme is insensitive to the regional specificities of each country or region being compared. Consequently, it defeats the purpose of taking into account the country specific differences for which a model may have been initially constructed as was the case with the FFC provincial capital expenditure model. To overcome the shortcomings above Cherchye *et al* (2006) propose the use of *Data Envelopment Analysis* (See Cooper *et al*, 2000) and the *Benefit of the Doubt* method for constructing composite indicators (see also the OECD Handbook on Constructing Composite Indicators: Methodology and User Guide, 2008).

DEA is a linear programming tool[17] and has been extensively used to construct composite indicators for policy performance assessment (Chercheye et al, 2006).

[17] *Linear Programming is a mathematical method for finding the maximum or minimum of a function under a set of given constraints. It is often used to determine the optimal allocation of scarce resources by selecting and applying appropriate weights to a set of observations.*

In the European Union it is used to address the need for a weighting system that includes country specific sensitivity and flexibility in allocating resources in the context of tensions between the centre and states. Chercheye et al (2006:4) argue that the DEA technique may also be used for constructing composite indicators where quantitative sub-indicators are available but exact information of weights is unavailable. Melyn and Moesen first applied the technique in 1991 to evaluate macroeconomic performance (As cited in Cherecheye et al, 2006: 4) and called it the '*Benefit of the Doubt'* method.

The *'Benefit of the Doubt'* method is based on a key principle of the DEA technique, namely that information on an appropriate weighting scheme may be sourced from official data available in a country. In evaluating performance, for example, one can assume that the required available sub-indicator data set will reflect the relative significance or importance of that particular sub-indicator in the policy decisions of the country. In other words the problem of lack of knowledge of a country's 'true' policy weights can be resolved by assuming that these can be inferred from analyzing the relative significance or importance that a country attaches to a particular sub-indicator. The country is given the 'benefit of the doubt' on the basis of the relative importance or, significance it attaches to a particular set of sub-indicators. Weights in this sense are estimated separately for each region and, region specific weights accorded to each sub-indicator are endogenously determined. Thus the problem of having to apply equal weights to all sub-indicators is averted and flexibility is introduced into the weighting scheme albeit within given parametric constraints.

Given the shortcomings associated with estimating weights discussed earlier it will be extremely difficult for policy makers to determine which of the many sub-indicators to prioritize when taking into account several dimensions in a model. Government policy statements about priorities themselves do not represent a quantitative weight that can be attached to each dimension to facilitate prioritization (Moesen and Chercheye, 1998: 14-15). Furthermore there is the possibility that governments may change priorities over time (Moesen and Chercheye, 1998: 15):

There remains…the more fundamental question of weather the publicly announced objectives coincide with the true goals of policy makers. In other words: the stated preferences may deviate from the actual preferences."

In the presence of this limited quantitative information, Moesen and Chercheye, (1998: 15) provide a rationale for applying the DEA and relative 'Benefit of Doubt' weights to construct a composite indicator to measure macroeconomic performance in the context of the European Union.

For all these problems we will…develop a mathematical technique which allows allocating relative weights when only relative information is available. The technique that will be used is based on DEA. This technique weights the components of the synthetic (read composite) performance indicator in such a way that each country gets the benefit of the doubt. The latter implies that the highest weights are attached to those indicators for which the country performs relatively better. In other words, a particular dimension is deemed to be important for a country if the country performs well in that dimension when compared to other countries.

In addition to its ability to estimate unequal weights in the presence of limited information it is also important to note two other properties of the DEA-'Benefit of Doubt' method. Firstly, in constructing a composite indicator, it allows for the estimation of weights associated with each sub-indicator to be bounded between values of 0 and 1. Secondly, both the weights and the benchmark (called the *efficiency frontier*) are endogenous to the model and estimated empirically from the data set used by the model. Although this method is not adopted for this thesis it provides a useful indication of the possibility that is available for prioritizing weights for disparity indicators. The literature reviewed in this section provides sufficient evidence to suggest that it is possible to use disparity indices such that they ensure parity, proportionality and priority in the equitable allocation of limited government infrastructure grants.

Taking account of economic disparities in infrastructure grant allocations as proposed in this thesis will have wider economic impacts than just addressing and mitigating the immediate effects of deprivation. It is implied in the literature (see

Taylor, 1991 and, Fitzgerald and Vos, 1989) reviewed in this chapter that in addition to addressing economic disparity, taking account of capital cost disparities will also have positive economic benefits for local communities and the national economy as whole. From the macroeconomic dimension, adequate and uniform access to services in general and public infrastructure services in particular are important for maximizing the gains from trade and promoting the efficiency of intra-regional common factor markets for goods and services. (*See Petchey et al, 2007)*. It is for this reason that a municipal infrastructure grant model also has to take account of fiscal capacity and economic efficiency when equitably allocating grants. This principle is explicitly recognized in Section 214(2) (e) of the South African Constitution.

To achieve maximum economic benefits the level of and, the changes in, the norms and standards of infrastructure provision have to be maintained at a constant and consistent rate to ensure sustainable economic growth. This is particularly important where the cost of socio–economic inequalities and disparities grow proportionately and differentiate communities across sub-regions. These cost disparities and inequalities are reflected in indicators of high unemployment, low fiscal capacity, economic inefficiency, poverty and deprivation. In the absence of uniform minimum norms and standards these disparities are further exacerbated and lead to unequal net fiscal benefit across regional boundaries (Boadway, 2004). Very often this translates into the rapid mobility and migration of labour, skills, goods, capital, services and other production factors across regional boundaries. The in-migration and over-crowding in towns and cities mentioned in the introduction to this thesis is one of the main consequences of this rapid mobility of factors. It is also clear from the literature on structural macroeconomic theory that allocating grants to address capital backlogs and provide basic infrastructure services will have significant impacts on the macroeconomic aggregates of any economy because of the positive impacts on capital stock aggregates. In the next part of the this chapter I review the literature with regard to understanding the relationships between infrastructure grants, investment in public capital stock and the impact of these variables on the macroeconomic structure of the economy (see Figure 4.1 in Chapter 4).

Infrastructure and Capital Stock in Macroeconomic Aggregates

Municipal service infrastructure constitutes a small but important component of the national aggregate fixed public sector capital stock. In turn the aggregated fixed public sector capital stock is a factor in determining the composition of the fixed investment variable in achieving macroeconomic policy objectives. In explaining the role of fixed public sector capital stock in South Africa's aggregate fixed investment Natrass (2000: 9) argues that:

> *The private sector accounts for the most significant fraction of total investment (currently more than 70%) in South Africa…the share of the government sector (the public authorities and the public corporations) has been declining steadily since the early 1980s. While this potentially frees up resources for the private sector, it can be harmful to growth in instances where public investment is a necessary condition for private investment (e.g. economic infrastructure).*

This argument neatly sums up why public investment especially at the local level is a necessary condition for promoting private investment and, consequently, economic growth and development.

A country's macroeconomic aggregate indicators for economic growth are captured annually in the National Accounts. Natrass (2000: 7-11) presents a succinct explanation of the role of capital stock in South Africa's National Accounts. I summarize the key points below.

Gross capital formation *(GCF*) consists of investment spending on fixed capital; that is, gross domestic fixed capital formation *(GDFCF)* plus changes in inventories of capital stocks such that:

$$GCF = GDFCF + \text{changes in inventories.} \qquad (2.5)$$

Investment is the sum of all spending on capital goods by both the private and public sector for a given period before taking into account the rate of depreciation.

Capital investment includes fixed investment in machinery, plant and related equipment, construction and building and changes in the inventories on existing capital stock due to additions to the physical stock of capital. Inventories refer to unsold stocks. In South Africa's the national accounts, gross domestic product (GDP), the key indicator for economic growth, is calculated from the sum of all expenditures, factor incomes or outputs.

Based on total expenditures GDP can be written as:

$$GDP = C + GCF + G + X - Z \qquad (2.6)$$

Where:

C = consumption

G = government spending

GCF = Gross capital formation

X = exports

Z = imports

Based on total factor incomes GDP can be written as:

$$GDP = C + GDS + T \qquad (2.7)$$

Where:

GDS = Gross domestic savings

T = Taxation (all taxes)

Generally accepted national accounting principles posit that total expenditures should equal total factor incomes such that:

$$GDP = C + GCF + G + X - Z = C + GDS + T \qquad (2.8)$$

Transposing and substituting GCF for GDCF

$$GDP = (G - T) + (X - Z) = GDS - GDCF \qquad (2.9)$$

In national accounting terms

$(G - T)$ is the government budget deficit or surplus

$(X - Z)$ is the balance of payments current account surplus or deficit

$GDS - GDCF$ is the net capital inflow from abroad and change in gold and other foreign reserves.

Generally accepted national accounting principles also posit that

$GDS = GCF$ and is an *ex post* (i.e. after the fact) national accounting identity. Therefore

GDS – GCF = 0 by definition.

From equation (2.8) it is clear that increased government spending (*G*) and increases in gross capital formation (*GCF*) will have a significant impact on economic growth.

Vane & Thompson, (1989: 23-24) explain the key determinants of fixed investment (i.e. gross capital formation) and the role this variable plays in the changes to the *GDP*. The authors explain that there are two important determinants of gross capital formation (*GFC*). One is the cost of borrowing funds to finance investment expenditure, i.e. the rate of interest. The other is a change in national income (or equivalent output) determined by investment spending in fixed capital stock. If the desired capital stock (*K**) is some function of output (*Y*) then:

$$K_t^* = vY_t \qquad (2.10)$$

If this relationship is lagged by one period we have

$$K_{t=1}^* = vY_{t-1} \qquad (2.11)$$

Subtracting (2.11) from (2.10)

$$K_t^* - K_{t-1}^* = vY_t - vY_{t-1} = v(\Delta Y_t) \qquad (2.12)$$

Where

Δ symbolizes change in a variable.

Assuming that actual levels of capital stock equals desired level of capital stock then

$$K_t^* - K_{t-1}^*$$

is the actual change in the capital stock or investment spending on fixed capital and

$$I_t = v(\Delta Y_t) \qquad (2.13)$$

where I_t represents investment spending at time *t*.

The authors argue that besides fixed capital investment there are other determinants of general investment. These determinants include variations in business confidence (for example, renewed optimism will lead to increases in investment), and government taxation policies leading to changes in the profitability of investment. (Vane & Thompson, 1989: 24). Provide full reference By the same token my argument is that any increase in allocations of government spending on municipal infrastructure will have a significant impact on the levels of capital stock in general and local economic development in particular. However, to determine the desired level of capital stock needed to achieve economic objectives a reasonable estimate of existing capital stock has to be calculated. The difference between the desired level and existing level of capital stock is the level of capital backlog that has to be eradicated. The cost of eradicating capital backlogs while taking account of capital cost disparities determines the level of fixed investment that will be required to achieve macroeconomic policy objectives.

Perspectives on infrastructure investment and economic growth and development

Literature on public infrastructure investment shows that there is a link between public capital investment, capital formation, increasing human resource potential and economic development and growth. The rapid growth and development in the economies of India, Malaysia, Singapore and South East Asia in general demonstrates the importance of public capital formation in economic growth strategies in these countries. In these economies capital formation and productivity growth is closely linked. Timmer and van Ark (2002) demonstrate this relationship in constructing fixed non-residential capital stocks for South Korea and Taiwan.

While the literature shows that most Asian economies saw an increase in capital stock infrastructure investment in the 1980s and 1990s, Ndulu et al (2005) and Ndulu (2006) notes that in sub-Saharan Africa inadequate public infrastructure is the greatest obstacle to faster economic growth. In this regard Sub-Saharan African economies were characterized by low capital accumulation, high prices of investment goods, low productivity of investment and a higher level of geographical disadvantages that compromised growth and regional integration.

Naqvi, (2003) in a macroeconomic study comparing the productivity of public capital against private capital in Pakistan from 1965 to 2000 examined the role of public infrastructure finance in economic development and growth as modeled by Aschauer, 1989. Using econometric co-integration techniques the study demonstrates that the externalities generated by public capital accumulation is clear evidence that public capital was more productive than private capital in macroeconomic growth in Pakistan. Romp and de Haan (2005) extensively surveyed the literature on the role of infrastructure investment and capital stock in European countries. The authors present an overview of theoretical and empirical case studies on the ways in which public capital investment can impact economic growth and development. The article concludes that although not all empirical studies can show that public capital has positive impacts on economic growth there is currently greater unanimity that public capital investment increases economic growth.

In recent years, however, the arguments and conclusions advanced by Aschauer and others have been challenged in the literature. Aschauer's seminal 1989 econometric study presented estimates that purported to show dramatic returns to public capital investment in the USA. Aschauer's argument, based on the premise that decreases in productivity and economic growth in the USA was a function of a decrease in public sector investment, was aimed at promoting further public infrastructure investment to enhance economic performance. Hulten and Schwab (1993) subsequently questioned Aschauer's argument both methodologically and conceptually. The authors argue that the US data may indicate a correlation between infrastructure and output growth, but this association cannot be interpreted to mean that lower infrastructure was the cause of slower growth. They suggest that any one of several other variables such as low productivity and higher costs may have had just as significant an impact on slowing growth for the period of Aschauer's study.

The Hulten and Schwab (1993) paper does not question the need for public infrastructure investment it merely challenges the presumed causality between public infrastructure investment and economic growth as advocated by Aschauer and his supporters. Hulten and Schwab propose that rather than arguing for more public infrastructure investment greater emphasis should be placed on developing and devising more effective ways of allocating and spending existing levels of public capital expenditure. Notwithstanding the debates and problems raised in the literature in the next section I review the concepts and definitions that will underpin the role of capital stock in a municipal infrastructure grant model.

Capital stock in an Infrastructure Grant Model: Concepts and definitions

Following from the above discussion of the literature the argument for an infrastructure grant model for equitable allocations to municipalities with capital cost disparities should also be about addressing the negative impacts of infrastructure backlogs on public capital stock accumulation. Financial resource allocation mechanisms to address infrastructure investment needs require a reasonable estimate of infrastructure backlogs.

In the literature (Levtchenkova and Petchey, 2000) to be discussed later in this chapter capital stock data is a critical input for measuring and forecasting infrastructure investment and, for estimating infrastructure deficiencies or backlogs as a function of a desired level of capital stock necessary for economic growth. The difference between the estimated level of capital stock and desired level of capital stock gives an indication of the level of capital backlog in the economy. For public sector infrastructure spending general capital stock estimates provide an important indicator for determining the amount of financing required thus enhancing government's contribution to the desired level of capital stock in the economy. Generally accepted international or nationally determined best practice estimates can be used as the standard benchmark for the desired level of capital stock.

In some developing and developed countries initial capital stock estimates by service can be obtained from local government financial records. These estimates are collected and recorded according to the 1993 United Nation's System of National Accounts called SNA93 (United Nations Economic Commission for Europe, Statistical Division, 2003). The Organization for Economic Cooperation and Development (OECD, 2001) has also published handbooks and manuals providing supplementary information on the SNA93.

Many different meanings have been applied to the term capital. The generally accepted SNA93 meaning of capital is that it is an input in the production process and consists of machinery; transport vehicles, buildings and any other tangible fixed assets purchased through investments that have value and that depreciate beyond the current year.

Capital stock and infrastructure investment - A review of the conceptual issues

For the purpose of this thesis capital refers to all durable and tangible production factors. In the system of national accounts this often corresponds to *fixed capital,* and in the business accounts, it corresponds to *tangible fixed assets.* Rakneurd et al (2003: 2-3) elaborate further:

> *In this sense, capital is an input in the production process, which generates operating profits.*
>
> *According to accounting standards, tangible fixed assets are assets that have value beyond the current year. It consists of machines, transport vehicles, buildings, etc. Tangible assets are acquired through investments, which are capitalized and depreciated over the expected lifetime of the asset.)*

The SNA93 defines fixed assets as produced assets that are used repeatedly, or continuously in the production process for more than one year. *Produced* assets are further distinguished from *non-produced assets*. The former are all non-financial assets produced as outputs in the production process as defined by the SNA93. The latter are assets required as inputs in the production process but have not them selves been produced. These include natural resources such as land, forests and mineral deposits.

Produced fixed assets are further sub-divided into *tangible* and *intangible* fixed assets. Tangible fixed assets consist of dwellings, other buildings and structures and machinery and equipment. In addition cultivated assets such as trees or animals repeatedly or continuously used for producing goods and services are also defined as tangible fixed assets.

Intangible fixed assets include mineral exploration, computer software, entertainment, literary or artistic originals and other intangibles fixed assets intended to be used for more than one accounting year.

Despite the usefulness for recording transactions, Diewert and Lawrence (2000) raise several other concerns about the SNA93 for measuring capital. Chief among the concerns is the inability of the SNA93 to take account of the recently developed theories of capital measurement for production function[18] and productivity estimation of services generated by a particular type of capital stock. The latter point is important as the productivity of public sector capital stock is a good measure of the efficient and aggregate service flow generated by a particular type of capital stock. In a more recent paper Diewert (2005:9) explains why accounting for the contribution of capital to production is more difficult than accounting for other factors of production.

The main problem is that when a reproducible capital input is purchased for use by a production unit at the beginning of an accounting period, we cannot simply charge the entire purchase cost to the period of purchase. Since the benefits of using the capital asset extend over more than one period, the initial purchase cost must be distributed somehow over the useful life of the asset. This is the fundamental problem of accounting.)

Diewert (2005: 10) further argues that this durable quality of capital inputs leads to more measurement problems that do not apply to goods and services used for production within a single accounting period. Notwithstanding these problems the author concludes that conventionally, the value of a capital asset "at the beginning of an accounting period is equal to the discounted stream of future rental

[18] *A production function is a compact mathematical expression used to analyze the physical relationship that shows how factor inputs are transformed into outputs of goods and services using a specific production technology. (Pindyck & Rubinfeld, 1995).*

payments that the asset is expected to yield. Thus the **stock value** of the asset is set equal to the discounted future **service flows** that the asset is expected to yield in future periods."

These concerns about the SNA93 were already raised in the OECD Manual (2001) for measuring capital stock. In the chapter on the basic definitions and uses of capital stocks and flows the Manual notes that the SNA93 does not take account of the gross fixed capital stock value [OECD, 2001 SNA 93: para. 4.11] although this capital stock value is a starting point for calculating consumption of fixed capital and net capital stock. The Manual defines gross fixed capital stock as, "…the value, at a point in time, of assets held by producers with each asset valued at 'as new' prices - i.e. at the prices for new assets of the same type - regardless of the age and actual condition of the assets. (Ibid: para. 4.9).

According to the OECD Manual gross capital stock has at least four analytical uses. Firstly, it is widely used as a broad indicator of the productive capacity of a country. Secondly, it is often compared with value added to calculate capital-output ratios for an economic sector or the country as a whole. Thirdly, the gross operating surplus is usually divided by the gross capital stock to calculate the profitability of a sector or the economy as a whole. Finally, it is sometimes used as a measure of capital input in studies of multifactor productivity.

Following from the above discussion one can argue that gross capital stock estimates are a key indicator in economic analyses. Based on the discussion one can also argue that capital stock estimates may also be applied to sub-regions within a country. The level and condition of gross capital stocks in a particular country also provide an indication of the flows of infrastructure investment for public capital to an area and the flows of services that the particular public capital stock may generate in that area. By implication public capital stock data estimates could be used by National, Provincial and Local Government departments for general financial planning and forecasting public sector capital expenditures to finance public infrastructure investments (Levtchenkova and Petchey, 2000). In this regard public capital stock data could provide government agencies with reasonable estimates of the value of their infrastructure in order to calculate the opportunity costs[19] of capital. Such costs could then inform decisions on charges for the use of public infrastructure.

As will be demonstrated in this thesis the database of capital stock estimates is also a key input in time series and cross-sectional studies of the role of public finance in public sector infrastructure investment. Levtchenkova and Petchey (2000: 196) illustrate this point as follows:

> *… one could use the data in a cost function model to estimate the extent to which capital costs vary across States because of economies of scale, population dispersion, age distribution of the population and income status, and the extent to which they differ because of inefficiencies and different State policies. This information would in turn be extremely useful…in measuring regional differences in the costs of providing services…*

According to the authors such capital stock data sets provide useful economic performance benchmarks (Bogetic and Ferdeke, 2006) for intergovernmental fiscal relations and for researchers working with Government countrywide economic models required to compute production functions. In a discussion paper examining a specific method for improved capital measurement Raknerud et al. (2003:3) underscore the importance of measures of capital stock in economic research.

> *Most studies of production, including some very important topics like measurement of productivity, returns to investments, and economic depreciation, rely on measures of capital stocks and services.*

Measuring capital stock

A key assumption for using public capital stock data estimates in a capital grant model is that the provision of good service outcomes and outputs required for the successful elimination of inequality and poverty is a function of adequate funding for the progressive eradication of infrastructure backlogs and on-going infrastructure needs (Levtchenkova and Petchey 2000:196). Thus not only must

[19] *"The value of that which must be given up to acquire or achieve something". The Penguin Dictionary of Economics, 1992*

existing capital stock be considered, but also capital deficits or backlogs and the rate at which the stock of capital depreciates must be taken into account. In addition the impact of the cost of inherited capital backlogs on the level of actual capital stock, on-going capital requirements and new capital investment must be estimated. In the public sector infrastructure backlogs tend to grow at a faster rate because of inadequate funding for maintaining and recapitalizing public and private capital stock. In a working paper on the estimating the restoration and modernization costs of infrastructure facilities in the USA, Lufkin et al (2005) argue that part of the problem for under spending may be attributed to a poor understanding of the level of funding required because budget estimates are based on ad hoc approximations or historical trends rather than all capital cost factors. Further, the authors argue that capital stock estimates cannot ignore restoration and modernization funding requirements. However, including restoration and modernization into the mix adds a further level of complexity as issues of obsolescence, changing uses and extraordinary damage to infrastructure, determine these issues.

> *Maintaining and recapitalizing facilities require substantial expenditures by virtually all public and private organizations. In the U.S. these expenditures amounted to $192 billion in 1992, or roughly 40% of total construction-related activity. While considerable, these expenditures are widely regarded as insufficient to maintain the productive capacity of the nation's facilities and infrastructure. Part of the problem is political: maintenance activities rarely have the same cache as ribbon-cutting celebrations for new construction. But some part of under funding must be attributed to the limited estimation tools available to policy planners. Without credible empirical support it is difficult to make a case for the required funds.) (*Lufkin et al, 2005: 3*)*

Conceptually the measurement of capital in general, and public capital more specifically, has always been considered controversial in the economic literature. In a frequently referenced article Hulten (1990) attributes this to the special role played by capital both as an input and also because of its durable characteristics.

Apart from the lack of appropriate estimation tools another area of concern addressed in the literature for measuring capital and allocating infrastructure finance is the difficulty of distinguishing between public capital stock and private capital stock. This problem is exacerbated by the difficulty in distinguishing between infrastructures for different services as the one facility in a sub-region may serve several service sectors simultaneously.

The capital grant model developed by Josie, MacDonald and Petchey (2008), is capable of allocating capital expenditures for economic infrastructure (e.g. road, rail, transport, communications, energy or water provision) and social infrastructure (e.g. health, education, welfare or housing facilities and services). The determinant factor distinguishing allocations for economic infrastructure and social infrastructure (education, health, recreational facilities, etc.) is the method used for measuring the required value of capital stock necessary for providing a service or promoting economic development.

Capital stock for economic infrastructure is estimated using optimization techniques to determine efficiency gains derived from the services of given economic infrastructure. Social infrastructure capital stock estimates are based on normative considerations to achieve a per capita minimum standard in the quest for equity in the provision of social services. The capital grants model developed by Josie, MacDonald and Petchey (2008) uses such capital stock inputs to explore the transition path to the agreed equalization standards for both economic and social infrastructure. In this sense the model attempts to determine the minimum funding required to ensure that the transition path of the existing capital stocks converge to the desired levels of stocks required for the provision of the necessary economic and social services. By the same token the model will very quickly establish the capital stock implications for under-funding or allocating too few resources for public capital formation.

The input costs determinants for capital stock encompass more than just public sector factors (Pindyck and Rubinfeld, 1995). As the different elements of capital stock cannot be added together their value is generally aggregated to produce an estimate at prices for a given year. Any level of new capital expenditure or net investment is a proportion of the difference between the desired capital stock and the actual capital stock. Thus, any backlog in new or replacement investment will increase the gap between actual and desired capital stock to be made up in any one period.

Notwithstanding the problems and difficulties associated with the methods used capital stock measures based on current spending trends are a good indicator of the efficient and actual capital stock required for capital service outputs. In other words they are important for determining an appropriate transition path and, for estimating capital need based on the difference between the actual capital stock and what stock is required to attain the defined transition path.

A review of the methods used for measuring capital stock

Empirical studies in the literature present different methods for estimating gross capital and net capital stocks. At least four techniques have been identified in the literature for estimating gross capital stocks for national accounting purposes. The perpetual inventory method (PIM); the survey method; the balance of fixed assets (BFA) technique; and the use of administrative records. Around these four techniques many variations and versions have been developed for estimations of capital stock in different sectors (private and public) of the economy.

Net capital stocks are generally derived from gross capital stock estimates and company accounts use many disparate techniques for calculating these estimates and this makes them unusable for national accounting purposes. These techniques include the use of insurance company records of current property values and values of tangible fixed assets owned by public companies. The most comprehensive survey of the capital stock estimation methods listed above is presented in the 2001 OECD Manual for measuring capital stocks. There have also been several empirical applications, reviews and adaptations of the techniques.

The Perpetual Inventory Method (PIM) is the most popular technique for estimating capital stocks in developed and developing economies. The technique entails adding gross fixed capital formation to an initial estimate of the capital stock and then deducting the value of capital assets that have reached the end of their service lives. The OECD, 2001, SNA93 (para. 6.189) elaborates:

> *The perpetual inventory method requires an estimate to be made of the stock of fixed assets in existence and in the hands of producers. This is done by estimating how many of the fixed assets installed as a result of gross fixed capital formation undertaken in previous years have survived to the current period.*

The PIM is extensively used for estimating capital stocks. The standard procedure is to estimate the gross capital stock by applying a depreciation rate to calculate the consumption of fixed capital. Thereafter, by subtracting the accumulated capital consumption from gross capital stock the net capital stocks are obtained. An alternative procedure uses a more integrated approach that combines the relationship between the service output efficiency, the age and the declining price value of the asset. The age-efficiency profiles are estimated for each service life for each asset type against a discount rate in order to generate the net capital stock. It is assumed in this approach that the market price of the asset is equivalent to the rentals the asset is expected to earn under market conditions.

The PIM estimation procedure requires several different categories of information. This includes a value of an initial or benchmark capital stock estimate; gross fixed capital formation for each year after the starting year; depreciation and average service life of the asset; information on how assets are written off; and rates of variations in the prices of assets.

The literature presents different versions of the PIM techniques used extensively in measuring capital stocks in developed economies (Diewert and Lawrence, 2000; Hulten, 1990, Rakneurd et al, 2003; Lufkin et al, 2005); in developing economies (Timmer and van Ark, 2002; Naqvi, 2003) and, in economies in transition (United Nations Commission for Europe, Statistical Division, 2002). In applications of the PIM several difficulties have been identified. These include data intensity, the numerous assumptions about fixed capital formation, and the consumption of fixed capital, depreciation, and the services generated by the asset, all of which pose practical problems for its indiscriminate application.

Nevertheless, despite these problems it is the preferred procedure for estimating capital stock. The UN Economic Commission for Europe, Statistical Division, 2002, “Measurement of Capital stock in Transition Economies” lists a few concerns about some of the alternative methods. The BFA, surveys and administrative records methods, for example, do not take account of declining efficiency, obsolescence and variations in inflation when evaluating assets. In many developing countries and countries in transition data surveys and the maintenance of records are costly. The lack of technology and skills also means that data may be limited, deficient, fragmented, out of date and not in conformity with SNA93 requirements. Further, the reporting requirement is an additional administrative burden on enterprises and other economic agents.

Following from the above discussion it is clear that capital stock estimates are a key indicator in economic analyses. Such estimates may also be applied to sub-regions within a country as the level and condition of capital stocks in a particular area also provide an indication of the flows of infrastructure investment for public capital to an area and, the flows of services that the particular public capital stock generates in the area. By implication, public capital stock data estimates could be used by National, Provincial and Local Government departments for general financial planning and for forecasting public sector capital expenditures to finance public infrastructure investments (Levtchenkova and Petchey, 2000).

The key premise for using public capital stock data estimates in this thesis is that the provision of service outcomes and outputs required for the successful elimination of inequality and poverty is a function of funding for the progressive eradication of infrastructure backlogs and on-going infrastructure needs. The thesis assumes that in the public sector infrastructure backlogs tend to grow at a faster rate because of inadequate funding for maintaining and recapitalizing public capital stock.

In developing a policy model for reducing capital backlogs in transitional economies and using South Africa as a case study, Petchey and Levtchenkova (2002) concluded that compared to an international benchmark, in South Africa, the overall amount of physical infrastructure available for the provision of important services such as housing, education and health is insufficient. The results from the study show a marked variation across provinces indicating that infrastructure ‘backlogs’ for the provision of services create widely variable access to services across provinces.

The Levtchnkova and Petchey (2000) version of the perpetual inventory method was initially developed for estimating capital stock data for National, State and Local components of the General Government in Australia for the period 1962 to 1999 for services provided. The estimates were produced using unpublished data supplied by the Australian Bureau of Statistics (ABS) on annual gross fixed capital expenditure flows, consumption of fixed capital and aggregate capital stocks. The study created the possibility to estimate two hundred and thirty-eight different regional capital stock series over four decades. This version of the PIM technique begins with a given estimated capital stock at some point in time. Thereafter it creates subsequent stock estimates using data on capital expenditure and depreciation.

For the purpose of estimating capital stock data for local municipalities in the Cape Winelands District of the Western Cape I use an adapted version of the Levtchnkova and Petchey (2000) method that assumes a constant depreciation rate invariant across time. The adapted version of the method was chosen because municipal boundaries in South Africa are about ten years old. This means that the data for the rate of depreciation across municipalities are probably unavailable or are not likely to vary across local municipalities. Therefore, in estimating capital stock for the Cape Winelands District Municipality my study assumes a constant depreciation rate invariant across time, municipality and service. The full version of the method is presented in Chapter 4.

Summary

In this chapter I critically reviewed the theories, concepts and methods that may inform the framework for a structural approach for the empirical case study on which this thesis is based. A structural approach provided the framework for analyzing and evaluating the systemic economic, social and institutional interrelationships of the intergovernmental financing of municipal infrastructure.

The definitions and concepts of the structural approach helped to show the linkages between the microeconomic decisions taken at municipal level and macroeconomic decisions taken at the level of national government. The application of the structural framework pointed the direction to the literature that highlighted processes that show how economic inequality and disparity become structurally entrenched as part of the political economy of a country. From this perspective I reviewed the literature and identified the concepts and definitions that can facilitate an understanding of the nature and impact of accounting for economic disparity in intergovernmental financing of local government. Key to an understanding of the nature and impact of economic disparities was a review of the literature on the constitutional and institutional intergovernmental arrangements that govern the allocations of infrastructure grants in South Africa.

I also examined the literature to understand the role of public infrastructure in mitigating the effects of structural spatial inequalities and disparities among local municipalities in the Cape Winelands District. I explored the literature on methods and procedures for constructing and using a composite capital cost disparity index to take account of disparities in capital grant allocation models.

In the final part of the chapter I reviewed the literature on infrastructure and capital stock in macroeconomic aggregates and, on the role and measurement of capital stock in infrastructure grant models. The literature pointed to the possibility that capital stock and capital backlog estimates can be used in conjunction capital cost disparity indicators to calculate, using a capital grant scheme, the level of funding required for financing public infrastructure in local municipalities. The literature reviewed in this chapter provides sufficient evidence to suggest that it is possible to use disparity indices such that they ensure parity, proportionality and priority in the equitable allocation of limited government infrastructure grants.

Chapter 3

Background And Motivation For A Review Of Municipal Infrastructure Grant Allocations In South Africa's Intergovernmental Fiscal Relations (IGFR) System

The introduction to this thesis briefly discussed the wave of municipal service delivery protests and demonstrations that swept across South Africa between 2004 and 2009. Given this situation this chapter provides a background as to why Government in South Africa is presented with a basic public finance dilemma of how to fairly and equitably finance municipal infrastructure services while simultaneously ensuring economic efficiency in the quest for growth and development. The chapter also provides a motivation for a restructuring of the institutional arrangements and formula used for the intergovernmental transfers of municipal infrastructure grants.

Under South Africa's intergovernmental fiscal relations system (The Constitution, 1996 and the Intergovernmental Fiscal Relations Act, 1997) national, provincial and local government spheres of government are entitled to an equitable share of nationally collected revenues for the provision of services to communities. However, raising adequate levels of revenues for redistributive purposes is a function of sustained investment, growth and development. Striking a balance between the need to provide constitutionally mandated basic services within macroeconomic constraints that limit the available resources is a fundamental problem that underpins South Africa's intergovernmental fiscal relations system. In Petchey *et al* (2007), this problem was discussed and a model to address equitable intergovernmental redistribution of nationally collected revenues was proposed as a solution to the dilemma. The model has a subcomponent that deals specifically with the equitable allocation of capital and infrastructure grants.

In the aftermath of the service delivery protests in South Africa finding solutions to the public finance dilemma took on a greater sense of urgency. National, provincial and local governments viewed the protests as an indication of the high degree of frustration resulting from extreme poverty and inequality and, the inability of the current intergovernmental systems to deliver basic services at the municipal level. The anxiety felt by all three spheres of government was expressed in a comprehensive assessment of the state of local government published in the fourth quarter of 2009 by the National Department of Cooperative Governance and Traditional Affairs (COGTA). The report entitled *"The State of Local Government in South Africa – Overview Report"* (COGTA, 2009) presents a grim assessment of the conjunctural effect of several external and internal factors that militate against the efficient and effective delivery of municipal services. The COGTA (2009) Report underscores the problems faced by different categories of municipalities[20] discussed in the introduction to this thesis. There are some points raised by the COGTA Report that are worth reiterating.

The assessment (COGTA: 10-29) emphasizes the point that different categories of municipalities face unique conditions and challenges and therefore, one-size-fits-all type systems and policy instruments are not likely to address the problems associated with service delivery. While some category B1 and B2 local municipalities may be stable and well resourced others face huge infrastructure and service backlogs due to, "*the negative impacts of demographic change and prevailing apartheid-based socio-economic legacies"* (Ibid: 22). High levels of community household inequality and poverty indicators exacerbated by in-migration pressures often characterize collective disadvantage in many municipalities. Category B3 and B4, essentially rural and small municipalities, are in economically depressed areas with low revenue generating capacity; inadequate institutional development and unable to attract skilled human resource capacity. The Report concludes from the above assessment that

> *...these municipalities are seriously challenged to fulfill their obligations. They may be financially non-viable, articulate distress via heightened levels*

[20] *There are 283 municipalities in South Africa grouped into seven categories. (A) – the 6 Urban Metros with large populations; (B1) – 31 local municipalities with large budgets and secondary cities; (B2) – 137 local municipalities with a large town as the core; (B3) – 31 local municipalities with small towns, small urban populations but no core large town; (B4) – 32 mainly rural local municipalities with communal land tenure and one or two small towns; (C1) – 25 District Municipalities which are not water service authorities; (C2) – 21 District Municipalities which are water service authorities.*

of community protest, and be particularly vulnerable to political control and poor institutional management and compliance. (Ibid: 22)

The Report assessment attributes these vulnerabilities to several external and internal factors. The intergovernmental fiscal relations system ranks second amongst the external factors.

Table: External and Internal Factors Impacting on Poor Municipal Performance.

External Factors	Internal Factors
National policies for local government	Sound political leadership
Intergovernmental fiscal relations system & design for local government transfers	Strong organizational capacity
The legislative and governance framework for local government	Good governance practices
Monitoring and oversight of local government	Relevant policies and programmes to be implemented
Capacity building policies	Adequate staffing and systems
Apartheid spatial legacies	Workable plans and budgets

(Source: Department of Cooperative Governance and Traditional Affairs, 2009)

The COGTA assessment further argues that the unintended consequences of the 'one-size-fits-all' approach led to both financial and operational non-viability of socio-economically vulnerable municipalities. Financial and operational non-viability was especially manifest in their inability to manage infrastructure development and investment policies. This point is important, as investment in the development of municipal infrastructure is a key component in the efficient and effective provision of many basic municipal services. The Report assessment proposes that government takes account of the vast differences between municipal spaces and, that a spatial differentiation approach be used to identify specific institutional and administrative policy instruments to target communities in remote areas with high backlogs, poor economic potential and high unemployment (Ibid: 29). The COGTA Report proposal begs the question of what type of approach is required to take account of factors that differentiate municipalities from each other. This is the fundamental question of the thesis. To support its proposal the Report in Chapter 3, presents an assessment of the current state of local government service delivery and infrastructure provision in South Africa.

In the Report service delivery and infrastructure are assessed against three constitutional criteria: The requirement for local government to ensure the provision of services in a sustainable manner; the need for local government to promote social and economic development, and the necessity for local government to promote a safe and healthy environment (Ibid: 34). While commending the progress made by stronger municipalities the Report highlights the unique and complex development problems faced by weaker and more

vulnerable municipalities. Among others these problems include a massive infrastructure backlog. This backlog is the legacy from the apartheid past and will require "extraordinary measures to address funding and delivery capacity" (Ibid: 34).

The corollary to the underdeveloped infrastructure and service delivery in weaker and vulnerable rural municipalities is that relatively more developed municipalities are under pressure from increased urban growth, in-migration, informal settlements and population growth as poor people leave weaker municipalities in search of jobs and security. These pressures require new forms of urban spatial, infrastructure and budget planning in developed municipalities as they struggle to cope with the consequences of an increasing financial burden. This COGTA assessment serves to confirm the views expressed by the Municipal IQ and Parliamentary Research Unit reports discussed in the introduction to this thesis. The COGTA Report concludes that:

> *The two main obstacles to accelerating basic services are therefore the lack of critical infrastructure in rural areas and the proliferation of informal settlements in urban areas. Both these obstacles are beyond the capabilities (institutional and fiscal) of powers and functions of municipalities to confront by themselves.* (Ibid: 35)

In examining the legislative and institutional policy instruments that govern the way service delivery and infrastructure are implemented the Report concludes that a major obstacle to service delivery is the lack of effective alignment of integrated planning and coordination among different government departments. For example some provincial infrastructure and regional planning policy objectives captured in the Provincial Growth and Development Strategies (PGDS) are not implemented, and are even more difficult to monitor and sanction, because they are not supported by legislative and institutional policy instruments. On the other hand local government integrated development plans (IDP) are legally binding on municipalities through the Municipal Systems Act and the Municipal Finance Management Act. In addition the haphazard manner in which the district facilitation role, as envisaged in the Municipal Structures Act, is implemented in practice aggravates the disjuncture between provincial and municipal policy objectives and plans (Ibid: 35). Most, if not all, disadvantaged rural local municipalities fall within district municipalities charged with facilitating sub-regional development.

With respect to integrated infrastructure development the Report (Ibid: 36-39) implies that in practice the absence of alignment, coordination and effective intergovernmental planning between national, provincial and local government spheres impedes the building of integrated human settlements and the provision of basic water, electricity and sanitation services. In urban environments increasing backlogs due to pressures of in-migration and homelessness exacerbates this situation. The COGTA Report calls for "*a national, differentiated and coordinated planning effort…to provide a new vision for intergovernmental developmental planning*" (Ibid: 37) to address these problems.

The COGTA assessment (Ibid: 40-50) found that many disadvantaged municipalities could not meet national public service infrastructure policy objectives because of inadequate funding or difficulties associated with national transfer funding mechanisms. As a result of the past and present problems the Report announces the emergence of a second-generation set of coordination, management and financial challenges. These challenges include higher demand for infrastructure services as a consequence of a growing economy; the need for upgrading, rehabilitation and replacement of aging assets, and the re-location of poverty and inequality from deprived rural areas to towns and cities. The Report suggests that overall, the current levels of municipal infrastructure investment are inadequate to meet the demands of a growing economy and that many local municipalities have indicated that they are 100% dependent on national grants (Ibid: 59). Further, the Report implies that the nature, diversity, design and coordination of the grants and the way they are allocated and disbursed to municipalities compromise the principles of democratic accountability and autonomy of local government (Ibid: 60). Interviews for this thesis among officials in three local municipalities in the Cape Winelands and the Cape Winelands District Municipality itself confirm this finding (see Summary report of interviews in the Appendix).

There are several points of concern raised by the COGTA Report (Ibid: 60) that have specific relevance for the questions around which the thesis is developed. For example the weak coordination in implementation of programmes between different departments is a source of delays in the delivery of services. The proliferation of grant transfers from different departments, for the same programme, adds another dimension of complication. In the introduction to this thesis both these points were presented as a rationale for a new approach for equitably allocating infrastructure grants.

Other points of concern raised by the COGTA Report include the weakening of democratic municipal accountability and oversight because of municipal dependence on infrastructure grant transfers. This argument was also made in the thesis rationale for a new approach to financing municipal infrastructure. The final point of concern in the COGTA Report that supports the thesis justification for a new approach to allocating infrastructure grants "*is the weak programme design, implementation and evaluation procedures (that) limit the impact of grants on the development outcomes sought by government…*" (Ibid: 60). In fact, addressing the limitations of "weak design" such that grant formulae take account of development outcomes, constitutional imperatives and differentiating disparity factors among municipalities is the main aim of this thesis.

Intergovernmental Principles for Financing Municipal Infrastructure Needs

The key financial policy objectives for sustainable local government in South Africa are derived from constitutional and other legal obligations. These obligations require municipal organization, planning and budgeting systems to equitably target the provision of basic services and socio-economic development for all citizens. Municipal budgets and municipal infrastructure grants are the main policy instruments that direct the expenditure stance of municipalities in achieving the infrastructure service delivery targets. Inadequate municipal infrastructure has negative consequences for the delivery of services and economic growth and development.

Despite much of the finance for municipal infrastructure being provided by national government through the Municipal Infrastructure Grant (MIG), recent trends discussed in the COGTA assessment indicate that municipalities have not shown any marked progress in construction, maintenance and repairs of basic infrastructure. Unless these issues are addressed the achievement of sustainable local government as envisaged in the Constitution will be delayed and the inequalities that characterize South African society will be aggravated and exacerbated. It is suggested in the reports reviewed in the introduction and in this chapter that the service delivery protests discussed are a direct consequence of the inability of municipalities to deliver infrastructure services such that inequalities are progressively eliminated. To provide a background to the problem of intergovernmental financing of municipal infrastructure this chapter reflects on recent assessments and the effectiveness of the Municipal Infrastructure Grant (MIG) in particular. The MIG is one among many infrastructure grants from national government to local municipalities. The table below showing MIG allocations as a percentage of all infrastructures transfers to local government also lists the other grants.

A central priority of national government in South Africa is to progressively provide basic services to all South Africans within the constraint of available resources. This objective is set out in the Constitution's Bill of Rights (The

Constitution, 1996) and is a fundamental responsibility of government. Rights to which all citizens are entitled are in areas such as freedom of movement; a protected environment that is not harmful to health and well-being; housing; health care; food; water and sanitation; social security, and education. Responsibilities in respect of realizing these rights are shared amongst national, provincial and local governments, with each sphere of government charged with fulfilling its assigned functions.

Under the Constitution, national government also has over-riding responsibility for the management of the country's affairs and shares responsibility with the provinces and local governments for the provision of basic social services. National government may mandate appropriate essential or minimum levels and standards of services. Provinces are responsible for delivering most of the range of social services, which fall in the areas of education, welfare, and health. Local governments carry responsibility for provision or local infrastructure and basic services such as sanitation and water reticulation.

The objective of South Africa's intergovernmental fiscal arrangements is to ensure that these inter-governmental responsibilities are carried out in the spirit of co-operation (Chapter 3 of the Constitution) and, take account of equity and efficiency. Ultimately, it is the well being of all citizens, wherever they reside, that should be the main goal guiding intergovernmental decisions around fiscal arrangements amongst the three spheres of government. This principle of the interrelationship between fiscal responsibility and meeting the constitutional requirements for the provision of basic services is illustrated in the diagrammes and tables in Chapter 4.

An important determinant in ensuring the well being of all citizens is the provision of adequate public infrastructure for communities, households and individuals to access publicly provided services. The main aim of this chapter is to present some perspectives on recent assessments of the current inter-governmental funding arrangements for the provision and maintenance of municipal infrastructure. In particular the chapter will examine the effectiveness of the conditional Municipal Infrastructure Grant (MIG) as a funding instrument targeting Government's fundamental policy objective to address inequalities and poverty that perpetuate the legacies of apartheid in communities. The COGTA assessment underscores the growing public perception (see the discussion in the Chapter 1) that increasing inequalities and the disadvantages of poorer communities are a consequence of historical infrastructural backlogs. As noted in the COGTA assessment the situation is made more difficult by an undifferentiated approach to costing the provision of infrastructure. Such an approach results in an inequitable allocation of grants, thus delaying access to services for the most vulnerable communities.

A review of the structure of the MIG formula and its application in allocating infrastructure grants presents an ideal focus for achieving the aims of the thesis. This chapter considers two questions that point to a level of dissonance in the way the MIG is implemented and monitored. Firstly, the chapter focuses on whether the current demand driven approach determined by municipal infrastructure project applications for MIG funds is consistent with all constitutional mandates? The second focus is whether the current MIG allocation formula adequately takes account of all disparity and inequality cost factors that differentiate municipalities from each other. Following this assessment the thesis presents in chapters 4, 5, 6, and 7 an alternative approach for the allocation of municipal infrastructure grants.

This chapter presents a brief assessment of the MIG and the difficulties associated with its implementation. The assessment draws on reviews undertaken by the Financial and Fiscal Commission (FFC) and a study commissioned by the national Department of Provincial and Local Government (DPLG). Following this assessment the chapter considers the Municipal Infrastructure Grant (MIG) in the context of South Africa's constitutional and intergovernmental fiscal relations system. Finally the chapter examines the adequacy of the MIG arrangements to take account of the disparity and inequality cost factors that differentiate municipalities from each other.

Perspectives on the MIG and its Implementation

In June 2006 the Department of Provincial and Local Government (DPLG) published a document describing the municipal infrastructure grant (MIG) and the management process and procedures for its use among municipalities (DPLG, 2006).

According to the DPLG document the key principles on which the MIG is founded are the following: financing infrastructure for the provision of basic services; targeting the poor in recipient municipalities; using the grant in such a way that it also maximizes economic benefits that include job creation and the development of enterprises; allocating the grant equitably and ensuring that it's outcomes are accessible by the poor; ensuring that spending decisions for the grant are best undertaken at municipal level in accordance with national norms, standards and conditions; using the funds efficiently such that optimal improvement in access to services are provided at the lowest possible cost; and, ensuring that the use of the grant reinforces local, provincial and national development objectives. In addition to the principles listed in the DPLG Report the Constitution, in the Bill of Rights, mandates government to provide some of these infrastructures supported services as socio-economic rights in themselves.

Following from these principles the DPLG document lists four main policy objectives for the MIG programme. These objectives underpin national government's obligation to fund infrastructure subsidies that ensure all households have access to a basic level of infrastructure services.

Firstly, the MIG programme is to fully subsidize the capital costs of providing basic services to disadvantaged and poor households. Secondly the MIG is to allocate funds equitably, transparently and efficiently in support of socio-economic development. Thirdly, the MIG is expected to strengthen municipal development capacity through encouraging multi-year planning and budgeting systems. Fourthly, the grant is expected to act as a catalyst for municipalities to synchronize local objectives with national priorities.

The MIG is a conditional grant from National Government's equitable share of total nationally collected revenue and is allocated to local government through the National Budget. Table (3.1) calculated from the 2008 Budget Review (National Treasury, 2008) shows the importance of MIG funds to local Government between 2003/04 and 2007/08. It is clear from this table that the MIG grants constituted the largest proportion of National Government transfers for financing municipal infrastructure over the period.

Table 3.1: Infrastructure transfers to local governments, 2003/04 – 2009/10

(*MIG as a % of all infrastructure allocations to municipalities*)

Outcome	Revised estimates				Medium-term estimates			
R million	**2003/04**	**2003/04**	**2003/04**	**2003/04**	**2007/08**	**2008/09**	**2009/10**	**2007/08**
Direct transfers for:	**71.78**	**71.78**	**71.78**	**71.78**	**86.63**	**87.57**	**83.77**	**86.63**
Municipal infrastructure grant (MIG)	42.73	42.73	42.73	42.73	52.78	41.19	49.98	52.78
National Electrification Programme	4.29	4.29	4.29	4.29	3.27	3.05	4.91	3.27
Implementation water service projects	17.88	17.88	17.88	17.88	0.00	0.00	0.00	0.00
Disaster relief	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poverty relief funds	6.88	6.88	6.88	6.88	0.00	0.00	0.00	0.00
Publc transport infrastructure & systems grant	0.00	0.00	0.00	0.00	8.21	16.21	12.73	8.21
Neighbourhood development partnership grant	0.00	0.00	0.00	0.00	3.50	7.67	9.03	3.50
2010 FIFA World Cup stadiums grant	0.00	0.00	0.00	0.00	18.88	19.44	7.12	18.88
Indirect transfers for:	**28.22**	**28.22**	**28.22**	**28.22**	**13.37**	**12.43**	**16.23**	**13.37**
Water & sanitation operating subsidy	14.30	14.30	14.30	14.30	3.43	2.72	2.15	3.43
National Electrification Programme	13.93	13.93	13.93	13.93	6.80	5.89	7.78	6.80
Bulk infrastructure	0.00	0.00	0.00	0.00	2.10	2.30	3.56	2.10
Backlogs water sanitation clinics & schools	0.00	0.00	0.00	0.00	0.73	1.07	1.92	0.73
Backlogs electrification clinics & schools	0.00	0.00	0.00	0.00	0.31	0.46	0.82	0.31
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Calculated from National Treasury; Budget Review 2008

The following two tables provide an indication of the importance of the MIG funds in the Cape Winelands District local municipalities. The second table shows that, if the Cape Town Metropolitan area is excluded, the Cape Winelands district at 16.20% has the second highest level of projected sanitation backlogs in the Western Cape Province.

Table 3.2: Cape Winelands District: Sanitation Backlogs Estimates for 2007

Local Authority	Number informal houses no access to basic sanitation	Number informal houses with access to shared services	Number backyard dwellers with access to shared services	Total existing backlog	Estimated future backlog due to growth	Growth as a % of existing backlog
Breede River Winelands	0	628	4635	5263	4510	3.1
Breede Valley	470	2041	5180	7691	6320	3.0
Drakenstein	1189	2112	10200	13501	7845	2.3
Stellenbosch	10	300	7560	7870	7781	3.5
Witzenberg	0	2227	1600	3827	2280	2.4
Farmland	370	0	0	370	0	0
Total	**2039**	**7308**	**29175**	**38522**	**28673**	**2.8**

(Source: January 2007, Department of Local Government and Housing, Western Cape Province & National Department of Water Affairs and Forestry)

Table 3.3: Cape Winelands District: Sanitation Backlogs Estimates as a Percentage (%) of All Western Cape Province Municipal Authority Sanitation Backlogs[D1]

Western Cape Local Authorities	Informal houses no access to basic sanitation	Informal houses with access to shared services	Backyard dwellers with access to shared services	Total of existing backlog	Estimated future backlog due to growth	Growth as % of existing backlog
Cape Winelands District	13.96	05.00	11.50	09.30	16.20	02.80
Central Karoo District	03.08	00.05	00.79	00.61	00.68	02.00
Eden District	57.34	05.29	07.70	08.70	16.58	03.10
Overberg District	18.14	03.07	04.11	04.25	08.94	03.30
West Coast District	00.68	01.70	04.94	03.87	06.72	02.80
Cape Town	00.68	84.76	70.96	73.20	50.85	01.80

(Source: January 2007, Department of Local Government and Housing, Western Cape Province & National Department of Water Affairs and Forestry)

[D1] *Totals may not add up to 100% because of rounding to the nearest whole number.*

Rationale for Reviewing the Current Municipal Infrastructure Grant Scheme

In many instances the inadequacies in municipalities identified in the COGTA assessment are reflected in poor revenue projections and poor collection and credit control systems. The unavailability of reliable financial data and unreliable socio-economic statistics led to inaccurate financial and service delivery information. This consequently resulted in municipalities being unable to undertake effective expenditure planning, budgeting and financial management. As noted in the COGTA assessment this trend has been most starkly demonstrated in the area of municipal infrastructure planning and delivery. Since 1998 poor planning and budgeting information meant the inequitable allocation and distribution of revenue for the provision of basic services and development in disadvantaged local communities.

By 2006 the annual Local Government Review by National Treasury (National Treasury, October 2006) identified key areas that require refinement and reform in the existing local government system for allocating infrastructure grants. The areas of concern identified in the Review are almost identical to the findings of the COGTA evaluation. Amongst others the Review included the misalignment between the different powers and functions of the category B local municipalities and the category C district municipalities as being typical of the dysfunctional arrangement of powers and functions between these institutions.

Another area of concern identified by the National Treasury Review was finding an alternative source of own revenue for municipalities to replace the abolished regional service council (RSC) levies. For many poorer municipalities the RSC levies were the main source of revenues. In the absence of this own source revenue and with no sustainable tax bases disadvantaged municipalities became totally dependent on MIG grants for infrastructure development. However, the Review of Transfers in the Intergovernmental Fiscal Relations Systems in South Africa by the FFC (Josie, Khumalo and Ajam, 2006) suggests that the conditions attached to the MIG limit the flexibility that local governments need to attain their objectives.

Given the high levels of service delivery and infrastructure backlogs and the consequent inequalities between and among municipalities the National Treasury Review implied that a re-evaluation of the local government equitable share formula and the municipal infrastructure grant (MIG) mechanisms may be necessary. The COGTA assessment provides substantive evidence to support this assertion by the National Treasury Review. Clearly the growing infrastructure backlogs and associated service delivery problems are an indication that the current mechanisms are inadequate or inappropriate and compromise local government's ability to deliver on their constitutional mandates and development imperatives.

The National Treasury Review also identified the lack of planning and coordination between municipalities and provinces where these two government spheres have concurrent funding responsibilities for the delivery of housing, health and public transport services.

The 2006 Review reflected government intentions to set specific policy targets to eradicate remaining backlogs in sanitation, water electricity and other service delivery backlogs between 2008 and 2013. Notwithstanding the enormity of this task municipalities are still expected to maintain appropriate current levels of service delivery in communities. In addition local governments are required to create conditions for economic growth. To support these policy objectives the Review reported that local government's share of nationally raised revenue has risen to 7% between the 2006/07 and 2008/09 medium term plan and it is expected that local governments should fund the bulk of their services from own revenues.

While National Treasury reported that over 90 per cent of local government revenue is generated from own revenue sources (Budget Review, 2006), this statistic is misleading for three reasons. First, over one-half of local government revenue is received in the form of user fees, paid by citizens for electricity, water, sanitation and other services. The services that do not yield income may be more dependent on transfer revenue for renewal and maintenance.

Secondly, as municipalities increasingly fulfill responsibilities to all South Africans, the situation of under-funding from own-source revenue and the reliance on the equitable share of national revenue and conditional grants may increase because of population growth from in-migration from rural areas. Thirdly, as noted above, there are considerable differences among municipalities. While some have an adequate tax base, there are many others that have insufficient tax bases to yield required revenues. New policy objectives set by government are expected to increase the need for more funds for financing public infrastructure.

The envisaged policy objectives for the 2006/07 medium term period were free basic services for households that cannot afford such services; a proper waste management system; eradication of the bucket sanitation system; housing and built environment with the necessary infrastructure for sustainable communities; enhancing financial management and the capacity of municipalities to deliver quality services and, ensuring that the delivery of municipal infrastructure contributes to job creation (Budget Review, 2006).

The provision of free basic services however, depends on adequate and well-maintained and operated municipal infrastructure. The development and construction of infrastructure is funded largely through the conditional municipal infrastructure grant (MIG) dedicated for spending on basic public infrastructure in previously disadvantaged communities.

The MIG is the largest infrastructure allocation and had increased by R21.5 billion for the 2006/07-2008/09 period (see Table 3.1 above). In addition to the MIG municipalities received R4.4 billion as part of the electrification programme for connections to poor households. Including the delivery of free basic services in the package to be provided by municipalities raises the question as to how the cost of such provision will be incorporated in the MIG formula.

In the 2006 Budget Review government committed to ensure the provision of free basic services to poor households. Included in this list of services were water, sanitation, electricity and waste management. In addition government committed to the eradication of the bucket system and the development of the built environment with the concomitant infrastructure for communities. These commitments were to be underpinned by increasing support for financial management and the capacity of municipalities to deliver services. Over the 2006/07, 2007/08 and 2008/09 budget cycles government added R8.3 billion, R10.5 billion and R13.9 billion respectively to the local government budget framework. Over the three-year cycle the equitable share baselines were revised upwards by R1.6 billion to support the rollout of free basic services.

It is clear from the reasons provided in the 2009 COGTA assessment that the ambitious objectives set for the municipal infrastructure grant (MIG) in the 2006 National Treasury Budget Review were not entirely achieved. One of the reasons advanced by the COGTA report is that infrastructure funding mechanisms do not adequately take account of all the cost factors that differentiate municipalities from each other. This is particularly true of the Municipal Infrastructure Grant (MIG) formula.

Perspectives on the Municipal Infrastructure Grant (MIG) formula

Recent studies indicate that while there has been a certain degree of over-spending and under-spending of infrastructure budgets until the appearance of the COGTA assessment (2009) there was no way to show how this may be associated with the attainment of planned output targets for the delivery of basic services. The COGTA Report (Ibid: 41) in particular avers that the spending of the MIG grants is uneven amongst local governments because of the varied ability and capacity of many municipalities.

Initially, municipalities were able to spend most of their infrastructure budget allocations. By 2006 both the National Treasury and the Financial and Fiscal Commission (FFC) observed a marked under spending on the MIG allocations. In its Review the FFC (Josie, et al, 2006) attributed this under expenditure to several reasons. The reasons included the fact that municipalities continued spending MIG funds rolled over from previous years; the lack of proper project planning; ineffective project management; the lack of capacity for managing MIG funds and, the late approval of projects and budgets by council officials.

The COGTA assessment supports the findings of National Treasury and the FFC and, adds a few other problems associated with the misuse of MIG funds. These problems include the use of MIG funds for municipal operational costs; municipalities retaining investment amounts in the face of huge service backlogs and, the negative impact of the rural nature and vastness of some regions on the ability of municipalities to provide basic services. The COGTA Report (Ibid: 41) advances three “challenging elements in the current MIG approach”.

Firstly, the annual MIG allocations to smaller municipalities are often inadequate to be used for financing larger bulk infrastructure projects. Secondly, and with specific significance for the main question of this thesis, the formula driven allocation amounts to municipalities are inappropriately determined resulting in “the poor selection of projects and ultimately poor outcomes.” (Ibid: 41). Thirdly, the COGTA assessment suggests that the preceding two “challenging elements” in the MIG approach introduces a “lumpiness” of capital investment. Implicit in this suggestion is the assumption that “lumpiness of capital investment” compromises the principle of stability, predictability, certainty and flexibility required for planning, budgeting and implementing infrastructure programmes over a medium to long-term cycle [see The Constitution, Section 214 (2) (i) and (j)]. Thus the COGTA assessment proposes that municipalities be allowed to pledge MIG funding up to 2018 in order to acquire loan finance.

While many problems and challenges associated with the MIG may be attributed to the lack of capacity and capabilities of some municipalities other problems and challenges such as the inadequacy of MIG funds; the inappropriate determination of the MIG allocation and, the “lumpiness of capital investment” derived from the MIG, are inherent in the design of the equitable sharing mechanisms of the transfer system in general and the MIG grant in particular.

As will be noted below the structure of the MIG does not include a comprehensive list of the differentiating cost factors in the input variables that make up the formula. A grant allocation based on a formula that does not take account of all input cost factors is likely to place increased budgetary pressures on municipalities. One of the biggest challenges for the costing of input factors is the lack of reliable financial data and information from municipalities. The 2006 Budget Review suggests that the major constraint in attaining policy targets is the lack of reliable data and information about the actual costs of input factors. This makes comparisons across local governments very difficult.

A review of the MIG must address some of the design issues. In particular national government needs to consider whether conditional grants such as the MIG should also be allocated equitably a discretionary transfer as infrastructure grants are also drawn from nationally collected revenue.

The MIG Formula

As the MIG allocations to municipalities are formula driven it will be important to understand the nature and structure of the formula. At least two major reviews of the MIG programme were undertaken in the recent past. One was done by the *Financial and Fiscal Commission (FFC)* in 2006 (Josie, et al, 2006: 18-21). The other, by the Department of Provincial and Local Government in 2007. Both these reviews discuss the MIG formula. The formula consists of percentage allocations for five different components representing different municipal infrastructure needs.

From the DPLG review the formula can be summarized as follows:

$$MIG = B + P + E + N + M$$

Where:

- B represents the allocation for basic residential infrastructure such as water, sanitation, roads, electricity, street lighting and solid waste removal.
- P denotes funds for new and rehabilitated municipal service infrastructure.
- E is the allocation for the construction of social service institutions and micro-enterprises.
- N is the allocation for nodal development and renewal programmes in targeted urban and rural municipalities and;
- M is a performance related adjustment to the total MIG allocation for a municipality.

In addition, each component is weighted by an identified socio-demographic disparity parameter that reflects differences among metropolitan and local municipalities. The disparity parameters for each of the five components are represented respectively by

$\chi, \phi, \varepsilon, \nu$ and μ

such that each parameter is a weighted adjustment for the corresponding service allocation component. The adjustments are supposed to take account of the costs of socio-demographic disparities that distinguish the metropolitan municipalities (Category A) from the local municipalities (Category B). The parameter values were estimated from the 2001 Census data (StatSA, 2001). The five components represent the generic costs of the broad categories of infrastructural services. The socio-demographic disparity parameters are adjustment weights associated with sub components of these broad categories. The socio-demographic disparities represented by the parameters may be designated as follows:

χ_1 = *weight* for inadequate household water and sanitation
χ_2 = *weight* for household in informal settlements with no access roads
χ_3 = *weight* for inadaquate household refuse and waste removal
ϕ = *weight* for public facilities for households earning *less* than R1100 pm
ε = *weight* for small business areas with households earning less than R1100 pm
ν = *weight* for nodal development areas with households earning less than R1100 pm
μ = *weight* for performance related adjustment

Thus the full MIG formula will be:

$$MIG = \sum_{\chi_{i=1}}^{3} \chi_i B + \phi P + \varepsilon E + \nu N + \mu M$$

where
i= is an index for disparities

The weightings for residential infrastructure in the MIG formula purport to take account of disparities in the provision of water, sanitation, roads and waste removal for households. According to the DPLG manual the disparity weights are there to distinguish the metropolitan municipalities from the local municipalities. There are several problems with the way the formula is constructed.

There is no clear description as to how and why certain disparity weights were selected and others not. In essence there are only two disparity indicators. The first three are indicators for inadequate provision. The second three are poverty weights for areas with households earning less than R1100 per month. There is no explanation as to why R1100 pm was selected as the poverty measure. The choice of the policies raises two fundamental questions. Firstly, how are the inadequacies in service provision estimated? Secondly, can the choice of a household poverty line truly represent disparities between metropolitan and rural local municipalities given that there are large pockets of informal settlements and unemployment within the boundaries of metropolitan areas?

The second problem is associated with setting minimum norms and standards for basic services. The DPLG manual (DPLG Manual: 7) defines the norm for a basic water supply facility as the infrastructure necessary to supply 25 litres of potable water per person per day supplied within 200 meters of a household and with a minimum flow of 10 litres per minute for communal water points. Formal house or yards with connections are entitled to a supply of 6000 litres of potable water per month. None of the other basic service norms and standards are clearly defined.

Thirdly, the formula does not have disparity components to show how local municipalities should be distinguished from each other. This lacunae means that horizontal grants, between and among local municipalities, will be inequitably allocated.

Finally, including a performance related weight in the formula seems to imply that local municipalities without the capacity to provide adequate services will be penalized. Yet the capacity to deliver services in disadvantaged local municipalities is a function of the legacy of past apartheid policies, the lack of technical skills and inadequate funds from own revenues and transfers from national government. The COGTA assessment recommends that government should review this formula.

Review of the MIG

In 2003 the FFC prepared an evaluation note of the draft policy framework document for the MIG. (Fast, 2003) In this evaluation several important points were raised that are as relevant now as they were in 2003.

The evaluation pointed to a fundamental contradiction in the requirement for infrastructure funds to be spent according to municipal Integrated Development Plans (IDP) and, according to the proportions attributed to the socio-demographic indicator weights in the formula. The evaluation made the point that:

> *IDPs reflect local priorities, which may vary across time and geography. For example, a municipality at risk for a cholera outbreak may choose to spend most infrastructure funding on water and sanitation infrastructure during the first years of the MIG programme.* (Fast, 2003)

This contradiction compromises the need for flexibility in allocating grants.

Another aspect of the MIG allocations that was raised as a potential problem by the evaluation, and that continues to present difficulties in the implementation of infrastructure projects, is the complexity of the intergovernmental arrangements between district and local municipalities. This point was underscored by the COGTA (2009) assessment.

In its basic form all the current MIG formula achieves is an incremental slicing of a given politically determined pool of funds from National Government's equitable share? The rationale for the formula does not give any indication as to how the pool of funds for the grant was determined. There is also no indication as to whether the cost factors determining infrastructure needs were taken into account in estimating the pool of funds or at least, taken into account in the determination of each municipality's MIG allocation? The onus is on municipalities to access these funds by submitting project proposals and plans to national government.

This formula approach to allocations seems to operate under the assumption that, as the conditional grants are drawn from national government's equitable share, they are exempt form the constitutional requirement for all collected revenues to be equitably shared. In other words they may be allocated at the discretion of national government. Such an assumption may be based on a restricted interpretation of Section 214(1) of the Constitution. Conditionality of a grant does not necessarily imply that it cannot be allocated equitably. Neither does it mean that the grant can be allocated without taking into account all the considerations listed under Section 214(2) of the Constitution.

South Africa's intergovernmental fiscal relations system is founded on the principle of equal treatment of all spheres of government (The Constitution, 1996 and the IGFR Act, 1997). This implies that the structure of an intergovernmental allocation formula in South Africa has to include mechanisms that are firmly based on principles of both Section 214(1) and (2) of the Constitution. In subsequent chapters this thesis will present an alternative approach to allocating capital grants to municipalities that takes cognizance of both Sections 214(1) and (2) of the Constitution.

In addition to the formula driven allocations the MIG pool of funds also consists of an allocation that is non-formula driven called a Special Municipal Infrastructure Fund (SMIF) targeting project based applications by municipalities that meet a set of pre-determined criteria.

Perspective on the project based approach to allocating MIG grants

In its 2006 review of the MIG the Financial and Fiscal Commission (Nthite et al, in Josie et al, 2006) argued that under-spending by disadvantaged municipalities maybe due to the stringent conditions attached to the MIG allocations. Another reason for under-spending may be the requirement that all municipalities provide adequate project management irrespective of their financial and human resource capacity. The FFC review suggested that all these problems seem to be associated with the fact that the structure, conditions and procedures of MIG were carried over from its predecessor, the Consolidated Municipal Infrastructure Programme (CMIP). The latter was a project proposal application approach similar to those used by development banks. These approaches are invariably underscored by the extensive use of cost benefit[21] and cost effectiveness methods. In general, municipalities in South Africa have little or no in-house capacity to plan and prepare proposals and manage major infrastructure projects. This is particularly true of the poorer local municipalities.

The MIG was instituted for the provision of basic infrastructure to municipalities with infrastructure backlogs and high levels of poverty and economic disparities. It is the largest single national transfer to municipalities. Despite the laudable objectives of the MIG National government's own assessments indicate that the allocations have been under-spent or only effectively spent by larger richer municipalities. Larger and richer municipalities have a relative comparative advantage in resource capacity, planning and preparing sophisticated infrastructure project proposals over their smaller and poorer counterparts. Whether these project proposals are underpinned by a cost benefit analysis (CBA) or cost effectiveness methodology is not immediately evident from the literature. However, it may be assumed that for decision-makers to make an informed choice from amongst several competing demands for infrastructure projects the proposals should be supported by cost benefit or cost effectiveness analyses and an understanding of the types of funding available.

In itself there is nothing wrong with municipalities accessing the pool of infrastructure funds through a process of submitting infrastructure project applications to national government. However, if the grant pool is politically predetermined without objectively taking into account all constitutional, economic and redistributive considerations then municipalities may argue that the determination of the pool of funds is a arbitrary process lacking transparency and not in keeping with the principles of co-operative governance in Chapter 3 of the Constitution. In this regard the fact the MIG is allocated according to a formula is a moot point, as it does not show how the pool of funds was determined and how it takes account of constitutional, economic and redistributive considerations.

[21] *A conceptual method used in the public sector for evaluating financial inputs and outputs of investment projects and, that takes into account future gains (benefits) and losses (costs) to investors and beneficiaries*

Allocations of finance based on applications from recipients are widely used to disburse grants, loans or donor funds to municipalities for development projects. However, as Harvey (1983), points out, this is an extremely hazardous task for any level of government in developing countries. With very little in-house capacity most local municipalities would opt for other forms of finance for infrastructure projects. Sometimes the wrong choice may add to the risk of project failure. To expect local municipalities to submit project applications in keeping with the MIG preconditions is unrealistic in South Africa. Harvey (1983:3) underscores some of the prerequisites for planning, preparing and implementing projects.

> *…those actually involved in preparing and implementing projects, as well as those who make decisions on the choice and financing of projects, need to have some knowledge of the costs and benefits of the more commonly available types of finance, ways of analyzing those costs and benefits, and some of the risks involved. In theory it would no doubt be better for government planners to separate project selection from the question of finance, rather than to react to proposals for projects with finance already integrated into the proposals. In practice, the planning process is normally a continuous mixture of both, and indeed individual projects sometimes come for consideration at several different stages. It is certainly better to match up a project to the most suitable type of finance at an early stage, rather than to make changes when a great deal of planning and negotiation has already taken place. At either stage, those involved should have background knowledge of costs and benefits referred to, and the suitability of different types of finance to different types of project.*

On its own a project based allocation arrangement does not provide the transparency and budget predictability so important for planning and required under Section 214 (2) of the Constitution and other legislation. Of course a project-based approach is appropriate for accessing private sector funding for deficit financing purposes where need is driven by competing municipal microeconomic demands. In such cases local governments have to fulfill a set of stringent conditions in order to access loans to finance municipal budget deficits. These conditions may include cost benefit analysis research; submission of business plans and, feasibility studies. A project-based approach is also appropriate for helping municipal decision-makers choose to fund certain projects amongst a range of alternative project options. Deficit financing of municipal infrastructure budgets is an important instrument in funding infrastructure plans and programmes. In the literature Venkatachalan (2005), the OECD (2005) and du Mhango (in Khosa, 2000) propose several innovative approaches that municipalities may use to access loans to complement and supplement municipal infrastructure budgets.

In South Africa, although a project-based approach may be used to inform municipal infrastructure budgets, it is proving to be a blunt instrument for informing National Government's determination of the pool of funds that may be available for MIG grants through the intergovernmental fiscal relations system. This is particularly true for municipalities without adequate sources of own revenues from taxes and user-fees. Different considerations listed under Section (2) 214 a-j of the Constitution have to be taken into account when allocating nationally collected revenues.

Under the current dispensation the microeconomic demands of municipalities are bound to come into conflict with the macroeconomic constraints determining the available MIG pool of funds from the nationally collected tax revenue and other sources. In the existing arrangement, to access the MIG funds, municipalities are expected to submit plans and project proposals based on actual costs. However, such an arrangement poses a fundamental contradiction. If each municipality had to take account of its real costs (including backlogs, inequality and other disparity factors) for building and maintaining infrastructure for the provision of basic services and economic development and, these amounts are aggregated across all municipalities, then the total sum may be greater than the national capital expenditure budget pool available for equitable allocation to municipalities. Thus, in public finance parlance, if this *hard budget constraint* limits the actual amount of MIG funds available why should municipalities submit plans and project proposals that national government departments may reject in any case?

As suggested above a project-based approach to funding is more appropriate to making loans from development banks than for equitably allocating government infrastructure grant transfers in a developing economy. The former runs a financial market for development funds and expects some form of return on its investment. Municipalities in such an environment are expected to operate according to competitive market rules and make choices about the suitability of the finance available. The *hard-budget constraint* may be one of the theoretical reasons why Harvey (1983: 3) suggests that, "*it would no doubt be better for government to separate project selection from the question of finance, rather than to react to proposals for projects with finance already integrated into the proposals.*" The current project approach for the intergovernmental allocating and disbursing of MIG funds may be one of the reasons for problems in intergovernmental planning and coordination and, inordinate bureaucratic delays in project implementation, compromising the attainment of the MIG objectives to deliver basic municipal services. An independent baseline study (Palmer Development Group, 2009) for the evaluation of government's Support Programme for Accelerated Infrastructure Development (SPAID) provided evidence to suggest that bureaucratic delays in project implementation undermine the MIG objectives.

Table 3.2: Delays in MIG project implementation by average number of days, August 2008

Project Category	Electricity	Municipal public services	Roads	Sanitation	Solid Waste Removal	Water
Consultant appointment:						
-No. of projects	138	156	533	272	24	451
-Days from registration	114	86	101	106	134	113
-Days Overdue	**15**	**37**	**62**	**27**	**79**	**51**
Tender Advert						
-No. of projects	30	82	333	116	13	340
-Days from registration	172	131	157	151	312	156
-Days Overdue	**77**	**109**	**121**	**78**	**172**	**91**
Contractor appointment						
-No. of projects	73	116	484	236	30	604
-Days from registration	206	185	203	294	551	259
-Days overdue	**117**	**130**	**119**	**158**	**212**	**140**
Project completion						
-No. of projects	44	48	203	97	11	341
-Days from registration	320	374	403	607	856	541
-Days Overdue	**78**	**117**	**129**	**73**	**63**	**137**

(Source: Adapted from SPAID 2008 Baseline Study Estimation)

Surely, given the legacy of apartheid inequality, the infrastructure development imperatives of local government cannot be founded on a municipality's competitive edge in producing infrastructure plans, project proposals and project monitoring capacity. Would it not be better if national government allocated the macro-economically determined pool of funds available for infrastructure through a capital expenditure grant scheme model that includes estimates of backlogs, capital stocks and the aggregated inequality and disparity factor costs of providing services to municipalities? Furthermore, if the MIG principle that all infrastructure funding for a municipal function be directed to or be under the jurisdiction of the relevant service authority it would not be necessary to have so many complex intermediate allocation and implementation mechanisms that tend to undermine this same principle.

Municipalities are better placed to handle allocations because they also have the added advantage of raising own tax revenues and borrowing to supplement shortfalls in capital expenditures. Thus, under such an arrangement, the MIG grants will amount to a revenue equalization transfer that offers poorer municipalities a lifeline to plan the gradual build-up of their tax base as infrastructure provision stimulates local economic growth and development. This is a significant incentive for using the MIG as part of a matching grant programme. More important such a capital expenditure grant model will provide national government with an effective policy instrument to work within the constitutional requirement to ensure the provision of basic services taking into account reasonable measures, progressive realization and available resources.

Conditions, intergovernmental coordination and institutional arrangements

The conditions attached to the MIG are intended to ensure that municipalities meet national priorities, norms and standards. In this regard the MIG is allocated to assist the poor to access infrastructure to improve their economic opportunities. Thus municipalities are required to prioritize public residential bulk infrastructure for the delivery of water, sanitation, electricity, refuse removal, street lights, roads and solid waste removal. In terms of MIG principles implementation plans must be aligned with the relevant government department's sector policy objectives set before the municipal financial year. (Nthite et al, in Josie et al, 2006).

Other conditions of a governance and institutional nature include compliance with proper planning and accountability guidelines set by different national departments responsible and accountable for integrating the construction of the elements that comprise residential bulk infrastructure services. Politically informed conditions include adherence to specific labour intensive methods and policies of transformation in the awarding of contracts. Monitoring the quality of infrastructure provided is an integral part of the conditional framework.

The institutional policy instruments and arrangements for the implementation of the MIG programme reside with both the local and provincial government spheres. The MIG manual (DPLG, 2007) affirms the primary role of municipalities in the planning, budgeting, financial management and operational arrangements for the grant. The municipal manager is responsible for the effective management of the programme.

At the provincial level relevant departments are expected to integrate their sectoral (e.g. water, roads and housing) plans with the MIG programme and provide planning support to municipalities. The manual provides a detailed responsibility matrix defining the roles and responsibilities of all spheres of government in the delivery of such services funded by the MIG grant. The key challenge in this regard is effective coordination as some of the functions have to be provided concurrently by the provinces and municipalities. While municipalities may have the capacity to raise own revenues for funding high infrastructure costs provinces do not have a corresponding revenue raising capacity. The ensuing tensions from such discrepancies have been the basis of growing current problems between national, provincial and local governments in South Africa.

An additional consideration arises specifically in the local government context, and that concerns the relationship of local governments to national and provincial governments. In most countries, the relationship among governments is strictly hierarchical. National governments deal with the provinces, while provinces alone deal with their municipalities. The situation in South Africa is more complex, where there are three spheres of government required under the Constitution to govern co-operatively. Despite this principle in practice, the local government sphere operates within the policy and funding parameters set primarily by national government.

Grants should be designed to ensure local government autonomy and achieve fiscal equity among municipalities, and should be transparent, stable and predictable. The question here is does national government have sole discretion over how the MIG is allocated and disbursed because it is a conditional grant drawn from the national equitable share? A related question is whether such allocations and disbursements should comply with the requirements listed in Section 214(2) of the Constitution? In other words should conditional grants drawn from the national equitable share be also subjected to the principle of equitable vertical and horizontal sharing amongst the three spheres of government?

The objective of South Africa's intergovernmental fiscal arrangements is to ensure that these inter-governmental responsibilities are carried out in the spirit of co-operation, fairness, and efficiency. In the end, it is the welfare of individual citizens, wherever they reside, that should be the ultimate objective guiding the decisions around fiscal arrangements. A national government transfer using a municipal infrastructure grant scheme will provide municipalities with autonomy, stability and predictability in exercising some flexibility in prioritizing, planning and choosing amongst infrastructure projects.

Given the current hybrid approach to allocating the MIG it is no wonder that municipalities find it difficult to access the funds. It is possible that as a result of this and the problems mentioned above a large part of the MIG pool of funds varies between being over-spent, unallocated, under-spent or misspent on unplanned infrastructure projects.

The preceding discussion presented some perspectives on the MIG and examined some of the structural difficulties associated with the formula and its implementation. Before considering an alternative approach to allocating infrastructure grants in the next section this chapter will assess the extent to which the current approach is consistent with all constitutional and legal mandates.

The Constitutional and Intergovernmental Context of the MIG

The Bill of Rights in the Constitution prescribes that certain public services be provided to all citizens as part of their economic rights. Depending on their service delivery responsibility spheres of government may be held accountable for ensuring that these rights are fulfilled. The provision of many of these services fall within the roles and functions of municipalities.

The Constitution does not speak directly to the issue of vertical and horizontal equity amongst and between sub-national governments, though it implies equal rights and obligations for individuals to basic services listed in Schedules 4B and 5B of the Constitution, (see Stytler and De Visser, 2007). For the respective spheres of government to provide basic services, the Constitution makes provision for the allocation of equal shares from the nationally collected revenues (See diagramme in Chapter 4). This is prescribed in Section 227 (1) and (2) of the Constitution (The Constitution, 1996):

> *(1) Local government and each province –*
>
> *(a) is entitled to an equitable share of revenue raised nationally to enable it to provide basic services and perform the functions allocated to it; and*
>
> *(b) may receive other allocations from national government revenue, either conditionally or unconditionally.*
>
> *(2) Additional revenue raised by provinces or municipalities may not be deducted from their share of revenue raised nationally, or from other allocations made to them out of national government revenue.*

From the foregoing, it is apparent that the Constitution approaches the requirement for equity in a particular manner and requires the mechanism of "equitable allocations" to play a particularly important role in financing the equity that is to be achieved through provincial and municipal programmes.

The municipal infrastructure grant allocations fall within the long-term vision of the inter-governmental system in South Africa. Municipal infrastructure grants are the catalyst for the building of public infrastructure necessary for local governments to provide key public services to which communities, households and individuals are entitled.

The long-term vision of the inter-governmental system is one where national government, in consultation and co-operation with sub-national spheres, sets standards for basic public services. Ideally, these standards should be transparent and should be provided for in national legislation. Sub-national spheres such as local municipalities, utilizing the resources available to them, have the responsibility to design and deliver programmes within their jurisdictions that satisfy these national standards.

At least two basic conclusions may be drawn from an examination of the constitutional provisions for equity in equitable allocations of infrastructure grants. Access to basic services is a fundamental right to which everyone is entitled. Basic services include access to adequate housing and health care services; sufficient food and water; social security and basic and further education, as elaborated in the Bill of rights (Chapter 2) of the Constitution. Secondly, certain rights may be provided within reason and must be subject to progressive realization, as governments must operate within available resources.

Equitable allocations, at a minimum, include an entitlement to enable the provision of basic services by provinces and local governments. Equitable allocations are provided out of national revenue. This suggests that equitable allocations must be adequate and distributed appropriately so as to ensure that all citizens have access to those basic services for which provinces and municipalities are responsible, subject to the constraint of available resources.

Although the equitable division of national revenue among the three spheres of government lies at the heart of intergovernmental fiscal elations in South Africa and is mandated in Section 214 (1) of the Constitution, this mandate is circumscribed by certain requirements. In Section 214 (2), clauses *a)* to *j)* the

Constitution requires that several considerations need to be taken into account before the equitable division can take place.

Many of these considerations are of relevance for intergovernmental relationships and the roles and responsibilities of municipalities in the delivery of services within their jurisdictions. Municipalities may, for instance, be required to participate in the attainment of policy objectives that serve the national interest (clause *a*). A typical example, that is also relevant for financing public infrastructure, is South Africa's hosting of the 2010 Soccer World Cup. Clause *b* (provisions for servicing the national debt and other national obligations) and *c* (needs and interests of national government determined by objective criteria) are of particular interest to all municipalities that may require national government's support for debt financing of infrastructure projects through borrowing in the domestic and international financial markets. National government may have to weigh such support against its room for balancing its various commitments and obligations with the macroeconomic constraints under which it has to manage public finances and the economy in general. [See diagramme and flowchart in Chapter 4].

The clauses that impact directly on financial and budgetary issues are *d), e), f), g), h)* and *i)*. Respectively, they are specifically pertinent for a municipality's ability to provide services and perform its functions; develop its fiscal capacity and be economically efficient; be developmental in its policy objectives; take account of disparities within its jurisdictions; recognize its obligations in terms of national legislation; and, receive stable and predictable allocations of revenue shares.

The list spans a wide spectrum of national requirements that range from the macroeconomic to the microeconomic. All the requirements listed above are very important considerations for national government in determining the equitable division of national revenue allocations through a formula driven process. Apart from being beyond the scope of local government's competency, the balance between macroeconomic and microeconomic policies is extremely onerous for municipalities to consider when preparing applications for infrastructure project finance. Municipalities are better placed to focus on infrastructure project priorities and plans informed by the needs of their communities. On the other hand, national government for example, may use fiscal capacity and economic efficiency assessments as key indicators for compensating municipalities for any shortfalls in infrastructure project finance.

A formula based on a model for the equitable sharing of the MIG pool of funds has a better chance of equalization to compensate for a municipality's inadequate fiscal capacity and, to sanction in the case of economic inefficiency. Local government is not in a position to incorporate market price distortions and equity considerations into infrastructure project plans and budgets. Market price distortions may negatively impact on the pool of funds that may be available for infrastructure funding. A nationally managed model for the equitable sharing of the MIG pool of funds is more suited to take account of market price distortions when compensating for inadequate fiscal capacity, economic efficiency and the social benefits and costs of projects. Such an approach will have the added advantage of introducing a relative degree of objectivity and transparency to the allocation process and provide a sound economic argument for the progressive and reasonable provision of basic services within available resources. Hansen, (1978: 1) underscores this point.

> *Often market price distortions cannot be removed through basic economic policy changes because of powerful political forces with vested interest in the status quo. Under such circumstance, one way of improving economic efficiency and social equity is to make investment decisions on the basis of shadow prices that reflect the true value to the country of its resources. These shadow prices may be 'national parameters' (e.g. the shadow price for foreign exchange) or they may be specific to a given sector, region and/or project (e.g. the shadow wage rate for labour).*[22]

[22] *A shadow price is the imputed value of a good or service in the absence of a market price. The shadow price represents the opportunity cost or real sacrifice to an economy of producing goods or services where charges or prices do not reflect the real value of the goods and services produced.*

A nationally managed model for the equitable sharing of the MIG is also better equipped to take account of the "*developmental and other needs of…local government and municipalities*" [Constitution, 1996, Section 214 (2) (*f*)] within the context of national development objectives. In the current approach project evaluation and monitoring of the MIG is solely concerned with the efficiency of the use of resources and the hard budget constraint than with disparities and the gross inequalities of income distribution that prevail within and between municipalities.

An alternative nationally managed equitable sharing model for allocating MIG should have the capacity for taking account of "economic disparities within and among" the municipalities [Constitution, 1996, Section 214 (2) (*g*)]. Expecting each municipality to be concerned with balancing between maximizing equity and efficiency in the local government sphere in general is unrealistic. Municipalities are generally concerned with microeconomic impacts of public infrastructure and, maximizing equity and efficiency within their own jurisdictions rather than about national macroeconomic growth and development strategies. In fact so-called applying efficient strategies alone can have negative consequences if not balanced with equity.

> *…'efficient' development strategies often leave the present inequities of income distribution unchanged, and may even make them worse. Efficiency and equity usually cannot be maximized simultaneously. There is a trade-off between them, and deciding where the balance lies is perhaps one of the hardest tasks facing development planners*. (Hansen, 1978: 1-2)

It would be much better for municipal decision makers to focus on choosing among infrastructure projects in keeping with their microeconomic plans and priorities and for national government to focus on making allocation decisions according to national macroeconomic growth, development and redistributive considerations listed in Section 214 (2) of the Constitution.

In its attempt to find the right balance between equity and efficiency the current MIG approach seeks to influence and manage infrastructure project investment decision-making at both macroeconomic and microeconomic levels. This is a difficult objective for national government to achieve. Hansen, (1978: 1-2) argues that

> *…decision makers 'at the top' generally find it difficult to offer any firm and quantitative rules about the relative importance of these two conflicting criteria (i.e. equity and efficiency) to guide project analysts in their choice among alternative projects and project designs…*

However, given that municipalities in South Africa have legal mandates (Constitution, Section 214 (2) *h*) project analysts and decision makers at the local government level may, as Hansen (1978) suggests, prepare alternative projects varying in the degree to which they maximize either efficiency or equity.

> *Then, by observing which projects are chosen by decision makers at the top the analysts can determine the implicit weights that are placed on these alternative objectives. This approach is of course, not limited solely to efficiency versus equity, but may also be used to determine the weights decision makers place on other non-efficiency goals such as meeting 'basic needs' of the poor…* (Ibid: 1-2).

If national government allocates MIG funds among municipalities on the basis of an equitable sharing model that is based on medium to long term policy objectives and targets and, incorporates weights for equity and efficiency together with weights for sub-regional economic disparity, decision making at the local government level will be enhanced. The approach will also achieve two other purposes. Firstly it will ensure stability and predictability in the allocations of revenue shares for infrastructure provision as per the requirement in Clause (*i*) in Section 214 (2) of the Constitution (1996) and secondly, it will explain the reasons for the determination of the MIG pool of funds.

Perspectives on Capital Cost Disparity Factors in a MIG-Type Formula

The current methodology for MIG (as presented in the DPLG 2007 Report on the Revision of the MIG Allocation Formula) was supposed to have introduced a formula based approach as opposed to the Consolidated Municipal Infrastructure Programme (CMIP) practice of allocations for approved infrastructure project applications. Although this is a significant change there is no explanation as to how and why the socio-demographic indicators used in the formula were chosen. The indicators seem to represent backlogs in water, sanitation and housing and a poverty line of households below a certain level of income (See formula explanation above). Each indicator is weighted with a percentage of the total MIG fund that is used to adjust a specific infrastructure service component allocation. The indicators are based on the 2001 Census (DPLG 2007). The indicator weights are introduced to show that the formula takes account of socio-demographic disparities within municipalities. However, they do not show how they are estimated and how they take account of the cost implications of backlogs and economic disparity factors that differentiate municipalities from each other.

An Alternative Approach to Allocating Municipal Infrastructure Grants

It is clear from the preceding discussion in this chapter that intergovernmental transfer systems are faced with the dilemma of having to balance the need for economic equity and stability with efficiency and predictability in the equitable provision of public services. In South Africa's case this is a constitutional obligation to be attained progressively and within reasonable fiscal constraints. Public finance literature and experiences of international practice indicate that resolving this problem is fraught with many challenges and difficulties. Notwithstanding these challenges there is agreement in the literature (see Boadway and Shah, 2007) that estimating the costs of providing public services within grant formulae is important in balancing the competing objectives of economic stability, equity and efficiency.

Grant systems whose amounts are determined by a well-specified formula have a number of advantages over those that are determined on a year-by-year discretionary basis. Formula-driven grants are more transparent, reliable and predictable, and are less subject to short-term fiscal constraints and day-to-day political considerations. Formula driven grants can be designed to be in place for intervals of several years. They can also be designed so that risks of unexpected changes in revenue are borne by national government, which may be especially important where municipal governments have little revenue-raising ability, and where they cannot use debt as a method of insuring themselves against revenue fluctuations.

The process by which grant formulae and amounts are determined should be transparent and undertaken from a longer-term perspective. Nevertheless, isolating national transfers from the budget process entirely is not feasible since money must be appropriated by the national legislature. Some countries, such as Australia, India and South Africa have established independent fiscal commissions for ensuring that longer-run considerations are taken into account in designing grants.

Political accountability is important for ensuring that public services are delivered in efficient ways and that they meet the needs of citizens. Therefore, explicit and unambiguous delineation of accountability relationships between the different spheres of government is critical. In the case of the MIG the delineation of accountability relationships between national government and local government must be explicit and clear. Nurturing responsible and autonomous decision-making at the municipal government level with respect to balancing equity and efficiency may involve some transition, but it will pay dividends in the long run.

The Josie, MacDonald and Petchey (2008) model and the Petchey et al (2004) provincial capital grant model introduce the notion of costs associated with capital stock, capital backlogs and socio-demographic and economic disparities that characterize inequalities between and within sub-regions such as municipalities. In South Africa the Constitution (1996) requires that these factors be taken into account in attempting to equitably allocate capital grants for public infrastructure.

The notion of cost disparity factors in a MIG-type capital grant model is an innovation that may be used to highlight the varying degrees of poverty and inequality across municipalities. The current MIG formula allocates funds across regions and sub-regions according to census population numbers and a politically determined indicator for poverty. No account is taken of aggregated socio-economic inequality and geo-physical disparities that may impact on the cost of delivery of services. Furthermore, no account is taken of the impact of the growing cost of inherited capital backlogs on the level of actual capital stock, on-going capital requirements and new capital investment.

Summary

In this chapter a rationale was presented for using a capital grant model for horizontally allocating MIG funds among municipalities. The chapter has shown that it is possible for a national government to use a capital expenditure grant model that takes account of all constitutional requirements; macroeconomic considerations and, also takes account of the real cost of financing infrastructure projects.

An appropriately designated local government authority is better placed to disburse the grant between competing demands for infrastructure project finance. It is more difficult for national government to manage a financing method that tries to achieve both macroeconomic and microeconomic objectives. This separation of roles will allow national government the possibility of a more objective oversight with respect to monitoring municipal compliance with constitutional requirements and other legal policy instruments. It will also create space to oversee the attainment of fundamental national policy objectives and targets. Separation of roles will also allow for local government autonomy in the monitoring and micro-management of municipal infrastructure development plans and objectives.

For national government, using such a capital grant model at the macro level, makes for an easy assessment of whether constitutionally mandated basic infrastructure services have been reasonably, progressively and affordably provided. From an economic perspective it makes for effective estimation of the marginal product of capital at the municipal level. These estimates may be useful cross-checks to verify the results from the application of cost benefit analysis methods at municipal level.

In summary, there is substantial scope for the current municipal infrastructure grant funding arrangements to use a formula that includes: allocations of national revenue to meet basic services; a provision for funding infrastructure backlogs key to economic growth and development; and, elements in a grant scheme that take account of the historical and spatial disparities that determine costs of providing services in areas that have been the victims of past apartheid discriminatory policies.

Chapter 4

Research Design, Methodology Data And Information

The research design employed in the study for the thesis was an eclectic mix of different methodologies and approaches each corresponding to the five key components of the thesis (see Figure 1.1. in Chapter 1). The thesis is empirical in the sense that it is a case study using hybrid textual and numeric data sets from five local municipalities in the Cape Winelands District Municipality. The research employs both qualitative and quantitative statistical techniques to provide an analysis of the five municipalities. Secondary data from official sources were used for statistical analyses. Much of the qualitative information was sourced from official reports and interviews with government officials. The sample of five municipalities from the Cape Winelands District was chosen because the municipalities constitute a homogenous group of local governments that can be compared with each other within the framework of a larger district municipality (The Cape Winelands District). The local municipalities studied were Breede River, Breede Valley, Drakenstein, Stellenbosch and Witzenberg. Both deductive and inductive approaches are used to adapt the Petchey et al (2004) provincial capital grant model for allocating grants to municipalities and, evaluate its analytical effectiveness for allocating municipal infrastructure grant shares.

The chapter restates the fundamental question to be addressed by the study for the thesis and restates the propositions of the thesis as hypotheses. The chapter next explains the different methodologies adopted for adapting the Petchey et al (2004) provincial capital grant model for application in municipal infrastructure grant allocations. Through this process the key approach, concepts, variables and definitions will be presented and discussed. Secondly, the chapter explains the eclectic set of methods used for estimating the variables in the model. Thirdly, the chapter explains how the information was collected from the five municipalities in the Cape Winelands District and other government sources. Fourthly, a description and explanation of the data and their sources are provided. Fifthly, the limitations, shortcomings and sources of error of the data are discussed.

Recall from the Chapter 1 that the study for the thesis asked a fundamental question: *How can municipal infrastructure grants take account of historical backlogs and disparities that differentiate municipalities from each other?* To answer this question the study focused on two specific propositions that challenge the way the current municipal infrastructure grant allocations are made and, may be expressed in terms of two fundamental hypotheses as follows:

- *The structure of existing infrastructure grant formulae does not adequately take account of all historical capital cost disparity factors that differentiate municipalities from each other in the provision of services. This inadequacy compromises the right of citizens to basic services as enshrined in the Bill of Rights and, also compromises the principle of the equitability and economic efficiency of allocations within and between municipalities as required in Section 214(1) (a) to (c) and Section 214(2) (d), (e), (f), (g) and (h) of the Constitution.*
- *National government's existing project approach to financing municipal infrastructure based on the unit costs of inputs is flawed. This flawed approach compromises the intergovernmental fiscal relations (IGFR) principle of municipal autonomy and, the requirement for stability, predictability and flexibility of municipal budgets required by section 214 (2) (i) and (j) of the Constitution.*

My hypotheses raised two secondary questions about the structure of the existing way infrastructure grants from nationally collected revenues are allocated to local municipalities. *The first question asked, what are the likely impacts on grant shares of including capital cost disparities in an intergovernmental infrastructure grant scheme intended to equitably allocate funding to municipalities? The second question asked, can equitability, stability, predictability and flexibility of municipal budgets be enhanced by the inclusion of capital cost disparities and economic efficiency considerations in a municipal infrastructure grant scheme?*

Although the current Municipal Infrastructure Grant (MIG) and other municipal infrastructure allocation instruments purport to take account of poverty in the formulae, the inclusion of this weight alone does not adequately take account of the key constitutional requirements identified in the hypotheses. In particular, as discussed in Chapter 3, the poverty variable in the MIG formula is a weak global indicator for capturing diverse disparity and inequality indicators representing regional differences in capital cost factors, socio-economic inequalities, the apartheid institutional legacy of historical disadvantage and, capital backlogs that impact on municipal economic efficiency and developmental needs. Furthermore, the current project based approach to funding municipal infrastructure through the MIG and other grants compromises stable, predictable and flexible municipal planning and budgeting processes to provide constitutionally mandated basic services and attain regional economic and developmental objectives. It is my contention that structural approaches to developing a municipal infrastructure grant model would be a more nuanced way to meet all the constitutional requirements identified in the hypotheses.

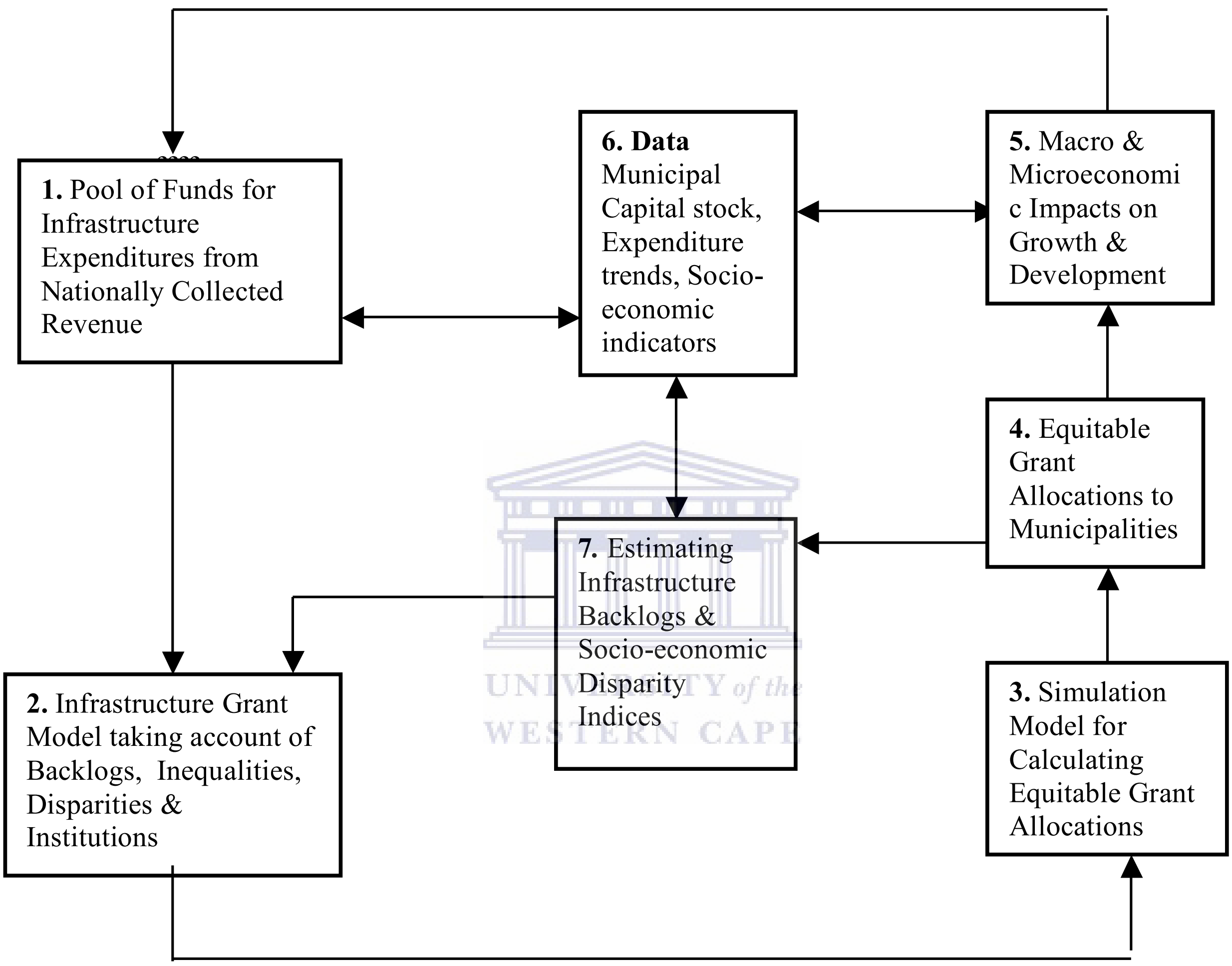
Using the principles of the structural approach discussed in Chapter 2 I contextualize the methodology for adapting the Petchey et al (2004) model within a structural framework. Fitzgerald *et al* presents Taylor's definition of structural analysis as follows:

> *...an economy has structure if its institutions and the behaviour of its members make some patterns of resource allocation and evolution substantially more likely than others. Economic analysis is structural when it takes these as the foundation stones for its theories"* (Fitzgerald *et al*, 1989: 31)

According to Taylor (1991: 5-6) analytical modeling needs to consider the macroeconomic impacts of decisions taken by economic agents and their institutions. These impacts emanate from the decisions of public and private sector economic agents and institutions that influence prices and demand and supply in markets. Secondly, modeling needs to consider how private and public sector microeconomic decisions, investment policy, fiscal demand, savings and income and wealth distribution influence macroeconomic stability. Other factors that impact on macroeconomic stability include monetary policy, inflation, and forms of financial intermediation, industrial policy and private sector capital formation. Although it is not the aim of this thesis the impact of local government level microeconomic decisions influenced by infrastructure grant allocations to municipalities is key to understanding the evolution of their eventual impact on macroeconomic stability, economic growth and development. From the literature (Chapter 2) we know that the amount of nationally collected revenue available for government infrastructure grant allocations will be determined by economic growth and development founded on a stable macroeconomic balance.

Taylor (1991: 6-10) presents five main principles that should govern structuralist analysis and modeling in developing economies. The first principle is to identify and specify how the relevant classes of socio-economic agents and institutions fit into available income and wealth distribution data by virtue of their main sources of income. Secondly, price and income flow data used must be in nominal or money terms rather than "real" terms or "relative prices" because socio-economic agents negotiate on the basis of actual money defined in nominal terms. Thirdly, structural modeling must recognize that price fluctuations, flows of funds, foreign exchange flows, financial surpluses and savings and investment ratios may be determined and controlled by different, but powerful, private and public sector socio-economic agents and institutions in society. Fourthly, the analysis should take account of the microeconomic and macroeconomic impacts on prices of borrowing by economic agents and institutions. Fifthly, a structural model must be able to show its role in the causal linkages in the macroeconomic system. For example, a model for allocating infrastructure grants may be validated if it can empirically show that it positively contributes to the macroeconomic system as a whole. The current approach to allocating municipal infrastructure grants does not take these principles into account. The models developed in Petchey et al (2007) and Josie et al (2008) show how the structure of the South African economy can be taken into account in intergovernmental grant allocations. Although this is not the objective of the thesis Figure 4.1 schematically illustrates how this can happen.

Figure 4.1: A Structural View for Modeling the Equitable Sharing of Infrastructure Grants to Municipalities in South Africa with high levels of Disparities



(Source: *Adapted from Petchey, MacDonald, Josie, Mabugu, Kallis: 2007)*

As illustrated in Figure 4.1 the microeconomic infrastructure investment decisions of local municipalities will be influenced by state intervention and institutional arrangements in the allocation of resources, income distribution and class relationships among households, investment decisions by firms, the technology costs of producing a service and, the macroeconomic impacts of debt, interest rates, prices and inflation and, foreign trade. In turn the microeconomic nature of infrastructure investment decisions by municipalities will have significant macroeconomic impacts for employment, income distribution, demand for goods and services and, domestic saving and investment opportunities. In this way regional economic growth and development prospects are enhanced creating the potential for a greater revenue base from which to finance future municipal infrastructure investment.

The use of a structural approach suggests two questions. The first question is why should the microeconomic infrastructure investment decisions of local municipalities impact on the overall macroeconomic balance and performance? The answer lies in the fact that investment in public infrastructure contributes to the aggregate capital stock of the national economy in general and the regional economy in particular. In Taylor (1991) the importance of the aggregate capital stock variable figures prominently in several macroeconomic models. While the MIG formula includes a factor for infrastructure backlogs it does not take account of the impact of a capital stock variable on the municipal economy. The second question is how to conceptualize the problem (identified in Chapter 3) of local government institutional arrangements in South Africa's (SA) intergovernmental fiscal relations (IGFR) system within a structural framework? This question will be addressed below.

A Stylized View of Local Government Institutional Arrangements in South Africa's (SA) Intergovernmental Fiscal Relations (IGFR) System

Following from the research design in Figure 1.1 in Chapter1 this section presents a structural framework for conceptualizing local government institutional arrangements in South Africa's (SA) post-apartheid intergovernmental fiscal relations (IGFR) system (represented in box A, Figure1.1). Chapter (3) discusses the framework and identifies the background to the problem of local government infrastructure grant allocations in South Africa's intergovernmental fiscal relations (IGFR) System. The framework provides a stylized view of the constitutional obligations and institutional arrangements within which intergovernmental fiscal relations are mediated. In this framework the place of local government's roles and responsibilities can be viewed in the broader context of the constitutional obligations and institutional arrangements that define and determine intergovernmental fiscal relations among the national, provincial and local spheres of government.

The questions about infrastructure grants implied in the hypotheses can best be understood within this structural analytical framework for two reasons. Firstly, such a framework for the study was useful in understanding the area of governance and accountability in post-apartheid South Africa in transition and, undergoing structural transformation (Fitzgerald and Vos (1989: 29). In this sense the approach provided the basis for understanding the processes for instituting, managing and monitoring prescribed policies of transformation and institutional restructuring of arrangements and transaction costs. Secondly, a structural analytical framework helped to understand infrastructure investment decisions as it focuses attention on the extent to which the availability of infrastructure, skilled labour markets, resource allocation mechanisms, production costs and imported inputs determine whether a local economy will attract investments. Clearly, both these reasons take on greater significance within the context of the constitutional requirement for equitable grant allocation mechanisms to municipalities to provide basic services to citizens and promote developmental and sustainable local government.

The key constitutional intergovernmental fiscal relations institutional arrangements of expenditure functions, governance responsibilities and accountability constraints discussed in Chapter 3 are captured in stylized form in the structural framework presented in the Table 4.1 below in columns 1, 2, 3, 4, and 5 respectively. The table presents a global stylized perspective of the interrelationships between the three spheres of government. However, in terms of South Africa's intergovernmental fiscal relations institutional arrangements local municipalities receive much of their infrastructure investment finance from the national government's equitable share.

Implicit in the hypotheses and objectives of the thesis is whether there is equitability and allocative efficiency in the way this grant is distributed. As noted in the introduction municipalities are faced with varying degrees of historical disadvantage, socio-economic inequalities and geo-spatial disparities. They also have to deal with past and present institutional arrangements and transaction costs and macroeconomic constraints that impede their ability to finance their infrastructure investments.

Table (4.2) is a summary of the sources of revenues that are available for the three spheres of government. It is clear from this table that national government has responsibility for collecting the bulk of the taxes and levies that constitute the national revenue from which the pool of funds for infrastructure grants is determined. From macroeconomic and public finance theory we know that government's fiscal policy stance (that is government's position on taxes, expenditures, borrowing and deficit financing) is a key variable in the determination of economic growth and eventual size of the revenue pool. Table (4.3) is a summary view of how the nationally collected revenue is shared amongst the three spheres of government.

Together the three tables above summarize in stylized form the various statutory, economic and institutional considerations that go towards informing government infrastructure investment decisions. If, as is argued in the structural tradition, infrastructure investment plays an important role (see the literature cited in Chapter 2) in determining the capital stock variable in the macroeconomic balance and stability and, the eventual growth of the economy, then the way municipal infrastructure grant allocations are made (see Box 4 in Figure 4.1 above) will be very important in determining macroeconomic policy objectives. In Chapter 3 the assessment of the statutory, institutional and governance policy objectives, targets, instruments and budgetary arrangements for infrastructure grant allocations used information from official documents and interviews with managers and financial officers from the local municipalities and relevant national and provincial government departments.

Table 4.1: Stylized View of IGFR Institutional Arrangements in SA

Expenditure shares in terms of Bill of Rights & Section 214 (1 & 2) of Constitution for:	Governance & institutional responsibility of:			Constraints in terms of Bill of Rights & Section 214 (2) clauses (a to j) of Constitution
	National Government	Provincial Government	Local Government	
National Interests (e.g. Defense & foreign)	Sole	No	No	1. Progressively provide basic services within available resources in terms of Bill of Rights; 2. Provincial & municipal fiscal capacity; 3. Provincial & municipal efficiency; 4. Economic disparities; 5. Stability of allocations; 6. Predictability of allocations; 7. Need for flexibility.
National Debt	Debt service & Deficit limits	Limited borrowing	Borrowing & bond issue	
Needs & interests of national government	Public service personnel, capital & operational, other	Agency role	As delegated	
Education	Higher, adult & technical; science & technology	Basic & early childhood	No	
Health	Teaching hospitals & medical research	Basic & primary health care	Some primary health care	
Welfare services	Support for non-governmental agencies	Full	No	
Social Security	Full	Agency role	No	
Housing	Subsidies to province & municipalities	Concurrent with national and local	Concurrent & as delegated by national & province	
Water & Sanitation	Infrastructure grants to municipalities	No	Provision and service delivery	
Transport & Roads	Funding of transport parastatal, network & national roads	Concurrent with national & local, for provincial roads	Urban roads & transport	
Electricity	Generation through parastatal (Escom)	No	Local distribution	
Safety & Security	Full	No	Metro Police	
Emergencies	Concurrent	Concurrent	Concurrent	
Contingency Reserve	Sole	No	No	

(Source: Adapted from Petchey, MacDonald, Josie, Mabugu, Kallis: 2007)

Table 4.2: Revenues Allowed for National, Provincial and Local Governments

Categories	National	Provincial	Local Govt.
Taxes	Personal Income; Value Added Tax (VAT); Corporate tax; Tariffs	Some surcharges on existing taxes; Tourism levies; Fuel levies; Gambling.	Property rates; Motor vehicle license; other
User Charges	Electricity generation; Airport & harbour fees; Rail transport; National toll roads; other.	Hospital fees; School fees; Provincial toll roads; other.	Water & sanitation; electricity distribution; other.
Borrowing	Treasury bond issue; national & international financial markets and institutions.	As per legislation & approval of national minister of finance.	Municipal bond issue; national financial markets; Development Bank of Southern Africa (DBSA); other.

(Source: Adapted from Petchey, MacDonald, Josie, Mabugu, Kallis: 2007

Table 4.3: View of Revenue Shares for National, Provincial and Local Governments

Types of Allocation	National Share	Provincial Share	Local Govt. Shares	Total Expenditures
Discretionary	NEA	PEA	LEA	ES
Conditional Grants	$-PCG - LCG$	PCG	LCG	$CG = PCG + LCG$
Total	$(NEA - PCG - LCG)$	$(PEA + PCG)$	$(LEA + LCG)$	$TNCR$

(*Source: Adapted from Petchey, MacDonald, Josie, Mabugu, Kallis: 2007)*

$$TNCR = (NEA - PCG - LCG) + PEA + PCG + LEA + LCG$$

$$TNCR = NEA + PEA + LEA$$

Where

$TNCR$ = Total nationally collected revenue

NEA = National government equitable allocation

PEA = Provincial government equitable alloaction

LEA = Local government equitable allocation

PCG = Provincial conditional grants

LCG = Local government conditional grants

ES = Equitable Shares

The Methods for Developing a Municipal Infrastructure Grant Model

The preceding sections of this chapter discussed the overall approach used in the thesis in general and, for assessing the intergovernmental fiscal relations institutional and governance policy instruments in particular. This section discusses the instruments and tools used in measuring and estimating the key variables used for constructing a municipal infrastructure grant model from the Petchey et al (2004) provincial capital expenditure grant model. The steps are represented in components C, D and E in Figure 1.1. In the study it was assumed that the budgeted pool of funds available for infrastructure grant allocations (see component B in Figure 1.1) were a pre-determined national government policy decision informed by macroeconomic considerations such as economic growth (GDP), nationally collected revenue from all taxes, debt repayments and deficit reduction.

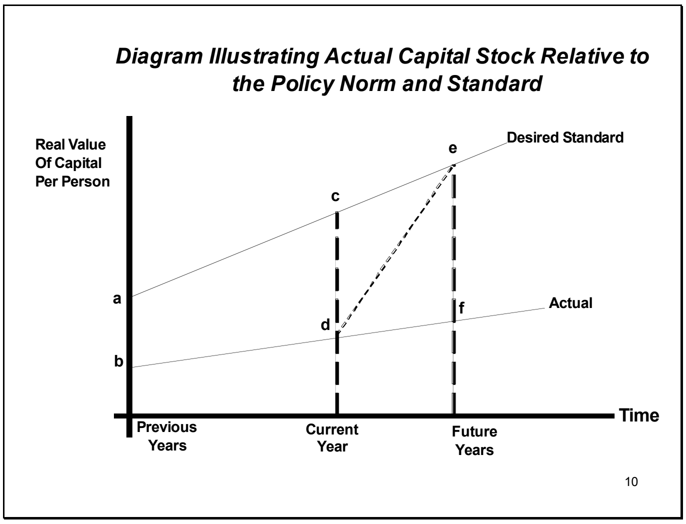
Based on the foundational principles (Young, 1994) discussed in Chapter 2 the development of the infrastructure grant model followed four steps. The first step was the assessment and construction of a reasonable estimate of the desired per capita level of public capital stock necessary to reach the national capital stock standard required to attain policy objectives (Levtchenkova and Petchey, 2000). The calculations were done in the Excel Simulation Model using the perpetual inventory method (see the Tab labeled Capital Stock PIM in the *Simulation Model with Scenarios Municipal Infrastructure Grants, MJJPhD 2010* in the attached compact disc). The second step was the construction of the composite disparity indices that differentiate the five local municipalities from each other (see the Tab labeled Disparity Index in the *Simulation Model with Scenarios Municipal Infrastructure Grants, MJJPhD 2010*). The third step used the results of step one and two for constructing a model for allocating infrastructure grants to municipalities (see Chapter 6). The fourth step constructed an Excel Simulation Model from the theoretical model in Chapter 6 (*Simulation Model with Scenarios Municipal Infrastructure Grants, MJJPhD 2010* in the attached compact disc); ran model simulations using data and information from the Cape Winelands District Municipalities and, produced the results and findings presented in Chapter 7. The methods, assumptions and data for each of the four steps are discussed in the sub-sections that follow.

The relationship between capital stock estimates and public infrastructure provision.

The first step in the construction of the municipal infrastructure grant model (component D Figure 1.1) is the estimation of a capital stock data set for the municipalities. The reason for estimating municipal level capital stock data is because there are no time series capital stock data for municipalities in South Africa. Estimating the municipal level public capital stock data using the perpetual inventory method (PIM) provides a data series that will help illustrate the role of the capital stock variable in a municipal infrastructure grant model. The role of the capital stock is best explained diagrammatically and is illustrated in Figure 4.2.

As illustrated in the diagramme the actual per person capital stock of a representative poor municipality for a particular service is plotted (point *b*) against the standard capital stock for the service across all municipalities in the district and in which the standard capital stock is growing over time.

Figure 4.2: The Role of Capital Stock in the Model



(Source: MacDonald, Petchey & Josie, 2005)

For example, at a given period in time, a minimum policy standard for the provision of water reticulation in a poor municipality characterised by economic disparities may be a tap within 200 meters of a household. If, in a preceding period the municipality may have actually had a tap within one kilometre of a household this would amount to a capital backlog measured against the minimum policy standard. The desired service standard or policy target over a planned period of time may be to progressively provide a tap inside every household in the district municipality.

In the diagramme above, for a relatively poor municipality, the actual capital stock is depicted below the standard. In a preceding period the municipality has a capital backlog defined as the difference between the standard and actual capital stock at a point in time and, equal to the distance in *ab* in the diagramme. In a current year or period, this would have grown to equal the distance *cd.* The reason for this growth is because we assume that the rate of net grant allocations and spending is insufficient to reduce the backlog of the preceding year or period. In addition because of continued low levels of net allocations and spending, by a given future year or period, the backlog has increased further to equal the distance *ef.* Therefore, municipalities that lie above the standard norm (i.e.; they have more than the nationally determined standard norm for the particular service), will have a capital stock surplus or negative backlog (no backlog).

Given the above scenario the key question is, with a limited amount of infrastructure grant funds, how to raise the level of net allocations and spending for the poor municipality so that its actual capital stock for the service equals the standard norm at some future period. Achieving this goal can only take place over a period of time through the progressive elimination of infrastructure backlogs and the consequent creation of new capital stock. A formula based on such an infrastructure financing grant model could provide an objective mechanism to equitably allocate additional resources from a limited grant pool to municipalities for a chosen period of time to enable them to transform their capital stocks from the actual starting point toward the desired standard. The particular path taken is the "transition path". The line *de* is one possible transition path that sees the backlog eliminated in equal increments over the period.

Estimating municipal capital stocks using the Perpetual Inventory Method (PIM)

An adapted version of the perpetual inventory method[23] (PIM) developed by Levtchnkova and Petchey, 2000, (see Chapter 2 for discussion) is used to estimate municipal capital stocks for the municipalities in the Cape Winelands District.

This version of the PIM technique begins with a given estimated capital stock at some point in time. Thereafter it creates subsequent stock estimates using data on capital expenditure and depreciation. Instead of using the term "year" I will apply the term "period" in keeping with the notion of the three year medium term expenditure framework (MTEF) used in the allocation of municipal infrastructure grants. The adapted version of the PIM technique is explained as follows.

The real capital stock for service s in municipality i for the current period $t(K_{i,t}^{s})$ is defined as:

$$K_{i,t}^{s} = K_{i,t-n}^{s} \prod_{\tau=t-n}^{t-n} (1-\delta_{i,\tau}^{s}) + \sum_{\tau=t-n}^{t-2} k_{i,\tau}^{s} \prod_{\tau'=\tau+1}^{t-1} (1-\delta_{i,\tau'}^{s}) + k_{i,t-1}^{s} \qquad (4.1)$$

where:

- $K_{i,t}^{s}$ is the capital stock for service s in period t for municipality i.
- $K_{i,t-n}^{s}$ is the capital stock estimate for service s in municipality i during the initial or current period $t-n$.

[23] *The Perpetual Inventory Method (PIM) is a technique for estimating capital stocks. The technique entails adding gross fixed capital to an initial estimate of the capital stock and then by applying a rate of depreciation, calculates the net capital stock. (UN SNA93).*

- $\delta^s_{i,\tau}$ is the rate of depreciation for service s in municipality i during period τ.

- n is the number of periods preceding the current period t.
- $\prod_{\tau=t-n}^{t-n}(1-\delta^s_{i,\tau}) + \sum_{\tau=t-n}^{t-2} k^s_{i,\tau} \prod_{\tau'=\tau+1}^{t-1}(1-\delta^s_{i,\tau'}) + k^s_{i,t-1}$ represents a stream of depreciated additions to the initial capital stock between period $t-n$ and t.

- $k^s_{i\tau}$ is the capital expenditure on service s in municipality i during period τ.

Equation (4.1) represents the last estimated time period (the current time period). However, the same expression applies to any intermediate time period for a given sample.

The expression shows that the value of capital stock for service s in municipality i at the beginning of the current year or period, $K^s_{i,t}$, is equal to an appropriately depreciated value of some initial capital stock estimate, $K^s_{i,t-n}$ and a stream of accumulated and depreciated additions to this initial capital stock. Additions to the capital stock, or capital expenditure, are not depreciated for the first period.

Equation (4.1) is a version of the technique where the depreciation rate δ is assumed to vary across periods, sub-regions and services given a set of observations that span a relatively long period of time. The authors also present an alternate version of the technique where the depreciation rate is invariant across time, sub-regions and service.

In this version the equation is reduced to:

$$K^{s}_{i,t} = K^{s}_{i,t-n}(1-\delta)^{n} + \sum_{\tau=t-n}^{t-1} k^{s}_{i,\tau}(1-\delta)^{t-\tau-1} \qquad (4.2)$$

For the purpose of estimating capital stock data in a municipality in the Cape Winelands District the second formula would be more practical for several reasons. The municipal boundaries are about ten years old. This means that the data for the rate of depreciation across sub-regions is probably unavailable or is not likely to vary across local municipalities. Therefore, in estimating capital stock for the Cape Winelands district municipality the study for the thesis assumes a constant depreciation rate invariant across time, sub-region and service and applies equation (4.2).

To estimate the initial capital stock for service s in municipality i during period τ it is necessary to define a weight factor. Thus, the equation can be represented as

$$w^{s}_{i,t} = \frac{k^{s}_{i,t}}{k^{R\&SR}_{WC,\tau}} \bullet \frac{P_{WC,\tau}}{P_{SA,\tau}} \qquad (4.3)$$

where

- $w^{s}_{i,\tau}$ is the weight for estimating the initial capital stock.
- $k^{s}_{i,\tau}$ is the capital expenditure of municipality i during period τ on service s (can be obtained from National Treasury or relevant provincial departments).
- $k^{R\&SR}_{WC,\tau}$ is the total capital expenditure in the Western Cape by the Province and Local Government during period τ (from relevant government departments).
- $P_{WC,\tau}$ is the population of the Western Cape Province during period τ .
- $P_{SA,\tau}$ is the population of South Africa during period τ .

The weight obtained in (4.3), which is specific to each period, is then averaged over the entire sample of municipalities from t-n (the initial period) to t (the current period) to obtain the following average,

$$w_i^s = \frac{\sum_{i=t-n}^{t} w_{i,\tau}^s}{n} \qquad (4.4)$$

where n is the number of periods from the initial period to the current period.

This average weight is then applied to an estimate of the aggregate capital stock for the province (using provincial capital stock estimates calculated by the FFC, 2007) and municipal sub-sector to obtain our estimate of the initial capital stock for service s, in municipality i,

$$K_{i,t-n}^s = w_i^s . K_{SA,t-n}^{WC\&L} \qquad (4.5)$$

where

- $K_{i,t-n}^s$ is the estimate of the capital stock for service s in municipality i in the period t-n, the initial period.

- $K_{SA,t-n}^{WC\&L}$ is the total aggregate capital stock (aggregated over all services for South Africa, provinces and local municipalities) for the Western Cape Province and local municipalities in the year $\tau = t - n$.

From (4.3) one can see that $k_{i,\tau}^s$, the actual capital spending by a municipality i on service s in each period τ (as well as its distribution across the entire sample from period t-n to t), will have a major influence on the size of the municipality's weight, and hence its initial capital stock estimate in (4.4). In general, the larger is a municipality's actual capital expenditure over the whole period (for a particular service), relative to expenditure by other municipalities on that service, the larger is its weight, and hence the estimate of its initial capital stock. Notice, also, that it is average expenditure over the entire period that determines the magnitude of the weight, rather than expenditure in just one period.

The weighting procedure assumes that a municipality with a high spending record on a particular service during the period (t-n to t) also has a relatively larger capital stock inherited from the period before the initial period. While there is likely to be a strong correlation between municipalities with relatively large (small) capital stocks and those that have relatively high (low) capital expenditures during the period, there may be extreme cases where this is not so. Another implication is that as time progresses, any error associated with the initial stock estimate diminishes as depreciation reduces the value of the initial period capital stock, and the capital stock series increasingly reflects new capital spending after the initial period. For this reason, it is always best to start the perpetual inventory procedure as far back as possible if one wishes to maximize the accuracy of the later estimates in the series.

Constructing a composite infrastructure cost disparity indicator

The second step in constructing an infrastructure grant model (component D in Figure 1.1) that complies with the requirements of the South African constitution (see Chapter 3) is to estimate a composite capital cost disparity indicator that captures the impact of both the geo-spatial and economic disparities on the other variables in the model. Such an indicator will more effectively take account of regional disparities and socio-economic inequalities (Constitution 1996, Chapter 13, Section (2), 214) in a capital or infrastructure grant model. In fact several composite cost disparity indices for disadvantage and socio-economic inequality may be constructed for a specific and local municipality from sets of sub-indicators. The first such sub-indicator may be population dispersion.

Consider, for example, a geographically large municipality with a dispersed population. The cost of providing water and sanitation for residents, schools or hospitals in the remote regions of such a municipality is higher than the cost of providing the same services for residents, schools or hospitals in an urban metropolitan municipality with a predominately city-based population. This is so because, to provide such services in a remote location, it is also necessary to incur the cost of providing access roads, extending electricity and water systems and other infrastructure. As a result of such 'population dispersion disparity' the *per unit* cost of the flow of capital services in such a municipality may be relatively high.

An example of a composite disparity measure that may be relevant in South Africa is the impact of debilitating diseases. If a municipality has a relatively high incidence of debilitating diseases such as Aids or TB in its population, then the cost of each unit of health and related services may be high compared to a municipality with a relatively lower incidence of such diseases. This is because Aids and TB require more public infrastructure services to manage health care.

The cost of providing a given unit of public service output may be higher in municipalities with structural disadvantages resulting from the injustices of policies of the apartheid past. For example, the cost of achieving given educational and health outcomes for people from poor families may be higher than the cost of achieving the same educational or health outcomes for people from richer backgrounds. Municipalities with more poor people (unemployed, lower incomes) and victims of past socio-economic discrimination might, therefore, be expected to incur higher costs in achieving given health and educational outcomes. Thus, some aggregated measure of socio-economic inequality such as deprivation may be included in a composite capital cost disparity index. The information and data for identifying the disparity measures for the Cape Winelands District was collected and collated from official data sources and interviews with national, provincial and local government officials.

In summary, the disparity and socio-economic inequality data used for constructing the indicators are regrouped into three broad categories: population dispersion; debilitating diseases (HIV and/or TB), and, socio-economic factors such as deprivation, unemployment, household income inequality, housing, water and sanitation backlogs.

Practically it will be cumbersome to use such a broad array of capital cost disparity indicators in a model for infrastructure grants to municipalities. One way of incorporating several indicators into a model is to aggregate all the indicators into a single composite capital cost disparity[24] indicator. This method is used extensively in the literature (See Chapter 2). One such approach was used to construct the Financial and Fiscal Commission's (FFC) *Capital Grant Scheme Model with Provincial Disabilities (Petchey, MacDonald, Josie and Nthite, 2004)***.**

In the Petchey et al (2004) model the incorporation of multiple disparity indicators (called disabilities) began with the definition of a capital cost disparity index gamma (γ).

In adapting this provincial application procedure for local government, an infrastructure cost disparity for a given municipality can be defined in order to arrive at an infrastructure cost disparity function. This function is indexed by *t,* the subscript for time and by *i* the subscript for the municipality. There will be five (5) such values for *i* representing the five Cape Winelands District local municipalities. The subscript *t* represents any designated period of time for the allocated municipal infrastructure grant. Thus let the infrastructure cost disparity be

$$\gamma_{i,t} = e^{\phi_{i,t}} \qquad (4.6)$$

(read as *gamma i, t equals e to the power phi i, t.*)

where

$$\phi_{i,t} = \sum_{i,t,j=1}^{J} \beta_{i,t,j} D_{i,t,j} \qquad (4.7)$$

[24] *Please note that the term disparity in this thesis refers to both geo-spatial cost disparity indicators and socio-economic inequality measures.*

is an infrastructure cost *disparity function* for municipality i in period t with subscript j representing the value of the chosen disparity indicator. Each of the elements in equation (4.7) can be defined as follows:

- $D_{i,t,j}$ is the percentage deviation, for municipality i, of the j^{th} disparity indicator from the mean or average value of the disparity indicator for all local municipalities (for period t).
- $0 \leq \beta_{i,t,j}$ is a parameter that captures the impact of the percentage deviation of the j^{th} disparity from its average value on the value of the disparity function (in period t) for municipality i.
- $D_{i,t,j} = \left(X_{i,t,j} - \overline{X}_{t,j}\right) / \overline{X}_{t,j}$, where $X_{i,t,j}$ is the value of the j^{th} disparity measure for Municipality i and $\overline{X}_{t,j}$ is the average value of the j^{th} disparity measure for all local municipalities $i = 1,....,5$ in period t.

The construction of equation *(4.6)* implies that the infrastructure cost disparity is a non-linear (exponential) function of $\phi_{i,t}$ (*phi*). This basically means that the capital cost disparity will increase over time according to some prescribed exponential growth factor in a non-linear fashion. This is a reasonable assumption as, at this stage, there is no advance information as to whether the infrastructure cost disparity is a linear or non-linear (i.e. whether it follows a straight or irregular path) function of $\phi_{i,t}$.

Policy decisions for prioritizing and ranking disparities

In keeping with the equity principles of *parity, proportionality,* and *priority* (Young, 1994) policy makers have to decide on which disparity receives the highest priority. The weight $\beta_{i,t,j}$ (*beta*) in the infrastructure cost disparity function is assumed to be a policy parameter for ranking the economic disparity according to its level of priority in achieving planned policy objectives and policy targets. This means policy decision makers may decide the *beta* value. One can see from equation (4.7) that the choice of $\beta_{i,t,j}$ will have a considerable impact on the relative importance of the different disparities incorporated into the disparity function, and on the overall magnitude of the aggregate value of the disparity function itself. It is for this reason it is argued in the literature (see Chapter 2) that the choice of $\beta_{i,t,j}$ has to be objectively informed by statistical analysis. In effect the weight associated with a disparity function determines the significance and importance of the disparity in the model.

Under ideal conditions the *weights* could be determined from an econometric study that yields estimates of the importance of each disparity in determining the value of $\phi_{i,t}$ from among a wide range of disparities (see Petchey et al, 2000). However, in the absence of reliable long-term official information and data for regions in South Africa I assume that these values are policy weights, which are disparity specific but not municipality specific[25]. However, in keeping with the hypotheses and the aims of my study I postulate that the policy-maker must choose *beta (β)* values for disparities in compliance with the policy objectives and constraints derived from the constitution and summarized in Tables 4.1, 4.2 and 4.3 above and, in accordance with the equity principles of *parity, proportionality,* and *priority* (see my discussion of Young, 1994 in Chapter 2). The policy objectives and constraints can be grouped into a list of criteria for prioritizing and ranking disparities. The policy-maker's choice of *beta (β)* values can then be informed by this list of criteria. Drawing from Tables 4.1, 4.2 and 4.3 I propose that the following criteria inform the prioritization of disparities and the choice of *beta (β)* values to ensure *parity, proportionality,* and *priority* in the equitable allocation of infrastructure grants. In terms of the constitutional obligations and policy objectives the policy makers choice of *beta (β)* values should prioritize:

- Overcoming the apartheid legacy of historical infrastructure backlogs in the interests of promoting accessibility to municipal services and increasing regional capital stock for economic development in historically disadvantaged areas.

[25] *In other words the state may determine the weights at a national or provincial level depending on the attainment of planned priority policy objectives at any given time.*

- Improving the physical and intellectual capabilities of previously disadvantaged communities to ensure their human development and effective participation in the economy.
- Targeting the unemployment and income distribution economic variables to ensure stable macroeconomic and regional economic balances between saving, investment and tax revenue.
- Ensuring compliance with the Bill of Rights and Section 214 of the Constitution to avoid the costs of litigation brought by citizens.
- Mitigating the potential for social and political conflict generated by growing socio-economic inequality, lack of social cohesion and, inadequate delivery of basic services within municipalities.
- The prudent use of natural resources for sustainable long-term human development.

In principle all disparities could be weighted equally or with zero values *(β =0)* being used for not including the disparity and non-zero values *(β =x)* for inclusion of the disparity. This means that the absolute value of weight influencing the aggregated magnitude of the disparity function becomes just as important as it results in a "reasonable" set of disparity weights – the higher the weight choice the greater the absolute value and variance of the disparity function. One possible option therefore is to include a wider range of disparities. A wide range of disparities that may be included as policy choices is presented in the summary table in Chapter 5, Table 5.10. These disparities capture the significance of most of the criteria presented above.

For example, if I select five disparities (unemployment, household income, population density, HIV/TB incidence, deprivation) from Table 5.10 as proxy indicators for some of the criteria listed above and if a weight of 0.5 is given to the first three disparities and the fourth and fifth is given a weight of 1, this implies that the fourth (HIV/TB) and fifth (deprivation) disparities are more important in constructing the capital cost disparity index. A simple trial-and-error process for making such a selection from a wider selection of disparities would be as follows:

- Establish two selection index sets for the *betas* ($\beta_{i,t,j}$) weights. Let $x = 1$ if the disparities are included in the construction of the index and, let $x = 0$ if they are not. This will show how the inclusion/exclusion of certain measures of disparity affected the index.
- To use the betas as weights – setting them to any non-zero value would include them in the index. Thus for example if there were 5 disparities with the *beta (*$\beta_{i,t,j}$*) value* 0; 1; 0.5; 0; 1; this would lead to the inclusion of the 2nd, 3rd and 5th with the 2nd and 5th weighted 1 and the 3rd weighted 0.5.

The signs for the infrastructure cost disparity are important in indicating the influence of the infrastructure cost disparity on the size of the municipality's infrastructure grant share. The infrastructure cost disparity can have three different signs. First, if $\phi_{i,t} = 0$ then the weighted sum of the percentage deviations for municipality i is exactly equal to zero. In this case, $\gamma_{i,t} = e^0 = 1$ and the infrastructure cost disparity has no influence on the municipality's grant. Second, if $\phi_{i,t} \leq 0$ then the weighted sum of the percentage deviations is negative implying that $0 \leq \gamma_{i,t} < 1$ (a relatively low cost municipality). If $0 \leq \gamma_{i,t} < 1$ then the disparity will tend to reduce a municipality's grant below what it would otherwise be. Finally, if $\phi_{i,t} \geq 0$ then the weighted sum of the percentage deviations is positive, implying that the municipality has relatively high costs, and $\gamma_{i,t} > 1$. Here, the effect of including disparities is to raise a municipality's grant above what it would be without including an infrastructure cost disparity.

A policy parameter for equitably sharing the available infrastructure grant pool

Given the expenditure constraints and constitutional requirements listed in Table 4.1 and the constraints determining the pool of nationally collected revenue listed in Tables 4.2 and 4.3, the policy-maker must also choose how much of the available infrastructure grant pool must go towards reducing disparities and how much should go towards the regular per capita economic efficiency allocation. Making this choice will indicate the transition path to be taken to achieve the desired level of capital stock (see Figure 4.2) and the speed with which historical backlogs will be reduced. If, for example, a portion of nationally collected revenue is designated for all infrastructure grants to municipalities then policy-makers are expected to equitably share (according to Section 214 (1) of the Constitution) these grants amongst municipalities taking into account the criteria above based on considerations listed in Section 214(2) of the Constitution.

Assuming that the grant pool available for municipal infrastructure is designated by (CP_t) the infrastructure grant-pool in period t, then the policy-maker has to make a decision as to how the grant pool can be shared between the two competing demands implied in the criteria presented above. That is how much goes to reducing backlogs and disparities and how much will go towards the regular per capita grant to ensure that municipalities are adequately funded to meet the economic efficiency demands. To do this the policy-maker can choose another policy parameter that can be used in the formula to apportion the grant pool equitably among municipalities to reduce backlogs and disparities. Call this policy parameter *delta* (δ) with a value between 0 and 1. Therefore to determine this portion in a given period the model requires $CP_t \cdot \delta_t$ where $0 \leq \delta_t \leq 1 =$ proportion of the capital grant pool allocated for reducing historical backlogs and disparities.

To ensure that municipalities are adequately funded to meet the economic efficiency demand, the remaining portion of the pool, ($1 - \delta$), is allocated to all municipalities to help them overcome their overall shortage of capital relative to a generally accepted standard (see Figure 4.2) to achieve per capita economic efficiency. To attribute values to *delta* (δ) policy-makers will have to consider:

- The rate at which historical backlogs and disparities have to be reduced to move disadvantaged municipalities to a desired standard of capital stock and,
- The rate at which to fund all municipalities to overcome their overall shortage of capital relative to a generally accepted standard and, to achieve per capita economic efficiency.

The greater is the value of *delta (δ)* the greater is the allocation to reduce the historical domestic backlogs[26] of a municipality. Conversely, the lower is the value of *delta* (δ), the smaller is the amount allocated for reducing the historical backlogs and the greater is the allocation of funds to addressing per capita economic efficiency. Policy makers therefore have the discretionary power to decide how quickly the historical backlog is eliminated. Once all historical backlogs are eliminated and there is more equality of access to services, the parameter *delta (δ)* can be set equal to zero, implying that all of the pool is allocated to the per capita economic efficiency-based grants to meet the requirement for municipal economic growth and development.

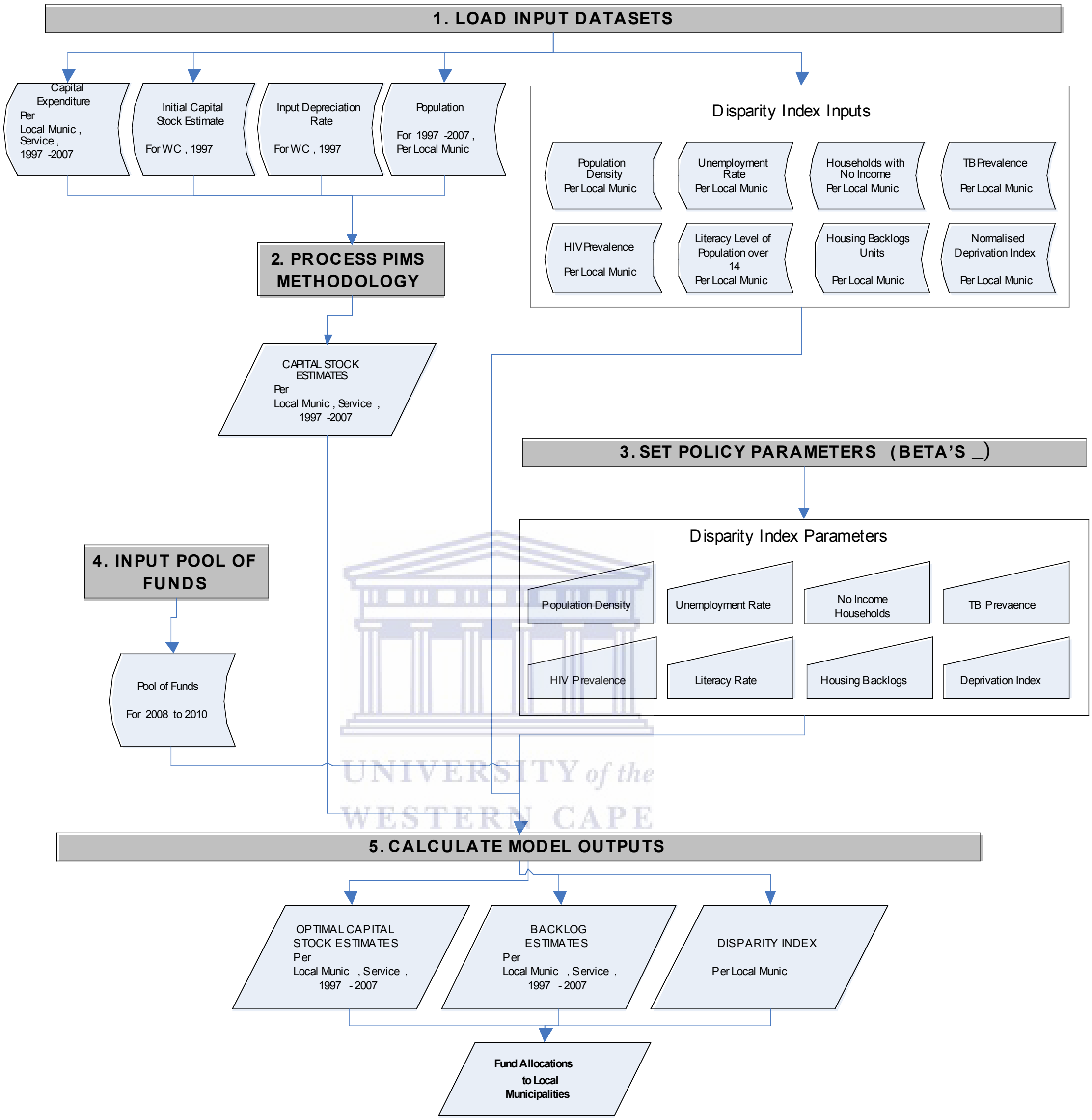
Based on the system of equations in the Petchey et al (2004) model and using the estimated capital stock data and the estimated infrastructure cost disparity weights a complete municipal infrastructure grants model can be constructed. The incorporation of the capital stock and infrastructure cost disparity indices into an infrastructure grant model is the subject of Chapter 6. Standard statistical techniques employing Microsoft Excel spreadsheets are used for estimating the capital stock and capital backlogs data and, for estimating the infrastructure cost disparity indices for the five Cape Winelands District municipalities.

The simulation model

To assess the consequences of taking account of disparities in equitably allocating municipal infrastructure grants I run two simulations of the adapted Petchey et al (2004) model presented in Chapter 6. The first simulation excludes disparities from the calculations and the second simulation includes disparities. The Microsoft Excel computer simulation model programme in the research design (see components E and D in Figure 1.1) is illustrated in the flowchart in Figure 4.3.

[26] *Historical domestic backlogs refer to the legacy of infrastructure backlogs inherited from the apartheid past and, backlogs resulting from the inadequate and inequitable financing of current basic municipal infrastructure needs.*

Figure 4.3: ***Flowchart representation of the simulation model with data inputs and outputs***



The method for developing the computer simulation programme requires converting the equations into a statistical computer spreadsheet format in Microsoft Excel (*Simon, 2005*). The Excel Simulation model runs simulations using data inputs for the model variables to generate output results that establish the operational ability of the model. The computer simulation programme of the model with its data inputs and outputs is schematically represented in Figure 4.3.

Each box in the flowchart represents an Excel worksheet Tab for the data input requirements or the data output results.

As mentioned above I compare the results of the simulations to evaluate the effects and impacts of excluding and including disparities attributing equal *beta* values to the set of disparity measures. To further compare the effects and impacts of excluding and including disparities when the beta values are varied I re-run the simulations to produce two alternative scenarios (see *Simulation Model with Scenarios Municipal Infrastructure Grants, MJJPhD 2010* in the attached compact disc).

To run simulations and generate results the programme requires five distinct processes. The first process is to load the data sets for estimating the capital stocks and the disparity indices. The second process is to apply the PIM methodology to calculate the capital stock. The third process is to set the policy parameters (*betas*) for each disparity index. The fourth process is to load the pool of funds available for municipal infrastructure grants. In the fifth process the programme calculates all the estimated outputs for capital stock, capital backlogs, municipal disparities and grant allocations. These processes are illustrated in the flowchart (Figure 4.3).

The Excel simulation exercise demonstrates how the estimated capital cost disparity indicator weights are calculated following the processes in the flowchart. The simulations use the example of infrastructure grants for financing infrastructure backlogs under two assumptions given a budgeted medium term expenditure framework (MTEF) pool of funds. The first assumption is that the available pool of funds consists solely of the Municipal Infrastructure Grant (MIG) allocations. The second assumption is that the available pool is a global pool of funds that includes the MIG and, all other infrastructure grants to municipalities. The results from both simulations are then compared in Chapter 7 to evaluate the impacts of disparities under the assumptions. The Excel Simulation Model also allows for the comparison and evaluation of results from scenarios with different values of *beta* (β) and *delta* (δ). This comparison and evaluation is presented in Chapter 7.

Reasons for choosing the five Cape Winelands Municipalities

Five Cape Winelands District local municipalities in the Western Cape Province were chosen for the empirical study. A map locating the municipalities in the Western Cape Province is presented in Chapter 5 of the thesis. Although in aggregate terms these municipalities are not the poorest in the Western Cape nevertheless, the Cape Winelands District Municipality was chosen because it includes a set of homogenous local municipalities typical of the Western Cape Province.

The District Municipality itself is administrative and is located in the Stellenbosch local municipality. It does not have any revenue raising powers. Thus, in the event of a restructuring of the intergovernmental transfer system it will be ideally placed to act as disbursement agency for infrastructure grants to local municipalities.

While population density is concentrated in the towns and urban centers there are other pockets of population sparsely dispersed across each municipality. The local municipalities are characterized by spatial disparities and socio-economic inequalities within themselves and between each other. The wine industry and its labour market institutions are common to all five local municipalities. These institutions have evolved over time from slave labour during colonialism; tenant labour, the "tot system" and job reservation during apartheid; to the current use of migrant and casual labour (see Chapters 2 and 3). However, the wine industry processing, marketing, business and administrative hub is mostly located in the Stellenbosch local municipality in close proximity to the offices of the District Municipality and the Stellenbosch University. All these institutions, in one location, are important repositories for data and information about the local municipalities within the District.

Data and Information

In this section I discuss the specific data requirements, sources and databases and methods used in the estimation of the model variables. The section also explains assumptions made when using the data and provides a brief explanation of the interview process used in gathering qualitative information from government officials and non-government sources. The section concludes with a discussion on the shortcomings and sources of error in the data.

Databases and estimation methods

It is obvious from the equations presented above that the proposed infrastructure grant model is data intensive. To run simulations the basic infrastructure grant model requires South African data on several economic and demographic indicators. The following data sets are used in the simulation model to estimate the basic per capita equitable grant shares to municipalities with and without infrastructure backlogs.

- Capital stock data aggregated at the level of the national economy and disaggregated to the provincial and local government levels.
- The estimated value of the actual capital stock for the particular service for all municipalities in South Africa for a specified period in time. As this is not readily available it is derived from provincial capital stock data using the *perpetual inventory method (PIM).*
- The estimated value of the actual capital stock for the particular service for an identified municipality in the specified period of time.
- Population data for South Africa and disaggregated to the provincial and local level.
- The macro-economically determined pool of budget funds available for infrastructure grants.

However, to estimate the impact of the disparity indicator (γ) on the allocations as shown in equations 4.6 and 4.7 two further sets of information are needed to construct the mean deviation[27] as specified by $(\phi_{i,t})$ in equation 4.7. The first requirement is a set of politically determined beta (β) policy weights. Secondly, the actual disparity data values ($X_{i,t,j}$) for each of the three disparity categories for each of the local municipalities are required to calculate the percentage deviation ($D_{i,t,j}$).

Following equations 4.6 and 4.7 the capital cost disparity index ($\gamma_{i,t}$) is calculated based on an average of all the disparity sub-indicators weighted by the estimated *beta*s ($\beta_{i,t,j}$) for each index in the following manner:

- The difference of the disparity indicators over the average of the disparity indicators is calculated [i.e., $D_{i,t,j} = \left(X_{i,t,j} - \overline{X}_{t,j}\right) / \overline{X}_{t,j}$].
- The average $(\overline{X}_{t,j})$ of the difference for each disparity indicator is calculated.
- Apply the *betas* ($\beta_{i,t,j}$) to each disparity difference.
- Calculate *phi* $(\phi_{i,t})$ by raising ***e*** in equation 4.6 above to the value calculated in point 3 above.

These disparities are calculated for each local municipality. (See equations 4.6 and 4.7 above).

To estimate the categories of capital cost disparity indicators the following data sets (as represented in the boxes in the flowchart) were required:

[27] *The Oxford Dictionary of Statistics, (2006) defines mean deviation as the difference between a value of a variable and the mean or average of its distribution and for a set of data*

$x_1, x_2, ..., x_n$, with frequencies $f_1, f_2, ..., f_n$, and with mean $\overline{x}$, the mean deviation is $\dfrac{\sum_{j=1}^{n} f_j |x_j - \overline{x}|}{\sum_{j=1}^{n} f_j}$

- Population Count of each local municipality in 1996, 2001 and 2007 as per Census 1996 and 2001 and the Community Survey of 2007.
- Mid Year Population Estimates for the Western Cape for 1997 to 2006 as per Statistics South Africa records.
- Chosen static Population Density Indicator for each Local Municipality.
- Unemployment Percentage Rate Indicator for each Local Municipality.
- Indicator of the Percentage of Households with no Income for each Local Municipality.
- Indicator for TB Prevalence per 100000 people for each Local Municipality.
- Indicator for HIV Prevalence for each Local Municipality.
- Indicator of percentage of illiterate people over 14 years for each Local Municipality.
- Housing backlogs indicator for each Local Municipality.
- Normalized Deprivation index for each Local Municipality.

The data listed above are presented and discussed in Chapter 5 of the thesis.

Notes on data sources

Much of the secondary quantitative and qualitative data for the empirical study was drawn from official statutory institutions such as Statistics South Africa (StatsSA), the Financial and Fiscal Commission (FFC); the Medical Research Council (MRC); National Government departments (National Treasury, Provincial and Local Government, now called Cooperative Governance and Traditional Affairs, Housing, Water Affairs and Forestry, Police Services); the equivalent departments of the Western Cape Provincial Government; the Cape Winelands District Municipality and, the published reports of the five local municipalities.

At this point a qualifying note about the data sources is in order. The value of the actual capital stock for all municipalities in the Western Cape Province is estimated using the perpetual inventory method (PIM) and is based on actual Municipal Infrastructure Grant and other infrastructure expenditure data for the specified period. The data was sourced from the Western Cape Province Department of Local Government and Housing. However, because the municipal boundaries were demarcated in 2002 the expenditure data series is limited to the period after this date. The weights for the capital stock were drawn from the FFC provincial capital-grant model average weights for the each of the nine provinces. The FFC weights are an average of National Treasury and South African Reserve Bank weights supplied to the FFC.

Disparity and socio-economic inequality data was sourced from StatsSA 2001 and StatsSA 2007 Community Household Surveys. Provincial and municipal revenue, expenditure and financial data were sourced from the National and Western Cape Provincial Treasuries and, from National and the Western Cape Provincial Department of Local Government and Housing. The disparity index input data sets and flows are summarized below.

Summary of data requirements for estimating capital cost disparity indices

The following datasets (as represented in the boxes in the flowchart) are required to estimate capital cost disparity indices for the model:

- Population Count of each local municipality in 1996, 2001 and 2007 as per Census 1996 and 2001 and the Community Survey of 2007.
- Mid Year Population Estimates for the Western Cape for 1997 to 2006 as per StatsSA.
- Population density indicator for each Local Municipality.
- Unemployment percentage rate for each Local Municipality.
- Percentage of Households with no income for each Local Municipality.
- TB Prevalence per 100000 people for each Local Municipality.
- HIV prevalence for each local municipality.
- Percentage of illiterate people over 14 years for each local municipality.
- Housing backlogs indicator for each local municipality.
- Normalized Deprivation index for each local municipality.

In addition questionnaire based interviews were conducted with infrastructure grant specialists and finance officers. The interviewees included senior officials from National Treasury; one Deputy Director General from the Western Cape Province Department of Provincial and Local Government; two senior officials from the Cape Winelands District Municipality and, three senior officials from two of the five local municipalities. The names, positions and location of the officials interviewed are presented in the table below. In addition officials from two private consulting firms operating in the Western Cape Province were interviewed.

Table 4.4: List of Officials Interviewed

Interview Date	Names of Officials	Position in Organization	Organization & Contact
10 March 2009	Mr. M. C. Hoffman	Chief Financial Officer	Breede River Municipality, Ashton. Telephone: 023 615 8000
16 March 2009	Mr. Hennie le Roux	Manager Financial Administration	Witzenberg Local Municipality, Ceres. Telephone: 023 3161854
20 March 2009	Mr. Jaco Jooste	Municipal Infrastructure Director	Breede River/Valley Municipality, Main Rd. Bonnivale. Telephone: 023 615 8000
28 April 2009	Mr. Stoffel Arrangie	Deputy Director Finance	Cape Winelands District Municipality, 46 Alexander St., Stellenbosch. Telephone: Tel: 021 888 5154
4 October 2009	Dr. Hildegarde Fast	Deputy Director General, Local Government & Disaster Management	Provincial and Local Government, Western Cape Province
9 November 2009	Mr. Feizal Toffey	Director for Performance Management	Cape Winelands District Municipality, 46 Alexander St., Stellenbosch. Telephone: Tel: 021 888 5154
18 October 2009	Ms. Malijeng Ngqualeni	Chief Director, Provincial & Local Government Infrastructure Development Improvement Programme	National Treasury, 40 Church Sq., Pretoria, 0002. Telephone: 012 315 5111
18 October 2009	Mr. Jonathan Patrick	Director, Provincial & Local Government Intergovernmental Policy & Planning	National Treasury, 40 Church Sq., Pretoria, 0002. Telephone: 012 315 5111
18 October 2009	Mr. Sello Mashaba	Director, Provincial & Local Government Intergovernmental	National Treasury, 40 Church Sq., Pretoria, 0002. Telephone: 012 315 5111

		Policy & Planning	
18 October 2009	Mr. Mbali Mthuli	Intern, Provincial & Local Government Intergovernmental Policy & Planning	National Treasury, 40 Church Sq., Pretoria, 0002. Telephone: 012 315 5111
18 October 2009	Ms. Zanele Mncwango	Director, Provincial & Local Government Intergovernmental Policy & Planning	National Treasury, 40 Church Sq., Pretoria, 0002. Telephone: 012 315 5111

Data shortcomings, general assumptions, sources of error and missing data

The model simulations in this thesis are for illustrative purposes and to demonstrate how the model can be used for allocating infrastructure grants. The reason for this qualification is that while the socio-economic disparity data for municipal regions are officially collected and published, capital stock data, unfortunately, are not collected at the municipal level. This is a significant shortcoming. The lack of municipal level capital stock data also means that there are no aggregated initial capital stock values that can be used to apply the perpetual inventory method (PIM) for municipal districts. To resolve this difficulty and to illustrate the workings of the model using the perpetual inventory method, I use the FFC provincial capital grant model capital stock estimates for the Western Cape Province as the initial capital stock value for estimating illustrative capital stock values for the five local municipalities in the Cape Winelands District.

The key assumption for using public capital stock data estimates in the infrastructure grant model is that the successful elimination of disparities and inequality is a function of funding for the progressive eradication of infrastructure backlogs and on-going infrastructure needs. The study assumes that in the public sector infrastructure backlogs tend to grow at a faster rate because of inadequate funding for maintaining and recapitalizing public capital stock (see literature review for discussion of this assumption). For determining the pool of funds available for municipal infrastructure for a specified period I use data from the National Treasury macroeconomic projections and assume that all constitutional requirements have been taken into account.

The required population data for the five municipalities was sourced from Statistics South Africa (StatsSA), the statutory agency responsible for collecting and publishing statistics. However, a second data shortcoming is that a consistent set of population data per local municipality for the given period was not available. Local municipality data was missing for several years. Data for the missing years are required to make the data set consistent. Therefore assumptions were made and applied to produce a consistent dataset.

To produce a consistent population data set I assumed[28] that Statistics South Africa population forecasts include estimates for migration, and mortality due to pandemics such as HIV-AIDS and related diseases. Using the Western Cape Province midyear estimates for 1996 – 2007 and, local municipality population data for 1996, 2001 and 2007 a consistent set of population data was estimated as follows:

- I calculated the share of Cape Winelands population from Western Cape Province population for 2001.
- I used the calculated share for the Cape Winelands to produce a time series for 1996 to 2001 for the Cape Winelands by dividing the new provincial total by the calculated share.
- I used the Cape Winelands Population figures for 1996 to 2001, calculate values for each local municipality by dividing the Cape Winelands Population by the 2001 share of population for each local municipality.
- The period of 2002 to 2007 is calculated in a similar fashion using the 2007 figures.
- Projected figures for the future period of 2008 – 2015 are based on the average growth rate (from Statistics South Africa) experienced from 1996 to 2007.
- Using the average growth rate, the local municipality population estimate for 2008 is the local municipality estimate for 2007 multiplied by the average growth rate.

[28] *The assumptions on data are based on explanations given by Statistics South Africa with respect to the demographic calculations and models used. Intergovernmental allocations made by National Treasury use the same population data.*

A final shortcoming is that out of a possible five municipalities I was only able to interview officials from two. For the purposes of the study I assume that views expressed by the three senior officials from two of the five local municipalities are representative of the position of all five municipalities for the following reasons. It was only possible to interview three of the officials from two municipalities because senior officials from the other three municipalities were not available despite formal written requests to municipal managers (see copy of the letter and list of municipal managers in the Appendix) from the University of the Western Cape and persistent telephone calls to the offices of the municipal managers. Furthermore, from the interviews with the two officials from the Cape Winelands District Municipality and the officials from the two local municipalities it emerged that the scarcity of financial management and civil engineering skills in local municipalities meant that all five local municipalities shared personnel and coordinated infrastructure spatial and integrated development planning (IDP) at the level of the District. Lastly, as mentioned earlier, interviews with the District Municipality officials resulted in obtaining consolidated information and data reports for each of the municipalities.

Data Limitations

Several difficulties are associated with the weighting scheme used in the FFC-type *Capital Expenditure Grant Scheme* model. A great degree of circumspection is required given the paucity of data and information in transitional economies like South Africa.

As can be seen from the capital cost disparity weights generated in the model simulations the weighting scheme does not offer the possibility of reasonable bounds within which the weights may be specified. Nevertheless, the usefulness of the model is that it can serve as an indicative tool in decentralized economic systems. This is preferable to arbitrary decisions based on prevailing political interests as the model provides a more objective mechanism for equitably allocating a limited pool of available funds. Given these shortcomings it may be prudent to explore other weighting schemes that go towards resolving these difficulties. Some of these procedures were discussed in the literature review.

Summary

In this chapter I restated the fundamental question and hypotheses and explained the methodologies for adapting the Petchey et al (2004) model for equitably allocating municipal infrastructure grants. Through explaining the methodologies, I discussed the approaches and definitions and, the variables to be used in constructing a municipal infrastructure grant model. I explained the eclectic set of methods for estimating the variables and policy parameters of the model. I also discuss the data sources and explain how the information and data were collected. Finally, I briefly discuss the data limitations and possible sources of error.

Chapter 5

Disparity[29] Data Profile Of The Cape Winelands District Municipality (CWDM)

To understand the role of public infrastructure provision in the context of inequality and poverty in the Cape Winelands District (sometimes referred to as the District or abbreviated as CWDM in this Chapter) I use published data and information that profiles the disparity in access to services and the inadequate provision of public infrastructure. The lack of access to services contributes significantly to increasing inequality, deprivation and poverty. The use of poverty and inequality indictors to profile countries, regions and sub-regions is well established in the literature and discussed in Chapter 2 of this thesis. A typical indicator used in many country profiles is the level of poverty (Boateng et al, 1992).

The use of poverty as an indicator poses many difficulties because it is a normative concept and dependent on the subjective value judgments of those using it. The standard measure for poverty is a line below which a human being cannot afford to provide for the requirements to meet minimal human physical needs. This can be an absolute standard around the costs of goods and services or, a relative standard based on one individual's resources in relation to others. A poverty line is normally established through income and expenditure household surveys. However, as noted by Boateng et al (Ibid: 34), poverty lines are invariably arbitrary. Given these conceptual difficulties attempting to establish a relationship of causality between poverty and infrastructure provision and access to services may prove to be a difficult task. Sen's (1999) "capabilities approach" is an attempt to go beyond the banal measurements and causal relationships between poverty and development. For Sen, individual freedom is inextricably

[29] *Please note that when used alone in this thesis the term "disparity" or "disparities" refers to the general notion of economic disparity meaning "a great difference" (Oxford English Dictionary, 2006) and assumes that this is the meaning used in* ***Section 214 (2) g*** *of the Constitution. Any other usage will be qualified with the appropriate adjective.*

linked to the endowment of abilities and capabilities necessary for every human being in the quest for true humanity. The capability approach as developed by Dubois and Rousseau (2008) (in Comim, Qizilbash and Alkire: 2008) is reviewed in Chapter 2 of this thesis. The authors demonstrate that a person's vulnerability is determined by a set of capabilities. Vulnerability increases in the face of higher risk and decreases with enhanced capability. The authors imply that by combining assets and access to services individuals and households can protect themselves from a pattern of various social risks and associated shocks. This conclusion is germane to my premise that public investment in municipal public infrastructure services provides accessibility to socio-economic opportunities enhancing an individual's capability and reducing vulnerability to risk.

Following Dubois and Rousseau (2008), my assumption in selecting the disparity indicators discussed in this chapter is that increasing socio-economic disparity within and among local municipalities increases the risk of vulnerability for individuals living in these areas. The inverse argument is that increased municipal infrastructure grants will constitute an additional injection of investment for municipal services thus increasing the level of capability and access socio-economic opportunities. However, to measure the risk of vulnerability one needs an appropriate set of socio-economic indicators that capture the level of vulnerability in communities. In this chapter I present a wide range of such indicators from which I will select a few to construct composite disparity indicators that can be used as weights in a municipal infrastructure grant scheme. My aim is not to apply the capability approach it is merely to show, by way of arguments in the literature, that public capital investment in infrastructure services can be a key variable in reducing the risk of vulnerability and enhancing the individual's capability.

For the Cape Winelands District municipalities the capability approach presents the possibility of using capital stock variables with measurable indicator weights that may capture the relative impact of infrastructure provision on inter and intra-regional disparity more comprehensively. These indicators are discussed below as a way of constructing a disparity profile for each of the five local municipalities.

The disparity indicators are aggregated into composite disparity indices in the municipal infrastructure grant model. The use of the disparity index weights in the model demonstrates how disparities and developmental considerations may, as required by the Constitution [Constitution, Section 214 (2), 1996], be taken into account for equitably allocating municipal infrastructure grants.

For a comprehensive disparity profile of the Cape Winelands District I present and discuss the main socio-economic inequalities, spatial disparities and infrastructure backlogs that differentiate the five Cape Winelands District local municipalities from each other. The chapter proceeds by first summarizing from the literature review (Chapter 2) the place of key concepts of socio-economic inequality, spatial disparity and infrastructure and capital backlogs in profiling the overall disparities that have to be taken into account when allocating infrastructure grants to municipalities. Thereafter the chapter draws on data and information from secondary sources and, from findings from interviews with government officials to present and discuss overall disparity profiles of the five local municipalities. The quantitative data presented in this chapter serve as inputs in illustrative model simulations discussed in Chapter 7. The qualitative information and findings garnered from the various interviews and secondary sources serve as inputs in formulating the assumptions on which the model is constructed in Chapter 6. The aim of this chapter is to present the data inputs and information context for understanding the output results of the simulation exercise and, the overall conclusions and recommendations of the thesis.

The Conceptual Foundations Of Disparity And Socio-Economic Inequality In The Cape Winelands District

In the introduction to this thesis I argued that the municipal service delivery protests that spread across South Africa over the past four to five years were symptomatic of the disparities and socio-economic inequalities that characterize poor and disadvantaged communities in local municipalities. In this section I discuss the conceptual foundations for constructing a set of disparity indicators for a comprehensive disparity profile of the District. Following the literature I argued, in the introduction, that inadequate and inappropriate publicly financed municipal infrastructure investment would impact negatively on the a capabilities and functionings[30] of individuals trapped within communities characterized by a long history of inequalities and spatial disparities. Inevitably, inadequate and poorly maintained service delivery infrastructure would exacerbate historical disparities and lead to community dissatisfaction and protests. I also pointed out that the local municipalities in the Cape Winelands District were not immune from the service delivery protests in which people claim their entitlement to municipal services under the Bill of Rights of the Constitution (1996).

To avoid making themselves vulnerable, the poor, according to Yaquib (in Comim et al, 2008) will only invest in activities with low risk thus perpetuating the cycle of poverty and low levels of capabilities and functionings. Yaquib's arguments are supported by the study carried out by Cunha and Heckman (2009) and other authors discussed in Chapter 2. Extrapolating from Yaquib's notion of capabilities evolving from the effects of the lifecourse of individuals and, aggregating these effects for generations of victims of colonialism and apartheid over centuries, I suggest that diminished capabilities and functionings of the people and households in the Cape Winelands District can also be viewed as the effect of several lifecycles under institutionalized oppression such as expressed in the policies of colonialism and apartheid. In the following section of this chapter I support this contention with a discussion on the historical context and disparity indicators that characterize the local municipalities in the District.

An historical perspective of disparity in the Cape Winelands District

The first wine and fruit farms of the Cape Colony (located in what is now called the Cape Winelands District Municipality and formerly called the Boland District) depended on slave and indentured labour for their growth and sustainability. Following the colonial subjugation and settlement of the Cape in the seventeenth century slavery and forced indenture labour was introduced and became the basis for labour, property, economic and social relations between European settlers, the

[30] Following Sen (1999), capabilities and functionings refers to the possible range of alternative things that human beings can do or be in their quest for true humanity and freedom.

slaves and the indigenous population in the Western Cape in general. Historically, the agricultural economy of the Western Cape depended on slave labour for its growth and development. Terreblanche, (2002), provides an in-depth analysis of the transition from slavery and indentured labour to legal and institutional inequality in South Africa under apartheid. The analysis argues that because of the history of slavery and apartheid the different forms of inequality have become systemically entrenched and will not be eradicated in the short-term. This analysis by Terreblanche echoes the arguments advanced by Yaquib (2008) and Cunha and Heckman (2009). The analysis by Terreblanche is discussed in Chapter 2 of the thesis. The legacy of some of these institutional patterns suggested by Terreblanche (2002) persist to this day in the economic, labour, property and social relations of the political economy of the Cape Winelands District.

One of the most enduring legacies of apartheid history in the Cape Winelands was the payment of slaves and indentured labourers with tots of wine during the course of the day. This form of payment became known as the so-called "tot or Dop system". Many studies on the devastating long-term effects of this system have been done in the Western Cape. The *Dop System in South Africa 1793-2008 - A Bibliography* compiled for the University of Cape Town by Allegra Louw (http://www.lib.uct.ac.za/asl/info/Dop_System.pdf) provides a comprehensive list of articles, monographs and theses undertaken on the Dop system. The University of Stellenbosch in the Cape Winelands District has also sponsored and promoted research on the impact of the Dop system on the incidence and prevalence of feotal alcohol syndrome (FAS) in the Cape Winelands District (See Nutrition Information Center - NICUS, University of Stellenbosch, Fetal Alcohol Syndrome Fact Sheet; http://www.sun.ac.za/nicus; and London, L. (1999) http://www.sahealthinfo.org/admodule/dopsystem.htm). To summarize the NICUS fact sheet and London, L (1999), the foetal alcohol syndrome can be described as the total long-term damage done to children before birth as a result of the mother drinking alcohol during pregnancy. This usually leads to brain damage, impaired growth and head and face deformities. It is one of the leading causes of mental retardation and is reported to be an irreversible lifelong condition affecting the life of affected children and the lives of their families.

At least one academic sociological study (Falletisch, 2008) concluded that former slaves, although free, continue working as labourers on wine estates and remain in a powerless and dependent paternalistic relationship with farm owners. The dependency is driven by a debt burden towards the farmer; economic deprivation; social and political marginalization and, the need for shelter. Furthermore, despite the new post-apartheid dispensation the former slaves are unable to break free of the legacy of slavery. The study also found that the tot system continued well into the twentieth century perpetuating a cycle of habitual drinking, domestic violence, foetal alcohol syndrome and poverty in communities in the Winelands District. Many of the former slaves constitute the majority of the so-called coloured population in the District – the largest population group in all five local municipalities.

In a study on chronic poverty in the Ceres region of the Witzenberg Municipality in the Cape Winelands District, du Toit (2004) examines how the historical patterns of institutional and structural inequality may have contributed to the vicious cycle of chronic poverty in this area. Following interviews and a household survey of four areas around Ceres du Toit (2004: 14) concludes:

> *… a look at the profile of Ceres at the beginning of the 21st century seems to indicate that the coming to power of a black majority government in South Africa has not signaled the end of white hegemony in the Ceres district or elsewhere in the rural Western Cape… the machinery of local government has not fundamentally changed. The white elite that has run the valleys of the Witzenberg since the 18th century has not been displaced…Paternalism and networks of patronage continue to shape the life chances and livelihood options of the poor.*

For du Toit the current levels of chronic poverty in the rural areas of the Western Cape may be associated with the continuities of the legacy *'of spatial apartheid, including the highly radicalized land tenure patterns on the farms and the* *persistent radicalization of public space, which lives on in the segmentation of Ceres into 'white', 'coloured' and 'black' (African) areas.'* (du Toit, 2004: 25). The only difference with the paternalistic patterns of past slavery and systems of indenture is that today the victims of structural inequality have been marginalized through a process of casualization[31] of their labour in the District as a whole. The existence of this new pattern of labour relations was confirmed through interviews with officials from the District municipality.

Disparities and Factors that Differentiate Local Municipalities in the Cape Winelands District

This section discusses a selection of disparity and that differentiate local municipalities in the Cape Winlands District (formerly known as the Boland District). The section also provides an estimate of the level of capital stock in the District calculated using the perpetual inventory method discussed in Chapter 4. The main sources of qualitative information for this Chapter were from the semi-structured interviews with the senior officials from the District and local municipalities. This information was supplemented by recent published data contained in the Cape Winelands District Municipality Annual Report for 2007/2008.

The Cape Winelands District is a category B municipality. It is made up of six local municipalities that include the Breede River, the Breede Valley, Drakenstein, Stellenbosch, Witzenberg and the Breede River District Management Administrative area. The latter area is a national park and administered by the District Council and not by a local administration. For the purposes of this paper this area will be ignored. Maps 1 and 2 respectively give the location of the Winelands District in the Western Cape Province and the boundaries of each local municipality within the District. Map 2 refers to the Boland District, as this was the old name for the Cape Winelands District.

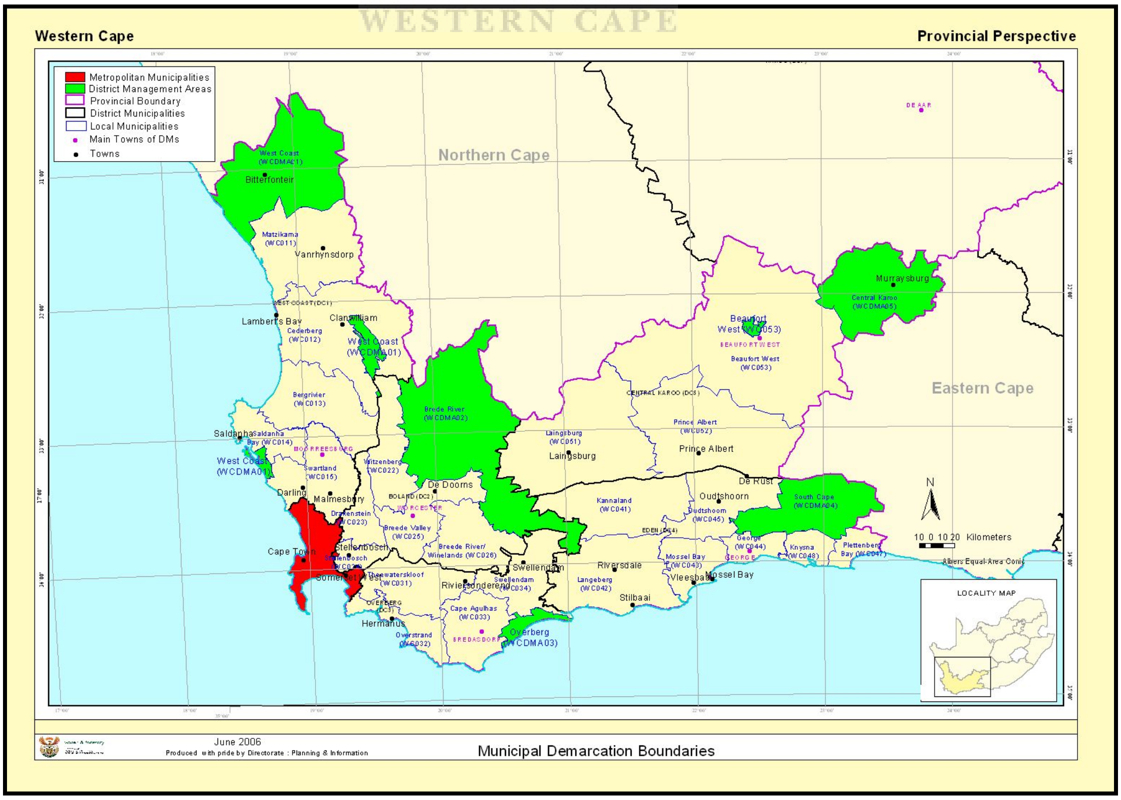
[31] *This is a process whereby former farm workers and labour tenants, after having been evicted, are re-employed as casual and seasonal labourers thus losing security of tenure and, whatever other benefits (such as housing and shelter) they may have enjoyed as formal workers on the farm or estate.*

As a category B municipality the Cape Winelands District Municipality powers, functions and legal obligations are extensive and include the following:

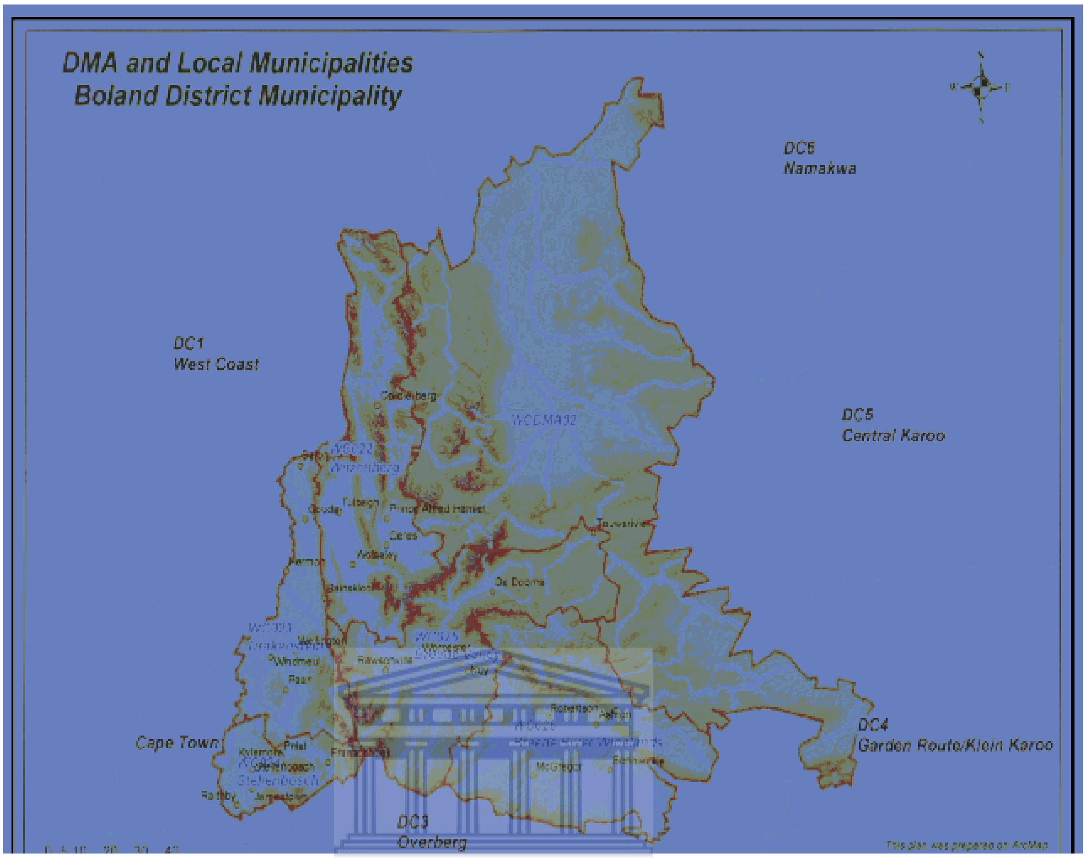
- Integrated development planning for the District as a whole and planning frameworks all local municipalities within the district;
- Municipal roads, road transport systems and municipal airports;
- Firefighting for the district;
- Monitoring solid waste sites;
- Health care services for the district;
- Promotion of local tourism;
- Municipal public works for the district and,
- Imposition and collection of taxes, levies and duties for above listed functions or as assigned by national legislation.

The District also performs an agency role, on behalf of the Western Cape Province, for the construction, repair and maintenance of roads in the district. This role is governed by a service level agreement.

Map 1: Western Cape Province



Map 2: Local Municipality Boundaries in the Cape Winelands District



(*Source: Boland District Municipality, Western Cape Province Government, 2006*)

As a precursor to discussing the disparity indicators for the Cape Winelands local municipalities, some general comments about the socio-economic disparity indicators are necessary. The analyses by Glyn and Miliband (1994), drawn from several countries and reviewed in Chapter 2, discuss indicators that do not fall obviously within the conventional set of indicators for welfare and absolute levels of consumption. The authors also show how welfare and levels of consumption can be dependent on psychosocial and relative material circumstances. Using evidence from different countries the authors point to cases where relative material deprivation can engender a sense of inferiority and social exclusion that results in mental and physical illness and anti-social behaviour. These indicators have to be taken into account in allocating grants as they reflect disparities that impose higher costs for health care, crime prevention and related infrastructure programmes in local municipal budgets. For example the crime statistics for the District presented in Table 5.18 on the next page provides an indication of the extent of anti-social behaviour in each of the local municipalities.

Following the arguments presented by Yaquib (2008) and Glyn and Milliband (1994) such disparity indicators have significant outcomes for the equality of capabilities. Hereafter, I discuss the extent to which a set of indicators may help us understand the economic profiles, spatial inequalities and disparities that differentiate the local municipalities from each other. A selection of eight of these indicators were selected and turned into composite indices for taking account of disparities in the municipal infrastructure grant allocation. The data selected are drawn from secondary sources produced by the Western Cape Provincial Treasury, Statistics South Africa and studies carried out by the Medical Research Council, The Health Economics Unit of the University of Cape Town and the Financial and Fiscal Commission (FFC).

The Disparity indicators for the local municipalities in the District

Firstly, consider the general economic situation of the District. The Cape Winelands District Municipal (CWDM) annual report for 2007/2008 indicated that on average economic growth for the district as a whole measured as the gross geographic product (GGP) was 3.4%. The GGP for each of the local municipalities and District Management Area (DMA) are presented in the table 5.1 below. Gross geographic product is the total value of the final goods and services produced in a specific geographic region.

Table 5.1: CWDM Local Municipalities Average (%) Economic Growth by GGP 2002/03 to 2006/07

Period	Breede River	Breede Valley	Drakenstein	Stellenbosch	Witzenburg	District Management Area
2002/03	1.7	1.8	1.7	2.5	-1.0	-1.4
2003/04	5.4	5.0	5.7	5.6	3.3	3.6
2004/05	6.4	5.8	5.6	5.4	5.3	6.1
2005/06	3.7	3.7	4.7	6.4	3.1	-1.5
2006/07	5.0	4.8	4.8	7.5	3.3	1.7

(Source: CWDM Annual Report 2007/2008)

The Annual Report notes that over the period, the financial and business sector produced the largest growth at 23.9% of GGP; manufacturing at 19.6% and, retail and wholesale trade at 15.2%. The financial and business sector grew by 7%; transport and communication by 6% and, retail and wholesale trade by 6%. The Stellenbosch local municipality made the biggest contribution to the financial and business sector while the Breede River and Breede Valley municipalities made significant contributions to the retail trade and wholesale sector. All the municipalities noted an increase in the construction sector. Although the District is known for its viticulture and wine production, in 2007 the agricultural sector fared badly when compared to the financial and business; manufacturing and retail, and the wholesale trade sectors. For the period Breede River registered about a 17% level of agricultural sector growth; Breede Valley, 16% and Stellenbosch about 5%. From the Report and interviews with municipal officials it is apparent that viticulture and the wine industry is losing its importance to other sectors. This is a significant development because agriculture and viticulture and, the wine industry in particular were traditionally the biggest employers in the District. As a counterpoint to this decline the municipal officials indicate that the community services sector contribution to GGP has seen a steady increase across all municipalities. This sector includes the provision of municipal services, welfare services and capital and current income and expenditures for community services generated in the municipality. The District Annual Report notes the community services sector contribution to GGP in 2007 was about 10% for Breede River; 19% for Breede Valley; 14% for Drakenstein; 11% for Stellenbosch and, about 12% for Witzenberg. These estimates suggest that the community services sector is playing a significant role in generating economic growth in the District. In this context targeted public sector investment in municipal infrastructure will contribute to increased capital stock formation and will play an important role in economic growth in the District. Also important is that government investment in municipal infrastructure projects is likely to generate direct employment creation opportunities. Such multiplier effects of public investment are not the objective of my thesis. Nevertheless this is an important economic objective that government needs to consider when allocating infrastructure grants to municipalities. In the following sections of this chapter I will present and discuss the various data requirements for developing and illustrating an infrastructure grant model that specifically targets infrastructure grants for municipal services.

Data Requirements For Financing Municipal Services Using An Infrastructure Grant Model

To run illustrative simulations for services using the adapted municipal infrastructure grant model I require two specific types of data that characterize disparity among the municipalities of the Cape Winelands District. The first type is the existing level of public capital stock and infrastructure backlogs for services for each local municipality. These data are presented and discussed under the sub-heading *The Capital Stock and Infrastructure Backlog data*. The second type of data is a selection of economic disparity indicators that differentiate municipalities from each other. A key variable requirement for using the model is the population trends in the Cape Winelands District. As I explained in the methodology chapter population trends are used in estimating capital stock and for calculating the per capita allocations for each local municipality. The economic disparity indicators are presented and discussed under the sub-heading *Socio-economic disparity indicators*.

Population Trends in the Cape Winelands District

The 2007 Winelands Municipal District Annual Report (2007/2008) noted that the District makes up 14% of the population in the Western Cape Province as a whole. This is second only to the Cape Town Metropolitan Municipality. Between 2001 and 2005 the population in the District grew rapidly by 0.6% per annum and, slowed to 0.37% from 2006 to 2007. The Report predicted, according to the South African Acturial Society, a slower growth of 0.2% between 2007 and 2012. In 2007 the population in the District was 652,154 and is expected to grow to 658,000 by 2012. The Annual Report and interviews with municipal officials suggest that the slower growth rate may be due to the exodus of seasonal, low-waged and low skilled farm workers to urban locations and, that this movement may be compounded by the casualization and seasonality of job opportunities especially in the agricultural and viticulture sectors of the District. These population trends were used as the basis for projecting local municipal population growth estimates required for demonstrating how the model may be used for calculating sanitation grant allocations over the medium term. In the methodology chapter I presented the procedure for making such projections. The table below presents the population for the Western Cape and the five Cape Winelands municipalities from the 2001 census. This was the last census undertaken in South Africa. This population data was used as the basis for estimating population density and future projections used in the model simulations for the thesis.

Table 5.2: Population: Western Cape Province and CWDM Local Municipalities from 1996 to 2007/08

	1996	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
Western Cape	3,956,875	4,011,000	4,086,900	4,149,242	4,223,920	4,299,962	4,736,400	4,645,600	4,530,916	4,639,221	4,744,494	4,839,766
CWDM												
Breede River	63,556	75,704	77,164	78,359	79,795	81,258	78,221	76,749	74,900	76,734	78,516	80,125
Breede Valley	128,820	135,995	138,618	140,765	143,345	145,973	131,076	128,610	125,512	128,585	131,571	134,267
Drakenstein	177,092	181,084	184,576	187,436	190,871	194,370	211,930	207,944	202,934	207,903	212,731	217,090
Stellenbosch	112,440	109,627	111,742	113,473	115,553	117,671	195,753	192,071	187,443	192,034	196,492	200,519
Witzenberg	73,077	77,825	79,326	80,555	82,031	83,535	73,360	71,980	70,246	71,966	73,637	75,146
Total	**554,985**	**580,234**	**591,426**	**600,587**	**611,595**	**622,807**	**690,339**	**677,353**	**661,035**	**677,223**	**692,947**	**707,147**

Source: *Statistics South Africa, 2001 Census.*

The Capital Stock and Backlog data

As I noted in Chapter 4 (Methodology), capital stock data is not currently collected at the municipal level in South Africa. To overcome this problem and, for the purpose of illustrating how the model works, I estimated a capital stock data series using the perpetual inventory method (PIM) based on municipal infrastructure grant expenditures in the municipalities from 1997 to 2006. This exercise was undertaken for illustrative purposes because, as explained in Chapter 4 (Methodology), the perpetual inventory method requires time series capital expenditure data over at least a twenty-five to thirty year period to produce reasonable robust estimates. This is not possible at present because the current municipal boundaries were demarcated in 2002 and, at this stage, consolidated data records from Government for municipal infrastructure grant expenditures are only available from 1997.

To illustrate the level of infrastructure backlogs I present the extent of sanitation backlogs for municipal services in the District using a 2008 profile of the sanitation situation of the municipalities in the District and a 2007 provincial government-calculated estimate of infrastructure backlogs. These data are presented in tables 5.3 to 5.7 below. The data for the sanitation profile of the Cape Winelands District was provided by the District Municipality and, the backlog estimates were extracted from a *Sanitation Backlog Study for the Western Cape Province (2007)* coordinated by the Department of Local Government and Housing of the Western Cape Province. The study was based on submissions from the chief-executive officer of each of the District municipalities in the Western Cape Province.

Table 5.3: CWDM 2008 Sanitation Profile by Number of Households and Toilet Type

Local Municipality	Flush Toilet	Ventilation Improved Pit (VIP) Toilet	Pit Toilet	Bucket System	No Toilet	Total
Breede River	24 224	184	658	66	1 061	26 194
Breede Valley	37 963	193	647	123	1 507	40 433
Drakenstein	48 134	174	367	405	1 711	50 790
Stellenbosch	35 341	162	433	285	1 164	37 385
Witzenberg	22 341	173	493	138	710	23 855

Source: *CWDM, 2008.*

Table 5.4: Sanitation backlog in the CWDM

Local Municipality	Number of Households					Growth as % of existing backlog
	Informal housing with no access to basic sanitation excluding back	Informal housing with access to shared service	Backyard dwellers (BD) with access to	Total existing backlog	Estimated future % backlog due to growth	
Breede River	0	628	4 635	5 263	4 510	3.1
Breede Valley	470	2 041	5 180	7 691	6 320	3.0
Drakenstein	1 189	2 112	10 200	13 501	7 845	2.3
Stellenbosch	10	300	7 560	7 870	7 718	3.5
Witzenberg	0	2 227	1 600	3 827	2 280	2.4
Farmland	370	0	0	370	0	0

Source: *Department of Local Government and Housing, Western Cape Province, (2007)*

Table 5.5: Summary of Present and Future Water Demand in the CWDM

Local Municipality	Annual Average Daily Demand (AADD) in kl/d			
	Actual Present	Future developments - other	Future developments - backlog	Total future
Breede River	17 158	6 976	5	29 997
Breede Valley	32 305	13 858	7	53 309
Drakenstein	42 607	40 604	9	92 491
Stellenbosch	28 952	14 776	9	53 081
Witzenberg	15 034	5 933	3	24 649
Farmland				
Total	136 056	82 147	35 323	253 527

Source: *Department of Local Government and Housing, Western Cape Province, (2007)*

Table 5.6: Summary of Present and future Sewer Flow in the CWDM

Local Municipality	Peak day Dry Weather Flows (PDDWF) in kl/d			
	Actual Present	Future developments - other	Future developments - backlog	Total future
Breede River	6 856	7 647	4 044	18 546
Breede Valley	22 794	8 840	6 002	37 636
Drakenstein	32 256	22 632	6 398	61 286
Stellenbosch	18 072	10 757	7 537	36 366
Witzenberg	8 598	4 919	3 093	16 610
Farmland				
Total	88 576	54 794	27 074	170 444

Source: *Department of Local Government and Housing, Western Cape Province, (2007)*

In making its submission to the overall provincial study the Cape Winelands District Municipality (CWDM) calculated backlogs for a total of 38 522 households assuming the standard provision of one full-waterborne sewerage connection per household in all urban areas and one ventilation improved pit (VIP) toilet per household in the rural areas. The submission assumed an installation cost of R29 000 per household for both urban and rural areas. The District submission also assumed that the rate of growth of the backlog would be influenced by the normal population growth rate and, the estimated population influx from the Eastern Cape Province.

Table 5.7: Summary of cost estimates to eradicate the Sanitation Infrastructure Backlog in the CWDM

Local Municipality	Total Costs (Rand) for			
	Bulk water	Bulk sewer	Internal water & sewer	Eradicating sanitation backlog
Breede River	76 195 000	94 301 000	36 864 000	207 360 000
Breede Valley	67 989 000	60 978 000	53 120 000	182 087 000
Drakenstein	135 372 000	125 995 250	108 008 000	369 375 250
Stellenbosch	65 678 000	106 040 000	62 960 000	234 678 000
Witzenberg	60 975 520	31 998 520	30 856 000	123 830 040
Farmland				1 480 000
Total	406 209 520	419 312 770	291 808 000	1 118 810 290

Source: *Department of Local Government and Housing, Western Cape Province, (2007)*

My estimation of capital stocks used the perpetual inventory method (PIM) as opposed to the engineering costs estimates of the District study. The complete PIM estimates calculated for capital stock and spending estimates for electricity, water, roads and transport and sanitation are presented in Chapter 6. For illustrating the level of capital stock and capital spending for sanitation alone in the five municipalities I present in Table 5.8 and Table 5.9 respectively the calculated capital stock and capital spending estimates. Water and sanitation expenditures make up the largest part of the municipal infrastructure grants from national government. These estimates give an indication of the level of public capital spending for sanitation provision in the local municipalities. The estimates demonstrate that the level of capital stock and capital spending for sanitation are very low and vary significantly across the local municipalities. The estimates present a rough indication of the level of sanitation capital stock.

Table 5.8: PIM Estimates for Sanitation Capital Stock based on MIG and CMIP Data: 1997-2006

Year	Breede River	Breede Valley	Drakenstein	Stellenbosch	Witzenberg
1997	R 39,296.12	R 57,976.94	R 148,854.74	R 22,566.66	R 21,890.39
1998	R 37,331.31	R 55,078.09	R 141,412.00	R 21,438.33	R 20,795.87
1999	R 33,691.51	R 414,265.98	R 591,709.33	R 1,341,311.09	R 899,768.27
2000	R 407,234.26	R 2,210,479.71	R 3,054,847.54	R 2,423,908.45	R 1,709,249.82
2001	R 1,531,125.45	R 4,071,182.04	R 6,272,242.63	R 3,596,495.34	R 3,170,253.11
2002	R 4,033,414.54	R 5,307,398.93	R 8,839,521.48	R 4,323,995.95	R 4,208,036.95
2003	R 6,658,602.24	R 6,979,630.99	R 10,550,592.27	R 4,892,575.96	R 5,148,501.59
2004	R 8,159,492.60	R 8,547,562.46	R 14,062,007.21	R 5,045,007.79	R 5,734,722.04
2005	R 10,212,817.20	R 11,575,864.27	R 19,160,128.95	R 4,893,883.78	R 7,425,708.49
2006	R 13,356,925.97	R 14,559,990.85	R 25,596,463.98	R 4,915,943.78	R 10,200,816.97

Source: Raw data from Western Cape Province: CMIP & MIG STATUS REPORT AS ON 27 OCTOBER 2006.

Table 5.9: Capital Spending Estimates for MIG and CMIP Sanitation Projects

Year	Breede River	Breede Valley	Drakenstein	Stellenbosch	Witzenberg
1997	R 0.00	R 0.00	R 0.00	R 22,566.66	R 0.00
1998	R 0.00	R 364,558.00	R 464,085.00	R 21,438.33	R 881,000.00
1999	R 378,348.00	R 1,508,968.32	R 2,106,650.00	R 1,341,311.09	R 100,861.00
2000	R 840,000.00	R 508,199.00	R 1,363,896.00	R 2,423,908.45	R 887,138.00
2001	R 1,709,199.79	R 0.00	R 391,332.00	R 3,596,495.34	R 65,800.00
2002	R 987,446.00	R 1,028,869.00	R 265,861.00	R 4,323,995.95	R 388,000.00
2003	R 554.00	R 749,131.00	R 2,844,040.00	R 4,892,575.96	R 186,884.00
2004	R 1,465,577.89	R 2,415,482.16	R 3,471,677.69	R 5,045,007.79	R 1,588,811.92
2005	R 2,360,643.02	R 1,654,334.37	R 4,181,253.26	R 4,893,883.78	R 2,080,650.70
2006	R 2,800,304.13	R 800,000.00	R 3,128,679.46	R 4,915,943.78	R 0.00

Source: Raw data from Western Cape Province: CMIP & MIG STATUS REPORT AS ON 27 OCTOBER 2006.

The capital stock value estimates are a key variable in the proposed infrastructure grant model. An appropriate benchmark for the desired level of capital stock required for the provision of services to all municipalities is established based on the most desired municipal standard within the District. Thereafter disparity indicators are used to weight the allocation esimates determined by population size so as to achieve a more equitable spread of public infrastructure investment taking into account municipal economic disparities.

The socio-economic disparity indicators in the CWDM local municipalities

The Western Cape Provincial Economic Review and Outlook (PERO), [Western Cape Provincial Treasury, March 2005], assess provincial inequality in terms of incomes, assets, opportunities and spatial factors. Income inequality is measured by the difference between highest income earning groups and lowest income earning groups. Asset inequality is defined as the difference in peoples' capabilities and opportunities for individual development through access to various assets, goods and services. Spatial inequality is presented as the manifestation of patterns of individual inequalities and disparities aggregated to a community level with special emphasis on their dislocation effects on living, working and recreational spaces of the most disadvantaged communities.

The Western Cape Provincial Treasury extends the methodology used at the provincial level to local municipalities in specialized profile reports for each district municipality. These reports were published as the "Socio-economic Profile of the Cape Winelands District - 2006" (SEP: CWD, 2006, Provincial Government, Western Cape Provincial Treasury) and I used the Cape Winelands District Report as the main source of secondary data for constructing the disparity profiles of the five local municipalities in the District. This source is supplemented with data and information from the Cape Winelands District Municipality (CWDM) Annual Reports and information gathered during the interview process with municipal officials. The SEP (2006) for the District includes consolidated data sets from surveys conducted by Statistics South Africa and submissions from the District municipality. The SEP (2006) report presents socio-economic data and indicators for the District as a whole and for each local municipality separately. There is no explicit comparative analysis. To provide the basis for a comparative analysis of levels of disadvantage that differentiate local municipalities from each other I constructed a general framework in Table 5.10 that presents, in summary form, a selection of disparity indicators from various sources. Thereafter I discuss some indicators that require further clarification and explanation.

Table 5.10: Summary – Indicators of Disparity for five Winelands District Local Municipalities

Indicators	Breede River	Breede Valley	Drakenstein	Stellenbosch	Witzenberg
Population					
Total (2006)	92 627	152 921	194 231	116 606	87 728
Population Density / Dispersion (p/km²)	27.783	51.059	126.288	140.32	30.771
% Population in rural areas	36.46	31.81	18.26	28.3	41.6
% Population in urban areas	63.54	68.19	81.72	71.7	58.5
Socio-Economic (2001)					
% Unemployment rate	12.2	19.7	22.8	17.1	14.6
No. unemployed	3 637	12 208	19 318	8 959	5 600
% households with no income	10.59	8.96	10.47	19.95	8.21
No. of households with no income	2 240	3 138	4 836	6 938	1 673
Supply/use of Public Infrastructure					
Health Trends 2006					
No. of medical facilities	25	12	23	16	16
Nurse patient ratio	39	29	30	34	34
% births under 2.5 kg	20	22	17	10	21
TB prevalence per 100 000	1 188	1 621	1 196	890	358
% TB cure rate	71	60	69	69	29
% HIV/AIDS prevalence (2005)	3.2	3.7	5.4	4.0	4.2
% HIV/AIDS prevalence (2010)	4.0	4.6	5.4	4.9	5.1
No. HIV/AIDS Deaths (2005)	120	234	327	193	158
No. HIV/AIDS Deaths (2010)	209	379	516	294	259
Education Trends 2006					
No. of schools (primary & high)	55	55	67	37	46
Educator learner ratio	36	38	38	38	37
% people over 14 illiterate (less than grade 7)	38	14	23	20	35
Crime Trends 2001/06					
No. of police stations (2004/05)	5	5	6	4	5
No. of murders (2001/06)	290	532	583	350	305
Drug related (2001/06)	3 824	4 294	6 501	2 914	4 724
No. of rapes (2001/06)	752	1 691	1 693	848	815
Roads 2007					
Total lengths (2007) (k)m	229	346.8	544.5	282.9	220.9

Unsurfaced (km)	50.7	35.9	54.1	18.1	28.2
Surfaced (k)m	178.6	310.9	490.4	264.8	192.7
Surfaced (km) poor and very poor (beyond repair)	25.00	46.64	19.62	18.54	9.64
Household Census 2001					
Changes in access to basic services (No. of households affected)					
Energy	-459	451	-872	-56	-232
Refuse removal	1 721	2 573	2 531	-177	965
Sanitation	658	1 605	1 334	58	591
Telephone services	-258	-1 206	-1 750	-1 380	-720
Water	-295	-139	-711	-607	-326
Housing 2001/04					
Households (2004)	24 203	38 601	50 157	35 466	22 322
Formal (2001)	18 651	35 095	46 268	34 845	20 458
Housing backlogs units (2004)	4 300	11 876	11 000	10 500	3 000
Informal / inadequate housing units	1 450	4 276	7 948	(13% of all housing)	2 154
Development indicators					
Human Development Index (2005, HDI) (Health, Income, Education)	0.65	0.68	0.70	0.74	0.72
City Development Index (2005, CDI) (HDI + infrastructure and waste)	0.71	0.74	0.78	0.80	0.69
Deprivation Index 2003 (normalized)	1.882	1.937	1.954	1.908	1.906

Sources:
Socio economic profile (SEP): Cape Winelands District 2006, Western Cape Provincial Treasury.
Deprivation in South Africa and its Potential Relevance to Resource Allocation issues: An analysis of 2001 Census Data, Di McIntyre and Okore Okarafor, Health Economics Unit, University of Cape Town, October 2003.
Information Management – South Africa Policy Service, Crime in the RSA for April to March 2001/02-2006/07.
Cape Winelands District Municipality – unpublished Assessment of Roads in Local Municipalities, 2007
IDP/Review 2005/2006, Cape Winelands District Municipality
Cape Winelands District Municipality, Unpublished Census and Household Data Base, 2009

Spatial disparity, population density and road infrastructure

Spatial disparity among the municipalities is indicated by population density; that is, the number of people living in a square kilometer of land surface within the municipality boundary. In the table below the population per square kilometer area is given for the period 2001 to 2010. For a comparative perspective of the differences in population density between the municipalities see the Summary Table (5.10) above. In this summary table it is easy to see that all five local municipalities have a preponderance of urban populations ranging from 58.5% for

Witzenberg to 81.72% for Drakenstein. Population dispersion per square kilometer varies widely across all five municipalities. Both these factors have significant implications for the provision of public infrastructure and the delivery of basic services. Highly agglomerated locations may present problems of overcrowding and related socio-economic consequences. High levels of population dispersion mean higher levels of public investment in physical infrastructure for transport, roads, rail, water reticulation and electricity distribution. Poor road and transport networks exacerbate interpersonal and spatial dimensions of inequalities.

The relationship between interpersonal and spatial disparities is explained in the multi-country study conducted by Kanbur and Venables (2005) and discussed in greater detail in Chapter 2 of this thesis. The study concluded that spatially targeted public infrastructure finance contributes to addressing disparities between and within regions. From the history of Cape Winelands District it is clear that in this region socio-economic inequalities coincide with the colonial and apartheid institutional legacies of discrimination.

In South Africa the Havemann and Kearney (2006) study investigating the relationship of spatial inequality to labour market outcomes found that location of population groups as a result of the apartheid political legacy of irrational racial spatial planning is a key determinant. (See Chapter 2 for a review of this article). Significantly, the study concluded that smaller municipalities, such as those located in the Cape Winelands, would benefit from location near to national highways or rail linkages to metropolitan areas. The authors suggest that the investment potential of such smaller municipalities with natural and human resources to influence labour market outcomes is indeed significant. For this reason the authors recommend increased public investment in public transport infrastructure as a means for reducing the structural spatial inequalities that separate the rural poor from the urban rich. Furthermore such investment creates opportunities for more positive labour market outcomes and higher household incomes.

In addition to the positive labour market outcomes of a good transport infrastructure network a good road network is important for communities to access services that would enhance their basic capabilities. Data supplied by the District indicate that the road system for all local municipalities requires significant upgrading and maintenance. Some areas such as Breede River and Breede Valley with larger rural populations have many kilometers of road that are un-surfaced. Kilometers that are surfaced are in poor to very poor condition and are characterized as being beyond repair. Table 5.11 below provides an indication of the differences in population density among the five municipalities.

Table 5.11: Population and Population Density CWDM

	Population				Population Density		
Local Municipality	**2001**	**2006**	**2010**	**Area (sq km)**	**2001**	**2006**	**2010**
Breede River	79439	92627	100151	3334	23.827	27.783	30.039
Breede Valley	143520	152921	155603	2995	47.920	51.059	51.954
Drakenstein	195628	194231	192336	1538	127.196	126.288	125.056
Stellenbosch	121843	116606	113043	831	146.62	140.32	136.03
Witzenberg	82831	87728	89888	2851	29.053	30.771	31.529
Breede River (DMA)	6659	6116	5881	12384	0.538	0.494	0.475

Source*: Economic Profiles, Cape Winelands District Municipality Data Base, 2007 ,*

Local municipalities in the District are responsible for maintenance and construction of roads within their jurisdictions. The District municipality itself is responsible for construction of main divisional and minor provincial roads within overall boundaries of the District. The District municipality performs this function as an agent of the Western Cape provincial department of Roads and Transport. In this capacity the District's responsibilities include maintenance and re-surfacing of permanent surface roads; re-gravelling of non-permanent surface roads; road construction and improvement projects; fencing and maintenance; placement and maintenance of kilometer markers; minor road maintenance and, placement and maintenance of road signs.

In 2007 the District's department of Engineering and Transport conducted a study to assess the state and maintenance costs of the roads in all the local municipalities in the District (Cape Winelands District Municipality, 2007). The study concluded that poor and unacceptable maintenance of the roads in the District had resulted in a R116 million backlog and the required funding to address the maintenance of municipal roads is estimated at R191 million over a 2 to 5 year period from the date of the study. Table 5.10 presents a summary of the 2007 study of the state of the roads and the related maintenance costs.

Table 5.12: CWDM - State and Maintenance Costs of the Roads-2007

Status	**Breede River**	**Breede Valley**	**Drakenstein**	**Stellenbosch**	**Witzenberg**
Roads length					
-surfaced (km);	178.6	310.9	490.4	264.8	192.7
-unsurfaced,	50.7	35.9	54.1	18.1	28.2
Total (Km)	229.3	346.8	544.5	282.9	220.9
Replacement value surfaced (Rmillion)	R188 900	R370 000	R582 500	R308 000	R200 100
Surfaced beyond repair: Km					
-poor/very poor	25.00	46.64	19.62	18.54	9.64
-value (Rmillion)	R14 557 961	R29 763 349	R43 196 170	R12 763 709	R15 335 554
Surfaced maintenance needs (Rmillion):					
-Resurface	R8 554 298	R15 737 449	R26 035 427	R8 386 957	R8 119 472
-Rehabilitate	R14 557 961	R29 763 349	R43 196 171	R12 763 709	R15 335 555
Unsurfaced maintenance needs (Rmillion)	R2 285 483	R2 193 699	R1 499 400	R222 073.00	R1 451 993
Maintenance expenditure: (Rmillion)					
-Actual	R1 371 000	R1 300 000	R6 978 180	R1 780 000	R1 317 698
-Require reseal	R2 211 615	R4 396 660	R7 153 020	R4 782 227	R2 523 623
-Require rehab	R14 557 961	R29 763 349	R43 196 171	R12 763 709	R15 335 555
-Total	R16 769 576	R34 160 009	R50 349 191	R17 545 936	R17 859 177
-Deficit	R15 398 576	R32 860 009	R43 371 011	R15 765 936	R16 765 936

Source: *Adapted from unpublished Report CWDM, 2007*

Unemployment[32], Income And Poverty

Unemployment

Unemployment in the Cape Winelands District has grown from 9.1% in 1996 to 14% in 2008. Of all the municipal districts this has been one of the fastest rates of unemployment growth given the size of the population (see Table 5.13).

Table: 5.13 Unemployment (%) by Municipal District in the Western Cape: 1996-2008

Year	Municipal District				
	West Coast	Cape Winelands	Overberg	Eden	Central Karoo
1996	6.7	9.1	5.9	13.1	16.2
1997	6.4	9.1	5.6	12.6	15.4
1998	8.2	11.7	6.9	15.5	18.9
1999	7.7	11.3	6.3	14.0	16.8
2000	8.9	12.9	7.3	15.4	18.1
2001	10.0	14.3	8.3	16.8	19.3
2002	10.6	15.4	8.9	17.5	21.5
2003	10.8	15.4	9.4	16.6	21.3
2004	10.1	14.4	9.2	14.5	19.6
2005	9.9	14.5	9.1	13.8	19.3
2006	10.2	14.8	9.6	13.0	19.5
2007	10.1	14.6	9.7	12.0	19.5
2008	9.6	14.0	9.4	11.0	18.6

Source: *Adapted from CWDM Data Base (2008)*

A significant aspect of the unemployment trends in the District from 1996 to 2008 is the racial profile of the distribution of unemployment. Table 5.14 shows that by far the African population has been hardest hit by unemployment with the coloured population coming in a close second and, the white community the least affected.

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[32] Unemployment statistical data is officially defined by Statistics South Africa as the number of people actively seeking work.

Table: 5.14 CWDM Unemployment Rate (%) by Race, 1996-2008

Year	Black (African)	White	Coloured	Asian	Total
1996	15.2	2.2	9.6	7.1	9.1
1997	16.9	2.3	8.9	7.4	9.1
1998	20.5	3.0	11.4	10.3	11.7
1999	18.8	3.0	11.0	11.4	11.3
2000	19.2	3.9	12.8	10.9	12.9
2001	20.7	4.3	14.2	11.2	14.3
2002	22.2	4.2	15.4	11.3	15.4
2003	21.8	4.0	15.6	10.6	15.4
2004	20.3	3.5	14.7	9.7	14.4
2005	20.4	3.4	14.7	7.7	14.5
2006	20.2	3.1	15.3	7.1	14.8
2007	19.4	3.0	15.3	5.9	14.6
2008	19.0	2.7	14.7	5.5	14.0

Source: *Adapted from CWDM Data Base (2008)*

In Table 5.10 under unemployment it is clear that the Drakenstein Municipality, with the largest population for 2006, also has the highest rate of unemployment. The Cape Winelands Annual Report 2007/08 notes that unemployment is most severe in the De Doorns and Touws River areas and, generally in informal settlements around urban centers in the District.

Income distribution and poverty

The Municipal District's Annual Report states that poverty in the District has deepened between 1996 and 2001 and that according to the Statistics South Africa 2001 census 11% of households were without incomes. The proportion of households in each local municipality earning less than R19 200 per annum ranged between, 41.4% in the Drakenstein Municipality to 56.7% in the Breede River Municipality. Table 5.15 provides a detailed local municipality profile of income distribution by income category. The SEP (2006) Report noted that in 2001 Stellenbosch had 19.95% of households with no income. Between 1996 and 2001 the Cape Winelands District Annual Report revealed a racial income distribution profile of 3 out of every 4 African and, 1 out of every 2 coloured households earning less than R19 200 per annum. The Report also revealed that single-women and child-headed households were the most vulnerable and, because households depended on wage income, the low levels of employment and the high seasonal nature of some employment meant that households were constantly caught in a poverty trap.

Table 5.15: CWDM: Number of Households by Income Category for 2008

Annual Income Category (Rand)	Breede River	Breede Valley	Drakenstein	Stellenbosch	Witzenberg
0-2400	70	79	105	183	41
2400-6000	227	266	308	367	183
6000-12000	2238	2553	2613	2860	1593
12000-18000	2558	3068	3077	2968	2062
18000-30000	2493	3530	3700	3042	2445
30000-42000	2935	4149	4218	3239	2718
42000-54000	2617	3770	3920	2978	2318
54000-72000	2904	4378	4884	3548	2619
72000-96000	2399	3847	4841	3332	2249
96000-132000	2188	3693	5249	3423	2116
132000-192000	1966	3595	5486	3365	1946
192000-360000	2159	4217	6774	4285	2068
360000-600000	942	1999	3288	2237	3288
600000-1200000	426	1032	1809	1210	479
1200000-2400000	96	270	502	340	126
2400000+	14	48	96	66	24
Total	26234	40496	50870	37443	23892

Source: *Adapted from Household Income and Expenditure, CWDM Data Base, 2008.*

The SEP Report (2006) noted that social grant transfers supplement incomes for a large percentage of poor households in the District. For example the proportion of total number of recipients of child support grants for all municipalities range between 40.2% for Stellenbosch and 50.6% for Breede Valley. In the medium to long-term social security transfers are not a satisfactory means for attaining basic capability equality amongst local communities.

Health, Mortality, Education, Transport, Safety, Crime, Housing And Access To Services

The supply and use of public infrastructure for the provision of health, education, safety and transport services present a very disparate picture for all five municipalities.

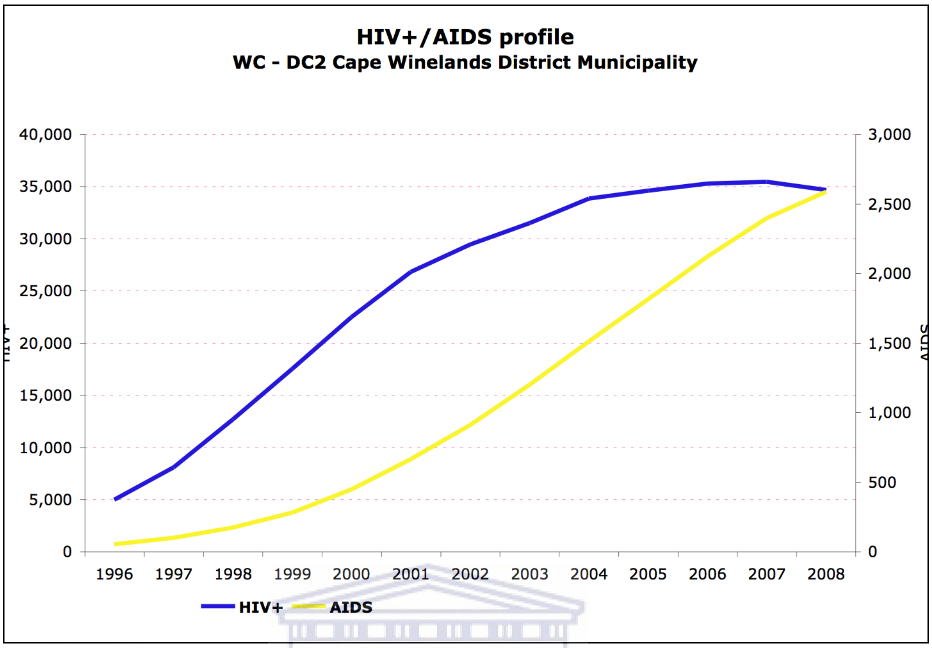
Health Trends and Debilitating Diseases

The Cape Winelands District 2007/08 Annual Report reveals that by 2007 there was a 27% vacancy rate for medical officers while the incidence of HIV had doubled over the period covered by the Report. Furthermore, the report noted that the HIV/Aids infections are projected to increase from 3.6% in 2005 to 4.7% by 2010. It was also observed in the Report that in certain communities in the District women were disproportionately affected and, that many patients in some communities present with dual tuberculosis (TB) and HIV/Aids infection. The Annual Report also noted that teenage pregnancy rates were above the national average and increasing annually. In addition low birth-weight figures in the District were unacceptably high. The SEP Report (2006) indicated that in 2006 there was 1 nurse for 32 patients (see Table 5.10) aggravating an already precarious situation with respect to the scarcity of health professionals in the District. Table 5.16 below for the Western Cape Province and, the accompanying graph, provides an indication of the increasing rate of HIV/Aids infections in the Cape Winelands District compared to other municipal districts in the province. Table 5.17 provides an indication of the prevalence of tuberculosis (TB) incidence in each local municipality.

Table 5.16: HIV and AIDS Estimates by Municipal District in the Western Cape: 1996-2008

Year	Municipal District									
	West Coast		Cape Winelands		Overberg		Eden		Central Karoo	
	HIV	AIDS	HIV	AIDS	HIV	AIDS	HIV	AIDS	HIV	AIDS
1996	1477	16	4981	54	1372	15	3331	36	370	4
1997	2624	32	8091	100	2311	28	5404	68	613	8
1998	4469	57	12684	173	3745	51	8499	119	979	14
1999	6499	98	17539	282	5365	87	11875	197	1355	22
2000	8693	166	22476	449	7116	143	15393	315	1733	35
2001	10702	257	26793	664	8788	220	18623	473	2042	52
2002	12118	364	29415	911	9964	311	20750	656	2217	70
2003	13205	495	31492	1201	10998	421	22516	874	2327	91
2004	14516	639	33826	1512	12088	543	24417	1113	2488	114
2005	15144	783	34582	1813	12621	664	25208	1348	2542	136
2006	15700	932	35269	2120	13106	790	25939	1590	2584	158
2007	15983	1072	35427	2397	13369	907	26278	1813	2585	178
2008	15753	1172	34661	2585	13292	992	25960	1972	2494	191

Source: *Adapted from Household Income and Expenditure Survey CWDM Data Base, 2008.*



Source: Adapted from Household Income and Expenditure Survey CWDM Data Base, 2008.

For an overall picture of the HIV/Aids and TB situation for each municipality in the District consider Table 5.10 above. This table shows that in 2005 Drakenstein had the highest percentage of HIV/AIDS prevalence at 5.4% while Breede Valley has the highest prevalence of TB per 100 000 inhabitants. The SEP Report (2006) suggests that the HIV/Aids prevalence is projected to remain the same by 2010.

Table 5.17: Incidences of TB Per 100000

Local Municipality	Incidence/100 000
Witzenberg	1324
Breede River	1021
Breede Valley	1536
Stellenbosch	982
Drakenstein	1010

Source: *IDP/REVIEW 2005/2006, CWDM*

The supply and use of public infrastructure for the provision of health, education, safety and transport services present a very disparate picture for all five municipalities. Using Table 5.10 it is evident that in Drakenstein, with the highest population and relatively high population dispersion there were only 23 public medical facilities. Breede River with a lower population and lower population dispersion had 25 facilities. Associated with HIV/Aids and other debilitating diseases is the issue of parental mortality for children in the 0-4 age group. Table 5.16 seems to imply that children without parents or living in single parent households have very little chance of acquiring any basic capabilities.

Table 5.18: CWDM Parental Mortality, for Children in Age group 0-4

Municipality	Mother Alive		Mother Not Alive	
	Father Alive	Father Not Alive	Father Alive	Father Not Alive
Breede River	8233	209	58	19
Breede Valley	14060	441	73	43
Drakenstein	16851	465	93	71
Stellenbosch	9159	249	42	12
Witzenberg	8095	224	40	15

***Source**: Statistics South Africa, Census 2001 (Mortality)*

Education and literacy trends

Indicators for education in Table 5.10 from the SEP Report (2006) show that Breede River and Witzenberg had the highest percentage of people over 14 years old who are functionally illiterate at 38% and 35% respectively. Functional illiteracy is defined as having less than a grade seven education. The Cape Winelands District Municipal 2007/08 Annual Report revealed that the District achieved lower outcomes in both numeracy and literacy among grade 3 learners between 2002 and 2007 compared to other municipal districts in the Western Cape. The Report also revealed that between 2005 and 2006 the total number of individuals without schooling in the District increased by 7% and, by 2006 only 2.3% had any post-graduate qualifications. Table 5.19 presents a picture in 2008 of the levels of racial disparity in educational achievement among the different communities in the District.

Table 5.19: CWDM – Highest Level of Education in 2008 by Race for Age 15 Years and Older

Grades	Black (African)	White	Coloured	Asian	Total
No Schooling	7098	432	13374	38	20942
0 – 2	2289	127	5941	104	8461
3 – 6	16512	1062	45868	221	63663
7 – 9	34137	7303	97171	292	138903
10 – 11	24133	10880	57305	187	92504
Less than grade 12	390	1389	967	85	2831
Grade 12 only	16683	35738	58453	380	111255

Source: Adapted from Cape Winelands District Municipality Data Base (2008)

Safety and crime trends

The picture for safety and crime is extremely bleak and seems to attest to the analysis presented in Glyn and Miliband (1994). High numbers of murder, drug related crimes and rape all seem to present a picture of dysfunctional communities. Table 5.20 presents a comprehensive summary of crime statistics for all five municipalities for the period 2001 to 2006.

Table 5.20: Summary of Key Crime Statistic Indicators for 2001 to 2006, for the CWDM

	Breede River	Breede Valley	Drakenstein	Stellenbosch	Witzenberg
All theft not mentioned elsewhere	4845	21183	26837	21340	5569
Common assault	5365	15151	14269	5229	5402
Assault with the intent to inflict grievous bodily harm	4355	11258	11400	5171	5497
Burglary at residential premises	3674	8890	11689	8004	3463
Malicious damage to property	2238	7699	8216	5762	2233
Theft out of or from motor vehicle	1254	5500	7505	10063	1195
Drug-related crime	3824	4294	6501	2914	4724
Crimean injuria	1034	3024	5097	1510	1022
Burglary at business premises	1267	2820	3152	2052	1301
Shoplifting	1050	2366	3609	1578	1163
Common robbery	252	1895	3529	1092	341
Rape	752	1691	1693	848	815
Driving under the	430	1309	1197	730	396

influence of alcohol or drugs					
Commercial crime	253	924	1534	940	320
Theft of motor vehicle and motorcycle	158	614	1190	1364	144
Robbery with aggravating circumstances	96	779	1358	980	82
General aggravated robbery (subcategory of aggravated robbery)	93	764	1321	894	81
Indecent assault	292	757	793	384	296
Murder	290	532	583	350	305
Stock-theft	388	277	201	375	380
Attempted murder	67	285	488	307	171
Culpable homicide	130	368	313	284	132
Neglect and ill-treatment of children	74	279	540	117	87
Illegal possession of firearms and ammunition	75	191	347	224	84
Arson	64	184	206	97	72
Abduction	10	72	121	47	16
Public violence	28	57	94	41	14
Kidnapping	17	68	58	27	15
Carjacking (subcategory of aggravated robbery)	1	10	21	27	0
Robbery at business premises (subcategory of aggravated robbery)	1	1	3	39	0
Robbery at residential premises (subcategory of aggravated robbery)	1	2	7	11	1
Robbery of cash in transit (subcategory of aggravated robbery)	0	0	3	4	0
Bank robbery (subcategory of aggravated robbery)	0	0	2	3	0
Truck hijacking (subcategory of aggravated robbery)	0	2	1	2	0

***Source**: Information Management - South African Police Service, Crime in the RSA for April to March 2001/2002 to 2006/2007*

The Cape Winelands District Municipality 2007/08 Annual Report notes that there were 23 police stations in the District. The Report also noted that there was a decrease in certain crimes between 2004/05 and 2006/07. Murder dropped by 22.3%; rape by 10.9% (although this could also be due to under-reporting of rape); neglect and ill treatment of children by 49.6% and, drug related crimes remained high, increasing by 20.8% in 2005/06.

Housing and access to basic services

Following the Guarcello et al (2004) study (see Chapter 2) one may examine the access to basic services such as energy (gas, paraffin, candles and other) and water. This is difficult to assess as the SEP Report (2006) for the District only presents data (see Table 5.10) between 1996 and 2001 that reflects changes in access to these services. What the changes in access to these services does show, however, is that four out the five municipalities have shown very limited improvement in household access to energy sources for cooking and lighting. For water the situation is negative improvement for all five municipalities.

The Cape Winelands District Municipality 2007/08 Annual Report observes that housing and access to basic services in the District is characterized by significant and, growing backlogs and sub-optimal accommodation. The Report notes that in 2005 the District had a 10% housing backlog of the Province's estimated total backlog of 296 000 units. However, the Report notes and, my interviews with local municipal officials reveal that the municipalities estimate the housing backlog to be in the region of 48 000 units. In addition the Annual Report suggests that the backlog situation is being exacerbated by evictions of farm-workers and their families. Between January and September 2005 352 farm-workers and their families faced eviction because the worker was retrenched or died. Other reasons included the sale or liquidation of the farm; wage disputes; drought and, the unemployment impact of the implementation of new legislation that seeks to provide security of tenure for farm-workers and their families (see also Falletisch 2008).

Aggregate housing provision is an important indicator for assessing inter-municipality spatial inequality and disparities. From Table 5.10 it is clear that in 2004 municipalities with the largest population had the highest housing backlogs and, the highest number of informal and inadequate housing units.

Inequality, deprivation and human development

The final set of indicators in Table 5.10 represents the level of aggregate development in each of the local municipalities. The human development index or HDI is a composite indicator between values of zero and one representing the level of health, education and income attainment in an area and where a value closer to one indicates higher human development. The Gini Coefficient measures the level of income inequality with one representing absolute inequality and zero absolute inequality. The city development index is the HDI plus the level of infrastructure and waste removal provision. Column two in Table 5.21 presents the HDI and Gini coefficients for the Cape Winelands District between 1996 and 2008. From Table 5.21 it is clear that income inequality is increasing in all municipal districts in the Western Cape Province with only marginal improvements in human development.

Table 5.21: HDI and GINI Coefficient by Municipal District in the Western Cape: 1996-2008

Year	Municipal District									
	West Coast		CWDM		Overberg		Eden		Central Karoo	
	HDI	GINI	HDI	GINI	HDI	GINI	HDI	GINI	HDI	GINI
1996	0.60	0.54	0.60	0.57	0.61	0.54	0.61	0.55	0.53	0.54
1997	0.57	0.56	0.57	0.57	0.58	0.56	0.58	0.56	0.49	0.56
1998	0.59	0.56	0.59	0.57	0.61	0.56	0.61	0.56	0.53	0.56
1999	0.60	0.56	0.60	0.58	0.62	0.56	0.62	0.56	0.54	0.56
2000	0.61	0.57	0.61	0.59	0.62	0.56	0.62	0.58	0.55	0.57
2001	0.62	0.59	0.62	0.60	0.63	0.57	0.64	0.58	0.54	0.59
2002	0.62	0.60	0.62	0.60	0.63	0.58	0.64	0.59	0.56	0.59
2003	0.62	0.60	0.62	0.61	0.63	0.59	0.65	0.60	0.57	0.60
2004	0.62	0.61	0.63	0.61	0.63	0.59	0.65	0.60	0.57	0.60
2005	0.63	0.61	0.63	0.61	0.63	0.59	0.66	0.59	0.57	0.60
2006	0.63	0.61	0.63	0.61	0.63	0.59	0.66	0.59	0.58	0.60
2007	0.63	0.62	0.63	0.61	0.63	0.60	0.66	0.60	0.57	0.60
2008	0.62	0.62	0.62	0.61	0.63	0.60	0.66	0.60	0.57	0.61

Source: *Adapted from Household Income and Expenditure Survey CWDM Data Base, 2008.*

For a more localized view of developmental disparity among the municipalities I consider the deprivation index. The deprivation index represents a state of social and material disadvantage experienced by an individual, household, group or community relative to the general norm in society as a whole. In this sense McIntyre et al (2000) assert that deprivation is closely related to Sen's human capabilities in that deprivation may be seen as the inability to achieve an adequate level of basic capability relative to the societal norm. McIntyre and Okorafor, (2003) developed a series of multiple deprivation indices at the level of the local municipality (see Chapter 2). Table 5.22 and Table 5.23 represent the McIntyre-Okorafor deprivation indices (Di McIntyre and Okore Okorafor, 2003) for the five local municipalities in the Cape Winelands District.

Table 5.22: Deprivation Index

Local Municipality	Municipality Code	Deprivation Index
Drakenstein	WC023	-1.36425
Breede Valley	WC025	-1.37312
District Management Area	WCDMA02	-1.39115
Witzenberg	WC022	-1.40588
Stellenbosch	WC024	-1.41633
Breede River/Winelands	WC026	-1.42491

Source*: Di McIntyre and Okore Okorafor, October 2003, Health Economics Unit, University of Cape Town*

Table5.23: Normalized Deprivation Index for the five local municipalities

Local Municipality	Municipal Code	Normalized Deprivation Index
Breede River	WC026	1.882
Breede Valley	WC025	1.937
Drakenstein	WC023	1.954
Stellenbosch	WC024	1.908
Witzenberg	WC022	1.906

Source*: Di McIntyre and Okore Okorafor; October 2003; Health Economics Unit, University of Cape Town*

The Human Development Indices (2005), Deprivation Indices (2003) and the City Development Indices (2005) for the five local municipalities are presented in Table 5.10. It is clear from this table that, for all three indices, the CWDM local municipalities perform very poorly indeed.

Summary

This disparity profile of the Cape Winelands District as whole shows wide variations and levels of disparity among the five local municipalities in the Cape Winelands District. The premise of the thesis is that public infrastructure provision can play an important role in mitigating the effects of structural and spatial disparities within and among local municipalities in the District. This chapter presents a variety of data sets and information to give an overall picture of disparity in the Cape Winelands District Municipality. However, to run illustrative model simulations that take account of capital stock weighted by population and economic disparity indices I selected the following eight disparity indicators from the data sets discussed in this chapter.

- Population density/dispersion per square kilometer,
- Unemployment rate,
- Household with no income,
- Tuberculosis (TB) per 100 000 inhabitants,
- Percentage of HIV/Aids prevalence,
- Percentage of persons over 14 years illiterate (with less than grade 7),
- Housing backlog units and,
- The normalized deprivation index

I used the data listed above to construct disparity indices as input weights in the municipal infrastructure grant model. I investigated whether such a financing formula could provide an objective mechanism to equitably allocate infrastructure grants to municipalities over a given period of time to enable them to address economic disparities and infrastructure backlogs. The full model, including the construction of the disparity indices is presented in Chapter 6.

Chapter 6

The Municipal Infrastructure Grant Model

In Chapter 3 I argued that government's current method for allocating municipal infrastructure grants to address historical backlogs was not equitable because it did not adequately take account of disparities as required by Section 214 (2) of the Constitution. Citing government reports I also suggested that inadequate financing of infrastructure made it more difficult for municipalities to provide basic services. Together, inequitable allocations and inadequate financing may be implicated in the social exclusion and marginalization of disadvantaged communities giving rise to anti-social behaviour and the violent service delivery protests discussed in earlier chapters.

Following my earlier arguments for an infrastructure grant model that takes account of municipal disparities, in this chapter, I develop and present a municipal infrastructure grant model that takes account of economic disparities. The model is based on the Petchey, Josie, MacDonald and Nthite (2004)[33] provincial capital grant model developed for the Financial and Fiscal Commission (FFC, 2005). My model is an adapted version of the Financial and Fiscal Commission (FFC, 2005) provincial capital expenditure grant model. Whereas the latter was for allocating capital grants to provinces the municipal infrastructure grant model is an adapted version for equitable allocation of infrastructure grants to municipalities taking account of economic disparities as prescribed in Section 214 (2) (g) of the Constitution.

Accounting for Economic Disparities in a Municipal Infrastructure Grant Model

This section of the chapter presents the formal structure of the grant model for allocating grants to municipalities taking into account economic disparities. The development of the municipal model follows the same processes used to develop the FFC provincial capital grant model. Following from equations 4.5, 4.6 and 4.7

[33] *See footnote 8 in Chapter 1: Introduction.*

in Chapter 4, the variables and parameters for the grant model for the five (Breede River, Breede Valley, Drakenstein, Stellenbosch Witzenberg) Cape Winelands local municipalities represented by *"i"* are defined as follows:

- K_t = Value of the actual capital stock (in constant prices) for the Cape Winelands District as a whole in period t.
- $K_{i,t}$ = Value of the actual capital stock (in constant prices) for Municipality i in the Cape Winelands District in period t.
- $P_{i,t}$ = Population of Municipality i in period t.
- P_t = Population of the Cape Winelands District in period t.
- $B_{i,t}$ = historical backlog for municipal i for period t
- CP_t = Capital (Infrastructure) grant-pool in period t (given as a policy parameter in government's medium term budget statement for municipal infrastructure grants)[34].
- $0 \leq \delta_t \leq 1$ = Proportion of the capital grant pool allocated to capital backlog (δ_1 is called *delta* and is a policy parameter).
- $0 \leq \gamma_{i,t}$ is the capital cost disparity for Municipality i in period t.
- $\phi_{i,t}$ = the disparity function for Municipality i in period t.
- $\tau_{i,t}$ *(tau)* is the ratio, which defines a share of the grant pool for municipality i in period *t* = 1, 2 or 3 as a proportion of the municipal's share of the Cape Winelands District population.

The model is constructed over three consecutive periods of the Medium Term Expenditure Framework (MTEF) cycle. Each MTEF is equivalent to three years. This is convenient as capital infrastructure budgets are normally spent over a longer period than annual operational expenditures. The formulae for each period are developed consecutively.

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[34] *In the Petchey et al (2004) version the capital grant pool can also be derived from macroeconomic forecasts.*

Period One

The grant is used to raise the overall level of public capital formation for the delivery of important public services and equal access to these services over time and, for long-term economic growth and development. For this reason, the model is divided into two components: a per capita component to address long-term economic growth and development and a municipality's backlogs component designed to address inequality of access to services created by the historical backlogs and socio-economic disparities. The formulae for each component (for period one) are developed below, starting with the historical backlog part.

The historical domestic backlog grant

In the first period, a portion of CP_1, the grant pool, is allocated to the municipalities according to their historical domestic backlogs. This portion of the grant is for financing municipal infrastructure to ensure equality of access to basic services especially for those previously disadvantaged by the historical legacies of colonial and apartheid policies of spatial and socio-economic disparity. The amount allocated to this component of the model is $CP_1 \cdot \delta_1$ where δ is a policy parameter (i.e. it is a value between 0 and 1 and may be determined by the policy maker.). To determine this allocation in period one, the model requires a value for the amount of capital needed by each municipality to provide basic services. A simple way to do this would be to use per capita values for minimum standards developed for each of the services and then estimate the amount of capital that a municipality would require to meet such standards. Comparison of these standard values against a municipality's actual capital stock would yield a measure of the historical backlog for each municipality. Unfortunately, there are no commonly established and consistent minimum standard values for all the relevant services in South Africa. If and when such countrywide standards are established this approach may be used.

In the *Josie, MacDonald and Petchey (2008)* article a simple per capita average value is used as the standard to establish whether each province has a historical backlog, that is; a shortage of capital compared to other provinces because of the historical legacy of apartheid. Analogously, a Cape Winelands Municipal district standard can be set to compare local municipalities with each other in a district municipality. In adopting this approach for municipalities, the first step in constructing this municipal district standard is to let the (per capita) stock of capital for period one be:

$$\frac{K_1}{P_1} \qquad \textit{(Municipal District Standard Capital Stock)} \qquad (6.1)$$

In the following analysis this municipal district standard is applied to each municipality to derive the amount of capital that a particular local municipality needs in order to meet the per capita average. Let us call this value of capital stock the municipal district standard.

As discussed in the Josie *et al* (2008) article there are problems associated with the use of a per capita average in this way. Chief among these is that a per capita average may conceal service specific backlogs within a region. For example, a municipality may have large deficiencies in infrastructure for one service but more than adequate infrastructure for all of its other services. An aggregate measure of the municipality's capital stock, together with the use of an average for the standard, may falsely show an overall excess of capital for the municipality, "concealing" the fact that there is a deficiency for one particular service[35].

It is important to note at this stage that the capital stock estimates used in the case study was the amount of capital per person in the Cape Winelands District as a whole. As noted in Chapter 5 the municipal PIM capital stock estimates were derived from national and provincial capital stock data. This is not an ideal solution because as noted by *Josie et al (2008: 1183)* and confirmed in my discussion in Chapter 5, municipal capital stock time series data are not available in South Africa.

[35] *It is not possible to convert 'excess' infrastructure used for example, for providing roads, into infrastructure for providing water and sanitation.*

In practice the problem of 'concealment', can be overcome. The model is developed so that all municipalities also receive a per capita grant from the grant pool in addition to the backlogs component of the grant allocation. To an extent, this allocation will overcome the "concealment effect" resulting from the use of a simple average for calculating a municipal district level standard. To ensure equity, while an affluent municipality may not have an historical backlog when estimated using an average, it will still receive an equal per capita allocation for capital spending from the grant pool. In this case a policy decision can be made within such a municipality to use this equal per capita allocation to also address any residual historical backlogs.

There are two advantages in using an average to set the district-level standard. Firstly, it is perceived as being fair and compliant with the equity principles of *parity, proportionality and priority* (Young, 1994) and, it is feasible. Secondly, being derived from a mathematical formula there is very little possibility for political interference.

The formal steps in the development of the model are presented in the following paragraphs. The aggregate amount of capital that municipality *i* requires in period one to achieve the municipal district level standard is the per capita standard from equation (6.1) multiplied by the population of municipality *i* taking account of its cost disparity ($\gamma_{i,t}$) which may be less or greater than one. If more than one, municipality *i* would need more than the standard amount of capital in order to provide the standard amount of services from that capital stock. If less than one it would require less than the standard in order to provide the standard amount of services. Thus the measure of capital needed in municipality *i* to achieve the standard in period one, taking account of cost disparities, is:

$$\left(\frac{K_1}{P_1} \cdot P_{i,1}\right) \cdot \gamma_{i,1} \qquad \textit{(Desired Capital Stock)} \qquad (6.2)$$

In period one this is what municipality *i* needs to achieve the Cape Winelands District standard taking into account its capital cost disparity. The municipality's historical domestic backlog depends on how its actual capital stock deviates from the disparity-adjusted standard capital stock for that municipality. This can be calculated for municipality *i*, and period one, as follows:

$$B_{i,1} = \left(\frac{K_1}{P_1} \cdot P_{i,1} \cdot \gamma_{i,1} - K_{i,1} \right) \qquad \textit{(Historical Backlog)} \qquad (6.3)$$

Municipalities with $B_{i,1} > 0$ (a positive capital backlog) have a deficiency in their capital stock in the sense that it is inadequate to achieve the municipal district standard, as determined from (6.2). Local municipalities with $B_{i,1} < 0$ have a negative backlog compared to the municipal district standard. Their capital stock exceeds what is required to achieve the standard. Finally, $B_{i,1} = 0$ implies that a municipality has no historical backlog. The capital stock in such a municipality is equal to what it needs to achieve the municipal district average, adjusted for cost disparities.

The available pool of funds is allocated among those municipalities with a positive historical backlog according to the following equation that automatically ensures that the sum of all the historical backlog grants is equal to the available infrastructure grant pool:

$$G_{i,1}^{D} = \left\{ \begin{array}{ll} \dfrac{B_{i,1}}{\sum\limits_{i:B_{i,1}>0} B_{i,1}} (\delta_1 \cdot CP_1) & \forall \ B_{i,1} > 0 \\ 0 & \forall \ B_{i,1} \leq 0 \end{array} \right\} \qquad \textit{(Historical backlog grant)} \qquad (6.4)$$

where $G_{i,1}^{D}$ is the historical backlog grant to local municipality i in period one. D here denotes a municipality's historical domestic backlog. Only those municipalities with a positive historical backlog (i.e., $B_{i,1} > 0$) receive this grant. Municipalities with a negative backlog (i.e., $B_{i,1} \leq 0$) receive no allocations from this part of the grant pool in period one.

The per capita economic efficiency grant

To ensure that municipalities are adequately funded to meet the economic efficiency standard, the remaining portion of the pool, $(1-\delta_1)$, is allocated on a per capita basis to all municipalities to help them overcome their overall shortage of capital relative to a generally accepted standard to achieve per capita economic efficiency. This can be a general internationally, nationally or regionally accepted standard. The aggregate amount remaining in the pool for this grant is:

$$CP_1(1-\delta_1). \quad \textit{(Pool available for per capita grant)} \quad (6.5)$$

As I noted in Chapter 4 the policy maker chooses the value of the parameter (δ_1). The greater is the value of δ_1 (delta), the smaller is the allocation to the per capita economic efficiency-based grants, and the greater is the allocation to the historical domestic backlogs. Conversely, the lower is the value of δ_1, the smaller is the amount allocated to equality of access component (the historical domestic backlogs) and the greater is the allocation of funds to addressing per capita economic efficiency. Policy makers therefore have the discretionary power to decide how quickly the historical domestic backlog is eliminated. Once all historical domestic backlogs are eliminated and there is more equality of access to services, the parameter (δ_1) can be set equal to zero, implying that all of the pool is allocated to the per capita economic efficiency-based grants to meet the requirement for municipal economic growth.

A municipality's unadjusted total per capita economic efficiency-based grant for economic growth from this component of the pool in period one is:

$$\left(\frac{CP_1(1-\delta_1)}{P_1}\cdot\frac{P_{i,t}}{P_t}\right)\cdot\gamma_{i,1} \qquad (6.6)$$

It is clear that equation (6.6) does not have a component to ensure that the sum of the grants so calculated is equal to the share of the pool designated to this part of the model. To ensure that such a "balanced budget" condition is satisfied as discussed in Chapter 4 (see tables 4.2, 4.3 and 4.4), we use (6.6) to construct shares that are then applied to the grant pool. The share *tau* ($\tau_{i,t}$), defined by equation 6.7, for municipality *i* is just its aggregate grant from (6.6) divided by the sum of the aggregate grants for all municipalities, also from (6.6). Simplified, this ratio, which defines the per capita economic efficiency share of the grant pool for municipality *i*, is:

$$\tau_{i,1} = \frac{P_{i,1} \cdot \gamma_{i,1}}{\sum_{i} P_{i,1} \cdot \gamma_{i,1}} \qquad 0 \le \tau_{i,1} \le 1 \quad \textit{(Share of the Grant Pool)} \quad (6.7)$$

The share of municipality *i* in the revenue pool is a function of its population relative to total district population (the higher its population the larger is its grant), and its capital cost disparity relative to the sum of all disparities (the higher is its disparity relative to the sum of the disparities in the Municipal District, the greater is its grant). Thus, one can consider this part of the scheme an equitable per capita economic efficiency grant, adjusted for capital cost disparities. If a municipality has a disparity of one then it will receive a share of the grant pool based purely on its population share.

Therefore, the aggregate grant for municipality *i* for this component of the scheme is:

$$G^{E}_{i,1} = \tau_{i,1} \cdot CP_1(1 - \delta_1) \quad \textit{(Per capita efficiency grant)} \qquad (6.8)$$

where E denotes per capita economic efficiency.

The aggregate grant

The aggregate infrastructure grant to municipality *i* is the sum of the per capita economic efficiency grant and any historical domestic backlog grant that may be received such that:

$$G_{i,1} = G^{E}_{i,1} + G^{D}_{i,1} \qquad \textit{(Aggregate Infrastructure Grant)} \qquad (6.9)$$

Municipalities with no historical backlog in period one will receive only a per capita economic efficiency grant. For these municipalities, $G_{i,1} = G^{E}_{i,1}$. Municipalities with a positive historical backlog will receive their per capita economic efficiency grant and a share of the pool allocated to historical backlogs. Their share of the backlog pool will depend upon the size of their backlog relative to the backlogs of other municipalities. Once the historical backlogs have been eliminated all municipalities will receive only the per capita economic efficiency grant (as noted above, once this point is reached, δ_t will be set equal to zero). Therefore, policy makers may wish to set δ_1 at a relatively high level in the early stages of the scheme since this implies that most of the pool will go towards eliminating the historical domestic backlogs and economic disparities. The National Government will then meet demands to address economic disparities and correct the historical backlogs as quickly as possible and improve equality of access to services. As the scheme progresses, increasingly more emphasis should be placed on the per capita grant by reducing δ_1 as economic disparities and the historical domestic backlogs diminish.

Period Two

At the start of period two the historical capital domestic backlog estimated in period one is adjusted to take account of the positive impacts of the historical domestic backlog grant made in period one. Thus, the estimate of the historical backlog for the start of period two is

$$B_{i,2} = B_{i,1} - G^{D}_{i,1}. \qquad \textit{(Historical Domestic Backlog)} \qquad (6.10)$$

The backlog grant for period two is now based on the estimate of each municipality's domestic backlog at the start of period two, namely;

$$G^{D}_{i,2} = \begin{Bmatrix} \dfrac{B_{i,2}}{\sum\limits_{i:B_{i,2}>0} B_{i,2}}(\delta_2 \cdot CP_2) & \forall \ B_{i,2} > 0 \\ 0 & \forall \ B_{i,2} \leq 0 \end{Bmatrix}. \quad \textit{(Historical backlog grant)} \quad (6.11)$$

As before, the per capita economic efficiency grant is

$$G^{E}_{i,2} = \tau_{i,2} \cdot CP_2 (1 - \delta_2) \qquad \textit{(Per capita efficiency grant)} \qquad (6.12)$$

where

$$\tau_{i,2} = \frac{P_{i,2} \cdot \gamma_{i,1}}{\sum_i P_{i,2} \cdot \gamma_{i,1}} \qquad (0 \le \tau_{i,2} \le 1)$$ *(Share of the infrastructure grant pool)*

and the total grant to Municipality *i* in period two is

$$G_{i,2} = G^{E}_{i,2} + G^{D}_{i,2}. \qquad \textit{(Aggregate Grant)} \qquad (6.13)$$

In calculating the share $\tau_{i,2}$ *(tau)* we use the cost disparity from period one. As will be seen below, this disparity is used again for the period-three estimates. This seems to be reasonable since it is unlikely that a disparity would change significantly between periods because disparity indicator data is normally collected in five-year intervals. This should not, however, preclude the use of revised estimates in subsequent periods.

Period Three

For period three the scheme proceeds as before thus the following analysis presents only the formulae without discussion. The backlog at the beginning of period three is

$$B_{i,3} = B_{i,1} - (G^{D}_{i,1} + G^{D}_{i,2}). \qquad (6.14)$$

The historical domestic backlog grant for period three is

$$G^{D}_{i,3} = \left\{ \begin{array}{ll} \dfrac{B_{i,3}}{\sum_{i:B_{i,3}>0} B_{i,3}} (\delta_3 \cdot CP_3) & \forall \;\; B_{i,3} > 0 \\ 0 & \forall \;\; B_{i,3} \le 0 \end{array} \right\}. \qquad (6.15)$$

The per capita economic efficiency grant is

$$G^{E}_{i,3} = \tau_{i,3} \cdot CP_3 (1 - \delta_3) \qquad (6.16)$$

where,

$$\tau_{i,3} = \frac{P_{i,3} \cdot \gamma_{i,1}}{\sum_i P_{i,3} \cdot \gamma_{i,1}} \qquad (0 \le \tau_{i,3} \le 1)$$

and the total grant to municipality *i* in period three is

$$G_{i,3} = G^{E}_{i,3} + G^{D}_{i,3} . \qquad (6.17)$$

At the end of the three periods (this could, for example, be nine years if each period is equal to three years corresponding with the MTEF cycle) the historical domestic capital backlog for municipality *i* is the backlog estimated in period one less the total of the backlog grants made during the period of the simulation of the grant scheme cycle, that is:

$$B_{i,3} = B_{i,1} - \sum_{t=1}^{T} G^{D}_{i,t} \qquad (T = 3) . \qquad (6.18)$$

If at the end of the cycle of three MTEF periods (T=3) the municipalities still have domestic backlogs, as measured by (6.17), then the backlog part of the grant scheme would require a second phase. This would be the same as the first three-period phase, but would use, as its initial backlog estimates, the results derived from (6.17). All municipalities would continue to receive the per capita grant on the assumption that there is still a need to raise the general level of public capital stock formation in the municipalities.

In the analysis for the FFC provincial capital grant scheme, the cost disparities are allowed to affect both components of the grant scheme, namely, the per capita economic efficiency part and the historical domestic backlogs part. However, in the simulation model in Petchey et al (2004) the authors also allowed for the possibility that the policy maker may wish to allow the cost disparities to affect only one part of the grant allocation (e.g. the per capita economic part) or have no influence at all (by setting all the betas equal to zero in the program). This technique offers maximum flexibility and can also be adopted for the municipal infrastructure grant model.

To use the model for making equitable municipal infrastructure grant allocations several data inputs are required. These data inputs are identified in Chapter 4, and illustrated in Figure 4.4 showing a schematic representation of the simulation model. The actual data is presented in Chapters 5.

To estimate the *Municipal District Standard Capital Stock* as represented by ($\frac{K_1}{P_1}$) in equation (6.1) for each of the five local municipalities the model requires municipal level capital stock and population data inputs. As the municipal level capital stock data are not available they are estimated using the perpetual inventory method formula $K^s_{i,t} = K^s_{i,t-n}(1-\delta)^n + \sum_{\tau=t-n}^{t-1} k^s_{i,\tau}(1-\delta)^{t-\tau-1}$ presented in equation *(4.2)* in Chapter 4 and based on the following data:

- Capital expenditure per local municipal service between 1997 to 2007,
- Financial and Fiscal Commission (FFC) initial capital stock estimates for the Western Cape Province for 1997,
- A 1997 depreciation rate for the Western Cape Province that is invariant across time, region and service,
- Population data (in Chapter 5, Table 5.2) for each of the local municipalities between 1997 and 2007
- Municipal capital expenditures directed at addressing the specific infrastructure needs (see Tables 5.8 and 5.9 in Chapter 5)

In addition to population and capital stock inputs, to estimate each municipality's *Desired Capital Stock* represented by $\left(\frac{K_1}{P_1} \cdot P_{i,1}\right) \cdot \gamma_{i,1}$ in equation (6.2) the model also requires the composite capital cost disparity indicator values represented by ($\gamma_{i,t}$) for each of the municipalities. The composite capital cost disparity indicators are estimated from the following data sets presented in Table 5.10 in Chapter 5.

- Population density/dispersion per square kilometer,
- Unemployment rate,
- Household with no income,
- Tuberculosis (TB) per 100 000 inhabitants,
- Percentage of HIV/Aids prevalence,
- Percentage of persons over 14 years illiterate (with less than grade 7),
- Housing backlog units and,
- The normalized deprivation index

However, as I noted earlier capital stock data is not available at the level of the municipality. For this reason I use a version of the perpetual inventory method (PIM) (discussed in Chapter 4) to estimate the capital stock for each of the five local municipalities. The capital stock estimation procedures, limitations and results are discussed and presented in the next section of this chapter.

Application of the Perpetual Inventory Method (PIM) in the CWDM

In this section I demonstrate how the PIM was used for estimating capital stocks for the five CWDM local municipalities by service from 1997 to 2005 using actual municipal infrastructure expenditures.

In Chapter 2 I presented a fuller discussion of different methods used for estimating capital stock from the literature. In the following sub-sections I explain how I applied a modified version of the perpetual inventory method developed by Levtchnkova and Petchey (2000) and show how municipal level public capital stocks were estimated for the CWDM.

The Perpetual Inventory Method (PIM)

The PIM is the most popular technique for estimating capital stocks in developed and developing economies. The technique entails adding gross fixed capital formation to an initial estimate of the capital stock and then deducting the value of capital assets that have reached the end of their service lives. The SNA93 elaborates:

> *The perpetual inventory method requires an estimate to be made of the stock of fixed assets in existence and in the hands of producers. This is done by estimating how many of the fixed assets installed as a result of gross fixed capital formation undertaken in previous years have survived to the current period*. [Para.6.189].

The standard procedure is to estimate the gross capital stock by applying a depreciation rate to calculate the consumption of fixed capital. Thereafter, by subtracting the accumulated capital consumption from gross capital stock the net capital stocks are obtained. An alternative procedure uses a more integrated approach that combines the relationship between the service output efficiency, the age and the declining price value of the asset. The age-efficiency profiles are estimated for each service life for each asset type against a discount rate in order to generate the net capital stock. It is assumed in this approach that the market price of the asset is equivalent to the rentals the asset is expected to earn under market conditions.

Financial resource allocation mechanisms to address infrastructure investment needs require a reasonable estimate of infrastructure backlogs. Capital stock data is a critical input for measuring and forecasting infrastructure investment and, for estimating infrastructure deficiencies or backlogs as a function of a desired level of capital stock necessary for economic growth. The difference between the estimated level of capital stock and desired level of capital stock gives an indication of the level of capital backlog in the economy. For public sector infrastructure spending general capital stock estimates provide an important indicator for determining what amount of government's contribution is required to enhance the desired level of capital stock in the economy. Generally accepted international or nationally determined best practice estimates can be used as the standard benchmark for the desired level of capital stock.

The PIM estimation procedure requires several different categories of information. This includes a value of an initial or benchmark capital stock estimate; gross fixed capital formation for each year after the starting year; depreciation and average service life of the asset; information on how assets are written off and, rates of variations in the prices of assets.

Recall from Chapter 2 that the Levtchnkova and Petchey (200) version of the perpetual inventory method was developed for estimating capital stock data for National, State and Local components of the General Government in Australia for the period 1962 to 1999 for a service or function provided. The version of the

PIM technique used in this thesis is presented in Chapter 4 and begins with an initial estimated capital stock at some point in time. Thereafter the formula creates subsequent stock estimates using data on capital expenditure and depreciation.

Some Capital Stock Data Issues

For estimating capital stock inputs in the simulation exercise provincial capital stock and infrastructure backlogs data for education, health, housing, water, sanitation and access roads were sourced from official reports published by the South African Reserve Bank, the Development Bank of Southern Africa, StatSA, National Treasury and the Western Cape Provincial Treasury and the Department of Local Government and Housing. For calculating the capital stocks for the Western Cape Municipal districts capital expenditure data for the municipal infrastructure grants was sourced from the Western Cape Department of Local Government and Housing.

Other official national and provincial sources of data disaggregated to various sub-regional levels include the Trends in Intergovernmental Finances published annually by National Treasury. Aggregated national capital stock data are regularly published in the South African Reserve Bank (SARB) Quarterly Reports. Public expenditure and infrastructure backlogs data are found in Annual Budget Reviews and other reports from National and Provincial Treasuries and government service departments.

To estimate municipal capital stocks within a province an initial provincially aggregated capital stock estimate for a given year is required. In South Africa, unfortunately, the South African Reserve Bank only publishes aggregated national capital stock data. This data is not disaggregated to provincial or local government level. For this reason the first step in estimating local government capital stock is to estimate the provincial capital stock for a particular service. Fortunately, such an exercise was carried out for a Financial and Fiscal Commission modeling project in 2007 by Petchey, MacDonald, Josie, Mabugu and Kallis (Unpublished research report available). I use the FFC initial capital stock estimate for the Western Cape to demonstrate how capital stock estimates may be calculated for municipalities in the Cape Winelands District. The estimation procedure follows a step-by-step iterative process.

Based on the Western Cape Province initial capital stock estimated by the FFC and, using the PIM equations presented in Chapter 4 in an Excel Simulation Model spreadsheet format, I estimated the capital stocks for the municipal districts in the Western Cape.

The First Iteration: calculating the capital stock data for the Western Cape Province

The Reserve Bank's capital stock values for 2004 were used in the FFC exercise. These values were then aggregated into provincial capital stocks and given in 2000 nominal prices. The capital stocks were then split into province and service specific components.

To split the provincial capital stocks into individual provinces actual capital payments data from Table A7 of Provincial Budgets and Expenditure Review (Natianal Treasury 2001/02 – 2007/08) was used. This data arranges payments according to Province and Service. The spending flow data was used to construct individual provincial weights and then they were disaggregated into capital stocks. The provincial capital stock series derived from this exercise are presented in the following Table 6.1. The actual calculations are presented in an Excel spreadsheet format in the Appendix section of this thesis.

Table 6.1: Estimated Provincial Capital Stocks, Rand (Millions, 2000)

	2002	2003	2004
SOUTH AFRICA	108621	108476	110037
Eastern Cape	10721.31929	17621.9007	16619.8259
Free State	6142.170336	5899.94394	5403.45399
Gauteng	22738.70125	20489.7552	19973.6938
Kwa Zulu Natal	27852.65059	26127.8788	25554.0193
Limpopo	8709.796385	9720.38516	13048.383
Mpumalanga	9070.382147	8083.11935	8165.79339
Northern Cape	3447.420995	2525.67224	2312.42118
North West	8010.575586	7171.28342	7323.02696
Western Cape	11927.98342	10836.0613	11636.3825

To disaggregate the data in Table 6.1 further by service, data from the Provincial Budgets and Expenditure Review (National Treasury, 2001/02 – 2007/08, Table A7) were used to sort payment flows by service and province. Based on these data service and province specific weights were constructed to arrive at service specific provincial capital stocks in 2000 prices. The provincial service specific capital stock series derived from this exercise are presented in Table 6.2.

Table 6.2: Estimated Provincial Capital Stocks by Service, Rand (Millions, 2000)

Province	Service	2002	2003	2004
Eastern Cape	Education	1501.52	1388.071	2821.388
	Health	1251.222	4994.373	4498.621
	Housing	49.16621	76.40853	55.51919
	Roads and Transport	6716.003	8873.32	7836.073
	Other	1203.408	2289.727	1408.226
Free State	Education	1748.595	1707.16	1247.264
	Health	632.3505	1344.937	1650.397
	Housing	0	33.01618	26.42633
	Roads and Transport	3214.599	2041.426	1660.33
	Other	546.6253	773.4048	819.0364
Gauteng	Education	4323.549	5871.504	7161.637
	Health	7088.884	5746.21	4325.126
	Housing	91.49975	56.90868	46.63329
	Roads and Transport	8860.98	7313.514	7344.52
	Other	2373.789	1501.619	1095.778
Kwa Zulu Natal	Education	5619.664	6176.21	5574.063
	Health	7641.529	5922.982	6267.042
	Housing	68.30814	44.4549	56.98932
	Roads and Transport	11466.76	11782.41	11727.76
	Other	3056.386	2201.823	1928.165
Limpopo	Education	2675.146	3522.37	4596.879
	Health	4059.482	3697.874	4212.667
	Housing	482.0651	585.2922	622.0286
	Roads and Transport	216.4252	246.8467	230.7204
	Other	1276.679	1668.003	3386.087
Mpumalanga	Education	1606.517	2459.147	1769.59
	Health	1619.642	1519.765	1815.713
	Housing	128.42	297.4365	424.4008
	Roads and Transport	4365.559	2966.208	3487.217
	Other	1350.243	840.5621	668.8725
Northern Cape	Education	223.4554	454.1565	253.7131
	Health	529.1825	484.1067	723.924

	Housing	343.5078	93.15999	14.36752
	Roads and Transport	2135.528	1277.54	1130.223
	Other	215.7472	216.7095	190.1935
North West	Education	1714.123	1646.253	1996.983
	Health	2626.792	1719.693	1770.945
	Housing	611.4277	226.5751	193.551
	Roads and Transport	2264.403	2715.328	2298.593
	Other	793.8308	863.4336	1062.954
Western Cape	Education	1481.912	1538.247	1882.791
	Health	2010.431	2286.489	3334.313
	Housing	24.46203	18.29483	27.86427
	Roads and Transport	6239.91	5668.525	5304.376
	Other	2171.267	1324.505	1087.038
South Africa	ALL SERVICES	108621	108476	110037

The second iteration: capital stocks for the WCDM by service: 1997-2007

In this illustrative exercise capital stocks for Western Cape district municipalities are calculated according to services provided in separate excel spreadsheets in the Simulation Model. The spreadsheets contain the formulae from Chapter 4 and use municipal infrastructure grant (MIG) expenditure data provided by the Western Cape Department of Local Government and Housing. The MIG expenditures are not the total capital expenditures made by the local municipalities. MIG represents only a proportion of all the capital expenditures.

Capital stock and infrastructure expenditures

The Excel Simulation Model estimates the value of capital stock within each local Western Cape Province district municipality per infrastructure related service. In order to do this the formula behind the model requires an identification of all funding directed to the district municipality that addresses the specific infrastructure need. However in the South African context, simply identifying the sources of funding is a problem on its own. Infrastructure funding is directed in many forms. In some cases it is difficult to identify the purpose of the related funding. In South Africa all municipal governments receive conditional and unconditional funding from national and provincial government sources.

The conditional funding is directed via the Municipal Infrastructure Grant (MIG) and before 2002, via the Consolidated Municipal Infrastructure Programme

(CMIP) and the Provincial Infrastructure Grant (PIG). The PIG allocates funds directed via the provincial departments for funding local government projects within the district municipality.

The unconditional funding is sourced via the Provincial Equitable Share (PES) and the Local Government Equitable Share. With unconditional funding, the relevant sphere of government may apply its discretion in distributing these funds to infrastructure related projects if it is deemed necessary. Including this funding stream into the model would require a complete analysis of every programme within each provincial and municipal department identifying the specific funds aimed at Capital Expenditure. At the provincial level such information is hard to get because of poor reporting and expenditure monitoring systems that do not clearly identify whether each sub-programme is a capital or current (or operational) expenditure item.

For illustrative purposes in this model, only the MIG, CMIP and other clearly identified infrastructure projects in the Western Cape Province were included in the model. The Excel Simulation Model spreadsheet used for this model has left placeholders (cells) that would support future incorporation of other sources of funding (e.g. the local government equitable share, etc). In the Simulation Model I separate the infrastructure expenditure data into two distinct sets. The first is the MIG/CMIP set and the second is called Global Capital Expenditure and includes the MIG/CMIP expenditures as well. The reason for this separation is to compare the results between the two sets of capital expenditure data.

Population: Western Cape Metropolitan and District Municipalities

The weighting formula requires population input data for the WC district municipalities. The most reliable population data available can be retrieved from the South African Census 2001 (Statistics South Africa, 2001). The Census 2001 data for the WC District Municipalities is captured in Table 6.3.

Table 6.3: Population: Cape Metropolitan & District Municipalities

Metropolitan & Municipal Districts	Population
City of Cape Town	5456328
Cape Winelands	1192559
Central Karoo	116569
Overberg	362113
Eden	835649
West Coast	517202
Western Cape	**8480803**

Source: *Statistics South Africa; Census, 2001*

The initial provincial capital stock data for the Western Cape is sourced from the first iteration of this exercise and is listed and highlighted in Table 6.4 below.

Table 6.4: Initial Capital Stock Value for the Western Cape

R' (000)	2002	2003	2004
SOUTH AFRICA	108,621.00	108,476.00	110,037.00
Eastern Cape	10,721.32	17,621.90	16,619.83
Free State	6,142.17	5,899.94	5,403.45
Gauteng	22,738.70	20,489.76	19,973.69
Kwa Zulu Natal	27,852.65	26,127.88	25,554.02
Limpopo	8,709.80	9,720.39	13,048.38
Mpumalanga	9,070.38	8,083.12	8,165.79
Northern Cape	3,447.42	2,525.67	2,312.42
North West	8,010.58	7,171.28	7,323.03
Western Cape	11,927.98	10,836.06	11,636.38

Source*: Petchey, MacDonald, Josie, Mabugu & Kallis, 2007, Financial & Fiscal Commission (FFC).*

The chosen value of **R11 636** million is based on the FFC 2007 estimation of WC Capital Stock.

The depreciation rate

The chosen time, region and service invariant depreciation rate is 0.05. This is an average rate that is very often used in municipal accounting in South Africa.

Selection and Classification of Actual Infrastructure Project Expenditure

As depicted in the tables in the Appendix the CMIP/MIG Projects within the Western Cape have been classified against the identified key infrastructure service areas. Various assumptions had to be made based on the name and intention of the particular project.

In Roads and Transport, access roads and storm water systems were included; in Sanitation, bucket system eradication, sewers and oxidation ponds were aggregated together; in Water, reservoirs, dams and pipelines were grouped together; and in electricity street lighting and distributors were grouped.

However there are various projects that are infrastructure related but do not fall within the above classification system. These projects have been assigned to either the "Other" or "Unknown" category. For the purposes of this exercise, this funding has not been incorporated.

To estimate the capital stock value for the Cape Winelands District I started with the Western Cape Province's capital stock estimate of R11, 636, 380 for 1997 (see Table 6.4 above) as the initial capital stock for all the municipal districts in the Province. Based on the name, project objectives and location of the CMIP and MIG projects I was able to classify the project spending across all district municipalities in the Western Cape Province according to local municipality and infrastructure service. I thereafter used the district municipality project spending data to build a PIM model for each district per service.

Using equation *(4.4)* $w_i^s = \frac{\sum_{i=t-n}^{t} w_{i,\tau}^s}{n}$ I calculated the average weighting per district municipality and per service where n is the number of periods (years) from the initial period, 1997 to 2007. These calculations are in the Excel Simulation Model spreadsheets for PIM. The services utilized in the exercise were grouped into the following categories: electricity, water, sanitation roads and transport and other. Based on this calculation the Cape Winelands initial stock value is reflected in Table 6.5 on the next page.

Table 6.5: CWDM Initial Capital Stock Estimate Value per Service for 1997

Service	Capital Stock Value (R million)
Electricity	468,709.38
Water	481,403.80
Sanitation	211,636.73
Roads and Transport	174,913.25
Cape Winelands Total Capital Stock	1,336,663.16

(*Source: Estimated using Initial Western Cape Capital Stock in Table 6.4)*

Data Requirements for Simulating Municipal Infrastructure Grant Allocations

Recall that the Cape Winelands District Municipality includes the Breede River, Breede Valley, Drakenstein, Stellenbosch and Witzenberg local municipalities. From Chapter 5, Tables 5.3 to 5.7 we have an official indication of the level of sanitation backlogs and the funding required to eradicate the backlogs in the five municipalities. Recall also that using the PIM methodology described above, in Tables 5.8 and 5.9 (Chapter 5), I presented the estimated sanitation capital stock values and capital spending estimates for MIG and CMIP sanitation projects for the municipalities. These estimates were based on MIG and CMIP data from 1997 to 2006. Tables 5.3 to 5.7 present a disaggregated picture of the current levels of backlogs and disparity in the provision of sanitation services within and among the local municipalities. On the other hand Tables 5.8 and 5.9 present an aggregated estimate of sanitation capital stock values and capital spending using the PIM methodology. These estimates will help calculate the future aggregated equitable infrastructure grant allocations for each municipality using the proposed municipal infrastructure grant model.

Data requirements

To conduct simulations for the five local municipalities using the infrastructure grant model in an Excel Simulation Model programme the capital stock and disparity data sets from Chapter 5 are used as inputs. These data sets are listed below.

Capital stock data inputs

- Complete expenditure history of funds dedicated to all infrastructure projects and activities for each local municipality.

- Sum of funding on CMIP and MIG projects in entire district municipality of the Cape Winelands.
- Population count of each local in 1996, 2001 and 2007 as per Census 1996 and 2001 and the Community Survey of 2007.
- Mid Year Population Estimates for the Western Cape Province for 1997 to 2006 from Statistics South Africa.
- An initial capital stock estimate for the Cape Winelands.

Disparity indicator data inputs

- A population density indicator for each local municipality.
- An unemployment percentage rate indicator for each local municipality.
- An indicator of the percentage of households with no income for each local municipality.
- An indicator for TB Prevalence per 100000 people for each local municipality.
- An indicator for HIV prevalance for each local municipality.
- An indicator for the percentage of illiterate people over 14 years for each local municipality.
- A housing backlogs indicator for each local municipality.
- A normalized Deprivation Index for each local municipality.

Activating the Excel Simulation Model

In this section, I will explain how the infrastructure grant model can simulate estimates for equitable grant allocations for sanitation services for the five Cape Winelands local municipalities. In this example the following outputs are calculated and generated by the Excel simulation model:

- The capital stock estimate for the municipal service/s for each local municipality from 1997 to 2015 using the PIM.
- The desired capital stock estimate for the municipal service/s for each local municipality from 1997 to 2015 using the PIM.
- The calculated capital stock backlogs for municipal service/s for each local municipality from 1997 to 2015.

- The desired capital stock per capita for the five combined Cape Winelands local municipalities from 1997 to 2015.
- The calculated composite capital cost disparity index for each local municipality.
- The estimated domestic grant allocation for each local municipality for 2007 to 2015.
- The estimated per capita economic grant allocation for each local municipality for 2007 to 2015.
- The total infrastructures grant allocation for each local municipality for 2007 to 2015.

Step 1: Producing the required population data series input

As noted earlier (see Chapter 4 and 5) a consistent set of population data per local municipality is not available for the required period. I therefore make some assumptions in order to produce a consistent population dataset.

The data that is available includes Western Cape midyear estimates for 1996 – 2007 and local municipality population for the five municipalities for 1996, 2001 and 2007. This means therefore that data per local municipality for the missing years are required. I calculate this as follows.

First, I derive the share of Cape Winelands population data from the Western Cape provincial population data for 2001. Secondly, I use the Cape Winelands share of the population data to produce a time series population data set from 1996 to 2001 for the Cape Winelands by dividing the Western Cape province data set total by the share calculated for the Cape Winelands District. Thirdly, using the Cape Winelands population data for 1996 to 2001 I can then calculate the missing-year population data values for each local municipality by dividing the Cape Winelands population by the 2001 ratio for each local municipality. Similarly, using the 2007 totals from Statistics South Africa, I am able to calculate the population data for 2002 to 2007.

In my example the simulation model is expected to generate allocations for three medium term expenditure programme budgets (three years per budget) from 2008 to 2015. I therefore also require a projected population data set for the future period of 2008 to 2015. This projection is based on the average growth rate experienced from 1996 to 2007. Using the average growth rate, the local municipality population data for 2008 is the local municipality population data for 2007 multiplied by the average growth rate.

Step 2: Estimating the disparity index for each local municipality

The Excel simulation model estimates the composite disparity indicator from an average of all the eight disparity measures multiplied by the *beta* weight for each indicator as follows. Firstly, the model calculates the difference of the disparity measure over the average value of the disparity and then calculates the average differences for each disparity. Secondly, the *betas* ($\beta_{i,t,j}$) are applied to the difference of the disparity value. Thirdly, the spreadsheet model calculates the disparity index (γ_i) from equation 4.6 in Chapter 4. Finally, the simulation model calculates the disparity indicator for each local municipality according to the Excel formula derived from equation 4.7 in Chapter 4.

Using the estimated values it is now possible to attach the disparity weights to the capital backlogs per service for periods 1, 2 and 3. By adjusting the *beta* (β) values and the input depreciation I can adjust the outcome of how to reduce the backlogs progressively over time according to the importance of the disparity. In order to prioritize the progressive reduction of capital backlogs it will probably be best to determine and rank the set of disparities that relate to a set of infrastructure services.

In this illustrative example I run simulations using the Excel model for basic services and the funding of related infrastructure. In Chapter 5 I identified eight disparities and all of them are used in the illustrative simulations. The disparity indicator input data are presented in Table 6.5 below.

Table 6.6: Disparity Indicator Input Data for Excel Simulation Model

Disparity Indicators	Breede River	Breede Valley	Drakenstein	Stellenbosch	Witzenberg
1. Population Density (Dispersion p/km²)	27.783	51.059	126.288	140.32	30.771
2. Percentage Unemploymen t Rate	12.2	19.7	22.8	17.1	14.6
3. Income Inequality as a Percentage of households with no income	10.59	8.96	10.47	19.95	8.21
4. TB prevalence per 100 000	1188	1621	1196	890	358
5. Percentage of HIV/AIDS prevalence (2005) in Population	3.2	3.7	5.4	4	4.2
6.Iliteracy: Percentage of poulation over 14 illiterate (less than grade 7)	38	14	23	20	35
7. Housing backlogs units (2004)	4300	11876	11000	10500	3000
8. Deprivation Index (normalized)	1.882	1.937	1.954	1.908	1.906

As in the FFC Capital Grant Scheme Model, developed by *Petchey, et al (2004),* all or some of the disparities can be switched off by the user by setting the associated *beta* value equal to zero. Setting a zero value for a *beta* will exclude its influence completely, whilst a low value (between 0 and 1) would reduce its overall influence. If all the *betas* are set equal to zero then the effect of the disparities are taken out of the simulations. The Excel simulation model also creates the possibility of including more disparities within the separate spreadsheet sub-programme without affecting the main programme that includes the formulae. However, the strength of the influence of the *betas* can only be determined over time with extended testing and revisions and, the exclusion of old and, inclusion of new disparities.

In the next chapter (Chapter 7) of this thesis, in addition to presenting the findings of the research, I will also show how the Excel simulation model uses the population data to generate for each disparity indicator (X) its percentage mean deviation from the mean value (D) and the resultant composite disparity index (γ_i) for each municipality and its shares ($\tau_{i,t}$) of the grant pool for each period.

Step 3: Generating PIM estimates for capital stock for each local municipality

The PIM Excel spreadsheet simulation model uses equation (4.2) in Chapter 4 to calculate stock values for each local municipality for each year from 1997 to 2007.

The Excel Simulation Model spreadsheet formula is derived from the two separate terms of equation (4.2) where, $K^s_{i,t}$, the capital stock, is equal to term one $K^s_{i,t-n}(1-\delta)^n$ plus term two $\sum_{\tau=t-n}^{t-1} k^s_{i,\tau}(1-\delta)^{t-\tau-1}$. Term one is the previous stock value reduced by the invariant depreciation rate to the power of the *n*th period. Term two is the sum of all infrastructure expenditure in the year reduced by the depreciation rate to the power of the number of years.

In the Excel Simulation Model spreadsheet the initial capital stock value is based on a different formula derived respectively from equations (4.3); (4.4) and (4.6) in Chapter 4. This initial capital stock value is estimated as the average weight, multiplied by the initial capital stock value of the Western Cape Province (derived from the Financial and Fiscal Commission estimates mentioned in Chapter 5) and not of the Cape Winelands District as a whole as this data are not available. The average weight is calculated as the average of the sum of weights which are individually estimated from the expenditure of a local municipality divided by the expenditure of the Cape Winelands District for a particular period and, multiplied by the ratio of the population of the local municipality, divided by the population of the Cape Winelands as a whole for 2001 **only**. This was a major shortcoming of the PIM application in the model as consistency between the population and the expenditure for the period could not be established with certainty.

Step 4: Determining the Capital Stock Value for Period One

Period one is the 3-year medium term expenditure framework (MTEF) of the three years following 2006. 2006 was the last year of expenditure data that was available from the CMIP/MIG dataset. Therefore period one includes 2007, 2008 and 2009.

Estimating the capital stock value for period one required population data for the same period as well the assumed spending for the period, i.e. the budgeted values that was collected from the infrastructure pool of funds available for each year for the particular period. The pool of funds used was the MTEF infrastructure budget (See Chapters 4 for an explanation of the determination of the pool of funds).

The population for 2007 is based on the 2007 community survey data whilst the population for 2008 and 2009 is a projection estimated according to the methodology discussed above. Feeding these values (population and pool of funds data) into the Excel Simulation Model PIM spreadsheet, I was able to estimate a capital stock value for Period One.

Step 5: Determining Capital Stock Values for Period Two

Period two is the 3-year MTEF following period one. Therefore period two includes 2010, 2011 and 2012.

Calculating the capital stock value for period two again required population for the same years as well the assumed infrastructure spending for the period. As this period is well in the future, the MTEF budgeted values would not be available. Of course the functionality of the model would be improved if the infrastructure budget values for period two and period three were released by national government. As this population and expenditure data is not available, it must therefore be estimated. The population for 2010, 2011 and 2012 was a projected estimate calculated in Step 1. Feeding these values (population and pool of funds) into the PIM model, I estimated a projected capital stock value for period two.

Step 6: Determining Capital Stock Values for Period Three

Period three is the 3-year MTEF following period two. Therefore period three includes 2013, 2014 and 2015.

Estimating the capital stock value for period three again required population data as well the estimated spending for the period. The population for 2013, 2014 and 2015 was the same projected estimate calculated in Step 1. Feeding these values (population and pool of funds) into the PIM Excel model, I estimated a projected capital stock value for period three.

Step 7: Estimating the Standard Desired Capital Stock Levels

The purpose of estimating the standard desired capital stock is discussed in Chapter 4 and illustrated in *Figure 4.2.* The figure shows that for a comparatively poor municipality, the actual capital stock is depicted below the standard. In the preceding period the municipality has a capital backlog defined as the difference between the standard and actual capital stock at a point in time. Therefore, municipalities that lie above the standard norm (i.e.; they have more than the nationally determined standard norm for the particular service), will have a capital stock surplus or no backlog.

In my illustrative simulation exercise the key question is, with a limited amount of infrastructure funds, how does government raise the level of net allocations and spending for the poor municipality so that its actual capital stock equals the standard desired capital stock at some future period. Achieving this goal can only take place over several medium term budget expenditure programmes through the progressive elimination of municipal service infrastructure backlogs and the consequent creation of new capital stock. Thus the Excel Simulation Model provides an objective mechanism to equitably allocate additional resources from a limited grant pool to municipalities for a chosen period of time to enable them to transform their capital stocks from the actual starting point toward the desired standard. As I noted in Chapter 4 the particular path taken is called the "transition path".

In the Excel Simulation Model the desired sanitation service capital stock levels were calculated for the period taking account of the data inputs available for infrastructure expenditure, population, the PIM estimated capital stock and, the given medium term budget pool of funds data.

The standard desired capital stock per capita was calculated in the simulation model as the total capital stock generated by the PIM for each local municipality divided by the total population of the Cape Winelands for each year. In turn the desired capital stock for each local municipality was calculated as the capital stock value for the local municipality multiplied by the per capita desired stock and, further multiplied by the calculated composite disparity index for each local municipality.

It should be noted that the composite disparity index is not dynamic – i.e. the formula used a static view of the disparity measure based on indicators at a specific point in time. However, as the disparity indicator data are collected periodically (every five to ten year intervals respectively) during national census or during household surveys it is reasonable to assume that the disparity indicator values will remain valid over the chosen period.

Step 9: Estimating the Capital Backlog Levels

Backlogs were calculated in the simulation model as the difference between the actual capital stock value (calculated by the PIM formulae) and the standard desired capital stock values. When backlogs were estimated and produced negative values – i.e. the model believes no backlog exist, I substituted the backlog value with a value of *(0.1)* to enable the division by zero errors. The zero errors occur because of inconsistencies in the datasets and the assumptions used in calculating the capital stock values.

Description and Location of the calculations in the Excel Simulation Model

The Excel Simulation Model is located in a separate Excel file folder called *Simulation Model with Scenarios Municipal Infrastructure Grants MJJPhD 2010* in a compact disc attached to a copy of the thesis. The Simulation Model folder is divided into six separate Excel files. The first Excel file runs a model simulation in which the capital cost disparity indices are excluded because the *beta* (β) values are all set to zero. The file is labeled *Scenario 0 - Simulation - MunCAPEX (REVIEW 20100817).xls*. The second, third and fourth files run simulation scenarios 1, 2, and 3 and, are discussed in Chapter 7. The files are labeled *Scenario 1 - Simulation - MunCAPEX (REVIEW 20100817).xls; Scenario 2 - Simulation - MunCAPEX (REVIEW 20100817).xls* and, *Scenario 3 - Simulation - MunCAPEX (REVIEW 20100817).xls* respectively. The fifth Excel file is labeled *Scenario Comparisons Simulations 20100817.xls*, and captures the results of all the scenarios in tables that facilitates comparisons on which my findings for the evaluation of the model are based. The sixth spreadsheet is labeled *Scenario Comparisons with total allocations in Tab 7.15. 20110126.xls* and, calculates the total allocations (historical backlog grant and per capita economic grant) for each municipality over the period. Each of the Excel files contains spreadsheet Tabs for estimating the capital stock data inputs. The Tabs are labeled *Capital Stock PIM*; *PIM Calculation* for each local municipality and, *Capital Expenditure Flows*.

Estimates for Capital Spending and Capital Stock in the Cape Winelands District

Following the process described above the simulation model firstly generated the capital stock estimates for electricity, water, roads and transport, and sanitation services in millions of Rand for the Cape Winelands District as a whole for the period 1997 to 2007. These estimates are presented in Table 6.7. The estimates calculated for the other four Districts (Central Karoo, Overberg, Eden and West Coast) are presented in the Appendix. Calculating the estimates for the Cape Town Metropolitan local municipality was not undertaken because I assumed that metropolitan municipalities raise much of their capital expenditures from own revenues or borrowing whereas the majority of the local municipalities depend largely on transfers from National and Provincial governments.

Secondly, the model generated the capital stock estimates for the five local municipalities (Breede River, Breede Valley, Drakenstein, Stellenbosch and Witzenberg) in the Winelands District. As I noted in Chapter 5 the illustrative capital stock estimates are based on CMIP, MIG and other infrastructure project spending data kindly provided by the Western Cape Province, Department of Provincial, Local Government and Housing during the process of interviews conducted in 2009. The calculated capital stock estimates for the five municipalities are presented in Tables 6.8 to 6.12. Based on these estimates the simulation model was able to calculate the capital backlogs and the desired level of capital stock for the five local municipalities.

Table 6.7: Cape Winelands Total Estimated Capital Spending and Capital Stock for Electricity, Water, Roads and Transport and Sanitation from 1997 to 2006 using CMIP and MIG Project Expenditures from Western Cape Department of Provincial, Local Government & Housing.

	Electricity		Water	
Year	**Capital Stock Estimate**	**Capital Spending**	**Capital Stock Estimate**	**Capital Spending**
1997	R 468,709.38	R 0.00	R 481,403.80	R 1,421,793.00
1998	R 445,273.91	R 2,642,573.00	R 1,879,126.61	R 2,840,237.00
1999	R 3,044,432.71	R 3,355,948.00	R 5,886,852.12	R 12,873,262.34
2000	R 8,476,612.84	R 618,200.00	R 21,901,895.51	R 7,781,207.45
2001	R 13,095,526.87	R 2,647,165.00	R 41,632,361.12	R 3,494,859.44
2002	R 18,661,943.15	R 18,661,943.15	R 58,312,660.68	R 1,606,504.00
2003	R 23,610,901.47	R 1,316,949.00	R 69,265,084.58	R 5,452,962.00
2004	R 27,203,347.56	R 2,544,674.21	R 78,903,278.45	R 7,766,539.41
2005	R 30,771,156.53	R 4,029,262.57	R 89,118,828.67	R 9,340,128.37
2006	R 35,510,470.77	R 1,776,643.03	R 100,441,360.10	R 3,852,296.99
2007	R 38,349,192.76		R 106,050,806.90	
	Roads and Transport		**Sanitation**	
Year	**Capital Stock Estimate**	**Capital Spending**	**Capital Stock Estimate**	**Capital Spending**
1997	R 174,913.25	R 0.00	R 211,636.73	R 0.00
1998	R 166,167.59	R 3,671,543.00	R 201,054.89	R 3,031,606.00
1999	R 3,821,509.25	R 7,071,371.00	R 3,213,058.04	R 4,260,593.32
2000	R 13,835,803.34	R 2,699,943.00	R 9,895,414.66	R 4,205,504.00
2001	R 24,000,661.30	R 1,317,643.76	R 19,048,969.15	R 2,166,331.79
2002	R 31,983,645.32	R 4,432,651.00	R 27,345,698.46	R 2,920,176.00
2003	R 40,685,340.87	R 5,791,484.00	R 34,997,447.98	R 3,780,609.00
2004	R 50,519,276.37	R 1,475,319.29	R 42,371,686.64	R 8,941,549.66
2005	R 55,992,665.57	R 4,408,705.04	R 54,086,872.57	R 10,638,881.35
2006	R 61,051,337.64	R 800,000.00	R 69,404,899.30	R 7,687,045.46
2007	R 61,827,584.59		R 82,793,168.24	

Table 6.8: Breede River - Total Estimated Capital Spending and Capital Stock for Electricity, Water, Roads and Transport and Sanitation from 1997 to 2006

	Electricity		Water		Roads and Transport		Sanitation	
Year	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending
1997	R 419.02	R 0.00	R 34,220.07	R 0.00	R 2,712.26	R 0.00	R 39,296.12	R 0.00
1998	R 398.07	R 60,000.00	R 32,509.07	R 100,118.00	R 2,576.64	R 161,133.00	R 37,331.31	R 0.00
1999	R 60,359.26	R 0.00	R 129,457.43	R 4,437,609.16	R 163,458.42	R 138,867.00	R 33,691.51	R 378,348.00
2000	R 108,750.52	R 0.00	R 4,643,714.83	R 1,675,154.00	R 432,088.51	R 0.00	R 407,234.26	R 840,000.00
2001	R 142,727.98	R 0.00	R 9,763,573.95	R 70,875.00	R 629,284.98	R 0.00	R 1,531,125.45	R 1,709,199.79
2002	R 161,882.69	R 0.00	R 13,307,919.64	R 250,000.00	R 750,407.59	R 385,000.00	R 4,033,414.54	R 987,446.00
2003	R 167,869.03	R 0.00	R 15,497,943.43	R 2,287,080.00	R 1,186,923.47	R 0.00	R 6,658,602.24	R 554.00
2004	R 163,656.06	R 0.00	R 18,539,501.56	R 1,431,920.00	R 1,432,412.61	R 0.00	R 8,159,492.60	R 1,465,577.89
2005	R 152,678.29	R 0.00	R 21,062,278.28	R 1,189,999.95	R 1,523,654.49	R 0.00	R 10,212,817.20	R 2,360,643.02
2006	R 138,125.64	R 0.00	R 22,789,142.86	R 1,422,839.37	R 1,504,976.91	R 0.00	R 13,356,925.97	R 2,800,304.13

Source: Infrastructure Expenditure Data: Western Cape Department of Provincial, Local Government & Housing CMIP & MIG Status Report, 27 October 2006

Table 6.9: Breede Valley - Total Estimated Capital Spending and Capital Stock for Electricity, Water, Roads and Transport and Sanitation from 1997 to 2006

	Electricity		Water		Roads and Transport		Sanitation	
Year	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending
1997	R 76,721.96	R 0.00	R 104,816.26	R 0.00	R 99,967.92	R 0.00	R 57,976.94	R 0.00
1998	R 72,885.86	R 1,885,521.00	R 99,575.45	R 1,651,912.00	R 94,969.52	R 1,741,775.00	R 55,078.09	R 364,558.00
1999	R 1,951,300.49	R 1,583,000.00	R 1,741,778.84	R 1,850,748.00	R 1,827,485.00	R 1,992,949.00	R 414,265.98	R 1,508,968.32
2000	R 5,047,241.21	R 500,000.00	R 4,913,422.03	R 1,352,976.45	R 5,214,475.20	R 930,483.00	R 2,210,479.71	R 508,199.00
2001	R 7,816,542.21	R 555,000.00	R 8,604,050.58	R 1,600,000.00	R 8,642,959.13	R 497,992.56	R 4,071,182.04	R 0.00

2002	R 10,123,547.43	R 0.00	R 12,629,586.08	R 598,656.00	R 11,361,699.24	R 592,173.00	R 5,307,398.93	R 1,028,869.00
2003	R 11,313,230.88	R 0.00	R 15,555,901.27	R 875,410.00	R 13,384,311.09	R 1,737,827.00	R 6,979,630.99	R 749,131.00
2004	R 11,578,369.67	R 0.00	R 17,697,071.24	R 4,495,938.95	R 15,865,387.82	R 0.00	R 8,547,562.46	R 2,415,482.16
2005	R 11,175,349.67	R 0.00	R 22,728,652.54	R 4,540,385.09	R 16,718,115.43	R 0.00	R 11,575,864.27	R 1,654,334.37
2006	R 10,362,579.07	R 0.00	R 29,303,756.14	R 386,791.47	R 16,419,640.73	R 800,000.00	R 14,559,990.85	R 800,000.00

Source: Infrastructure Expenditure Data: Western Cape Department of Provincial, Local Government & Housing CMIP & MIG Status Report, 27 October 2006

Table 6.10: Drakenstein - Total Estimated Capital Spending and Capital Stock for Electricity, Water, Roads and Transport and Sanitation from 1997 to 2006

	Electricity		**Water**		**Roads and Transport**		**Sanitation**	
Year	**Capital Stock Estimate**	**Capital Spending**	**Capital Stock Estimate**	**Capital Spending**	**Capital Stock Estimate**	**Capital Spending**	**Capital Stock Estimate**	**Capital Spending**
1997	R 110,983.85	R 0.00	R 140,268.75	R 1,421,793.00	R 119,131.44	R 0.00	R 148,854.74	R 0.00
1998	R 105,434.66	R 0.00	R 1,555,048.31	R 558,207.00	R 113,174.87	R 0.00	R 141,412.00	R 464,085.00
1999	R 95,154.78	R 0.00	R 3,312,341.45	R 1,701,075.00	R 102,140.32	R 3,840,000.00	R 591,709.33	R 2,106,650.00
2000	R 81,583.33	R 0.00	R 6,354,458.58	R 2,604,307.00	R 3,927,572.56	R 0.00	R 3,054,847.54	R 1,363,896.00
2001	R 66,450.13	R 816,691.00	R 11,118,866.07	R 456,176.00	R 6,847,032.40	R 573,800.00	R 6,272,242.63	R 391,332.00
2002	R 868,108.84	R 1,511,909.00	R 14,705,706.46	R 282,025.00	R 9,337,503.15	R 1,286,860.00	R 8,839,521.48	R 265,861.00
2003	R 2,925,905.22	R 443,837.00	R 16,889,103.42	R 685,153.00	R 11,988,212.84	R 1,021,972.00	R 10,550,592.27	R 2,844,040.00
2004	R 4,660,482.92	R 336,163.00	R 18,254,548.78	R 1,258,754.76	R 14,261,863.64	R 610,259.25	R 14,062,007.21	R 3,471,677.69
2005	R 5,914,376.06	R 1,198,337.00	R 19,506,440.45	R 2,787,743.33	R 15,667,416.10	R 3,157,264.70	R 19,160,128.95	R 4,181,253.26
2006	R 7,607,259.66	R 809,176.89	R 22,107,865.74	R 1,715,866.15	R 18,927,158.61	R 0.00	R 25,596,463.98	R 3,128,679.46

Source: Infrastructure Expenditure Data: Western Cape Department of Provincial, Local Government & Housing CMIP & MIG Status Report, 27 October 2006

Table 6.11: Stellenbosch - Total Estimated Capital Spending and Capital Stock for Electricity, Water, Roads and Transport and Sanitation from 1997 to 2006

	Electricity		Water		Roads and Transport		Sanitation	
Year	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending
1997	R 99,314.08	R 0.00	R 16,434.43	R 0.00	R 50,753.11	R 0.00	R 22,566.66	R 0.00
1998	R 94,348.37	R 397,052.00	R 15,612.71	R 0.00	R 48,215.46	R 1,310,985.00	R 21,438.33	R 1,321,963.00
1999	R 482,201.41	R 1,252,948.00	R 14,090.47	R 883,830.18	R 1,354,499.45	R 194,015.00	R 1,341,311.09	R 18,037.00
2000	R 2,043,574.83	R 0.00	R 895,911.00	R 1,012,770.00	R 2,600,764.72	R 351,000.00	R 2,423,908.45	R 412,000.00
2001	R 3,213,144.50	R 1,108,474.00	R 2,582,133.78	R 701,750.00	R 3,836,817.33	R 219,027.00	R 3,596,495.34	R 0.00
2002	R 5,065,951.99	R 278,319.00	R 4,459,544.13	R 0.00	R 4,820,437.41	R 1,613,584.00	R 4,323,995.95	R 250,000.00
2003	R 6,452,957.16	R 873,112.00	R 5,616,636.05	R 211,400.00	R 6,916,050.69	R 2,715,889.00	R 4,892,575.96	R 0.00
2004	R 7,972,018.73	R 2,027,321.34	R 6,355,244.69	R 200,000.00	R 10,749,582.06	R 0.00	R 5,045,007.79	R 0.00
2005	R 10,608,515.62	R 1,342,115.54	R 6,727,490.52	R 822,000.00	R 12,755,346.00	R 1,120,000.00	R 4,893,883.78	R 362,000.00
2006	R 13,081,855.99	R 967,466.14	R 7,447,723.71	R 76,800.00	R 14,501,710.23	R 0.00	R 4,915,943.78	R 958,061.87
2007	R 14,876,109.57		R 7,583,367.74		R 14,822,237.50		R 5,641,416.60	

Source: Infrastructure Expenditure Data: Western Cape Department of Provincial, Local Government & Housing CMIP & MIG Status Report, 27 October 2006

Table 6.12: Witzenberg - Total Estimated Capital Spending and Capital Stock for Electricity, Water, Roads and Transport and Sanitation from 1997 to 2006

	Electricity		Water		Roads and Transport		Sanitation	
Year	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending
1997	R 17,436.46	R 0.00	R 27,984.23	R 0.00	R 30,871.17	R 0.00	R 21,890.39	R 0.00
1998	R 16,564.63	R 300,000.00	R 26,585.01	R 530,000.00	R 29,327.61	R 457,650.00	R 20,795.87	R 881,000.00
1999	R 314,949.58	R 520,000.00	R 553,992.98	R 4,000,000.00	R 484,118.17	R 905,540.00	R 899,768.27	R 100,861.00
2000	R 1,075,029.90	R 102,200.00	R 4,978,479.73	R 1,136,000.00	R 1,755,378.32	R 1,353,460.00	R 1,709,249.82	R 887,138.00
2001	R 1,742,568.57	R 167,000.00	R 9,469,327.85	R 666,058.44	R 4,056,518.74	R 26,824.20	R 3,170,253.11	R 65,800.00
2002	R 2,338,968.84	R 0.00	R 13,136,852.57	R 475,823.00	R 5,661,095.59	R 555,034.00	R 4,208,036.95	R 388,000.00
2003	R 2,660,429.40	R 0.00	R 15,651,800.63	R 1,393,919.00	R 7,112,586.24	R 315,796.00	R 5,148,501.59	R 186,884.00
2004	R 2,751,895.83	R 181,189.87	R 18,019,411.62	R 379,925.70	R 8,086,382.99	R 865,060.04	R 5,734,722.04	R 1,588,811.92
2005	R 2,856,171.61	R 1,188,810.03	R 19,069,088.24	R 0.00	R 9,193,160.54	R 131,440.34	R 7,425,708.49	R 2,080,650.70
2006	R 3,967,892.80	R 0.00	R 18,777,191.90	R 0.00	R 9,562,488.75	R 0.00	R 10,200,816.97	R 0.00
2007	R 4,435,126.71		R 17,663,563.19		R 9,305,494.75		R 11,352,336.08	

Source: Infrastructure Expenditure Data: Western Cape Department of Provincial, Local Government & Housing CMIP & MIG Status Report, 27 October 2006

Summary

In this chapter I present the complete technical formulation of a municipal infrastructure grant model and its Excel simulation model counterpart. I also describe and locate the Excel Simulation Model. The model is an adaptation of the provincial capital grant model first developed by Petchey et al (2004) for the Financial and Fiscal Commission (FFC, 2005) and later published as a journal article in 2008 (*Josie et al, 2008)*. Following a discussion of the required population, capital stock and disparity data I also present a step-by-step discussion of how the model can be used to simulate capital stock outputs that can then be used as inputs to generate equitable infrastructure grant allocations from a given and limited pool of funds. In the next chapter I will use the output data and present results and findings to illustrate how the model can produce composite disparity indices and equitable allocations given different values of the *betas*.

Chapter 7

Model Simulations, Results And Findings

The purpose of the research for this thesis was to study the implications of taking account of capital cost disparities and capital backlogs in intergovernmental infrastructure grant transfers to municipalities with historically disadvantaged communities. The ultimate aim was to explore and test the possibility of accounting for capital cost disparities in a grant model intended to equitably allocate infrastructure finance to municipalities within the constraints of a limited available pool of funds. My preliminary research from interviews with municipal, provincial and National Government officials (see Appendix for a summary of the responses to my interview questions) and, from government reports and the literature found that there is a disjuncture in the way the current municipal infrastructure grant allocations are made. Informed by this initial finding I posed a fundamental question and two sub-questions that guided my case study on which this thesis is based. The questions were informed by the two propositions derived from my preliminary research and presented in Chapter 1.

Recall that the study sought to answer the fundamental question that asked: *How can municipal infrastructure grants take account of historical backlogs and disparities that differentiate municipalities from each other?* From the main question the empirical research was guided by two sub-questions suggested by the two propositions respectively. The first asks: *What is the likely impact on grant shares of including capital cost disparities in an infrastructure grant model?* The second asks: *Can equitability, stability, predictability and flexibility of municipal budgets be enhanced by the inclusion of capital cost disparities and efficiency in a municipal infrastructure grant model?*

To address the main question and the two sub-questions I set myself three fundamental objectives. The first was to analytically review the way in which municipal infrastructure grants are currently allocated for redressing socio-economic disparities and infrastructure backlogs. The second was to evaluate the appropriateness of the Financial and Fiscal Commission (FFC) Provincial Capital

Expenditure Grant Scheme (Petchey et al, 2004) for allocating targeted municipal infrastructure grants. The third was to assess the trade-off between the equitability of allocations that take account of capital cost disparities within and between municipalities and, economic efficiency considerations.

I argued in chapters 1, 3 and 4 that government's current approach and formula used for equitably allocating infrastructure grants to local municipalities is not equitable, stable, predictable and flexible enough to enable municipalities to provide basic services as required in the Bill of Rights. My main argument is that equitability is compromised by government not adequately taking into account capital cost disparities and economic efficiencies that differentiate local municipalities from each other. Furthermore, I also argued that the unit-cost driven project based approach currently used for allocating municipal infrastructure grants undermined the budgeting principles of stability, predictability and flexibility in the Constitution. In the absence of capital budget stability, predictability and flexibility local municipalities will not be able to ensure the progressive eradication of historical backlogs and the provision of basic services as required by the Bill of Rights. My analysis was based on a review of the relevant international and national public finance and related socio-economic literature and, the relevant government and media reports. These analyses were presented in the preceding chapters of this thesis.

My arguments were also supported by statistical analyses based on officially published secondary data for the Western Cape Province and the five Cape Winelands District local municipalities. In this chapter I will present the findings and results of my analyses. All calculations are undertaken and, results generated, in the Excel Simulation Model. By first excluding and then including disparities in the simulations I was able to undertake the following comparisons: the positive or negative effects of disparities on infrastructure backlogs; the impact of disparities on the municipalities' share of the available infrastructure grant pool; the impact of disparities on the speed with which municipal backlogs are reduced and, how disparities affect the economic per capita portion of an infrastructure grant.

The Excel Simulation Model is located in a separate Excel file folder called *Simulation Model with Scenarios Municipal Infrastructure Grants MJJPhD 2010*. The Simulation Model folder is divided into six separate Excel files. The first Excel file runs a model simulation in which the capital cost disparity indices are excluded because the *beta* (β) values are all set to zero. The file is labeled *Scenario 0 - Simulation - MunCAPEX (REVIEW 20100817).xls*. The second, third and fourth files run simulation scenarios 1, 2, and 3 as discussed in the first section of this chapter. The files are labeled *Scenario 1 - Simulation - MunCAPEX (REVIEW 20100817).xls; Scenario 2 - Simulation - MunCAPEX (REVIEW 20100817).xls* and, *Scenario 3 - Simulation - MunCAPEX (REVIEW 20100817).xls* respectively. The fifth Excel file is labeled *Scenario Comparisons Simulations 20100817.xls*, and captures the results of all the scenarios in tables that facilitates comparisons on which my findings for the evaluation of the model are based. The sixth spreadsheet is labeled *Scenario Comparisons with total allocations in Tab 7.15. 20110126.xls* and, calculates the total allocations (historical backlog grant and per capita economic grant) for each municipality over the period. Chapter 7 is presented in two sections aimed at addressing the two sub-questions.

Section One: The impacts on grant shares of including capital cost disparities in a grant model for equitably allocating infrastructure funds to municipalities.

The first step in analyzing and discussing the impact of capital cost disparities is to aggregate all eight disparity indicators presented in Chapter 5 into one composite disparity index. The next step is to assess the impact of the composite disparity index on the share of infrastructure grants to the five municipalities. A municipality's percentage share of the grant is from the designated national pool of funds available for infrastructure for the five local municipalities in the Cape Winelands Municipal District.

Estimating a Composite Capital Cost Disparity Index in an Infrastructure Grant Model

Based on a selection of the eight socio-economic indicators discussed in Chapter 5 I will define a set of disparity measures that differentiates five local municipalities from each other. My argument here is that if these disparities are taken into account within an infrastructure grant model the allocations to municipalities will come close to reflecting the real cost of infrastructure based services while at the same time meeting the requirements set out in *Section 214(1) (a) to (c) and Section 214(2) (d), (e), (f), (g) and (h)* of the Constitution. From these disparity measures I will be able to construct composite capital cost disparity indices that may be assigned as weights for each of the municipalities in my infrastructure grant model. By taking the composite capital cost disparity indices into account in the model I will be able to show how disparities can impact on the way infrastructure grants are shared amongst municipalities.

To test the impact of disparities on the infrastructure grant shares my case study used the defined disparity indicators (see Chapter 5) from the following five local municipalities falling within the jurisdiction of the Cape Winelands District Municipality of the Western Cape Province, viz; Breede River, Breede Valley, Drakenstein, Stellenbosch and Witzenberg[36]. By running simulations that includes disparities in the model calculation I assess the impact of disparities on a municipality's share of the infrastructure grant pool allocated through the National Government intergovernmental transfer. In Chapter 4 I presented in Table 4.1, a set of criteria against which my main propositions may be discussed and, based on Tables 4.1, 4.2 and 4.3 I proposed criteria for the prioritization and ranking of disparity indicators and the choice of *beta (β)* values to be taken into account when allocating infrastructure grants. Recall that the *beta (β)* values rank the importance of a given disparity indicator. The criteria included overcoming the legacy of apartheid; improving the capabilities of previously disadvantaged communities; targeting unemployment and income distribution variables for macroeconomic stability; ensuring compliance with the Bill of Rights; mitigating

[36] *The profiles of the five municipalities are presented in detail in Chapter 5.*

the potential for conflict generated by inequality and inadequacy in the delivery of municipal services and, ensuring sustainable use of natural resources.

I assume the role of policy-maker and informed by the criteria I prioritize my set of disparity indicators and, assign three different *beta (β)* values for all the disparities measures in order to derive three sets of composite capital cost disparity indices. Using the Excel Simulation Model I construct the three sets of disparity indices. The results from these simulations constitute three scenarios in which the *beta (β)* values are varied. The idea behind this exercise is to compare results of the impact of the composite disparity index under three different assumptions for the *beta (β)* policy parameter given that the *beta (β)* value defines the degree of importance of a disparity.

At this point it is important to note that by setting all the β's equal to zero the simulation can be run without disparities affecting the outcome. The use of this procedure implies that the policy-maker has the option of allocating grants to municipalities with or without taking account of disparities. Depending on the importance of a disparity or disparities in the pursuit of policy objectives the policy-maker can vary the value of the β's for each disparity in the set of disparities. In the simulation model the policy-maker has the choice of adding more disparities, refining the existing set of disparities or reducing the number of disparities.

Summary of data inputs

Several data inputs are used in the simulation to generate a composite capital cost disparity index. The details are listed and explained in the *data input and the disparity index calculation* spreadsheet file in the linked Excel Simulation Model in a compact disc appended to this thesis. In summary the data inputs include the following:

- Total population for the Western Cape Province, the district and local municipalities. Figures for the district and local municipalities were estimated from Statistics South Africa 2001 (StatsSA) census estimates.
- The population of each of the five local municipalities as a proportion of the total Cape Winelands District population.

- Eight disparity measures for the five Cape Winelands local municipalities selected from Table 5.10 in Chapter 5. The selected disparity measures included are: *Population density per square kilometer, Unemployment rate, Households with no income, Tuberculosis prevalence per 100000 persons, HIV/AIDS prevalence, Percentage persons over 14 years illiterate (i.e. less than grade seven education level) and, housing backlog units.* This data was sourced from the Cape Winelands District, Socio Economic Profile, the Western Cape Provincial Government, 2006. In addition I included the *Deprivation Index* developed by McIntyre and Karafor (2003).
- National Government infrastructure grant transfers to the municipalities to define the available grant pool. The data was sourced from National Government's Medium Term Expenditure Framework published estimates for the periods under consideration.

I constructed the set of composite capital cost disparities using equations 4.6 and 4.7 (see Chapter 4) and, the key data from the *data input spreadsheet* in the Excel simulation model. The results in the tables below are drawn from the *model output spreadsheet*. I present the results of this exercise in the tables below for each of the eight disparities selected from the data presented in Chapter 5. The disparity indicators in these tables are not expected to change over life of the allocation cycle of the budget because national census and household survey data are collected every 5 to 10 years. Thus it is important to note that in this application there is no time dimension to the disparities as denoted by the subscript *t* in the generic formula.

From the original Petchey et al (2004) model equation 4.6 and equation 4.7, $D_{i,t,j}$ is the percentage deviation, for municipality i, of the j^{th} disparity indicator from the average value of the disparity indicator for all local municipalities (for period t); $0 \leq \beta_{i,t,j}$ is a parameter that captures the impact of the percentage deviation of the j^{th} disparity from its average value on the disparity function represented by equation 4.7 in period[37] t and, $D_{i,t,j} = \left(X_{i,t,j} - \overline{X}_{t,j}\right) / \overline{X}_{t,j}$, when $X_{i,t,j}$, is the j^{th} disparity measure for municipality i and $\overline{X}_{t,j}$ is the average of the j^{th} disparity measure for all local municipalities given that *i = 1,....,5* in period *t*.

With the above formula and using the values of the disparity measures (X) for all five local municipalities I am able to calculate the average disparity measure ($\overline{X}_{t,j}$) for all municipalities. The results for ($\overline{X}_{t,j}$) are reported in Table 7.1. This average allows me to calculate the percentage mean deviation of X from the average value D and the average per municipality for all disparity measures in Table 7.2. The mean deviation and its average by municipality shows whether the percentage of the disparity measure for a municipality falls above or below the average. Depending on the particular disparity measure this value should indicate whether a municipality is at an advantage or disadvantage.

From the socio-economic indicators presented in Chapter 5 I selected eight disparity measures to construct one aggregated composite disparity index[38] that can be taken into account in an infrastructure grant model to meet government's constitutional obligations. I applied the disparity measure data to the formula $D_{i,t,j} = \left(X_{i,t,j} - \overline{X}_{t,j}\right) / \overline{X}_{t,j}$ for the five local municipalities to demonstrate how the use of disparity measures in an infrastructure model presents a more comprehensive picture of the characteristics of inequality and poverty that differentiate municipalities from each other. In other words $D_{i,t,j}$ will show the percentage deviation of the disparity from its average value for all five local municipalities. In Table 7.1 the eight disparity measures (X) are listed in column 1

[37] *Note that the period (t) has no effect as I assume that the disparity indicators apply for the full three periods (nine years) of the simulation because census data is collected every ten years and are not likely to change in between.*

[38] *In the Petchey et al (2004) model the disability index (γ) for the FFC provincial capital grant model is constructed for each indicator separately as if it were the only disability and thereafter all are aggregated into a single index. I chose to calculate a single composite disparity indicator from the eight single disparities although the simulation model has the option of calculating each disparity separately. See the Excel Simulation Model for an explanation of how this can be done using the spreadsheet Disparity Index Calculation.*

with their values for each municipality in the rows. The values of the corresponding average disparity measure ($\overline{X}_{t,j}$) are reported in column 7.

To understand Table 7.1 consider the disparity measure 2 – the *Unemployment Rate* for each of the five local municipalities. The argument here is that because high unemployment creates the condition for socio-economic disparities such as poverty and inequality it is a good proxy indicator and, therefore, should be taken into account when allocating grants. This data is sourced from Statistics South Africa and reflects the rate of unemployment for each of the local municipalities in the Cape Winelands District (See Chapter 5). In Table 7.1 the Drakenstein local municipality has the highest unemployment rate at 22.80% and Breede River has the lowest rate at 12.20%. The average unemployment rate for the five local municipalities is 17.28%. As Drakenstein with 22.80 % and Breede Valley with 19.70% have above the average rates these municipalities are considered to have a positive unemployment rate disparity. If this were the only disparity taken into account in the grant scheme then these municipalities should receive a proportionately higher share of the grant allocation. The other three municipalities (Breede River, Stellenbosch and Witzenberg) are below the average and therefore have a negative unemployment rate disparity. These municipalities will therefore receive a proportionately smaller share of that part of the per capita allocation earmarked for municipalities with unemployment rate disparities.

Table 7.1: Average Disparity Measure ($\overline{X}_{t,j}$)

Disparity (X)	**Breede River**	**Breede Valley**	**Drakenstein**	**Stellenbosch**	**Witzenberg**	**Average Measure** ($\overline{X}_{t,j}$)
Population Density (P/km^2)	27.78	51.06	126.29	140.32	30.77	**75.2442**
Unemployment Rate (%)	12.20	19.70	22.80	17.10	14.60	**17.28**
(%) Households with no income	10.59	8.96	10.47	19.95	8.21	**11.636**
TB Prevalence Per 100 000	1188.00	1621.00	1196.00	890.00	358.00	**1050.6**
(%) HIV/AIDS (2000)	3.2	3.7	5.4	4.0	4.2	**4.1**
(%) Illiteracy	38	14	23	20	35	**26**
Housing Back-log (units, 2004)	4300	11876	11000	10500	3000	**8135.2**
Deprivation Index (Normalized)	1.882	1.937	1.954	1.908	1.906	**1.9174**

Similarly, each of the other disparity measures can be taken into account in the model. However, it is up to the policy maker to make a decision about the importance of a disparity measure in the model. For example, in Table 7.1 disparity measure 1, *Population Density* (the number of people per square kilometer) may be considered by a policy maker to be an important factor. This may be so because it is often argued that it costs more to provide certain municipal infrastructure (for example water and sanitation) to sparsely populated communities than to communities that are more densely populated. On the other hand a policy maker may believe that municipalities with densely populated townships and informal settlements may be a higher priority than a sparsely populated rural municipality because of overcrowding and slum development. In the latter case a ratio of rural to urban populations in a region may be a more appropriate measure. This means having to calculate the total number of households in urban and non-urban regions. The *Petchey et al* (2004) paper uses the number of households per province classified as non-urban as a proxy to capture spatial disparity. In the *Petchey et al* paper (2004)[39], the rural to urban ratio is chosen to avoid the possibility of introducing an upward bias of the disparity measure resulting from large uninhabited regions in some provinces.

In my simulation exercise I retain the use of population density as a disparity to show spatial impacts in the provision of infrastructure services because all five local municipalities in the Cape Winelands District have rural and semi-rural communities. However, to avoid the possibility of an upwards bias of the disparity indicator I give this disparity a very low beta weight compared to the other seven disparities. In Chapter 5, Table 5.10, I also present data showing the total number of urban and non-urban households in each of the municipalities. A *rural to urban ratio* disparity measure can be constructed from this data set as an alternative if necessary. From Table 7.1 it is clear that Stellenbosch and Drakenstein have higher than average population densities and Breede River, Breede Valley and Witzenberg have lower than average population densities. These three municipalities will have a positive disparity with respect to population dispersion per square kilometer whilst Stellenbosch and Drakenstein will have a negative disparity.

To capture a disparity measure for income inequality and poverty I use the percentage number of households with no incomes from data provided by the Western Cape Province government. This is disparity 3 in Table 7.1. My argument is that municipalities with large numbers of households with no incomes imply that these municipalities have a higher number of people living in absolute poverty. Therefore these municipalities will have a positive *income inequality and poverty disparity* compared to other municipalities and should receive a proportionately higher share of the grant. In the *Petchey et al (2004)* paper the simulation model uses data on household incomes below R4 800 to construct an *income poverty* disparity measure for provinces.

[39] *In the Petchey et al (2004) model the ratio of rural to urban incomes is used as the disparity measure because it focuses on the notion that the cost of infrastructure provision is higher in provinces with a greater non-urban population.*

In Table 7.1 on average 11.63 percent of households in the District have no incomes. Stellenbosch with 19.95 percent has the largest number of households with no incomes. It is the only municipality above the average and will therefore have a positive disparity for income inequality and poverty and, should therefore receive a proportionately higher share of the grant. All the other municipalities have disparity measures below the average.

In the preceding paragraphs of this chapter I discussed the role of disparity measures for population density, no income households and the unemployment rate. The discussion in Chapter 5 and the literature review in Chapter 2 address some of the reasons why disparities should be taken into account when allocating infrastructure grants. For income inequality and the unemployment rate it is obvious that municipalities with a larger proportion of households living in poverty will have a positive disparity. Both of these indicators are associated with socio-economic disparities and inequality. From table 7.1 and 7.2 it is clear that Drakenstein and Stellenbosch are the most affected by these disparities.

Taking these disparities into account when allocating grants for municipal infrastructure services will have significant impacts for the local economy. It is well known that the construction, operation and maintenance functions of municipal infrastructure is labour intensive over the life span of infrastructure services and, therefore, will have positive local employment creation and income generation effects.

In the literature the infection rates of debilitating diseases such as HIV/AIDS and the incidence of tuberculosis in disadvantaged communities are also associated with poor sanitation and other associated municipal services (*David A. M. et al, 2007; Lienhardt C., 2001*). My argument is that municipalities play a key role in providing primary health care services for disadvantaged communities. Higher rates of HIV/AIDS and tuberculosis infections will lead to higher costs for the provision of primary health care services. By the same token, improved sanitation services will contribute to the improved health and the prevention of infectious diseases such as TB. The provision of sanitation infrastructure not only ensures that the right to basic health care is supported; it also ensures a healthy population.

In Tables 7.1 it is evident that Breede Valley had the highest prevalence of tuberculosis with 1621 per 100 000 inhabitants, Drakenstein next in line with 1196 and, Witzenberg with the lowest at 358 per 100 000. Breede Valley and Drakenstein clearly are above the average disparity measure of 1050.60 per 100 000. The picture for HIV/AIDS infection rates in Table 7.1 reveals that Drakenstein and Witzenberg had the higher than average rates of HIV/AIDS infection with 5.4% and 4.2% respectively in 2000. The results for debilitating diseases suggest that these disparity measures will have a significant influence on the composite disparity index for the Drakenstein municipality as on both counts the disparity measure is above the average.

In Table 7.1 the results for illiteracy, defined as persons with an education level below grade seven, reveal that Breede River and Witzenberg had higher than average (26%) rates with 38% and 35% respectively. Illiteracy is an important indicator of disadvantage in South Africa as the unequal and inadequate provision of basic education was one the pillars of apartheid policy. With respect to the disparity measure for housing backlog units Table 7.1 show that in 2004 Breede Valley (11876), Drakenstein (11000) and Stellenbosch (10500) had higher than average (8135.2) backlogs. Housing backlogs are a significant indicator for municipal decision-making on the provision of related municipal infrastructure. It is the role of municipalities to construct low-cost houses and provide infrastructure services for the houses built. The significance of each of these disparity measures in the capital cost composite disparity index *(γ_i)* will depend on the *beta* weights assigned to each of them.

In the next step I calculate the deviation and the average deviation for each municipality from Table 7.1 using the formula $D_{i,t,j} = \left(X_{i,t,j} - \overline{X}_{t,j}\right) / \overline{X}_{t,j}$. The calculations are processed in spreadsheet *Disparity Index Calculation* in the Excel Simulation model and presented in Table 7.2 below. Using the calculated deviation $D_{i,t,j}$ and the average deviation I then assign three different *beta (β)* policy parameters for constructing composite capital cost disparity indices for each municipality.

Table 7.2: Deviation ($D_{i,t,j}$) & Average Deviation by Municipality

Disparity	Breede River	Breede Valley	Drakenstein	Stellenbosch	Witzenberg
Population Density (P/km^2)	- 6.3	- 0.32	0.68	0.86	- 0.59
Unemployment Rate (%)	-0.29	0.14	0.32	-0.01	-0.16
(%) Household no income	-0.09	-0.23	-0.10	0.71	-0.29
TB Prevalence Per 100 000	0.13	0.54	0.14	-0.15	-0.66
(%) HIV/AIDS (2000)	-0.22	-0.10	0.32	-0.02	0.02
(%) Illiteracy	0.46	-0.46	-0.12	-0.23	0.35
Housing Back-log (units, 2004)	-0.47	0.46	0.35	0.29	-0.63
Deprivation Index (normalized)	-0.02	0.01	0.02	0.00	-0.01
Average by Municipality	**-0.14**	**0.01**	**0.20**	**0.18**	**-0.25**

Constructing the Composite Disparity Index using the Simulation Model

The disparity measures are grouped into a single composite capital cost disparity index for each municipality by assigning the selected β weights to the average deviation following equations 4.6 and 4.7. This process is demonstrated in the spreadsheet *Disparity Index Calculation* in the Excel Simulation Model. The aggregate or composite disparity index is constructed using the input data calculated for each of the disparities for each municipality. The "Average by Municipality" column shows the average by municipality of the deviation (D) over all the disparities given that D measures the municipal deviation from the average for each disparity.

Thus, to calculate the aggregated capital cost composite disparity index *gamma* (γ_i) for each scenario for a municipality from equations 4.6 and 4.7, I assume the role of policy-maker and assign a *beta* (β) value to the mean deviation average for all disparities from a scale ranging between 0 and 1 (See spreadsheet *Disparity Index Calculation* in the Excel Simulation Model). The weighting determines the composite disparity index and has the effect of prioritizing the disparity indicators according to their importance in meeting policy objectives in the delivery of municipal infrastructure services in disadvantaged communities. The function of the *beta* values ranks the relative importance of disparity weights in determining the shares of the grant in the simulation.

As noted previously if the policy-maker uses a *beta* (β) value of zero for any of the disparities that particular disparity will be excluded from the simulation. This is demonstrated in Table 7.3 below. By assigning a *beta* (β) value of zero to all the disparity measures in the *Disparity Index Calculation* spreadsheet in the simulation model I exclude the impact of the disparity index for each municipality. By virtue of the fact that each municipality's disparity index is approximately equal to one it will not change the value of the population and capital stock variables in the grant model[40]. The *Disparity Index Calculation* spreadsheet in the simulation model is set up so that disparity measures can be added or removed. The *beta* values can also be varied according to the policy maker's decisions.

Table 7.3: Control Scenario 0 - *Disparity Index (γ_i) when (betas) $\beta 1 = \beta 2 = \beta 3 = \beta 4 = \beta 5 = \beta 6 = \beta 7 = \beta 8 = 0$, for all Eight Disparity Measures.*

Municipality	Average by Municipality	θ_i	Control Disparity Index (γ_i)
Breede River	0.03	-0.57	**0.99**
Breede Valley	0.04	0.02	**1.01**
Drakenstein	0.04	0.80	**1.01**
Stellenbosch	- 0.01	0.72	**1.00**
Witzenberg	- 0.10	- 0.98	**1.00**

To generate composite capital cost disparity indices for each municipality I simulate three different scenarios with three different permutations for the *beta* (β) values. In the first scenario of my simulation exercise I set the *betas* (β) values equal to 0.5 such that $\beta 1 = \beta 2 = \beta 3 = \beta 4 = \beta 5 = \beta 6 = \beta 7 = \beta 8 = 0.5$, for all eight disparity measures. This means that all eight disparities in the composite disparity

[40] *Mathematically, any value multiplied by one will remain unchanged.*

index are treated equally. I call this first simulation *Scenario one (S1)* and the results are presented in Table 7.4.

However, to demonstrate that disparities maybe used with different *beta (β)* permutations depending on the decisions of the policy-maker to prioritize or not to prioritize particular disparity measures, I also simulate for two other scenarios where the permutations for the *beta (β)* values are varied. Table 7.5 presents results for *Scenario Two (S2)* when the *betas (β)* for each disparity measure are varied such that *β1 = 0.2 and β8 = 0 and β2 = β3 = β4 = β5 = β6 = β7= 0.5.* Table 7.6 presents results for *Scenario Three (S3)* when the *betas* (β) for each disparity measure are varied such that *β1 = 0.2 and β2 = β3 = β8 = 0.5 respectively and, β4 = β5 = β6 = β7= 0.*

As I discussed in Chapter 2 the *beta* values and composite disparity indicators may be also determined using econometric and linear programming techniques such as data envelopment analysis (DEA).

Table 7.4: Scenario One - *Disparity Index S1 (γ_i) when* (betas) *β1 = β2 = β3 = β4 = β5 = β6 = β7= β8 = 0.5, for all Eight Disparity Measures.*

Municipality	Average by Municipality	θ_i	Disparity Index S1 (γ_i)
Breede River	-0.14	-0.57	**0.57**
Breede Valley	0.01	0.02	**1.02**
Drakenstein	0.20	0.80	**2.24**
Stellenbosch	0.18	0.72	**2.06**
Witzenberg	-0.25	- 0.98	**0.37**

From the model presented in Chapter 4 we know that the exponential transformation of the disparity function in equations 4.6 and 4.7 means that the disparity index is normalized around one[41]. This implies that municipalities with

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$$\gamma_{i,t} = e^{\phi_{i,t}} \qquad (4.6)$$

[read as *gamma i, t equals e to the power Φ (phi) i, t.*]
where

$$\phi_{i,t} = \sum_{i,t,j=1}^{J} \beta_{i,t,j} D_{i,t,j} \qquad (4.7)$$

positive disparities take *gamma* (γ_i) values in excess of one and municipalities with negative disparities take values below one. It is clear from Scenario One in Table 7.3 that if all the disparity measures are weighted equally with a *beta (β)* value of 0.5 then Drakenstein with a *gamma* (γ_i) value of 2.24 will have the highest positive *disparity index* followed by Stellenbosch with a value of 2.06. At 0.37 (the lowest) and 0.57 (the second lowest) respectively Witzenberg and Breede River have negative disparities with values below one. This means that the composite capital cost disparity *gamma (γ_i)* for each municipality is important for calculating the desired capital stock and, through this result, the historical domestic backlog. A municipality with a positive composite capital cost disparity *gamma (γ_i)* greater than 1 will have a greater historical domestic backlog and, consequently, need a higher level of desired capital stock. By allocating a greater share of the infrastructure grant for infrastructure services to such municipalities, government will not only ensure the delivery of services to municipalities that were previously disadvantaged it will also contribute towards building up the higher level of desired capital stock in these municipalities through an increase in public infrastructure thus promoting per capita economic efficiency.

In Scenario Two in Table 7.5 I assign a *beta (β)* value of 0.2 for disparity measure 1 (population density) and 0 for disparity measure 8 (the deprivation index) and, 0.5 for the six other measures. For disparity measure 1 my reasoning is that population density and spatial inequality is not highly significant in the local municipalities of the Cape Winelands District Municipality. This observation was verified through interviews with municipal officials and visits to the municipalities themselves (See summary report of interviews with municipal officials in Appendix...). By way of comparison the Cape Winelands District reports (from data supplied by the Global Insight Southern Africa Explorer 451) reveal that in 2008 it had an overall population density of 30.03 persons per square kilometer while the other four Western Cape Province district municipalities – the West Coast (10.57), Overberg (22.19), Eden (22.73) and Central Karoo (1.58) had much lower population densities. Furthermore, the latter group of district municipalities is located in very mountainous areas and faces the challenge of higher unit costs for the provision of municipal services to communities living in such locations.

Table 7.5: Scenario Two - ***Disparity Index S2 (γ_i) when disparity measures 1 and 8 have*** *(betas)* ***$\beta 1 = 0.2$ and $\beta 8 = 0$ respectively, and $\beta 2 = \beta 3 = \beta 4 = \beta 5 = \beta 6 = \beta 7 = 0.5$.***

Municipality	Average by Municipality	θ_i	Disparity Index S2 (γ_i)
Breede River	-0.14	-0.37	**0.69**
Breede Valley	0.01	0.11	**1.12**
Drakenstein	0.20	0.59	**1.81**
Stellenbosch	0.18	0.47	**1.59**
Witzenberg	-0.25	-0.80	**0.45**

My reasoning for assigning a *beta* value of 0 for disparity measure 8 (deprivation index) and 0.5 for each of the other six was that the deprivation index measure calculated by McIntyre[42] and Okarafor (2003) already incorporates measures for poor health, education and housing. My assumption here is that I can either have 0.5 values for the six other disparities and 0 for the deprivation index or, 0.5 for the deprivation index and 0 each for illiteracy, TB, HIV and housing backlogs, as is the case for Scenario Three. In Scenario Three I also retain *beta* values of 0.2 for population density and, 0.5 for households with no incomes and the rate of unemployment.

Table 7.6: Scenario Three - ***Disparity Index S3 (γ_i) when disparity measures 1, 2, 3 and 8 have*** *(betas)* ***$\beta 1 = 0.2$ and $\beta 2 = \beta 3 = \beta 8 = 0.5$ respectively and, $\beta 4 = \beta 5 = \beta 6 = \beta 7 = 0$.***

Municipality	Average by Municipality	θ_i	Disparity Index S3 (γ_i)
Breede River	- 0.14	- 0.33	**0.72**
Breede Valley	0.01	- 0. 10	**0.90**
Drakenstein	0.20	0.25	**1.29**
Stellenbosch	0.18	0.52	**1.69**
Witzenberg	-0.25	- 0.35	**0.71**

[42] *The paper by McIntyre and Okarafor (2003) presents a detailed review and analysis of the development of deprivation indices and the construction of the Deprivation Index for South Africa. See Chapter 2 for a review of this paper.*

Findings for the Impact of Composite Capital Cost Disparity Indices on Municipal Infrastructure Grant Shares

The composite capital cost disparity index *gamma* (γ_i) in the model is the main determinant of the per capita allocation intergovernmental share of the municipal infrastructure grant pool from National Government to municipalities. Using equation 6.7 the model calculates the share *tau* (τ), adjusted for disparities (γ_i), of the grant pool (designated by *CP* in the model in Chapter 6) for each municipality with data inputs for both the municipal population and the total district population. To calculate the per capita allocation I first have to determine the share (τ) of the grant pool (*CP*) for municipality i in period t. To do this I require the local municipality population as a proportion of the total District population. The model calculates the share (τ) of the grant pool (*CP*) adjusted for disparities for each municipality by using the inputs defined by equation 6.7 in Chapter 6. The calculations are carried out in the Excel Simulation Model.

A municipality's share in the grant is a function of its population relative to total district population. The allocations are based on the projected population shares for each of the three periods in the nine-year cycle (2007 to 2015) used in the simulation. Table 7.7 presents the projected municipality population shares from 2007 to 2015 from the spreadsheet *Population* in the Excel Simulation Model.

Table 7.7: Local Municipality Population Shares as a Proportion of District Population

Municipality	2007	2008	2009	2010	2011	2012	2013	2014	2015
Breed River	0.1133	0.1126	0.1119	0.1111	0.1103	0.1094	0.1085	0.1074	0.1064
BreedeValley	0.1899	0.1854	0.1809	0.1765	0.1721	0.1677	0.1632	0.1589	0.1544
Drakenstein	0.3069	0.3041	0.3011	0.2980	0.2946	0.2912	0.2876	0.2839	0.2800
Stellenbosch	0.2836	0.2940	0.3048	0.3158	0.3270	0.3382	0.3497	0.3614	0.3732
Witzenberg	0.1062	0.1036	0.1011	0.0985	0.0960	0.0934	0.0908	0.0883	0.0858

(Totals may not add up to 1 because of rounding. See spreadsheet Population/ Share of Population in the Excel Simulation Model)

To demonstrate the workings of the simulation model, I first consider the impact of the disparity index on the grant shares for 2007. Column 4 in tables 7.8 to 7.10

below shows each local municipality's population as a proportion of the Cape Winelands District population as a whole for 2007. A municipality's share (τ_i) in the per capita grant will depend on whether its composite capital cost disparity *(γ_i)* is above or below the average. The third column of the tables 7.8 to 7.10 shows each municipality's population as a proportion of the total district population. Those above the average will receive a share greater than their population share and those below the average will receive less than their population share. The average by municipality (column 2) shows whether the percentage of the disparity measure for a municipality falls above or below the average. Depending on the particular disparity measure this indicates whether a municipality is at an advantage or disadvantage. If a municipality happened to have a zero disparity (i.e. its X value just equaled the average) then the measured disparity ***(γ)*** would equal 1 (since *e to the power of 0 =1* in equation 6.7) and the calculated (τ) would simply equal the population in the municipality as a proportion of the total District population. Therefore a comparison of columns 3 and 4 of the tables 7.8 to 7.10 shows the impact of the disparities. If a municipality had a positive disparity its share in the pool is raised from its share value (or percentage value) in column 3 (municipal population as a proportion of total district population) to its share in column 5 (τ for the period). If a municipality had a negative disparity its share would fall in the opposite direction. The calculated percentage share (τ_i) for 2007 population shares for each municipality in the per capita grant is presented in column 5 in the tables below.

Table 7.8: Scenario 1: Average Growth of Municipal Share (τ_i) of per capita Grant based on projected 2007 Municipal Population Shares.

Municipality	Average by Municipality	**Disparity Index S1** γ_i	**Municipal population proportion of District population for 2007**	**Municipal Share** (τ_i)
Breede River	-0.14	0.57	0.1133	**0.03**
Breede Valley	0.01	1.02	0.1898	**0.02**
Drakenstein	0.20	2.24	0.3069	**0.31**
Stellenbosch	0.18	2.06	0.2835	**0.63**
Witzenberg	-0.25	0.37	0.1062	**0.00**

The results for Scenario 1 presented in Table 7.8 report that all the disparities aggregated into one composite capital cost disparity will mean that Stellenbosch will receive the largest share (63%) of the infrastructure grant for infrastructure services. Drakenstein will be next with a share of 31% of the grant followed by Breede River (3%), Breede Valley (2%) and Witzenberg (0%).

Table 7.9: Scenario 2: Average Growth of Municipal Share (τ_i) of per capita Grant based on projected 2007 Municipal Population Shares.

Municipality	Average by Municipality	**Disparity Index S2** γ_i	**Municipal population proportion of District population for 2007**	**Municipal Share** (τ_i)
Breede River	- 0.14	**0.69**	0.1133	**0.05**
Breede Valley	0.01	**1.12**	0.1898	**0.03**
Drakenstein	0.20	**1.81**	0.3069	**0.31**
Stellenbosch	0.18	**1.59**	0.2835	**0.63**
Witzenberg	-0.25	**0.45**	0.1062	**0.00**

For Scenario 2 in Table 7.9, with a slightly varied *beta* value, Stellenbosch and Drakenstein will still receive the largest share of the grant.

Table 7.10: Scenario 3: Average Growth of Municipal Share (τ_i) of per capita Grant based on projected 2007 Municipal Population Shares.

Municipality	Average by Municipality	**Disparity Index S3** γ_i	**Municipal population proportion of District population for 2007**	**Municipal Share** (τ_i)
Breede River	- 0.14	**0.72**	0.1133	**0.05**
Breede Valley	0.01	**0.90**	0.1898	**0.02**
Drakenstein	0.20	**1.29**	0.3069	**0.24**
Stellenbosch	0.18	**1.69**	0.2835	**0.68**
Witzenberg	-0.25	**0.71**	0.1062	**0.01**

A further variation of the *beta* values for Scenario 3 in Table 7.10 shows a very small drop in the share for Drakenstein and an increase in the share for Stellenbosch with very little change in the shares for the other municipalities. It is important to note that the calculations in Tables 7.8 to 7.10 are based on municipal population shares for 2007 only. The infrastructure grant allocations, however, are made over several three-year medium term expenditure framework (MTEF) cycles with each cycle representing one period.

To calculate the shares over the three periods I chose three MTEF cycles from 2007 to 2015 representing three distinct periods as defined in the Tables 7.11 to 7.13 below. The municipal population shares (Table 7.7) are calculated from the spreadsheet called *Population* (under heading Share of Population) in the Excel Simulation Model. Tables 7.11 to 7.13 present the results for the average growth of municipal shares based on the projected growth of population shares over the three periods for the three scenarios.

Table 7.11: Scenario 1: Average Growth of Municipal Share (τ_i) of per capita Grant based on projected Municipal Population Shares for 3 MTEF Periods from 2007 to 2015.

Municipality	Disparity Index S1 γ_i	Average share of Population per Period			Average Share (τ_i) of per capita grant per Period		
		Period 1 2007/09	Period 2 2010/12	Period 3 2013/15	Period 1 2007/09	Period 2 22010/12	Period 3 2013/15
Breede River	**0.57**	0.11263	0.11031	0.10745	**0.0405**	**0.0389**	**0.0373**
Breede Valley	**1.02**	0.18534	0.17202	0.15877	**0.1200**	**0.1094**	**0.0992**
Drakenstein	**2.24**	0.30403	0.29454	0.28378	**0.4307**	**0.4098**	**0.3879**
Stellenbosch	**2.06**	0.29437	0.32721	0.36172	**0.3841**	**0.4193**	**0.4553**
Witzenberg	**0.37**	0.10363	0.09591	0.08827	**0.0245**	**0.2234**	**0.0201**

Based on projected population shares (Table 7.7) for each MTEF cycle period, Scenario 1 in Table 7.11 reveals a more nuanced sharing of the infrastructure grant than the shares for 2007 alone. Although Drakenstein and Stellenbosch still receive the larger part of the grant for the three periods it is more evenly distributed between these two municipalities when compared to the calculations based on the 2007 single-year population shares. Over the three periods the shares for Drakenstein will show a gradual decrease from about 43% in the first period, 41% in the second period and, 39% in the final period. Stellenbosch on the other hand will show a gradual increase in shares from 38% in the first period, 41% in the second period and, 46% in the last period. One of the main reasons for these inverse trends observed in Drakenstein and Stellenbosch is that the projected population shares (see Table 7.6 and, *Population Shares* in the spreadsheet *Population* in the Excel simulation model) for Drakenstein decreases over the three periods while the projected population shares for Stellenbosch increases. The implication of this observation is that the population share variable in the model is a key driver in determining the grant share while the inclusion of the disparity index serves to increase the share in favour of the most disadvantaged or, decrease the share for the more advantaged municipality.

Table 7.12: Scenario 2: Average Growth of Municipal Share (τ_i) of per capita Grant based on projected Municipal Population Shares for 3 MTEF Periods from 2007 to 2015.

Municipality	Disparity Index S2 γ_i	Average share of Population per Period			Average Share (τ_i) of per capita grant per Period		
		Period 1 2007/09	Period 2 2010/12	Period 3 2013/15	Period 1 2007/09	Period 2 22010/12	Period 3 2013/15
Breede River	**0.69**	0.11263	0.11031	0.10745	**0.0577**	**0.0559**	**0.0539**
Breede Valley	**1.12**	0.18534	0.17202	0.15877	**0.1537**	**0.1410**	**0.1287**
Drakenstein	**1.81**	0.30403	0.29454	0.28378	**0.4068**	**0.3897**	**0.3713**
Stellenbosch	**1.59**	0.29437	0.32721	0.36172	**0.3472**	**0.3817**	**0.4172**
Witzenberg	**0.45**	0.10363	0.09591	0.08827	**0.0344**	**0.0314**	**0.0286**

Scenario 2 in Table 7.12 presents a similar result as for Scenario 1 although here both Drakenstein and Stellenbosch receive smaller shares over the three periods. The reason for the smaller shares is clearly the impact of the variation in *beta* values.

Table 7.13: Scenario 3: Average Growth of Municipal Share (τ_i) of per capita Grant based on projected Municipal Population Shares for 3 MTEF Periods from 2007 to 2015.

Municipality	Disparity Index S3 γ_i	Average share of Population per Period			Average Share (τ_i) of per capita grant per Period		
		Period 1 2007/09	Period 2 2010/12	Period 3 2013/15	Period 1 2007/09	Period 2 22010/12	Period 3 2013/15
Breede River	**0.72**	0.11263	0.11031	0.10745	**0.0671**	**0.0644**	**0.0615**
Breede Valley	**0.90**	0.18534	0.17202	0.15877	**0.1381**	**0.1256**	**0.1137**
Drakenstein	**1.29**	0.30403	0.29454	0.28378	**0.3242**	**0.3080**	**0.2909**
Stellenbosch	**1.69**	0.29437	0.32721	0.36172	**0.4098**	**0.4467**	**0.4841**
Witzenberg	**0.71**	0.10363	0.09591	0.08827	**0.0606**	**0.0550**	**0.0496**

A similar pattern is observed in Scenario 3 in Table 7.13 where *beta* values have been changed to show disparity measures where *betas* $\beta 1$ = 0.2 and $\beta 2 = \beta 3 = \beta 8$ = 0.5 respectively and, $\beta 4 = \beta 5 = \beta 6 = \beta 7$= 0. In this scenario it is clear that *beta* values that favour disparity measures of *households with no income*;

unemployment; the *normalized deprivation index* and, to a lesser degree, *population density*, will have a significant impact on the distribution of shares. In this scenario Drakenstein's share over the 3 periods drops sharply while the share for Stellenbosch increases substantially over the period. In relative terms the shares for the other municipalities remain relatively small but show consistently similar trends when the *beta* values change over the three periods. A general observation of the results from this exercise is that the capital cost disparity index has a gradual and nuanced incremental impact on the infrastructure grant shares over a longer period of time. The implication here is that the model gives the policy-maker an important tool to determine the size of the grant pool and, within available resources, equitably allocates funds for the progressive provision of basic infrastructure services as prescribed in the *Bill of Rights* of the South African Constitution (1996). In this context, while the population data is the primary variable in determining grant amounts, it is the composite capital cost disparity index weight that is ultimately used to take account of disparities when allocating infrastructure grants to municipalities.

In the next section of this chapter I will use the composite capital cost disparity indices in the model to determine actual infrastructure grant allocations for the five local municipalities. To do this I used re-constructed capital expenditure data to build a capital stock data series using the perpetual inventory method (PIM). The purpose of this simulation is to illustrate the likely effects on backlogs and economic efficiency when capital cost disparity measures are taken into account in infrastructure grant schemes in contrast to the instability, lack of predictability and flexibility of the current project based approach.

Section Two: *Taking Account of Disparities in Capital Grants: Findings, Conclusions and Recommendations.*

In this section of the chapter I address the second sub-question and present my analyses and findings for the effects on capital backlogs of including (or excluding) disparities in a municipal infrastructure grant model. In particular I consider the effects for equitability of transfers and, the stability, predictability and flexibility of municipal budgets. The data assumptions for this section are the same as for section one.

Disparity effects on backlogs and economic efficiency using reconstructed capital stock data

To address the second sub-question I collected data from and, conducted semi-structured interviews with officials from the Cape Winelands District Municipality and the five local municipalities. I also collected data from and, interviewed officials from related provincial and national government departments. The aim of the interviews was to establish the extent to which the current project based approach undermined municipal infrastructure budget processes and compromised the constitutional principle of equitability, stability, predictability and flexibility of local government revenues and budgets. This constitutional principal requires that National Government ensure that its transfers are not only equitable but that they also take account of the need for stability and predictability of sub-national budgeting processes. (See Appendix 1 for a summary and discussion of the responses from government officials).

Given that the current project based approach to allocating municipal infrastructure grants undermines municipal budget processes and compromises constitutional requirements my analysis asses whether *the inclusion of capital cost disparities and an economic efficiency component in a grant model* may enhance *equitability, stability and predictability of municipal budgets.* I carry out my assessment by evaluating the effects for capital backlogs by excluding and including disparities in my municipal infrastructure grant model through attributing different *beta* (β) weights to the disparity index (γ_i). I evaluate the effects by using reconstructed municipal capital stock data based on municipal capital expenditures to illustrate how a grant scheme that includes disparities can have medium-term positive effects for reducing infrastructure backlogs and enhancing per capita economic efficiency. These positive effects will in turn enhance *equitability, stability and predictability of municipal budgets* because the grant model can be used over several medium-term expenditure cycles to determine equitable, stable and predictable grant shares for targeted municipalities with historical backlogs. The allocations targeting historical backlogs can be reduced and eventually stopped once all backlogs have been eliminated. In addition, the per capita economic efficiency component of the model will ensure that over the medium-term expenditure cycle all municipalities will receive an equitable, stable and predictable share of the grant. Once all backlogs have been eliminated then municipalities will only receive the equitable, stable and predictable per capita economic efficiency grant.

I will illustrate the effects of capital cost disparities in the grant model by running the scenario simulations from section one above using two different reconstructed capital expenditure data sets covering the period 1996 to 2007. The first capital expenditure data set constitutes global capital expenditures allocated to the municipalities. The second data set constitutes only project-based expenditures allocated from the Consolidated Municipal Infrastructure Programme (CMIP) and the Municipal Infrastructure Grant (MIG) programme for municipal services. By comparing the *global expenditure* generated results with the *project-based expenditure* results I will be able to assess the effects of including capital cost disparities in the model.

Simulation Model Procedures in Taking Account of the Composite Disparity Index (γ) for Allocations

In the model presented in Chapter 6 the total infrastructure grant pool available for reducing historical backlogs and enhancing per capita economic efficiency in period one is represented by *CP*. Given the pool of funds available, the simulation model first calculates the share of the grant dedicated for reducing historical infrastructure backlogs before calculating the grant share for enhancing the per capita economic efficiency of the five municipalities. The formal theoretical model in Chapter 6 is converted into the Excel Simulation Model using data from the five local municipalities in the Cape Winelands District. The Excel Simulation Model is presented in a separate computer file attached to this thesis in compact disc format. The first set of data in the *User Input* spreadsheet of the Excel Simulation Model is the available pool of funds (*CP*) for municipal infrastructure for the Cape Winelands District municipalities over the three medium term expenditure framework (MTEF) periods from 2007 to 2015. The Rand amounts for the three periods from the spreadsheet are summarized in Table 7.14 below.

Table 7.14: Available Pool of Funds for Infrastructure: Cape Winelands District Municipalities

Period 2007 to 2010 (Rand)	Period 2010 to 2012 (Rand)	Period 2013 to 2015 (Rand)
992,155,469.06	3,348,524,708.07	11,301,270,889.73

To calculate the per capita economic efficiency grant the model uses inputs defined in the simulation model and calculates the desired capital stock for *period one* adjusted to take account of the composite capital cost disparity index *(γ_i)*. The model uses equation 6.2 (in Chapter 6) $\left(\frac{K_1}{P_1} \cdot P_{i,1}\right) \cdot \gamma_{i,1}$ with the variables for capital stock and population. The subscript *1* indicates *Period One*.

In the next step the simulation model calculates the historical backlogs (represented by $B_{i,1}$ that differentiate municipalities from each other using equation (6.3) $B_{i,1} = \left(\frac{K_1}{P_1} \cdot P_{i,1} \cdot \gamma_{i,1} - K_{i,1}\right)$ with the input variables adjusted to take account of the disparity index. Recall that a municipality with a positive disparity will have a value for *(γ_i)* more than 1. Thus the positive disparity will increase the size of any backlog and raise the level of the desired capital stock and the commensurate funding requirement from the grant pool in *period one*. As noted in Chapter 6 those municipalities with a disparity index value greater than 1 will have $B_{i,1} > 0$ and therefore a positive capital backlog because their capital stock is inadequate to achieve the municipal district average standard, as determined from equation (6.2). By the same token municipalities with $B_{i,1} < 0$ have a negative backlog compared to the municipal district average. This means that their capital stock exceeds what is required to achieve the district average and, in cases where $B_{i,1} = 0$ it means that municipalities have no historical backlog. In such cases the capital stock (adjusted for cost disparities) is equal to what municipalities need to achieve the district average. This is how the disparity variable impacts on the historical infrastructure backlog of municipalities.

The speed with which backlogs are eliminated is determined in equation (6.6), adjusted to take account of the disparity index. This is achieved by assigning a value to *delta* (δ). Delta (δ) is the policy parameter that determines how much of the grant pool will go towards reducing municipal historical backlogs and how much will be used for enhancing the per capita economic efficiency part of the grant.

From equations (6.4), and (6.5) $[CP_1(1-\delta_1)]$ we know that the greater the value of δ_1 *(delta),* the greater is the allocation for the reduction of the historical infrastructure backlogs and the smaller is the allocation for increasing the per capita economic efficiency grant. Note also that CP_1 represents the total infrastructure grant pool available for period one. In equation (6.4) $G^D_{i,1}$ is the historical backlog grant to local municipality *(i)* in period one. D here denotes a municipality's historical domestic backlog. Only those municipalities with a positive historical backlog (i.e., $B_{i,1} > 0$) receive this grant. Municipalities with a negative backlog (i.e., $B_{i,1} \leq 0$) receive nothing from this part of the grant pool in period one. However, to ensure that municipalities are adequately funded to achieve economic efficiency objectives, the remaining portion of the pool, $CP_1(1-\delta_1)$, defined by equation 6.5, is allocated on a per capita basis to all municipalities to help them overcome their overall shortage of capital relative to a generally accepted district average necessary to achieve economic efficiency. If $G^D_{i,1}$ represents the aggregate historical backlogs part of the grant for municipality *(i)* then $G^E_{i,1} = \tau_{i,1} \cdot CP_1(1-\delta_1)$, from equation (6.8), is the aggregate *per capita economic efficiency grant* for municipality *i* with G^E denoting the aggregate per capita economic efficiency component of the grant. Recall from my explanation in the first section of this chapter that the simulation model calculates each municipality's share (τ) of the grant pool (CP) for *period one* using the inputs defined in equation (6.7), adjusted to take account of the disparity index.

In the simulation model the policy-maker can choose the value of the policy parameter *delta* (δ_1). Policy makers therefore have the discretionary power to decide how quickly the historical domestic backlog is eliminated. Once all historical domestic backlogs are eliminated and there is more equality of access to services, the parameter (δ_1) can be set equal to zero, implying that all of the pool is allocated to the per capita economic efficiency-based grants to meet the requirement for municipal economic growth and development. The simulation model *User Input* spreadsheet includes a *Delta Policy Parameter Choice Key* that can be set by the simple choice of a policy parameter to accelerate or reduce the rate at which a municipality's domestic historical backlogs are eliminated.

Once the Simulation Model determines the historical backlogs and per capita economic efficiency shares of the grant the aggregate infrastructure grant for *period one* to municipality *i* is calculated. The aggregate historical domestic backlog grant and per capita economic efficiency grant received by each municipality is denoted by $G_{i,1}$ in equation (6.9) such that $G_{i,1} = G^{E}_{i,1} + G^{D}_{i,1}$. Municipalities with no historical backlog in period one will receive only a per capita economic efficiency grant. For municipalities with no historical backlog the Simulation Model calculates $G_{i,1} = G^{E}_{i,1}$.

Municipalities with a positive historical backlog will receive their per capita economic efficiency grant and a share of the pool allocated to historical backlogs. Their share of the backlog pool will depend upon the size of their backlog relative to the backlogs of other municipalities. Once the historical backlogs have been eliminated all municipalities will receive only the per capita economic efficiency grant (as noted above, once this point is reached, δ_t will be set equal to zero). In such cases policy makers may wish to set δ_1 at a relatively high level in the early stages of the scheme since this implies that most of the pool will go towards eliminating the historical domestic backlogs. This policy stance suggests that National Government is responsive to demands to correct the historical backlogs as quickly as possible and improve equality of access to services. As the scheme progresses, increasingly more emphasis should be placed on the per capita economic efficiency grant by reducing δ_1 as the historical domestic backlogs diminish.

For the start of *Period Two* the Simulation Model uses equation (6.10) to calculate the historical backlog part of the grant for *Period Two*. This is the basically the value of the historical backlog from *Period One* less the value of the historical backlog part of the grant. Thus in *Period Two* the Simulation Model calculates the historical capital domestic backlog estimated in *Period One* adjusted to take account of the positive impacts of the historical domestic backlog grant made in period one. The backlog grant calculated for period two is now based on the estimate of each municipality's domestic backlog at the start of period two. The new per capita economic efficiency grant for *Period Two* is now calculated using equation (6.11) and, the total grant to Municipality *i* in *Period Two* is defined in equation (6.12).

The Simulation Model uses the capital cost disparity indices defined by $\tau_{i,2}$ *(tau)* for *Period One* to calculate municipal grant shares for *Period Two* and *Period Three*. This seems a reasonable assumption since it is unlikely that a disparity measures would change significantly between periods because disparity indicator data is normally collected in five to ten year intervals. This should not, however, preclude the use of revised estimates in subsequent periods.

For *Period Three* the Simulation Model uses the same process used to calculate the grant shares for *Period Two* where the historical backlog at the beginning of period three is defined by equation (6.13) and the historical backlog grant is specified in equation (6.14) in Chapter 6. The *per capita economic efficiency* part of the grant for *Period Three* is calculated using equation (6.15).

In my illustrative exercise I run the simulations for nine years from 2007 to 2015 dived into three periods of three years each corresponding with National Government's Medium Term Expenditure Framework (MTEF) cycle. At the end of the three periods the historical backlog grant calculated for municipality i is the backlog estimated in period one less the total of the backlog grants made during the period of the simulation of the grant scheme cycle. In the grant model in Chapter 6 this is defined by equation (6.17), where T represents the MTEF periods. If, at the end of the 9-year cycle municipalities still have domestic backlogs then the backlog part of the grant scheme would require a second phase.

The second phase would use, as its initial historical backlog estimates, the results derived from (6.17) and, all municipalities would continue to receive the *per capita economic efficiency* grant on the assumption that there is still a need to raise the general level of public capital stock in the municipalities.

Illustrative Simulations using Data from the Cape Winelands District Local Municipalities

The simulations and results presented in this section are based on several broad assumptions with respect to the data sets used in the Simulation Model. The assumptions were necessary because of the limited availability of long-term time series capital stock and capital expenditure data from government. The simulations and results are therefore purely illustrative and only presented as an example to show the effects of disparities on municipal infrastructure grant allocations. I briefly discuss the assumptions below.

Assumptions used in Estimating Municipal Capital Stock

In order to estimate the initial capital stock data applying the perpetual inventory method (PIM) I used the Western Cape provincial level capital stock data from the provincial estimates calculated by the Financial and Fiscal Commission (2007). I then disaggregated this stock data to the district and local municipal level. The model allocates to each local municipality a share of the total capital stock of the District in order to calculate the capital backlogs resulting from the difference between the desired capital stock and measured capital stock. To estimate the municipal capital stock for the five local municipalities applying the perpetual inventory method (PIM) I reconstructed two capital expenditure data sets from 1996 to 2007. I reconstructed a first set of municipal capital expenditures from the Consolidated Municipal Infrastructure Programme (CMIP) and Municipal Infrastructure Grant (MIG) project expenditures for the period. I then reconstructed a second set of capital expenditures using all capital expenditure figures for two years and applying the average incremental expenditure growth rate to generate a global capital expenditure data set for the rest of the period. The data was sourced from the Western Cape Province and Cape Winelands District Municipality budget expenditure reports. The capital stock and capital expenditure data assumptions are used uniquely to illustrate how disparities can be taken into account for the equitable allocation of municipal infrastructure grants.

Population data are used in the model for two reasons. Firstly, the population data are used to calculate the amount of capital stock per person in the local municipality. Secondly, the simulation model requires projected future population data estimates in order to calculate and allocate the per capita part of the pool of funds over the full cycle of the future three MTEF periods. I assume that the population forecasts include the effects of HIV/AIDS and Tuberculosis and therefore the backlog calculations include the effects of population change.

The total infrastructure grant pool is determined exogenously by National Government's budgeted amount of funds set aside for municipal infrastructure grants. Therefore, in this example I also used the same two projected expenditure data sets to represent the infrastructure grant pool available for the project-based and the global capital expenditure grants.

The proportions of the infrastructure grant pool represented by *delta* (δ) and ($1-\delta$) allocated to the historical domestic backlogs and the per capita economic efficiency components respectively, are set over the three periods. Assuming the role of policy-maker I set *delta* (δ) at 0.3; 0.2; and 0.1 for periods 1, 2 and 3 with the understanding that the higher the value of this policy parameter the faster the eradication of historical domestic backlogs in a municipality and, the lower the values, the greater the allocation for the per capita economic efficiency component.

To evaluate the effects of the constructed capital cost disparity indices I run the illustrative simulations using the same three *beta (β)* scenarios used in the first section of this chapter.

I assume a depreciation rate 0.002 because the lifespan of municipal infrastructure in South Africa has been somewhere between 20 to 30 years.

Findings Based on Illustrative Simulation Results

The simulation user inputs and results can be observed in the Excel Simulation Model spreadsheets entitled *User Inputs* and *Model Outputs* respectively. To observe the results under conditions of the two different capital expenditure data sets the user can switch between the two data sets by setting the *Capital Expenditure Data Set Choice Key* in the *User Inputs* spreadsheet to *1* for the *global* capital expenditure data set and *0* for the *CMIP/MIG project-based* data set.

The first set of results presented is the simulation findings for infrastructure grant allocations based on the CMIP and MIG Capital Expenditure data set. The idea here is to assess the effectiveness of the project based approach to allocating conditional grants against allocating capital expenditures from a more global pool of funds. The second set of results presented is the simulation findings using the *global* capital expenditure data set.

Results using the CMIP and MIG Capital Expenditure (Capex) Data Set

To get a picture of the results when only the CMIP and MIG expenditures are applied the user need only change the 1 to 0 in the *Capital Expenditure Data Set Key Choice* cell in the *User Input Spreadsheet.* Illustrative results for this possibility are presented in Tables 7.15 and 7.16.

Table 7.15: *S0* CMIP/MIG Capex: Capital Backlogs and Desired Capital Stock Budget 2006/07 to 2015

Year	Breede River	Breede Valley	Drakenstein	Stellenbosch	Witzenberg
Desired Stock					
2006/07	15291768.49	25624709.89	41431388.72	38268831.52	14341531.79
2007/08	20315534.12	34043130.36	55042737.01	50841192.97	19053118.59
2008	25045544.81	41222804.11	67611694.37	65379298.04	23049534.28
2009	29539371.89	47754478.67	79453339.01	80432822.51	26676372.56
2010	33778051.73	53635613.53	90524274.58	95937618.04	29933256.01
2011	37745085.85	58868758.69	100788373	111824518	32822648.89
2012	41426561.15	63461327	110216968.3	128019988.5	35349716.84
2013	44811233.82	67425313.09	118788948.9	144446853	37522157.61
2014	47890576.08	70776965.01	126490747.5	161025081	39350006.53
2015	50658785.91	73536415.45	133316233.5	177672627.5	40845420.44
Backlog					
2006/07	0.01	0.01	0.01	24418941.21	0.01
2007/08	0.01	0.01	0.01	33972651.12	0.01
2008	0.01	0.01	0.01	45591591.94	0.01
2009	0.01	0.01	0.01	57834821.97	0.01
2010	0.01	0.01	0.01	70646716.3	0.01
2011	0.01	0.01	0.01	83965725.71	0.01
2012	0.01	0.01	0.01	97724990.67	0.01
2013	0.01	0.01	0.01	111853039.7	0.01
2014	0.01	0.01	0.01	126274561.5	0.01
2015	0.01	0.01	0.01	140911238.2	0.01

According to these results only Stellenbosch will receive an allocation for historical backlogs. These results must be considered with extreme caution for several reasons. Firstly, because the CMIP/MIG grant is allocated on the basis of project proposals submitted by municipalities it is possible that Sellenbosch, with a highly developed financial and human resource capacity, was able to submit better project proposals and therefore able to access most of the funds earmarked for historical backlogs despite other municipalities having higher levels of backlogs. Secondly, the model calculates the backlogs on the basis of past expenditures. In reality the past CMIP/MIG grant allocations do not present trends of capital expenditure data for all municipalities that are consistent and comparable. Many municipalities forego CMIP/MIG grants because of the onerous bureaucratic and administrative processes involved in accessing the grant. Municipal managers revealed this difficulty during interviews. Municipalities rather choose to use global capital expenditure budgets and loans to finance municipal infrastructure.

Table 7.16: ***S0*** **CMIP/MIG Capex: Grant Allocations Per Period 2007-09 to 2012 -15 (R million)**

Allocation per Period	*Period 1 2007/08-09*	*Period 2 2010-12*	*Period 3 2013-15*	**Total**
Historical Backlog Grant				
Breede River	**0.01**	**0.01**	**0.02**	**0.04**
Breed Valley	**0.01**	**0.01**	**0.02**	**0.04**
Drakenstein	**0.01**	**0.01**	**0.02**	**0.04**
Stellenbosch	**27,385,099.46**	**92,424,710.73**	**311,933,398.75**	**431,743,208.93**
Witzenberg	**0.01**	**0.01**	**0.02**	**0.04**
Economic Efficiency Grant				
Breede River	**3,079,768.57**	**10,176,138.47**	**33,438,116.87**	**46,694,023.92**
Breed Valley	**5,045,988.84**	**15,799,281.37**	**49,195,186.39**	**70,040,456.60**
Drakenstein	**8,306,176.94**	**27,147,293.96**	**88,236,010.13**	**123,689,481.03**
Stellenbosch	**8,132,388.29**	**30,495,070.64**	**113,719,317.32**	**152,346,776.25**
Witzenberg	**2,820,776.84**	**8,806,926.33**	**27,344,768.13**	**38,972,471.30**
Total Infrastructure Grant				
Breede River	**3,079,768.58**	**10,176,138.48**	**33,438,116.90**	**46,694,023.96**
Breed Valley	**5,045,988.84**	**15,799,281.38**	**49,195,186.42**	**70,040,456.64**
Drakenstein	**8,306,176.95**	**27,147,293.97**	**88,236,010.15**	**123,689,481.07**
Stellenbosch	**35,517,487.76**	**122,919,781.37**	**425,652,716.06**	**584,089,985.19**
Witzenberg	**2,820,776.84**	**8,806,926.34**	**27,344,768.16**	**38,972,471.34**

Results using the Global Capital Expenditure (Global Capex.) Data Set

Using the Global Capital Expenditure Data set for *Scenario 0 (S0)* I run the simulation with the *beta values* equal to zero to generate a set of results when disparities are excluded from the model calculation of the infrastructure grant allocations. The default *delta* (δ) policy parameter is set at 0.3, 02 and 0.1 for *Period 1, 2* and *3* respectively in the *User Input* spreadsheet. The first results I consider are the determination of the desired capital stocks and the historical backlogs for the budget years 2007/08 to 2014/15 for the five municipalities. These results are presented in Table 7.17 below.

Table 7.17: *S0* Global Capex: Capital Backlogs and Desired Capital Stock Budget 2006/07 to 2015

Year	Breede River	Breede Valley	Drakenstein	Stellenbosch	Witzenberg
Desired Stock					
2006/07	656879009.3	1100744761	1779742454	1643890447	616060281.2
2007/08	796833201.8	1335268686	2158933164	1994136621	747317663.4
2008	926827636.7	1525478260	2502017320	2419405956	852963892.3
2009	1049676997	1696947991	2823362076	2858167870	947940760.4
2010	1164877331	1849689580	3121840069	3308525823	1032284859
2011	1271996939	1983857744	3396534915	3768449361	1106112438
2012	1370679368	2099742995	3646745477	4235793463	1169615005
2013	1460645343	2197762953	3871987227	4708319881	1223054134
2014	1541693647	2278452385	4071990729	5183720153	1266755592
2015	1613700943	2342452169	4246697346	5659639909	1301102904
Backlog					
2006/07	0.01	0.01	329 911 508	410 827 433	0.01
2007/08	0.01	0.01	397 077 529	501 686 533	0.01
2008	0.01	0.01	438 457 016	676 203 485	0.01
2009	0.01	0.01	469 386 013	837 651 720	0.01
2010	0.01	0.01	489 671 062	1 092 864 441	0.01
2011	0.01	0.01	499 019 848	1 332 462 669	0.01
2012	0.01	0.01	497 581 679	1 590 871 453	0.01
2013	0.01	0.01	485 406 113	1 866 338 970	0.01
2014	0.01	0.01	462 709 778	2 156 058 169	0.01
2015	0.01	0.01	429 817 465	2 460 690 605	0.01

The scenario in Table 7.17 reveals that while all municipalities have a desired capital stock, only Drakenstein and Stellenbosch have significant backlogs. Based on this scenario the infrastructure grant allocation for each municipality is presented in Table 7.18. It is clear from these results that all the funds earmarked for the historical backlogs will be shared between Drakenstein and Stellenbosch while all the municipalities will receive a share of the funds earmarked for economic efficiency.

Table 7.18 *S0* Global Capex: Grant Allocations Per 3 Periods 2007-09 to 2012 -15 (R million)

(Where the *delta* (δ) policy parameter is set at 0.3, 02 and 0.1 for *Period 1, 2* and *3* respectively)

Allocation per Period	*Period 1 2007/08-2009*	*Period 2 2010-2012*	*Period 3 2013-2015*	**Total**
Historical Backlog Grant				
Breede River	0.00	0.00	0.00	0.01
Breed Valley	0.00	0.00	0.00	0.01
Drakenstein	113,932,968.41	176,826,167.08	191,745,792.20	482,504,927.70
Stellenbosch	183,713,672.30	492,878,774.52	938,381,296.76	1,614,973,743.57
Witzenberg	0.00	0.00	0.00	0.01
Economic Efficiency Grant				
Breede River	78,105,484.49	258,075,308.86	848,018,367.92	1,184,199,161.27
Breed Valley	127,970,460.62	400,682,874.92	1,247,630,715.36	1,776,284,050.89
Drakenstein	210,651,534.07	688,477,882.97	2,237,738,374.46	3,136,867,791.50
Stellenbosch	206,244,109.80	773,380,275.33	2,884,016,173.35	3,863,640,558.49
Witzenberg	71,537,239.36	223,350,953.57	693,485,991.72	988,374,184.65
Total Infrastructure Grant				
Breede River	78,105,484.49	258,075,308.86	848,018,367.92	1,184,199,161.28
Breed Valley	127,970,460.62	400,682,874.92	1,247,630,715.37	1,776,284,050.90
Drakenstein	324,584,502.48	865,304,050.05	2,429,484,166.66	3,619,372,719.20
Stellenbosch	389,957,782.10	1,266,259,049.85	3,822,397,470.11	5,478,614,302.06
Witzenberg	71,537,239.36	223,350,953.58	693,485,991.72	988,374,184.66

Table 7.18 presents the illustrative grant allocations for Scenario 0 given the global capital expenditure data set and *delta* (δ) set at 0.3, 02, and 0.1 for each of the consecutive three periods. The results confirm that Drakenstein and Stellenbosch receive all the funds earmarked for the historical backlogs grant while the other three municipalities receive no funds from this part of the grant. The shares for Drakenstein and Stellenbosch increase progressively over the three periods with Stellenbosch receiving the largest share. However, all the municipalities receive a share of the grant earmarked for the per capita economic efficiency grant.

Finally, as noted earlier, the results for both the CMIP/MIG and Global Capital Expenditure sets of data are significantly influenced by the chosen disparity weights in the model. It is clear that compared to the CMIP/MIG the results generated by the Global Capital Expenditure data set present a very different picture. For example, if greater emphasis is placed on spatial disparities it is possible that the rural municipalities with dispersed populations and/or living in mountainous areas may be able to access larger shares of an infrastructure grant with fewer administrative obligations and conditions.

Given the problems associated with using the CMIP/MIG data set the findings presented in the rest of this chapter are based solely on the Global Capital Expenditure data set that also includes the CMIP/MIG expenditures. Based on the findings from interviews with municipal officials my argument is that equitably allocating infrastructure funds from a combined and specific purpose capital expenditure grant pool offers municipalities the possibility to target disparities and promote economic growth and development based on their own integrated development plans (IDP) and budgets without deferring to narrow conditions and bureaucratic project proposal application processes as is the case with the existing MIG allocations.

The Rate of Reducing the Level of Historical Backlogs – Applying the **Delta** *(δ) Policy Parameter*

To illustrate how the choice of the *delta* (δ) policy parameter influences the rate at which historical backlogs are reduced, consider a situation where the policy maker chooses to accelerate the speed at which historical backlogs are eliminated at the expense of promoting per capita economic efficiency. Recall that the *delta* (δ) policy parameter key in the simulation model can be set anywhere between 0 and 1 for the three periods. The closer to 1 the faster are backlogs eliminated and the lower the amount of funds available for the per capita economic efficiency allocation. For example to generate the simulation results presented in Table 7.18 the *delta* (δ) policy parameter key was set at 0.3, 0.2 and 0.1 for *periods 1, 2* and *3* respectively. If the policy maker wishes to increase the rate at which backlogs are eliminated by a hundred percent then the value of the *delta* (δ) policy parameters must be increased to 0.6, 0.4 and 0.2 respectively for each of the three periods. Table 7.19 presents simulation results when *delta* (δ) is doubled for each of the consecutive three periods. When comparing over the three periods the findings show that the total historical backlog grant for Drakenstein increases twofold to about **R965 million** in Table 7. 19 from about R**483 million** in Table 7.18. On the other hand the total economic efficiency grant has decreased proportionately to about **R1,8 million** in Table 7.19 from about **R3,1 million** in Table 7.18. Similar findings can be observed for the other municipalities. Assuming all other policy requirements and conditions are met elsewhere (*certeris paribus)*, one can conclude that the Drakenstein municipality will have more financial resources to accelerate the reduction of historical backlogs over the three periods. However, this reduction will be at the expense of achieving per capita economic efficiency.

Table 7.19: ***S0*** **Global Capex: Grant Allocations Per 3 Periods 2007-09 to 2012 -15 (R million)**

(Where the *delta* (δ) policy parameter is set at 0.6, 0.4 and 0.2 for *Period 1, 2* and *3* respectively)

Allocation per Period	*Period 1 2007/08-09*	*Period 2 2010-12*	*Period 3 2013-15*	Total
Historical Backlog Grant				
Breede River	0.01	0.01	0.01	0.02
Breed Valley	0.01	0.01	0.01	0.02
Drakenstein	227,865,936.82	353,652,334.17	383,491,584.41	965,009,855.40
Stellenbosch	367,427,344.60	985,757,549.04	1,876,762,593.51	3,229,947,487.15
Witzenberg	0.01	0.01	0.01	0.02
Economic Efficiency Grant				
Breede River	44,631,705.42	147,471,605.06	484,581,924.52	676,685,235.01
Breed Valley	73,125,977.50	228,961,642.81	712,931,837.35	1,015,019,457.65
Drakenstein	120,372,305.18	393,415,933.12	1,278,707,642.55	1,792,495,880.86
Stellenbosch	117,853,777.03	441,931,585.91	1,648,009,241.92	2,207,794,604.85
Witzenberg	40,878,422.49	127,629,116.33	396,277,709.55	564,785,248.37
Total Infrastructure Grant				
Breede River	44,631,705.43	147,471,605.07	484,581,924.53	676,685,235.03
Breed Valley	73,125,977.50	228,961,642.82	712,931,837.36	1,015,019,457.67
Drakenstein	348,238,242.01	747,068,267.29	1,662,199,226.96	2,757,505,736.25
Stellenbosch	485,281,121.62	1,427,689,134.94	3,524,771,835.43	5,437,742,092.00
Witzenberg	40,878,422.50	127,629,116.33	396,277,709.56	564,785,248.39

The Effects of Including the Disparity Weights

This section presents the effects of including the impact of disparity weights in the calculation of the infrastructure grant allocations. To do this I run the simulations **with** and **without** the impact of disparities and compare the results for the three scenarios over the three periods. The disparity indices or weights calculated in tables 7.4, 7.5 and 7.6 are summarized in Table 7.20 and used in the simulations to assess the impact of disparities. The results and findings are presented and discussed below with the aid of the graphs and tables.

Table: 7.20: Summary Municipal Disparity Indices (γ_i) for Three Scenarios

Municipality	Scenario 1 (γ_i)	Scenario 2 (γ_i)	Scenario 3 (γ_i)
Breede River	0.57	0.69	0.72
Breede Valley	1.02	1.12	0.90
Drakenstein	2.24	1.81	1.29
Stellenbosch	2.06	1.59	1.69
Witzenberg	0.37	0.45	0.71

Tables 7.21(*a*), presents the simulation results for including and excluding the disparity impact on historical capital stock backlogs for Period 1. The effect is captured in the row indicating *"Effect on Backlog"*. Analogous to the FFC Provincial Capital Grant Scheme model (*Petchey et al, 2004*), a positive *"Effect on Backlog"* means the municipality's historical capital stock backlog has grown. Conversely, if the *"Effect"* is negative or zero the historical backlog will decrease.

In considering the results of the simulation that excludes disparities Breede River's capital stock will drop to an optimal level of about R1,049 million from more than R1,588 million; Breede Valley will drop to R1,697 million from R1,937 million; Drakenstein will increase to R2,823 million from about R2,354 million; Stellenbosch will increase to R2,858 million from about R1,985 million and, Witzenberg will drop to about R948 thousand from R1,512 million. With the inclusion of varying disparity weights for the three different scenarios the consequent effect on backlogs changes the optimal capital stock value of the municipalities. In Scenario 1 where all the disparities are given an equal *beta* weight of 0.5 the optimal capital stock increases to about R1,458 million for Breede River; R2,078 million for Breede Valley; drops to R2,620 million for Drakenstein ; drops to about R2,288 million for Stellenbosch and, decreases to about R750 thousand for Witzenberg.

For Scenario 2 where the disparity weight for *population density* is given a *beta* weight of 0.2, the *deprivation index* is excluded (*beta = 0*) and all the other disparities are given an equal weight of 0.5 the effect on backlogs again changes the optimal capital stock value for all municipalities. While Breede River sees a slight increase from the original capital stock, it sees a decrease from Scenario 1.

Breede Valley has a slight increase from Scenario 1 and, from its original capital stock. Drakenstein experiences a significant increase from Scenario 1 and its original stock value. Stellenbosch sees an increase from its original stock value and a slight drop from Scenario 1. Witzenberg has significant decrease in its capital stock value. Except for Stellenbosch and Witzenberg all the other municipalities will increase their optimal capital stock values if disparities are included under Scenario 2.

Table 7.21 (a): Disparity Impact on Desired Capital Stocks and Domestic Backlogs: Period 1.

Total Cape Winelands District Population (Million)					1,1487,36.21
Capital Stocks & Disparity Impact	**Breede River**	**Breed Valley**	**Drakenstein**	**Stellenbosch**	**Witzenberg**
Capital Stock	1,588,935,916.61	1,937,096,558.60	2,353,976,061.61	1,984,516,149.77	1,511,571,008.01
Population (2009)	83,815.69	135,499.65	225,442.71	228,221.92	75,692.15
Optimal capital stock without disparities	1,049,676,997.47	1,696,947,991.24	2,823,362,075.59	2,858,167,869.90	947,940,760.39
Backlog without disparities	0.01	0.01	469,386,013.99	873,651,720.12	0.01
Optimal capital stock with disparities (S1)	1,457,824,428.26	2,077,952,605.74	2,620,758,129.19	2,288,163,474.62	750,075,306.67
Optimal capital stock with disparities (S2)	1,176,590,543.89	2,098,844,537.74	3,122,827,154.18	2,791,385,579.15	632,974,649.66
Optimal capital stock with disparities (S3)	996,357,484.23	1,614,299,239.59	2,811,951,774.80	3,556,877,441.46	847,000,605.69
Backlog with disparities (S1)	0.01	140,856,047.14	266,782,067.59	303,647,324.85	0.01
Backlog with disparities (S2)	0.01	161,747,979.15	768,851,092.57	806,869,429.38	0.01
Backlog with disparities (S3)	0.01	0.01	457,975,713.19	1,572,361,291.69	0.01
Effect on Backlogs (S1)	0.00	140,856,047.13	-202,603,946.40	-570,004,395.27	0.00

Effect on Backlogs (S2)	0.00	161,747,979.14	299,465,078.59	-66,782,290.74	0.00
Effect on Backlogs (S3)	0.00	0.00	-11,410,300.79	698,709,571.56	0.00

Legend: S=Scenario

In Scenario 3 where *population density* is given a weight of 0.2; *unemployment rate, households with no income* and *the deprivation index* given weights of 0.5 and, the other disparities excluded (*β=0*) the effect on backlogs again changes the level of optimal capital stock compared to the situation when disparities are excluded and, compared to the optimal capital stock results in Scenario 1 and 2. Scenario 3 shows that optimal capital stocks for Breede River decrease significantly compared to when disparities are excluded and, compared to Scenario 1 and 2. Breede Valley sees a slight drop compared to when disparities are excluded and, a significant drop compared to Scenario 1 and 2. Drakenstein has a slight decrease compared to when disparities are excluded, a slight increase compared to Scenario 1 and, significant decease compared to Scenario 2. Stellenbosch on the other hand will experience a significant increase in optimal capital stock levels compared to when disparities are excluded and, compared to Scenario 1 and 2.

It is clear from the simulation results that the inclusion of disparities will have a significant effect on capital backlogs and consequent impacts on the level of capital stock for each municipality. For example, it seems that in Scenario 1 where disparities have equal weights Breede Valley and Drakenstein are favoured; in Scenario 2, where the *deprivation index* is excluded Drakenstein and, to lesser degree, Breede Valley will benefit and, in Scenario 3, by including disparities for the *unemployment rate, households with no income* and *the deprivation index* with weights of 0.5 and excluding the other disparities Stellenbosch is most favoured. In the three scenarios the disparity weights have a noticeable backlog effect and, therefore, impact on the relative size of the optimal capital stock. In general, assuming a given disparity weight, municipalities that face larger disparities in the provision of capital goods will require a greater stock of physical capital. However, as noted earlier, the pool of funds available for a municipal district's capital expenditure is limited and may be inadequate to cover the costs of eliminating all historical backlogs in one period or, in one medium term expenditure framework (MTEF) cycle.

Based on the results presented in Table 7.21(a) the simulation model will generate respective grant allocation shares for Period 1 from the infrastructure grant pool for the Cape Winelands District for each of the five municipalities. Period 1 grant allocation shares for each municipality are presented in Table 21(b) and represented in the histogramme in Figure 7.1.

Table 7.21 (b): Historical Backlog Allocations: Period 1

Scenarios	Breede River	Breede Valley	Drakenstein	Stellenbosch	Witzenberg	Total
1	0.00	74,874,030.46	120,881,272.73	101, 891, 337.5	0.00	297, 646, 640.7
2	0.001923921	34, 423, 437.5	136, 877, 546.9	126, 345, 656.3	0.001923921	297, 646, 640.7
3	0.001703519	0.001703519	73,207, 782.96	224. 438, 857.8	0.001703519	297, 646, 640.7
0	0.004317074	0.004317074	189, 888, 280.7	306, 189, 453.8	0.004317074	496, 077, 734.5

Figure 7.1: Historical Backlog Allocations: Period 1

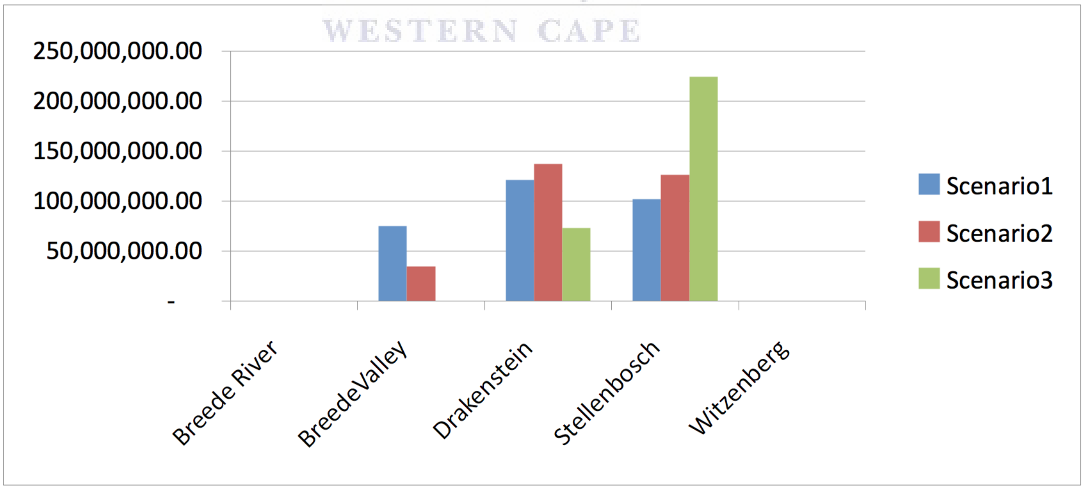


Table 7.22(a) presents the results for Period 2. Recall that for the start of *Period Two* the Simulation Model uses equation (6.10) to calculate the historical backlog part of the grant that is, the historical backlog from *Period One* less the value of the historical backlog part of the grant. In *Period Two* the historical capital domestic backlog estimated in *Period One* is adjusted to take account of the

positive impacts of the historical domestic backlog grant made in period one. The new per capita economic efficiency grant for *Period Two* is estimated using equation (6.11) and, the total grant to the five municipalities in *Period Two* is calculated using equation (6.12). The results for Period 2 in Table 7.22 (a) indicate a similar variable trend for the three scenarios during Period 1 with Drakenstein and Stellenbosch showing increasing optimal capital stock values with the inclusion of disparities. The increase in optimal capital stock for the three scenarios translates into correspondingly higher grant allocation shares for Stellenbosch and Drakenstein in Table 7.22(b) and Figure 7.2.

Table 7.22 (a) Disparity Impact on Desired Capital Stocks and Domestic Backlogs: Period 2.

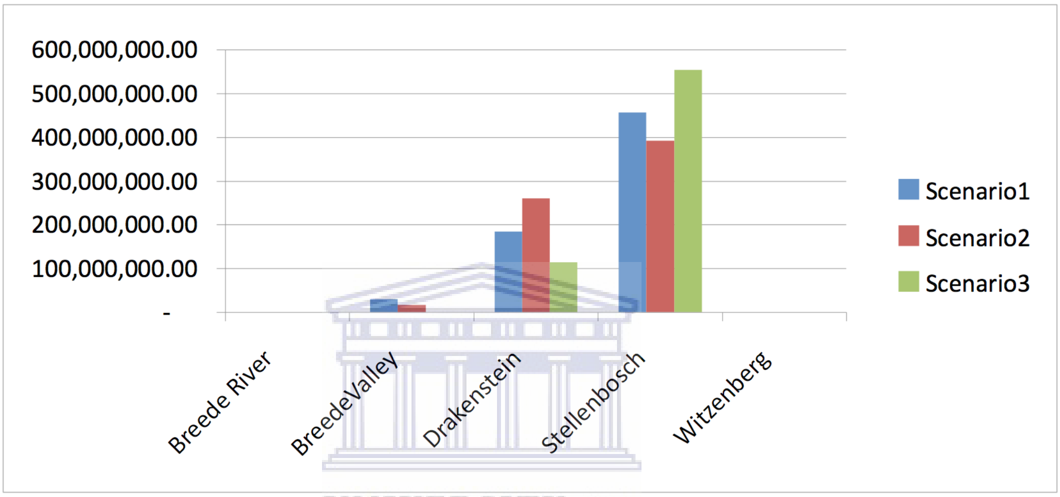
Total Cape Winelands District Population (Million)					1,1487,36.21
Capital Stocks & Disparity Impact	**Breede River**	**Breed Valley**	**Drakenstein**	**Stellenbosch**	**Witzenberg**
Capital Stock	2,125,701,605.23	2,585,727,196.12	3,149,163,797.97	2,644,922,009.25	2,017,061,699.76
Population (2009)	89,672.90	137,369.87	238,578.22	277,115.05	76,518.82
Optimal capital stock without disparities	1,370,679,368.04	2,099,742,995.18	3,646,745,477.18	4,235,793,462.76	1,169,615,005.17
Backlog without disparities	0.01	0.01	497,581,679.22	1,590,871,453.51	0.01
Optimal capital stock with disparities (S1)	1,903,642,616.59	2,571,184,532.89	3,385,055,688.41	3,391,049,206.60	925,479,070.36
Optimal capital stock with disparities (S2)	1,536,404,424.43	2,597,035,465.33	4,033,544,226.93	4,136,822,372.39	780,994,634.97
Optimal capital stock with disparities (S3)	1,301,054,181.54	1,997,476,374.02	3,632,007,564.83	5,271,278,280.42	1,045,070,176.53
Backlog with disparities (S1)	0.01	0.01	235,891,890.45	746,127,197.35	0.01
Backlog with disparities (S2)	0.01	11,308,269.21	884,380,428.96	1,491,900,363.14	0.01
Backlog with disparities (S3)	0.01	0.01	482,843,766.86	2,626,356,271.17	0.01
Effect on Backlogs (S1)	0.00	0.00	-261,689,788.77	-844,744,256.16	0.00
Effect on Backlogs (S2)	0.00	11,308,269.20	386,798,749.74	-98,971,090.38	0.00
Effect on Backlogs (S3)	0.00	0.00	-14,737,912.36	1,035,484,817.65	0.00

Legend: S=Scenario

Table 7.22 (b): Historical Backlog Allocations: Period 2

Scenarios	Breede River	Breede Valley	Drakenstein	Stellenbosch	Witzenberg	Total
1	0.01	29,450,169.71	184,042,277.57	456,212,494.32	0.01	669,704,941.61
2	0.003019508	17510837.51	260022870.2	392171233.9	0.003019508	669,704,941.61
3	0.002385148	0.002385148	115008176.5	554696765.1	0.002385148	669,704,941.61
0	0.008911587	0.008911587	442065417.7	1232196936	0.008911587	1,674,262,354.03

Figure 7.2: Historical Backlog Allocations: Period 2



For *Period Three* the same process is used to estimate the grant shares. In this case the historical backlog at the beginning of period three is defined by equation (6.13) and the historical backlog grant is calculated using the formula specified in equation (6.14). The *per capita economic efficiency* part of the grant for *Period Three* is calculated using the formula from equation (6.15). In Period 3 [Table 7.23(a) and 7.23(b)] Stellenbosch gets the largest share of the historical backlog grant under the three scenarios indicating that this municipality, despite having received the largest portion of the grant in the preceding two periods, is still more severely affected by disparities and has a greater historical backlog to eliminate compared to the other municipalities. Drakenstein will receive a considerably lower share of the grant for Period 3 indicating a proportionately larger reduction of the backlog. In the next part of this section of the chapter I will undertake a comparative analysis of the degree of the reduction in historical backlogs with and without disparities.

Table 7.23 (a) Disparity Impact on Desired Capital Stocks and Domestic Backlogs: Period 3.

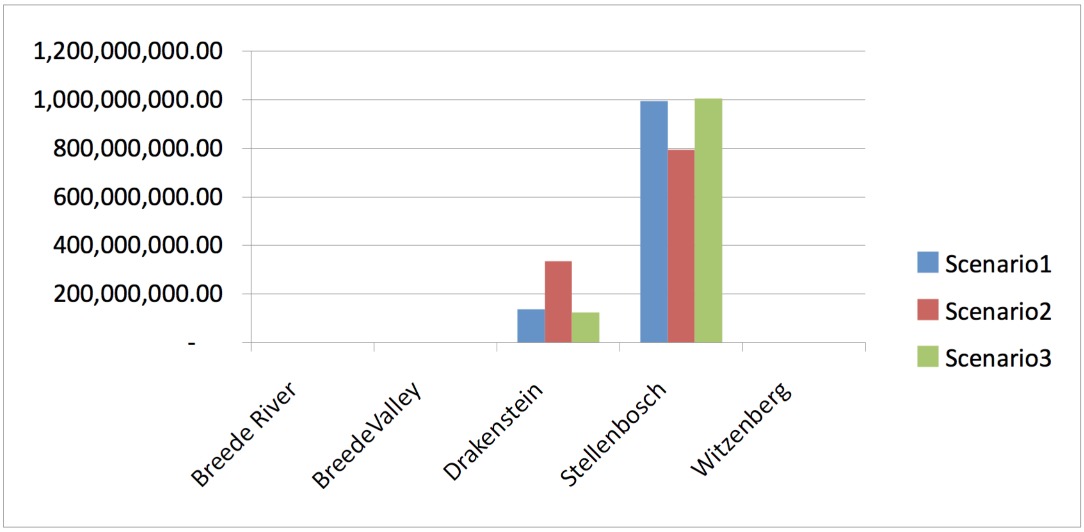
Total Cape Winelands District Population (Million)					1,1487,36.21
Capital Stocks & Disparity Impact	**Breede River**	**Breed Valley**	**Drakenstein**	**Stellenbosch**	**Witzenberg**
Capital Stock	2,576,422,370.96	3,130,085,076.87	3,816,879,880.83	3,198,949,303.06	2,441,256,639.51
Population (2009)	95,939.42	139,265.90	252,479.06	336,482.79	77,354.52
Optimal capital stock without disparities	1,613,700,942.75	2,342,452,169.19	4,246,697,346.31	5,659,639,908.63	1,301,102,904.37
Backlog without disparities	0.01	0.01	429,817,465.47	2,460,690,605.57	0.01
Optimal capital stock with disparities (S1)	1,613,700,942.75	2,342,452,169.19	4,246,697,346.31	5,659,639,908.63	1,301,102,904.37
Optimal capital stock with disparities (S2)	1,613,700,942.75	2,342,452,169.19	4,246,697,346.31	5,659,639,908.63	1,301,102,904.37
Optimal capital stock with disparities (S3)	1,531,731,204.44	2,228,364,555.08	4,229,534,795.84	7,043,199,152.09	1,162,556,769.48
Backlog with disparities (S1)	0.01	0.01	125,075,240.30	1,331,988,664.00	0.01
Backlog with disparities (S2)	0.01	0.01	880,251,210.90	2,328,450,746.00	0.01
Backlog with disparities (S3)	0.01	0.01	412,654,915.00	3,844,249,849.00	0.01
Effect on Backlogs (S1)	0.00	0.00	-304,742,225.22	-1,128,701,941.39	0.00
Effect on Backlogs (S2)	0.00	0.00	450,433,745.48	-132,239,859.62	0.00
Effect on Backlogs (S3)	0.00	0.00	-17,162,550.47	1,383,559,243.46	0.00

Legend: S=Scenario

Table 7.23 (b): Historical Backlog Allocations: Period 3

Scenarios	**Breede River**	**Breede Valley**	**Drakenstein**	**Stellenbosch**	**Witzenberg**	**Total**
1	0.01	0.01	136,500,249.17	993,626,839.78	0.01	1,130,127,088.97
2	0.003783186	0.003783186	336,185,675.80	793,941,413.10	0.003783186	1,130,127,088.97
3	0.002861907	0.002861907	125,092,111.80	1,005,034,977.00	0.002861907	1,130,127,088.97
0	0.021130018	0.021130018	958,728,961.00	4,691,906,484.00	0.021130018	5,650,635,444.86

Figure 7.3: Historical Backlog Allocations: Period 3



Comparative Analysis of Backlog Reduction Without and With Disparities

In this sub-section I present a comparative analysis of the impact of disparities on the speed with which the historical backlogs are reduced and the concomitant effect on the per capita economic efficiency portion of the grant pool. The cumulative level of the reduction in historical backlogs with and without disparities is illustrated in Table 7.24 for the three periods and for each of the three scenarios. The table presents the backlog at the beginning of each period. The results are generated in the Simulation Model in the Spreadsheet called *Scenario Comparisons Simulations 20100817* using equation (6.6) of the model.

In Table 7.24 the row for Period 2 presents the backlog at the beginning of Period 2 after the allocation of the backlog grant for Period 1. As *delta* is set at 0.3, 0.2 and 0.1 for Periods 1, 2 and 3 respectively the pool of funds for these periods will decline proportionately as the backlogs are reduced. Cumulatively there is a progressive reduction of backlogs from Period 2 to Period 3 in the region of R1, 347 million without disparities and, if a fourth Period is included in the cycle the backlog reduction goes up to about R2, 149 million. With disparities it is in Scenario 3 that we can observe a significant progressive reduction of backlogs over the same periods to about R1, 973 million and, to R3, 121 if a fourth period is added. Of course the assumption here is that the pool of funds is used strictly for the reduction of backlogs and, that inflation is taken into account in the value of the grant. The inclusion of disparities raises the total level of the historical backlogs by increasing the optimal capital stock in municipalities with backlogs and, draws other municipalities into the historical backlog part of the grant scheme. Given a limited pool of funds the raising of the total historical backlog will invariably slow down the rate of backlog elimination if more funds are spent on the per capita economic efficiency part of the grant.

Table 7.24: Backlog Reduction Without and With Disparities Per Period

Disparity Impact	Total Backlog at beginning of period in 2007 (constant prices, R million)	Backlog Reduction per period	Cumulative Backlog Reduction
Without Disparities			
Period 1	740,738,941.62		
Period 2	1,343,037,734.14	-602,298,792.53	
Period 3	2,088,453,132.76	-745,415,398.62	-1,347,714,191.14
Period 4	2,890,508,071.07	-802,054,938.31	-2,149,769,129.45
With Disparities			
Period 1(S1)	433,802,280.69		
Period 2(S1)	711,285,439.60	-277,483,158.92	
Period 3(S1)	982,019,087.83	-270,733,648.22	-548,216,807.14
Period 4(S1)	1,457,063,904.46	-475,044,816.63	-1,023,261,623.77
Period 1(S2)	1,053,270,582.62		
Period 2(S2)	1,737,468,501.12	-684,197,918.50	
Period 3(S2)	2,387,589,061.33	-650,120,560.21	-1,334,318,478.71
Period 4(S2)	3,208,701,956.93	-821,112,895.60	-2,155,431,374.31
Period 1(S3)	1,135,412,837.39		
Period 2(S3)	2,030,337,004.91	-894,924,167.52	
Period 3(S3)	3,109,200,038.06	-1,078,863,033.15	-1,973,787,200.67
Period 4(S3)	4,256,904,764.06	-1,147,704,726.00	-3,121,491,926.67

In Table 7.25 we can observe how the inclusion of disparities has affected the municipal percentage shares of the per capita economic efficiency part of the grant pool among over the three periods for the three scenarios. Recall that equation (6.8) is the aggregate per capita economic efficiency grant for municipality i with GE denoting the aggregate per capita economic efficiency component of the grant and, that the simulation model calculates each municipality's share (τ) of the grant pool (CP) for period one using the inputs defined in equation (6.7) adjusted to take account of the disparity index. The results in Table 7.25 show that with the inclusion of disparities, there is very little change in the percentage share of the per capita economic efficiency part of the grant over the three periods.

Table 7.25: Municipal Percentage Shares in Per Capita Economic Efficiency Grant

Disparity Impact	Breede River	Breede Valley	Drakenstein	Stellenbosch	Witzenberg
Without Disparities					
Period 1	11.246	18.426	30.331	29.696	10.300
Period 2	8.918	13.845	23.790	26.724	26.724
Period 3	10.720	15.771	28.287	36.456	8.766
With Disparities					
Period 1(S1)	15.895	22.962	28.653	24.195	8.295
Period 2(S1)	11.010	17.094	29.372	32.994	9.529
Period 3(S1)	10.720	15.771	28.287	36.456	8.766
Period 1(S2)	12.026	21.741	32.004	27.668	6.561
Period 2(S2)	11.010	17.094	29.372	32.994	9.529
Period 3(S2)	10.720	15.771	28.287	36.456	8.766
Period 1(S3)	10.208	16.762	28.888	35.340	8.801
Period 2(S3)	11.010	17.094	29.372	32.994	9.529
Period 3(S3)	10.720	15.771	28.287	36.456	8.766

The possible implication of such a result is that municipalities now have a degree of predictability, certainty and stability in determining their policy objectives and policy targets for addressing socio-economic disparities and economic efficiency in integrated development plans (IDP).

Table 7.26: Municipal Shares in Per Capita Economic Efficiency Grant (R Million)

Disparity Impact	Breede River	Breede Valley	Drakenstein	Stellenbosch	Witzenberg	Total
Without Disparities						
Period 1	55,789,631.78	91,407,471.87	150,465,381.48	147,317,221.29	51,098,028.11	496,077,734.53
Period 2	184,339,506.33	286,202,053.51	491,769,916.40	552,414,482.38	552,414,482.38	2,067,140,441.01
Period 3	605,727,405.65	891,164,796.69	1,598,384,553.19	2,060,011,552.40	495,347,136.94	5,650,635,444.86
With Disparities						
Period 1(S1)	108,475,353.42	156,702,829.71	195,535,218.50	165,112,848.64	56,605,137.15	682,431,387.41
Period 2(S1)	184,339,506.33	286,202,053.51	491,769,916.40	552,414,482.38	159,536,395.41	1,674,262,354.03
Period 3(S1)	605,727,405.65	891,164,796.69	1,598,384,553.19	2,060,011,552.40	495,347,136.94	5,650,635,444.86
Period 1(S2)	87,549,002.88	158,278,334.78	232,994,675.52	201,425,129.69	47,768,026.14	728,015,169.01
Period 2(S2)	184,339,506.33	286,202,053.51	491,769,916.40	552,414,482.38	159,536,395.41	1,674,262,354.03
Period 3(S2)	605,727,405.65	891,164,796.69	1,598,384,553.19	2,060,011,552.40	495,347,136.94	5,650,635,444.86
Period 1(S3)	74,138,029.34	121,737,742.31	209,800,209.55	256,662,678.67	63,919,695.83	726,258,355.69
Period 2(S3)	184,339,506.33	286,202,053.51	491,769,916.40	552,414,482.38	159,536,395.41	1,674,262,354.03
Period 3(S3)	605,727,405.65	891,164,796.69	1,598,384,553.19	2,060,011,552.40	495,347,136.94	5,650,635,444.86

Table 7.26 presents the monetary value of the grants when disparities are included. It is safe to assume from Table 7.27 that the slight variations in the grant shares (τ) may be due to changes in the shares of the population forecasts for the three periods.

Table 7.27: Municipal Population Forecasts and Estimated Grant Shares (τ) With Disparities

Scenario *(S)*	Forecasts Period 1	Forecasts Period 2	Forecasts Period 3	Shares (τ) Period 1	Shares (τ) Period 2	Shares (τ) Period 3
Breede River ***(S1)***	113,833.37	121,788.28	130,299.10	0.1591	0.1571	0.1544
Breede Valley ***(S1)***	165,167.22	167,446.92	169,758.09	0.2309	0.2161	0.2013
Drakenstein ***(S1)***	205,376.13	217,342.44	230,005.98	0.2871	0.2804	0.2726
Stellenbosch ***(S1)***	171,499.02	208,240.11	252,852.43	0.2395	0.2685	0.2994
Witzenberg ***(S1)***	59,676.58	60,328.34	60,987.21	0.0834	0.0779	0.0723
Breede River ***(S2)***	91,873.39	98,293.69	105,162.65	0.1204	0.1182	0.1155
Breede Valley ***(S2)***	166,827.82	169,130.45	171,464.85	0.2187	0.2035	0.1884
Drakenstein ***(S2)***	244,720.85	258,979.60	274,069.13	0.3208	0.3116	0.3010
Stellenbosch ***(S2)***	209,215.77	254,037.11	308,460.75	0.2740	0.3054	0.3385

Witzenberg ***(S2)***	50,359.96	50,909.97	51,465.98	0.0660	0.0613	0.0565
Breede River ***(S3)***	77,800.00	83,236.82	89,053.58	0.1023	0.0993	0.0958
Breede Valley ***(S3)***	128,313.47	130,084.51	131,879.98	0.1688	0.1553	0.1420
Drakenstein ***(S3)***	220,359.05	233,198.35	246,785.73	0.2899	0.2783	0.2656
Stellenbosch ***(S3)***	266,589.78	323,702.64	393,051.07	0.3503	0.3859	0.4225
Witzenberg ***(S3)***	67,388.03	68,124.01	68,868.03	0.0887	0.0813	0.0741

Summary

In addressing the fundamental question and sub-questions of the thesis and, in fulfillment of the three objectives of the research discussed above, this chapter presented the results and findings of applying an adapted version of the Financial and Fiscal Commission (FFC) capital expenditure model (2004) to equitably allocate infrastructure grants to five municipalities in the Cape Winelands District Municipality. The exercise was undertaken using official government data and information in a computer version of the model to firstly test and evaluate the impacts on grant shares of including capital cost disparities in the grant model. A composite capital cost disparity index was constructed and used as a weight in the model to assess the effects of disparities on grant shares. The findings for the impact of the composite capital cost disparity indices on grant shares under three different scenarios showed that disparities had a significant effect on the municipal infrastructure grant percentage shares drawn from a limited pool of available funds.

Secondly, I ran illustrative simulations using the constructed disparity indices to study the effects of taking account of disparities in capital grants. I studied the effects with particular reference to the impact on the trade-off between equitably addressing historical infrastructure backlogs against considerations of achieving economic efficiency. The simulation results were used to compare the effects of disparities under two different capital expenditure data assumptions. The illustrative simulation results showed that when compared to the current approach used to allocate the conditional Municipal Infrastructure Grant (MIG), allocations made from a more global infrastructure grant pool that takes account of disparities provided municipalities with the possibility of equitable, stable, predictable and flexible budgets. A grant scheme based on such an approach was more likely to respect the intergovernmental autonomy of municipalities and, fulfill all the requirements of the Constitution for the progressive provision of basic municipal services targeted at disadvantaged communities.

Chapter 8

Conclusion, Possibilities, Limitations and Recommendations

In this chapter I draw conclusions, highlight the possibilities and limitations of the study and, propose policy recommendations that may make the current municipal infrastructure grant allocation system more equitable and effective in achieving its stated policy objectives.

Conclusions

The introduction to this thesis stated that the purpose of the research was to study the implications of taking account of capital cost disparities and capital backlogs in infrastructure grant transfers to municipalities with communities historically disadvantaged by apartheid. The study asked: ***How can municipal infrastructure grants take account of historical backlogs and disparities that differentiate municipalities from each other?*** The question was posed as a way to evaluate two fundamental propositions about the nature of the current intergovernmental system of infrastructure grants to municipalities.

The first proposition argued that the structure of the existing infrastructure grant formulae does not adequately take account of disparities that differentiate municipalities from each other and thus compromises the constitutional rights of citizens to basic services and violates the constitutional requirement for allocations to be equitable. To address this proposition I *analyzed the likely impact on grant shares of including disparities in an intergovernmental infrastructure grant model intended to equitably allocate funding to municipalities*.

The second proposition argued that government's existing approach to financing municipal infrastructure based on the unit costs of inputs is inadequate and compromises the intergovernmental fiscal relations (IGFR) principle of municipal autonomy and the constitutional requirement for stability, predictability and flexibility of municipal budgets. To address this proposition I evaluated whether *equitability, stability, predictability and flexibility of municipal budgets may be enhanced by the inclusion of disparities and economic efficiency considerations in an intergovernmental municipal infrastructure grant model.*

The ultimate objective of the study was to explore the possibility of taking account of capital cost disparities in an intergovernmental infrastructure grant model intended to equitably allocate finance to municipalities within the constraints of a limited available pool of funds. To achieve the main purpose of the research I set three goals for the study. The first was to analytically review the way in which municipal infrastructure grants are currently allocated to municipalities for redressing socio-economic disparities, infrastructure backlogs and inequalities in historically disadvantaged communities. The second goal was to evaluate whether the Financial and Fiscal Commission (FFC) Provincial Capital Expenditure Grant model could also be used for allocating municipal infrastructure grants and assess whether this approach may be appropriate for addressing disparities and inequalities within and between municipalities. The third goal was to assess the trade-off between economic efficiency considerations and the equitability of allocations that take account of disparities within and between municipalities in achieving their targets as required by the Constitution.

As local municipalities in South Africa receive a large part of their infrastructure investment finance from national government through the use of the municipal infrastructure grants I examined the extent to which there is equitability and efficiency in the way this finance is allocated. Municipalities are faced with varying degrees of historical disadvantage, socio-economic inequalities and geo-spatial disparities. They also have to deal with past and present institutional arrangements and transaction costs and, macroeconomic constraints that impede their ability to finance their infrastructure investments.

The goals of the thesis were addressed by using data and other information from five local municipalities (Breede River, Breede Valley, Drakenstein, Stellenbosch, Witzenberg) in the Cape Winelands Municipal District. The data and information was used to examine whether National Government's municipal infrastructure grants are equitably allocated and redress socio-economic disparities, infrastructure backlogs and inequalities in historically disadvantaged communities. The study used an adapted version of the Financial and Fiscal Commission (FFC) Provincial Capital Expenditure Grant model (Petchey et al, 2004) to examine the notion of equitability in South Africa's intergovernmental fiscal relations system against government's constitutional obligations to provide certain basic municipal services to all citizens (Bill of Rights, Chapter 2 of the Constitution). The adapted grant model was used to process and analyze the data by running simulations in an Excel Computer Model. I argued that if disparities are taken into account within an infrastructure grant model the intergovernmental allocations to municipalities will come close to reflecting the real cost of infrastructure based services while at the same time meeting the requirements set out in *Section 214(1) (a) to (c) and Section 214(2) (d), (e), (f), (g) and (h)* of the Constitution.

In order to analyze and discuss the impact of disparities in the model I constructed a set of composite capital cost disparity indices for the five municipalities. Each composite disparity index was constructed by aggregating the values of eight disparity indicators into one disparity index. Three scenarios with varying weights between 0 and 1 were applied to the indicators to determine their importance. Using the set of composite disparity indices I assessed the impact of the capital cost disparity on the share of infrastructure grants to the five municipalities given that a municipality's share of the grant is from a designated national pool of funds available for infrastructure. By taking the composite capital cost disparity indices into account in the model I was able to show how disparities can impact on the way infrastructure grants are shared amongst municipalities.

In the next step of my analysis I compared the effects and impacts of including disparities in the model simulations in order to study the appropriateness of the model for allocating infrastructure grants to municipalities while taking account of disparities. Firstly, I examined the positive or negative effects of disparities on infrastructure backlogs. Secondly, I assessed the impact of disparities on a municipality's share of the limited grant pool available for infrastructure grants. Thirdly, I assessed the impact of disparities on the speed with which municipal backlogs can be reduced. Fourthly, I assessed how including disparities may affect the structure of the regional economy through impacts on the per capita economic efficiency portion of the infrastructure grant pool. The aim of this assessment was to evaluate the trade-off between economic efficiency considerations and the equitability of allocations that take account of capital cost disparities within and between municipalities. The latter assessment was undertaken to evaluate whether municipalities can achieve their targets with specific reference to the requirements listed in clauses (e), (f) and (g) in Section 214(2) of the Constitution (1996).

The findings of my research show that the use of the proposed municipal infrastructure grant model to allocate capital grants satisfy the various statutory, economic and institutional considerations that go towards informing government infrastructure investment decisions. The various statutory, economic and institutional considerations were presented in Chapter 4, tables 4.1, 4.2 and 4.3. The findings support my structural approach argument that municipal infrastructure investment plays an important role in determining the capital stock variable in the macroeconomic balance and the eventual growth and stability of the economy as a whole. The reason for this is that the way municipal infrastructure grant allocations are made (see Box 4 in Figure 4.1 above) will become a key element in determining macroeconomic policy objectives for investment and employment.

Through the model simulations I found that the use of a grant system based on the adapted version of the *Petchey et al (2004)* model offered policy makers the choice of increasing or reducing the rate at which historical backlogs can be eradicated against the rate at which per capita economic efficiency can be enhanced. This option is possible because the grant shares are drawn from an exogenous macro-economically determined pool of funds over which municipalities have no control. In other words while offering municipalities greater fiscal autonomy and, the possibility of equitable, stable, predictable and flexible infrastructure budgets, the use of the model also imposes a degree of fiscal discipline on municipalities. Using the model for allocating infrastructure grants from a designated pool of funds for capital expenditure obliges municipalities to make a choice that will simultaneously balance the need to address disparities and infrastructure backlogs and, enhance the local economic prospects of the area over a nine-year budget cycle.

The final set of simulations explored the effects of including the disparity weights in the calculation of the infrastructure grant allocations. To do this I ran the simulations with and without the impact of disparities and compared the results for the three scenarios over the three periods. Without disparities the results from the simulation calculations show that the pool of funds to finance municipal infrastructure will decline proportionately over the three medium term budget periods as the backlogs are reduced with a cumulative progressive reduction from the second to third period. However, with the inclusion of disparities the results show a more significant progressive reduction of backlogs for all municipalities over the same period because on aggregate the optimal capital stock is increased drawing other disadvantaged municipalities into the historical backlogs part of the grant.

The calculations also reveal that with a limited grant pool an increase of the total historical backlog will invariably slow down the rate of backlog elimination if more funds are spent on the per capita economic efficiency part of the grant. On the other hand while the inclusion of disparities shows a significant effect on the reduction of historical backlogs there is very little change in the percentage share of the per capita economic efficiency part of the grant over the three periods. This means that municipalities within a district will have medium to long-term certainty and predictability in integrated planning for the eradication of disparities and promoting efficient economic growth and development in the region as a whole.

Over several budget cycles the use of infrastructure grants to increase the level of capital stock in a more balanced and equitable way will promote the economic prospects of the disadvantaged local municipalities making them more reliant on own revenues and less dependent on infrastructure grants to address disparities. In this way local municipalities will not only promote economic growth and development in the municipal district as a whole they will also contribute towards the stability and balance of the structure of the regional economy.

It is obvious that the exercise of greater fiscal autonomy and fiscal discipline by disadvantaged municipalities will have positive benefits for the structure of the national economy as well. Greater municipal fiscal autonomy and fiscal discipline will mean prudent and more realistic infrastructure budgets and a greater degree of public finance accountability. The concomitant increase in municipal own revenues from local economic growth over time will mean less dependence on grant transfers from the national fiscus. Over the long term, with growth and development, municipalities will be able to finance public infrastructure through borrowing on the financial markets with fewer guarantees from National Government.

In general it is in this way, (as alluded to in Chapter 4 and illustrated in Box 4, Figure 4.1) that the use of the proposed municipal infrastructure grant model provides a small but key link in the macroeconomic structure as whole. The CMBS macroeconomic model (Petchey et al, 2007) prepared for the FFC demonstrated how this might be achieved for provinces. Analogously, a similar application for municipalities will most likely generate positive results.

The questions and objectives that informed the study for this thesis presupposed an analytical understanding of the political economy structure in which infrastructure grants are determined and allocated to municipalities in South Africa's intergovernmental fiscal relations context. In this sense intergovernmental fiscal relations decisions that affect municipalities are determined by both macroeconomic and microeconomic structural constraints. This is particularly so with respect to the roles, decision-making behaviour and linkages of economic agents and institutions within municipal boundaries with large communities which have been disadvantaged by apartheid. Thus, my approach can be defined as *structural* because it seeks to model the way policy-makers should behave and impact upon intergovernmental fiscal relations agents and institutions in allocating infrastructure grants to municipalities.

In this study for the thesis I have demonstrated the relevance of the structural approach in analyzing infrastructure investment decisions by local municipalities with specific reference to the influence of state intervention and institutional arrangements in the allocation of financial resources. In particular I showed how this intervention might impact on income distribution and class relationships among households, the macroeconomic impacts of debt and, consequentially interest rates, prices and inflation. In the long term one can argue that through a multiplier effect, the microeconomic nature of infrastructure investment decisions by municipalities will have significant macroeconomic impacts for employment, income distribution, demand for goods and services and, domestic saving and investment opportunities for disadvantaged communities.

Through the process of interviewing government officials and analyzing official data from the five local municipalities in the Western Cape Winelands District, the thesis evaluated the approaches that maybe adopted for the equitable and efficient allocation of existing municipal infrastructure grants such that they take into account the cost of structural socio-economic disparities that differentiate local municipalities from each other. Appraising the equitable sharing models proposed by Josie, MacDonald and Petchey (2008); Petchey, MacDonald, Josie, Mabugu, Kallis (2007) the thesis evaluated the provincial capital grant scheme model (Petchey et al, 2004) of the Financial and Fiscal Commission (FFC) for application to municipalities with disparities that differentiate them from each other.

The findings and results from my research for this thesis show, indeed, that the current approach to intergovernmental financing of municipal infrastructure does not sufficiently account for capital cost disparities that differentiate municipalities from each other. By not comprehensively accounting for socio-economic disparities in infrastructure grants government undermines the constitutional requirement for equitability, adequacy and efficiency of intergovernmental grant allocations to municipalities. Consequently, the right of citizens to basic municipal services as enshrined in the *Bill of Rights* is compromised. Furthermore the research shows that under the present conditional infrastructure grant system the macroeconomic structure and institutional arrangements are weakened and, the intergovernmental principle of local government autonomy is undermined because historically disadvantaged communities cannot meet the legal requirement for stability, predictability, flexibility and economic efficiency of municipal capital budgets.

Possibilities and Limitations

There are several possibilities and limitations associated with using the infrastructure grant model proposed in this thesis. The thesis problem statement highlighted the disjuncture between the possibility of high municipal infrastructure budgets informed by the project-based unit-cost approach and, the limited infrastructure funds available from national government through the MIG conditional grants. While municipalities with substantial own revenue sources may be able to close this *budget expectation gap* through deficit financing and borrowing, poorer disadvantaged municipalities with higher levels of socio-economic disparities and need will not be able to close the *gap* because of low own revenues and limited access to financial markets. These municipalities are almost totally dependent on infrastructure grant transfers from national government. The pool of funds available for infrastructure grant transfers is macro-economically determined using a model that may include and, may be constrained by, a variable for the level of capital stock in the country. The infrastructure grant model proposed in this thesis offers the possibility of incorporating capital stock data at the municipal level and, therefore, a more realistic long-term (at least three medium-term expenditure cycles) municipal infrastructure budget estimate that takes account of macroeconomic constraints, socio-economic disparities and per capita economic efficiency considerations.

For disadvantaged municipalities prior knowledge of available infrastructure grants will strengthen their integrated development planning (IDP) processes and their ability to progressively provide constitutionally mandated basic services (CMBS). Of course, as noted elsewhere in this thesis, the lack of municipal level capital stock data is the single most important limitation to applying the model in South Africa. Alternatively, as shown in this thesis, it is possible to generate municipal level capital stock estimates using the perpetual inventory method (PIM) on long-term capital expenditure time series data. However, even this possibility is limited because long-term (25-30 years) municipal capital stock time series data does not exist in South Africa as the current municipal boundaries were only demarcated in 2002.

Taking account of disparities in the allocation of infrastructure grant transfers to municipalities offers local government the distinctive possibility of reducing historical backlogs and addressing inequality and poverty thus complying with the requirements set out in the Constitution. The findings from the simulation model indicate that the definition, benchmarking and ranking of the disparity indicators play a role in determining the share of the grant allocated to municipalities. Good long-term municipal-level household disparity indicator data in South Africa is collected regularly and is available and reliable. The disparity weights are policy parameters and, therefore subject to political decision-making. This is not an ideal situation if policy-makers wish to make grant allocations based on objectively determined criteria. The choice of a disparity weight in the model should ideally be based on a set of generally agreed standards and criteria and, its importance should be ranked and benchmarked according to accepted statistical procedures and techniques. International practice shows that achieving this goal is not easy. The Australian Grants Commission and the European Commission have undertaken several research projects to address this difficulty. In this regard the econometric studies in Australia by Koshy et al (2000) and Chan et al (2007) and, in the European Commission, the research by Cherchye et al (2008) and Nardo, M. et al (2005) using Data Envelopment Analysis (DEA) techniques are significant (see literature review). The difficulty of objectively benchmarking and ranking disparities in South Africa is a limitation because it leaves open the possibility of the manipulation of politically determined disparity weights in deciding grant shares.

Recommendations: Issues to consider

The findings of the thesis raise several issues that may be considered by policymakers. Fundamentally, policymakers may wish to consider whether the requirements of Section 214 (1) and (2) of the Constitution are in fact comprehensively taken into account in a municipal infrastructure grant formula? In this regard policy makers need pay careful attention to the role of infrastructure grant transfers to disadvantaged local governments with respect to the equitability, adequacy, predictability and stability of municipal budgets. Some of the broader institutional, macroeconomic and microeconomic principles that need to be considered are addressed in the Introduction and Chapters 2 and 3 of the thesis.

The requirements of the Bill of Rights and Chapter 13, Section 214 (1) and (2) of the Constitution (1996) are explicit that factors for equitability, disparity, efficiency, predictability, stability and flexibility should be considered in intergovernmental grant transfers for municipal infrastructure. Acknowledging these constitutional requirements and taking cognizance of the findings and results of my study I recommend that national government give serious consideration to adopting the municipal infrastructure grant model proposed in Chapters 6 and 7 of this thesis. In considering the adoption of the municipal infrastructure grant model national government must also take steps to address some of the limitations highlighted above.

With respect to the limitations discussed in this chapter policymakers need to address the need for reliable time series capital stock data at the local municipality level. Currently, the capital stock data are aggregated at the national level. In the absence of capital stock data at local municipality level it will be extremely difficult to use the municipal infrastructure grant model to establish the level of municipal capital stock backlogs and future infrastructure requirements. A key benefit of local capital stock data is that it provides useful information for assessing capital formation at local municipality level in the interests of planning economic policy objectives and specific infrastructure investment targets. Nationally aggregated capital stock data is used in the construction of the national accounts and in particular used to determine the level of annual gross domestic fixed investment or gross capital formation in the national accounts. Annual gross domestic fixed investment in the national accounts is a key variable in structural macroeconomic planning models used to determine the projected pool of funds available for infrastructure grant allocations.

The collection and aggregation of capital stock data at local municipality or district municipality level should not be difficult because currently in South Africa capital stock data is aggregated at the national level but collected from public sector institutions and enterprises by nine economic sectors or economic activity and for three types of organizations (public, authorities, public enterprises and private enterprises). Identifying the geographic location of the data sources will provide the necessary information for disaggregating capital stock data to the provincial and local government level. The geographic disaggregating of capital stock data will enhance integrated development planning at local government level and provide vital information for efficient determination of intergovernmental infrastructure grant transfers because capital stock data is a more effective indicator for identifying the aggregate level of regional capital stock backlogs and infrastructure investment needs. Furthermore, disaggregating capital stock data to municipal level will provide useful information for further research into the microeconomic and macroeconomic implications of infrastructure investment in local municipalities.

Another key limitation identified in this chapter is the risk of the arbitrary and subjective choice of disparity indicators that could be taken into account in an infrastructure grant allocation model. Such arbitrariness begs the question as to what socio-economic disparity indicators should policy-makers select for inclusion in an infrastructure grant scheme that takes account of disparities? This difficulty is addressed, but not resolved in Chapters 4 (discussion of methodology and variables) and 5 (discussion of disparity data). One way of addressing this challenge is to undertake an extensive econometric or statistical study that will help to identify the socio-economic indicators that correlate most closely with the provision of municipal infrastructure. Koshy et al (2000) and Chan et al (2007) conducted such econometric studies for the Australian Grants Commission.

Related to the issue of identifying the most appropriate socio-economic disparity indicator is the criteria that policy-makers should use to arrive at decisions about prioritizing and ranking infrastructure disparities to be targeted for funding? The objective choice and role of the *beta* (β) policy parameter (discussed in chapters 4, 6 and 7) in ranking and prioritizing disparity indicators in the model is important in arriving at an unbiased policy decision. The literature indicates on-going international work in developing methodologies for the determining appropriate weights for ranking variables in models. The studies carried out in the European Union using linear programming and data envelopment analysis (DEA) techniques (Cherchye et al, 2008) reveal some examples of best practice in determining appropriate weights for ranking variables in models. It should not be inconceivable for similar research to be undertaken in South Africa. Policy makers and researchers should seriously consider using the experience and example of international best practice for identifying parameter weights for ranking and prioritizing socio-economic disparities in South Africa.

In the introduction to the thesis I also discussed the issue of the possible link between the legacy of apartheid disparities, socio-economic inequality and the rising tide of service delivery protests and demonstrations in local municipalities. In May 2011 South African local government elections will be held and the specter of more violent service delivery and related protests is a very strong possibility. Although the studies cited in the introduction allude to the possible link between protests and municipal service delivery there are no empirical studies providing concrete evidence of such a linkage. As a way to assess if there is a correlation between protests and the delivery of municipal infrastructure services a community survey research project should be considered for municipalities with disadvantaged communities. The results of such research will provide the necessary qualitative information to assess the risk of inadequate investment in local municipal infrastructure in particular and fixed capital investment in general.

Summary

The premise on which this thesis was based suggested that Government in South Africa is presented with the challenge of equitably financing the provision of municipal infrastructure services while ensuring economic efficiency in the quest for growth and development. Local government is constitutionally entitled to an equitable share of nationally raised revenues for the provision of services to communities. Municipalities, at the coalface of service delivery and development are faced with many problems, not the least of which is the poverty and deprivation consequent on structural inequalities inherited from the apartheid past. These inequalities inhibit the ability of municipalities to deliver the concomitant services as mandated by the Constitution. Among the risks facing municipalities are disparities in the quality, availability and adequacy of public infrastructure across local municipalities. For its part National Government is required to allocate adequate and equitable levels of capital grants to local governments to eliminate the socio-economic inequalities and disparities that limit their infrastructural capacity to promote growth and development in the quest to eradicate inequality and poverty. Using secondary data and information from five local municipalities in the Cape Winelands District Municipality, the study for my thesis found that government's existing municipal infrastructure grants are not allocated equitably and, they do not adequately take into account the cost of socio-economic inequalities and disparities that differentiate local municipalities from each other.

In the final analysis growing inequality and disparities inherited from colonialism and the apartheid past pose a serious threat to democracy and social justice in South Africa. The post-apartheid Constitution and the democratic institutional foundations of the new South Africa provide an opportunity to develop new models that can be used as policy instruments to mitigate the potential risks of socio-economic instability and threats to democracy. Hopefully, the research and up-dated model presented in this thesis will make a small contribution to the body of knowledge related to policy instruments aimed at the equitable financing of municipal infrastructure taking into account backlogs and socio-economic disparities.

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Appendices

Appendix 1

Summary of Interview Responses from Government Officials

The semi-structured interviews were conducted with 3 officials from 2 out of 5 Cape Winelands District local municipalities; 2 officials from the Cape Winelands District Municipality which is responsible for the five local municipalities; the Deputy Director-General, Local Government & Disaster Management, Western Cape Provincial, Local Government and Housing and, 5 officials from National Treasury variously responsible for provincial and local government infrastructure policy, planning and development. The respondent names, positions, contact details and dates of the interviews are listed in Table 4.4 in Chapter 4 of the thesis. The interviews were based on two semi-structured questionnaires. The first questionnaire was intended for the officials from the local and district municipalities and, the second questionnaire was intended for officials from the Western Cape Province Department of Provincial, Local Government and Housing and, National Treasury. The questionnaires are reproduced in Appendices 2 and 3.

The questionnaire for the officials from the local and district municipalities included questions and points for discussion on the state and financing of local municipal infrastructure targeting socio-economic disparities, poverty and economic development. The questionnaire for the Western Cape Province and National Treasury officials included questions on capital expenditures and financing infrastructure in local governments in general and the Cape Winelands District municipalities in particular. The responses from the government officials are summarized according to the two sets of questions. Thus, the first section of the summary captures the responses and discussions with the local and district municipalities and, the second section presents a summary of the responses and discussions from the Western Cape Province and the National Treasury officials.

Although I made every effort to interview officials from all the five local municipalities in the study it was not possible to do so because officials from the Breede Valley, Drakenstein and Stellenbosch municipalities were unavailable for interviews. Fortunately, however, the officials interviewed from the Cape Winelands District Municipality were able to provide the relevant information and data that I needed from these three municipalities. Soliciting data and information was one of the main aims of the interviews. I am pleased to report that the District Municipality officials kindly provided financial, demographic and disparity indicator data for all the five municipalities from the District Municipality database. In this summary I will discuss the responses pertaining to questions related to the substantive issues of the intergovernmental arrangements rather than those related to data. In the body of the thesis I make adequate and detailed references to the data sources. One caveat to this, however, is that all the local officials interviewed bemoaned the lack of in-house capacity to capture and store data for integrated development planning purposes.

Responses from the Municipal Officials

In response to the question about municipal infrastructure services required to target economic disparities the officials reported that water and sanitation, street lighting electricity, roads and transport and sewage services were provided according to the number of houses built. The houses for indigent communities were built under the national Reconstruction and Development Programme (RDP).

Under the RDP indigent households are entitled to a subsidized basic four-roomed structure connected with electricity and water and sanitation. However, as the provision of housing is a concurrent function with provincial and national departments of housing the officials expressed frustration at the interminable number of bottlenecks in the implementation of the housing programme. The most important of these is the fact that national government is responsible for disbursing the RDP housing grants to the provinces and the latter is responsible for constructing the houses. Sometimes the province will delegate this responsibility to a municipality that has been accredited to build houses.

The disjuncture between the municipalities and the province resides in the fact that municipalities have legal authority over the land on which houses have to be built. Furthermore, municipalities are legally bound to provide bulk infrastructure services to the new households. Officials argued that very often the decisions to build houses is not adequately planned and coordinated within their own integrated development plans. Consequently, allocating funds to construct bulk infrastructure and provide municipal services has to be financed outside the plans and budgets of the municipalities. The increased budgetary pressure is further exacerbated by the influx of new indigent migrants into the area and the subsequent growth of informal shack settlements. The informal settlements very soon degenerate into overcrowded slums that also have to be serviced in terms of the Constitution and according to certain norms and standards. For example informal shack dwellers are entitled to piped water within 200 meters of their dwelling place.

The local municipalities in the Cape Winelands claim that almost all residents are connected to electricity and, within most towns the same standard of tarred roads are built. However, the officials expressed concerns that road construction and maintenance suffers from inadequate funding and the fact that some roads in the district fall under the jurisdiction of the provincial administration while others are under the municipality. While municipalities provide the physical infrastructure, the provincial administration is responsible for the provision of social infrastructure such as housing, health care and education. The officials were apprehensive that the construction, maintenance and supply of municipal services to new social infrastructure facilities will place added pressure on their budgets. National government is responsible for security, crime prevention and national roads.

Questions 2 and 3 were used to gather data and information from the local municipalities and the District Municipality. While the local municipalities were able to provide much of their financial records and annual reports the District Municipality was able to supply data trends covering current infrastructure need and historical backlogs. From the discussions around question 3 I was able to establish that capital stock data is collected according to magisterial district jurisdiction by economic sector but not according to local municipality.

Questions 4, 5, 6 and 7 were intended to establish the main sources of municipal finance for building and maintaining infrastructure and, to establish the most important challenges associated with financing the infrastructure budget. In general water and sanitation, street lighting, roads and transport and sewage infrastructure are all partially financed through conditional grants from the Municipal Infrastructure Grant (MIG) allocations as per project application. Water and sanitation is sometimes co-funded through conditional grants from the Department of Water and Forestry (DWAF). The officials indicated that DWAF conditional grant allocations were not predictable and, were mostly allocated from DWAF funds that were carried over from the previous unspent budget expenditures. Officials perceived this allocation as a form of 'fiscal dumping' as it did not form part of the annual division of revenue allocation.

Many of the poorer municipalities financed their operational costs from the discretionary local government equitable shares transferred from the national division of revenue allocations. On average District Municipal officials indicated that five percent of the discretionary equitable share allocation was spent on administration. This allocation however, constituted between ten and twelve percent of the municipal budgets. Electricity, sewage, water and sanitation services are mostly financed through own revenues from user fees. From 2002 to 2007 property rates in the District on average, ranged between eight and ten percent across the local municipalities. Housing for indigent households was financed through Reconstruction and Development national housing subsidies. Electricity was financed through the Integrated National Electricity Programme. Shortfalls in funds in some instances (e.g. Breede River) are financed from surplus funds kept in a reserve trust. Almost all the local municipalities finance their deficit through private bank loans. Municipal officials implied that they preferred to finance some infrastructure projects through loans from the Development Bank of Southern Africa (DBSA) rather than apply for MIG funding because of the onerous conditions and unpredictability and uncertainty associated with approval for MIG allocations.

A problem often associated with the project applications for the MIG grants was that municipalities were required to finance the costs of environmental impact assessments and that these assessments had to be part of the documentation. Without these assessments MIG allocations were not approved. Officials complained that the added costs of environmental impact assessments were too excessive for poorer municipalities to bear. Other problems associated with MIG funding were the requirement to include detailed business plans with project applications although there was no guarantee that the amount requested would be allocated. As MIG funds were intended for basic municipal services this uncertainty created instability in municipal budgeting and planning processes. Furthermore there was no cross compensation for the costs incurred for environment impact assessments, business plan development and, project cost benefit analyses.

Officials indicated that since 1994 many municipalities had to secure private bank loans to finance services in some poorer communities. One of the reasons for this was that housing subsidies were insufficient. Another problem associated with the housing subsidy was that the amount did not cover the costs of electricity connections and municipalities are unable to recover these costs from user fees. This is especially so in areas where the bulk of the connections are for indigent households that also receive a portion of electricity supply as a national free basic service allocation. In addition the conditions attached to MIG does not allow for this grant to be used for electricity connections. On the other side of the equation the National Integrated Electricity Programme (INEP) does not finance electricity reticulation to households. The National Department of Minerals and Energy (DME), also responsible for the national electricity programme, expects municipalities to recover the costs of electricity reticulation from users.

Officials indicated that municipalities have had to sometimes fund bulk services through loan-financed public-private partnerships. Servicing such loans adds another level of obligation to users and the municipalities. In 2007/08 financial-year for instance the Breede River Municipality had to secure a R30 million loan to finance bulk infrastructure to meet growing housing demand. According to the Breede River and Witzenberg officials servicing of loans becomes a problem with higher liabilities for the provision of basic services as poorer households and commercial users are unable to pay the increased costs for services. For example the loan-financed construction of the Koekemoer Dam in the District meant that households and small and medium sized commercial farmers had difficulties paying increased costs for pumped water services from the dam.

Given the current dispensation for the intergovernmental financing of municipal infrastructure the general consensus from municipal officials was that the targeting of economic disparities in fulfillment of the Bill of Rights was very difficult to achieve. With respect to questions 7, 9, 10 and 11 the municipal officials argued for the discretionary equitable allocation of all municipal infrastructure grants targeted at addressing economic disparities as opposed to the current conditional grant mechanism based on the submission of project proposals. Their argument was based on an assumption that municipalities have a legal obligation to provide constitutionally mandated basic services as was determined by the Constitutional Court in the ruling in favour of Mrs. Grootboom (see Chapter 5).

The municipal officials took issue with the way in which indigent households are defined according to the poverty-line norm of between R2700 to R3000 per annum. They argued that many households have very little to no incomes at all.

As a result of the casualization and seasonal nature of farm labour in many instances indigent household incomes in the District are also seasonal. The officials suggested that income inequality and geo-spatial disparity indicators within and between municipalities would be a much better way of accounting for economic disparities and equitably allocating infrastructure grants. The officials felt that the lack of cohesion and coordination of the disparate infrastructure grant allocations from different national government departments compromised their ability to plan effectively. This in turn compromised planning, predictability and stability of municipal budgets leading to delays in the implementation of infrastructure projects and the subsequent perception of non-delivery of basic services.

Question 11 asked about the extent to which taking account of economic disparities would impact on the cost of infrastructure provision. The question specifically focused on income inequality, poverty, unemployment, population density, access to services, debilitating diseases and other disadvantages. Respondents were asked to rate the impact according to no impact at all, weak, medium, strong or excessive impacts. For water and sanitation all the officials rated the impact as strong. This was so mainly because indigent residents have to be provided with free basic services that many poorly resourced municipalities cannot afford. There was no cost impact on the provision of electricity because this service is provided by ESKOM, the national state enterprise responsible for the supply of electricity.

The cost impact for street lighting and roads and transport was rated medium. Although street lighting, roads and transport, security and crime prevention infrastructure are public services that were available to the populace at large, the provision of these services in informal settlements with large numbers of indigent households meant that municipalities incurred higher unplanned costs. The cost impact for sewage services was rated strong as municipalities found it very difficult to recover user fees from indigent households. In many informal settlements there was no provision for waste removal and sewage services were provided communally in outside toilets.

The cost of housing provision was rated as having an excessive impact because of the influx of new migrants, the rapid growth of informal settlements and, the retrenchment and eviction of many farm workers formerly resident on farms. The lack of coordination and delegation of responsibility between national, provincial and national governments meant that municipalities were placed in an invidious predicament of having to provide housing although they did not have the necessary funds to build low cost houses. At least one municipality, Breede River, had to secure bank loans to cover the cost of providing low cost houses. In 2009 Mr. Jaco Jooste, the municipal director for infrastructure, estimated that there was a total backlog of about 2000 houses for the five towns (Robertson, McGreggor, Bonnivale, Ashton and Montagu) that make up the Breede River Municipality. The increased housing demand meant increased supply and higher costs for the provision of other municipal services. These costs cannot be covered by property rates and taxes. The delivery of housing in the District was further complicated by administrative delays by provincial government in conducting environmental impact assessments.

Responses from Provincial and National Government Officials

The ten questions for the provincial government official (Dr. Hildegarde Fast) and the officials from national government are listed in Appendix 3. Questions 2 and 8 asked about the availability of municipal infrastructure disparity and expenditure trends data. Dr. H. Fast, the Deputy Director General from the Department of Provincial, Local Government and Housing, made available copies of raw data for the Western Cape Province on the completed municipal infrastructure projects from 1996 to 2006 funded under the Consolidated Municipal Infrastructure Programme (CMIP) and the Municipal Infrastructure Grant (MIG) formula. The projects are listed in Appendix 4 and the their costs are captured in the PIM spreadsheet calculations in the Excel Simulation Model. The National Treasury made available actual financial expenditure statements and budget allocations for the period studied. These data covered the actual capital spending trends and the global amounts of municipal infrastructure grants for the period. These data are used as inputs for the PIM calculation and for running simulations on the allocations under different scenarios in the Excel Simulation Model.

Questions 1, 2, 3 and 4 asked about the extent to which economic disparities were taken into account, how they were defined and determined and, how they were incorporated into the grant formula. It became clear from the national and provincial respondents that greater importance in the application of the MIG formula was attached to targeting infrastructure backlogs rather than economic disparities. The weight for poverty in the formula was seen to be an adequate proxy for all economic disparities.

Question 5, about the problems associated with the project-based approach to allocating MIG and other infrastructure funds, elicited significant responses from national and provincial officials. The disjuncture between the MIG formula and the housing grant formula proved to be the most significant challenge in coordinating and planning integrated infrastructure development. While both depend on project applications from municipalities, the housing allocations have to be approved by several intermediate levels of bureaucracy from national and provincial departments before funds are released. If municipalities are not accredited to build houses then provinces take on the responsibility. However, to build the houses the provinces have to seek approval from municipalities in terms of municipal by-laws for planning and land use, property evaluations, property rates and the provision of bulk services and roads. The officials felt that this level of disjuncture presented the biggest challenge for the municipal service delivery across the country.

Officials from national and the province provided similar responses to Question 6 about the criteria and conditions for determining MIG allocations. There was general agreement that the conditions were onerous and the reporting requirements excessively time-consuming. Officials from National Treasury argued that the conditions were necessary to ensure that funds were spent for infrastructure. The provincial official, however, felt that that MIG projects reflected in the municipal Integrated Development Plans, do not always show how they intend to contribute to the overall national and provincial policy objectives.

On question 7 the officials agreed that there was no specific requirements for municipalities to undertake cost-benefit or cost effectiveness analyses before making project application proposals. In fact official felt that municipalities either did not have the in-house capacity to do such studies or they could not afford to pay for consultancy services. However, environmental impact assessment studies were a requirement for certain projects. Such studies proved to be politically and finically costly for municipalities faced with priorities of service delivery to disadvantaged and indigent communities.

Question 9 highlighted the concerns raised in the 2008/09 Auditor General's Report on Municipal finances. The question specifically asked about the Report's concerns about the unconditional and conditional funding of municipal infrastructure, housing and social facilities with specific reference to the Cape Winelands District and the Western Cape Province. The officials responded by suggesting that the Auditor General's concerns were symptomatic of underlying systemic problems in the way in which intergovernmental grants were allocated to municipalities in general.

With specific reference to the Western Cape Province all the officials agreed that the municipal accreditation process for housing delivery was a major difficulty for grant allocations targeted at reducing infrastructure backlogs. The backlog weight in the housing grant formula is different from the weight in the MIG formula. Furthermore, while the MIG at least includes a weight for poverty the housing formula does not include any weight for economic disparities.

Dr. Fast raised some pertinent points about how the MIG and housing grant allocations were perceived in the Western Cape. Projects were very often approved because of political preference or public pressure rather than on the basis of objective criteria and costing processes. The housing grant in the Western Cape was used to fund land purchase, construction and the provision of bulk services. This led to decisions being made on the basis of where it was cheaper to build rather than where there was the greatest need. In the short run this may have been cheaper, however, in the long run it places a greater financial burden on indigent households because of increased transport and infrastructure service costs. For most residents in disadvantaged communities such decisions seem to be perpetuating and entrenching apartheid-type spatial planning policies.

In response to question 10 the officials agreed that there was a need for a re-evaluation of the municipal infrastructure grant system and the related intergovernmental institutional arrangements. I was told (in late 2009) that the

Department of Provincial and Local Government[43] had just completed a major review of local government issues and problems.

[43] *The Department is now called Cooperative Governance and Traditional Affairs (COGTA)]. The review was published in late 2009 by COGTA and isdiscussed and reffered to as the COGTA Report in this thesis.*

Appendix 2

Questionnaire for Interviews with Cape Winelands Local and District Municipal Managers and Officials

1. What basic infrastructure is required to target socio-economic disparities, poverty and economic development in your municipality with respect to:
   - Municipal services such as water, sanitation, street lighting, electricity, roads and transport, sewage, other?
   - Social infrastructure such as housing, primary health care facilities, social welfare facilities, educational facilities, recreational facilities, security and crime prevention facilities, other?
2. Is there any data and information covering the past five (5) to twenty (20) years that show the level of current need and, the trends in historical backlogs with respect to the infrastructure identified in 1 above?
3. Is there any recorded data and information showing long-term (more than ten years) trends in the value of public and/or private capital stock? Such data is a good regional and sub-regional indicator of economic development.
4. Please comment on the main sources of funds for financing the building and maintenance of the respective infrastructure listed in 1 above? Are they financed from property rates; user charges; specific purpose and conditional grant transfers (e.g. Municipal Infrastructure Grant-MIG, roads, housing and other departmental grants); loans from private banks or development banks (e.g. Development Bank of Southern Africa-DBSA); donor funding; other?
5. Can you provide actual infrastructure spending data on the items listed in 1 above and financed from the main sources in 4 above?
6. Please comment on the main problems encountered in accessing and using specific purpose and conditional grant transfers with respect to the infrastructure needs listed above in relation to: the grant system; the transfer mechanism and time delays; the structure of the formulae; the associated conditions; your administrative capacity to manage and monitor the funds; your human resource capacity and, the geographical impediments to implement specific projects; other?
7. Please comment on how the different infrastructure grant transfers are made from the different sources (National and provincial government departments) and comment on the fairness/equitability and efficacy [fairness, in this sense, means the equitable allocation of nationally collected revenue to all spheres of government as prescribed in Section 213 of the Constitution of South Africa and, efficacy refers to the ability of the grant mechanism or instrument to produce an intended result or achieve the desired policy objective and target taking into account Section 214(2) a-j of the Constitution]?
8. What alternative infrastructure grant transfer mechanism would be more suited for targeting poverty, socio-economic disparity and economic development in your municipality?

9. Please comment on the methods (e.g.; cost benefit analysis; cost effectiveness analysis) and procedures used for selecting infrastructure projects for funding.
10. Please comment on the criteria used for funding and budgeting for infrastructure projects taking into account development and other needs and, socio-economic disparities (such as poverty, unemployment, income inequality; geographical features such as population density and physical accessibility; debilitating diseases and historical disadvantage) as required in *Section 214 (2) d, e, f, g, h, i and j* of the Constitution.
11. Please comment on the types of development and other needs prioritized in your municipality with specific reference to municipal infrastructure services and social infrastructure facilities.
12. Please comment on the different types of socio-economic disparity targeted in your municipality with specific reference to municipal infrastructure services and social infrastructure facilities.
13. Please indicate whether you have prepared capital and infrastructure budget estimates for the next two medium term expenditure cycles to finance the priorities and targets listed above. Can these estimates be made available for use in the research project?
14. Please comment on the extent to which taking into account socio-economic disparity factors impacts on the cost of infrastructure provision.
15. Please comment on what methods and steps are used for determining the real costs of socio-economic disparity factors when deciding on infrastructure project budget allocations.
16. What socio-economic disparity and developmental need indicators (data and information) are available for use in determining the real cost of infrastructure provision in your municipality?
17. Are there any other comments or suggestions you wish to make that may be relevant to the issues discussed above?

Appendix 3

Questionnaire for Interviews with Provincial and National Treasury Officials Responsible for Management and Financing of Local Government infrastructure

1. Are economic disparities [as stipulated in Section 214 (2) (g) of the Constitution] taken into account when allocating capital and other infrastructure grants to local municipalities?
2. If ***yes*** please list the economic disparities considered and what data sources are used and whether any analyses of the significance of disparity data trends have been undertaken for the Cape Winelands?
3. If disparities are ***not*** considered please give reasons why not?
4. If disparities are taken into account how are these incorporated into both the unconditional and conditional capital and infrastructure grant formulae (including housing and roads grants). Can the formulae for all these grants be provided?
5. Can you please comment on the problems associated with the ***<u>project-based approach</u>*** to allocating the ***Municipal Infrastructure Grant (MIG)*** and other capital grants for housing and roads?
6. Can you please comment on the criteria used for determining the MIG and other capital/infrastructure allocations to municipalities?
7. Are cost-benefit analyses, feasibility studies and environment impact analyses undertaken and, their results, considered in allocating grants using ***the project-based approach***? Please provide reasons for your response.
8. Does your department have capital/infrastructure (CMIP/MIG) grant actual expenditure data and trends and reports for the Cape Winelands municipalities for the past ten years and, can these be made available?
9. Does your department have any specific concerns with respect to the financing of unconditional and conditional capital grants for municipal infrastructure, housing and other social infrastructure in the Cape Winelands municipalities in particular and the Western Cape in general? Please discuss in relation to the latest Auditor General's Report on municipal finance and the National Governments recent report on local government service delivery.
10. Do you have any alternative proposals for allocating capital/infrastructure grants to municipalities taking into account disparities?

Appendix 4

List of the Consolidated Municipal Infrastructure Programme (CMIP) and Municipal Infrastructure Grant (MIG) Projects for the Western Cape Province Completed between 1996 and 2006 (*Source: Department of Provincial, Local Government and Housing, Western Cape Province, 2007*)

The costs for each project are captured in the Excel Simulation Model spreadsheet labeled Perpetual Inventory Method (PIM) calculations.

Roads and transport			
Access Road Programme	Bardale: New Stormwater System	Bulk Stormwater	Chris Hani Park: Roads & Stormwater
Extension of Maroela Street Ph1A	Extension of Roads	External Stormwater	Ext Maroela Street Ph1B
Access Road Programme	Bardale: New Stormwater System	Bulk Stormwater	Chris Hani Park: Roads & Stormwater
Extension of Maroela Street Ph1A	Extension of Roads	External Stormwater	Ext Maroela Street Ph1B
Formalise Stormwater	Hex River: Rehabilitate Stormwater Canal	Industrial Park: New Roads	Link Roads & Associated Stormwater
Mooi Uitsig: Upgrade Stormwater	Mooiwater: Upgrade Stormwater	New Access Collector	New Access Collector/Bus Route
New Access Collectors	New Access onto Dassie Road	New Access Road	New Access Roads
New Access Roads & Stormwater	New Bulk Roads	New Bulk Stormwater	New Bulk Stormwater Channel Ph1
New Bulk Stormwater Channel Ph2	New Bulk Stormwater Pipeline	New Bulk Stormwater Pond	New Bus Route
New Bus Route Ph1	New Bus Routes	New Link Road	New Main Collector Roads
New Main Roads	New Main Roads Ph2	New Minibus Taxi/Trade Area Ph1	New Pedestrian Walkway
New Pedestrian Walkway (Labour Int)	New Pedestrian Walkway (Labour Int)	New Primary Road	New Primary Roads
New Primary Roads	New Road & Associated Stormwater	New Roads	New Roads & Associated Stormwater
New Roads & Bridges	New Roads Ph2	New Roads & Stormwater	New Sercor Drive
New Stormwater	New Stormwater Canal	New Stormwater Channel	New Stormwater Channel
New Stormwater Channels	New Stormwater Connector	New Stormwater Culvert	New Stormwater Detention Pond
New Stormwater Drainage	New Stormwater Network	New Stormwater Pipeline	New Stormwater Pipelines
New Stormwater Pipes	New Streets & Stormwater	New Taxi Rank	New Taxi Route
New Taxi Terminus	New Taxi/Trading Area	New Traffic Calming Measures	New Transport Interchange
Noordend: New Roads & Stormwater	Obiqua Crescent: Rehabilitate Roads	Pedestrian Bridge Over River	Pedestrian Bridge over Vanguard Drive
Planning of Frans Conradie Drive	Primary Roads	Rehabilitate Access Road	Rehabilitate Access Road from Bitterfontein
Rehabilitate Access Roads	Rehabilitate Access Streets	Rehabilitate Bo-Dal Road	Rehabilitate Concrete Road

Rehabilitate Concrete Roads	Rehabilitate Concrete Roads Ph2	Rehabilitate Etlinger Street	Rehabilitate Gravel Roads
Rehabilitate Gravel Roads (Labour)	Rehabilitate Internal Roads	Rehabilitate Main Access Road	Rehabilitate Main Access Road
Rehabilitate Main Road	Rehabilitate Parking Areas	Rehabilitate Roads	Rehabilitate Roads
Rehabilitate Roads & Associated Stormwater	Rehabilitate Roads & Associate Stormwater Ph3	Rehabilitate Roads Ph1	Rehabilitate Roads Ph2
Rehabilitate Roads Ph3	Rehabilitate Roads Ph4	Rehabilitate Roads & Stormwater	Rehabilitate Roads & Stormwater Ph2
Rehabilitate Roads & Stormwater Ph2	Rehabilitate Roads & Stormwater Ph3	Rehabilitate Stormwater	Rehabilitate Stormwater Canal
Rehabilitate Streets	Rehabilitate Streets & Associated Stormwater Ph1	Rehabilitate Streets & Associated Stormwater Ph2	Rehabilitate Streets Ph2
Rehabilitate Streets & Stormwater	Rehabilitate Streets & Stormwater	Rehabilitate Streets & Stormwater Ph3	Rehabilitate Taxi Routes & Stormwater Ph2
Rehabilitate Taxi Route & Stormwater	Roads	Roads & Stormwater	South Western Area: Rehabilitate Roads
Stock Road Bus & Taxi Facility	Upgrade Access Road	Upgrade Bulk Stormwater	Upgrade Bulk Stormwater
Upgrade Bulk Stormwater Drainage	Upgrade Bus & Taxi Facility	Upgrade Existing Stormwater	Upgrade Main Access Road
Upgrade Minibus/Taxi Route	Upgrade Primary Road	Upgrade Primary Roads	Upgrade Primary Street
Upgrade Road	Upgrade Road Junction to Hydroponics	Upgrade Roads & Stormwater	Upgrade Sidewalks
Upgrade Sidewalks along Diaz Road	Upgrade Sidewalks (Labour Intensive)	Upgrade Stormwater	Upgrade Stormwater
Upgrade Stormwater along Chris Hani Drive	Upgrade Stormwater Berm & Retention Pond	Upgrade Stormwater Buitenkant Street	Upgrade Stormwater Canal
Upgrade Stormwater Channel	Upgrade Stormwater Channel (Labour Int)	Upgrade Stormwater Channels (Labour Intensive)	Upgrade Stormwater Channels Ph1
Upgrade Stormwater Control to River	Upgrade Stormwater Discharge	Upgrade Stormwater Drainage	Upgrade Stormwater Drainage Ph2
Upgrade Stormwater Open Drain	Upgrade Stormwater Pump Line	Upgrade Stormwater System	Upgrade Taxi Rank
Upgrade Taxi/Trade Facility Ph2	Widening of Hlathi Road		

Sanitation			
Ashbury (680 erven): New Bulk Sewer	Berg River Pollution: New Sewer Pumps & Connectors	Bucket Eradication: New Sewer Pipe Network	Bucket Eradication: New Sewer Reticulation
Bucket Eradication: Sanitation	Bucket Eradication: Upgrade Sanitation	Bucket Eradication: Water Meters & Sanitation	Buffer South Ph2: New Sewer Line
Bulk Sanitation Studies/Design	Bulk Sewer Connector	Chris Hani Park: New Connector Sewer Line	Cleaning of Sewer Lines
Construction of 1200 New VIP Toilets	Eikevlei: New Sewer Main	Extend Existing Waste Disposal Site	External Water Supply

Farming Village: New Bulk Sewer	Informal Settlements: New Basic Sanitation	Landfill Extension Cells 1 & 2	Leachate Treatment
Line Oxidation Pond at Beukeskraal	Main Outflow Sewers: Capacity Investigation	Main Sewer Pipe Line	New Bulk Outfall Sewer
New Bulk Sanitation	New Bulk Sewer	New Bulk Sewer	New Bulk Sewer Main
New Bulk Sewer Mains	New Bulk Sewer Pipeline	New Bulk Sewer Pipeline Ph2	New Bulk Sewer Pipe Lines
New Internal Sewer Reticulation	New Main Outfall Sewer	New Main Sewer	New Main Sewer Outfall East Pipeline
New Outfall Sewer	New Oxidation Ponds	New Oxidation Ponds & Outflow Line	New Oxidation Ponds Ph2
New Refuse Site	New Refuse Transfer Station	New Regional Landfill Site	New Sanitation
New Sewage Pump Station	New Sewage System	New Sewage Works	New Sewer
New Sewerage & Connector Pipe	New Sewerage Pump Station	New Sewerage Reticulation	New Sewerage Works
New Sewer Connect	New Sewer Connector	New Sewer Connector Ph2	New Sewer Connector Ph3
New Sewer Interceptor Pipe Line	New Sewer Line	New Sewer Line & Works	New Sewer Link
New Sewer Main	New Sewer Main	New Sewer Main & Pump	New Sewer Mains
New Sewer Network	New Sewer Outfall	New Sewer Outflow	New Sewer Pipeline
New Sewer Pump Stations	New Sewer Pump Stations & Main	New Sewer Reticulation	New Sewer Reticulation
New Sewer Reticulation Ph2	New Sewer Reticulation Ph3	New Sewers	New Sewer System
New Sewer System Ph2	New Solid Waste Disposal	New Solid Waste Recycling Centre	New Solid Waste Transfer Station
New Waste Disposal Site	New Waste Water Treatment Facility	New Waterborne Toilets	Noordend: New Sewer Pipeline
Planning Waste Disposal Site	Regional Waste Disposal	Rehabilitate Ablution Facilities at Sports Fields	Rehabilitate Access Collector & Stormwater
Rehabilitate Internal Sewer	Rehabilitate Main Sewer	Rehabilitate Oxidation Dams	Rehabilitate Oxidation Ponds
Rehabilitate Refuse Site at Overhills	Rehabilitate Sanitation	Rehabilitate Sewage Pipes	Rehabilitate Sewage System
Rehabilitate Sewage Treatment Works	Rehabilitate Sewage Works	Rehabilitate Sewerage Treatment Works	Rehabilitate Sewer Mains
Rehabilitate Sewer Outfall Relocation	Rehabilitate Sewer Pipeline	Rehabilitate Sewer Pipe Network	Rehabilitate Sewer Pipes
Rehabilitate Sewer Pumps	Rehabilitate Sewer Pumps Ph2	Rehabilitate Sewer Pump Station	Rehabilitate Sewer Reticulation
Rehabilitate Sewer Treatment	Rehabilitate Sewer Treatment Plant	Rehabilitate Sewer Works	Rehabilitate Solid Waste Disposal Site
Rehabilitate Sports Stadium	Rehabilitate Waste Water Treatment	Rehabilitate Waste Water Treatment Works	Rehabilitate Waste Water Works
Rehabilitate Water Reticulation	Rehab Sewer System: Pipes	Replace Pitch Fibre Sewer Pipes	Sewer Pump Station
Sewer Works: Re-use of Treated Effluent	Solid Waste Transfer Station	SPCA: Upgrade Waste Water Pump Station	Stormwater

Stormwater Retention Pond (Labour Int)	Swartklip Refuse Transfer Stn	Upgrade Bulk Sanitation	Upgrade Bulk Sewer
Upgrade Connector Sewer	Upgrade Disposal Site	Upgrade Existing Sewerage Purification Plant	Upgrade Existing Sewerage Works
Upgrade External Sewer	Upgrade External Sewer System	Upgrade Internal Sewerage	Upgrade Landfill Site at Karwyderskraal
Upgrade Main Sewer	Upgrade Main Sewer Line	Upgrade Main Sewer Pump Station	Upgrade Outfall Sewer Line
Upgrade Potsdam Sewer Treatment Works	Upgrade Refuse Site	Upgrade Sanitation	Upgrade Sanitation
Upgrade Sanitation: Oxidation Ponds	Upgrade Sanitation Ph3	Upgrade Sanitation System	Upgrade Sanitation System
Upgrade Sanitation Works	Upgrade Schulphoek Access	Upgrade Sewage	Upgrade Sewage Pump
Upgrade Sewage System: Effluent Irrigation	Upgrade Sewage Treatment	Upgrade Sewage Treatment Works	Upgrade Sewage Works
Upgrade Sewer	Upgrade Sewerage Network	Upgrade Sewerage Pump Station	Upgrade Sewerage Pump Stations
Upgrade Sewerage Treatment Works	Upgrade Sewerage Work	Upgrade Sewerage Works	Upgrade Sewer Dams
Upgrade Sewer Line	Upgrade Sewer Main	Upgrade Sewer Main Ph1	Upgrade Sewer Main Ph2
Upgrade Sewer Outfall	Upgrade Sewer Pipe	Upgrade Sewer & Pump Station	Upgrade Sewer Pump Station & Pump Line
Upgrade Sewer Pump Station & Rising Main	Upgrade Sewer System	Upgrade Sewer System Ph2	Upgrade Sewer Treatment
Upgrade Sewer Treatment at Kleinkrantz	Upgrade Sewer Treatment Works	Upgrade Sewer Treatment Works (Oxidation Pond)	Upgrade Sewer Works
Upgrade Shelly Point Sewer Treatment Works	Upgrade Solid Waste Disposal Site	Upgrade Solid Waste Site	Upgrade Treatment Works
Upgrade Waste Disposal	Upgrade Waste Disposal Site	Upgrade Waste Water Treatment Works	Upgrade Water Works Sludge Disposal
Waste Disposal Site	Waste Water Treatment Works		

Electricity			
Buffer South Ph2: New Local Distributor	Community Lighting	Community Lighting: Wind Generation	Groendal Road: New Streetlights
High Mast Lighting	High Mast & Street Lighting	Mooiwater & Langrug: New Street Lighting	Morkels Cottage: New Street Lighting
N2 Lights	New Bulk Electricity Infrastructure	New Community Lighting	New Community Lighting
New Community Lights	New Community Lights	New Flood Lights for Rustdene Stadium	New High Mast Lighting
New High Mast Lighting	New High Mast Lighting for 2 Sports Fields	New High Mast Lighting Ph2	New Lighting
New Local Distributor	New Local Distributor (Saxdowns Road)	New Night Lighting	New Residential Street Lights

New Sports Field Lighting	New Street & High Mast Lighting	New Street Lighting	New Street Lighting
New Street Lighting along Eerste River Road	New Street Lighting & Bulk	New Street Lighting & Bulk Supply	New Street Lighting in Beach Road
New Street Lighting on Stock Road	New Street Lighting Ph1	New Street Lighting Ph1	New Street Lighting Ph2
New Street Lighting Ph2	New Street Lights	New Street Lights	New Street Lights along Pedestrian Walkway
New Street Lights & Associated Bulk Supply	New Streetlights & Electricity	New Street Lights on Access Roads	New Streetlights on Mossel Bay/Oudtshoorn Roads
Pama & Spine Roads: New Street Lighting	Rehabilitate Bulk Electricity	Rehabilitate Electricity Reticulation Street Light	Rehabilitate High Mast Lighting
Rehabilitate Street Lighting	Rehabilitate Street Lights	Sheffield Rd: New Street Lighting	Solar Driven Street Lights
Street Lighting	Street Lighting on Access Road	Street Lights on Main Access Roads	Upgrade Bulk Electricity
Upgrade Bulk Electricity Supply	Upgrade Community Lighting	Upgrade Electrical Control Room & Fault Repor	Upgrade Electricity Supply
Upgrade Flood Lighting for Sports Field	Upgrade High Mast Lighting	Upgrade Lighting: 22kV Auto Reclosers	Upgrade Lighting Ph2
Upgrade Street Lighting	Upgrade Street Lighting & Associated Bulk Supply	Upgrade Street Lighting Ph2	Upgrade Street Lights

Water				
Ashbury (680 erven): New Main Water Line	Augmentation of Raw Water Supply	Buffer South Ph2: New Water Pipe	Buffer South Site B: New Water Connector	Bulk Water Supply
Bulk Water Supply Ph 2&3	Bulk Water Supply Telemetry	Chris Hani Park: New Water Connectors	Eikevlei: New Water Main	Extension to Waste Water Treatment Works
Extension to Water Treatment Works	Industrial Park: New Water Pipeline	Informal Settlement: New Water	Informal Settlements: New Basic Water Supply	Investigate Water Network Losses
Investigation of New Water Supply Ph1-3	New 1Ml Raw Water Reservoir	New 2Ml Reservoir	New 500Kl Reservoir	New 5Ml Reservoir
New Booster Pump Station	New Bulk & Connector Water	New Bulk Water	New Bulk Water	New Bulk Water Main
New Bulk Water Main	New Bulk Water Mains	New Bulk Water Ph2	New Bulk Water Provision	New Bulk Water Supply
New Bulk Water Supply: Irrigation	New External Water Supply	New Gravity Sand Filters	New Internal Water Reticulation	New Koekedouw Dam
New Main Water Supply	New Pump Station	New Reservoir	New Reservoir & Main	New Reservoir (Old CMIP 4207.1)
New Reservoir & Pipe	New Reservoir & Pipeline	New Reservoir & Pipe Line	New Water	New Water Connect
New Water Connector	New Water Connector Ph3	New Water Connectors	New Water Main	New Water Main

New Water Mains	New Water Pipe	New Water Pipeline	New Water Pipes	New Water Reticulation
New Water Reticulation	New Water Reticulation Ph2	New Water Reticulation Ph3	New Water Stabilisation	New Water Storage
New Water Supply	New Water Supply Network	New Water Supply Pipeline Ph1	New Water Treatment Works	Raw Water Storage
Reconstruct Wesselsgat Water Pipe Bridge	Rehabilitate Bulk Water	Rehabilitate Bulk Water Supply	Rehabilitate Gamka Dam Pipe	Rehabilitate Internal Water
Rehabilitate Internal Water Network	Rehabilitate Internal Water Ph2	Rehabilitate Internal Water Reticulation	Rehabilitate Low Level Reservoir	Rehabilitate Low Water Bridge
Rehabilitate Main Water Supply	Rehabilitate Main Water Supply	Rehabilitate Main Water Supply Pipeline	Rehabilitate Main Water Supply Pipelines	Rehabilitate Raw Water Channels
Rehabilitate Reservoir	Rehabilitate Water	Rehabilitate Water Connection	Rehabilitate Water Main	Rehabilitate Water Mains
Rehabilitate Water Main & Works	Rehabilitate Water Network	Rehabilitate Water Network	Rehabilitate Water Network	Rehabilitate Water Pipe
Rehabilitate Water Pipe from Bok River Ph1	Rehabilitate Water Pipe Network	Rehabilitate Water Pipes & Meters	Rehabilitate Water Resources	Rehabilitate Water Reticulation
Rehabilitate Water Reticulation Network	Rehabilitate Water Reticulation Ph1	Rehabilitate Water Supply	Rehabilitate Water Supply from Bok River Ph2	Rehabilitate Water Supply Network
Rehabilitate Water Supply Ph3	Rehabilitate Water Treatment at Stettynskloof Dam	Rehabilitate Water Treatment Works	Rehab Water Connector	Replace Raw Water Pipeline
Rural Water Scheme	Upgrade Bulk Water	Upgrade Bulk Water Ph2	Upgrade Bulk Water Pipeline	Upgrade Bulk Water Supply
Upgrade Bulk Water Supply Pipeline Ph4	Upgrade Chlorination of Potable Water	Upgrade Existing Water	Upgrade Existing Water Network	Upgrade & Extend Water Supply
Upgrade Keurbooms Water Supply	Upgrade Lotus Canal	Upgrade Lotus River Canal Ph2	Upgrade Lotus River Canal Ph3	Upgrade Lotus River Canal Ph4
Upgrade Main Water Supply	Upgrade Rising Water Main	Upgrade Roodefontein Dam	Upgrade Water	Upgrade Water Main
Upgrade Water Main Ph2	Upgrade Water Main Supply	Upgrade Water Network	Upgrade Water Pump Station	Upgrade Water Resources
Upgrade Water Services	Upgrade Water Source: Fencing	Upgrade Water Storage	Upgrade Water Supply	Upgrade Water Supply Line
Upgrade Water Supply: New Connector	Upgrade Water Supply: New Reservoir	Upgrade Water Supply: Pipeline	Upgrade Water Supply Pipelines	Upgrade Water Supply: Pipes
Upgrade Water Supply: Reservoir	Upgrade Water Supply & Storage	Upgrade Water Supply to Göldnerville Reservoir	Upgrade Water Treatment	Upgrade Water Treatment at Reservoir
Upgrade Water Treatment Plant	Upgrade Water Treatment Works	Water Supply	Water Supply Scheme	Water Treatment

Unknown			
Completion of C-Field	Construct Cell Ph2B	LED	Mountain View: Rehabilitate Main Access
New Construction of Cell 3	New Main Supply Line	New Rag/Sand Trap at Monwabisi	PMU
Rehabilitate Access Collector	Upgrade Access Collectors	Upgrade Main Supply	Upgrade Pump Station
Upgrade Pump Station & Rising Mains			

Other			
Art & Craft Village	Capping & Remediation Ph2	Cemetery Extension	Embankment Protection Ph1
Flood Damage	Irrigation of Community Recreation Centres	Irrigation of Sports Fields	New Athletics Track at CBD
New Cemetery	New Cemetery Ph1	New Cemetery Ph2	New Colorado Park Community Centre
New Community Centre	New Community Facility: Fish Market	New Community Hall	New Community Hall at Bergsig
New Community Sports Ground	New Cricket Oval	New Detention Ponds	New Lentegeur Hall
New Multi Purpose Sports Centre	New Recreational Facilities	New Recreational Facility	New Rehabilitation Centre for HIV/AIDS
New Sidewalks, Pedestrian Crossings, Kerbing	New Sports Complex	New Sports Complex	New Sports Field
New Sports Field Lighting	New Sports Ground	New Undercover Structure	Pedestrian Safety Improvements
Phumlani Square: New Library & Clinic Access	Rehabilitate Community Recreation Centres	Rehabilitate Fencing at Sports & Rec Facilities	Rehabilitate Internal Services
Rehabilitate Outfall Works	Rehabilitate Roofs to Sport & Recreation Centres	Rehabilitate Van Riebeeck Sport Stadium	Sea Erosion
Upgrade Blyth Street Cemetery	Upgrade Clanwilliam Clinic	Upgrade Community Facility	Upgrade Debt Collection Office
Upgrade Göldnerville Cemetery	Upgrade Irrigation & Pump at Oxidation Pond	Upgrade Public Open Space	Upgrade Public Space at Flats
Upgrade Rustdene Regional Sport Stadium	Upgrade Sludge Drying Beds	Upgrade Sport Facilities	Upgrade Sports Facilities in Rustdene
Upgrade Sports Facilities Ph1	Upgrade Sports Facility	Upgrade Sports Fields: High Mast Lighting	Upgrade Sports Grounds
Upgrade Supply Line	Upgrade Telemetry System Ph2	Upgrade Telemetry System Ph3	

Appendix 5

Estimated Perpetual Inventory Method (PIM) Capital Stock Calculations for the four (Central Karoo, Overberg, Eden, West Coast), Western Cape Province District Municipalities excluding the Cape Winelands District Muncipality.

Central Karoo

	Electricity		Water	
Year	**Capital Stock Estimate**	**Capital Spending**	**Capital Stock Estimate**	**Capital Spending**
1997	R 17,354.39	R 62,030.00	R 11,166.65	R 0.00
1998	R 78,516.67	R 234,970.00	R 10,608.32	R 300,298.00
1999	R 364,759.79	R 220,000.00	R 309,872.01	R 1,354,080.81
2000	R 811,939.50	R 1,785,000.00	R 1,905,040.42	R 1,210,489.00
2001	R 2,920,573.19	R 0.00	R 4,319,552.05	R 1,947,870.63
2002	R 4,406,165.09	R 4,406,165.09	R 7,919,748.14	R 2,435,364.00
2003	R 7,860,095.39	R 2,398,733.00	R 12,605,599.69	R 2,345,934.00
2004	R 12,277,831.97	R 4,188,108.31	R 17,593,558.60	R 819,361.11
2005	R 18,782,865.39	R 785,399.22	R 20,842,355.64	R 2,538,371.73
2006	R 22,728,914.81	R 8,651.81	R 24,386,162.00	R 1,864,123.64
2007	R 23,963,766.43		R 27,152,785.31	
	Roads and Transport		**Sanitation**	
Year	**Capital Stock Estimate**	**Capital Spending**	**Capital Stock Estimate**	**Capital Spending**
1997	R 14,179.87	R 0.00	R 20,007.83	R 285,368.00
1998	R 13,470.87	R 445,000.00	R 304,375.44	R 751,136.00
1999	R 457,157.46	R 204,330.00	R 1,296,934.43	R 1,044,529.82
2000	R 1,019,035.38	R 1,501,575.00	R 3,127,612.80	R 204,873.00
2001	R 2,927,311.69	R 48,596.00	R 4,667,204.13	R 296,249.82
2002	R 4,306,129.93	R 10,241,580.00	R 5,921,400.17	R 2,031,746.00
2003	R 15,345,961.54	R 15,881,356.00	R 8,579,025.50	R 323,905.00
2004	R 38,169,545.63	R 13,529,290.92	R 10,329,898.11	R 3,414,820.22
2005	R 64,931,991.26	R 14,245,030.57	R 14,389,788.08	R 2,771,147.20
2006	R 92,797,437.83	R 952,512.97	R 19,000,189.14	R 151,000.00
2007	R 105,794,151.10		R 20,961,597.10	

Overberg

	Electricity		Water	
Year	**Capital Stock Estimate**	**Capital Spending**	**Capital Stock Estimate**	**Capital Spending**
1997	R 44,049.11	R 0.00	R 48,125.56	R 0.00
1998	R 41,846.66	R 880,969.00	R 45,719.28	R 8,836,822.00
1999	R 918,735.61	R 953,488.00	R 8,878,083.65	R 3,792,890.07
2000	R 2,578,109.49	R 825,363.00	R 19,799,717.94	R 4,848,613.79
2001	R 4,626,137.42	R 0.00	R 32,554,085.22	R 859,982.00
2002	R 5,979,555.51	R 5,979,555.51	R 41,655,449.23	R 1,297,085.00
2003	R 7,652,893.41	R 755,421.00	R 47,560,100.65	R 1,197,978.00
2004	R 9,194,223.99	R 479,679.00	R 50,503,511.92	R 2,424,126.59
2005	R 10,236,742.00	R 3,124,821.26	R 52,355,182.09	R 3,180,846.62
2006	R 13,506,772.52	R 284,800.00	R 54,085,283.64	R 0.00
2007	R 15,074,121.95		R 52,416,895.16	
	Roads and Transport		**Sanitation**	
Year	**Capital Stock Estimate**	**Capital Spending**	**Capital Stock Estimate**	**Capital Spending**
1997	R 24,992.60	R 0.00	R 42,007.81	R 0.00
1998	R 23,742.97	R 1,437,721.00	R 39,907.42	R 3,556,864.00
1999	R 1,459,149.03	R 2,977,679.76	R 3,592,880.44	R 1,562,229.61
2000	R 5,594,552.61	R 3,358,341.86	R 8,021,696.28	R 1,852,969.00
2001	R 12,041,478.90	R 186,258.00	R 13,080,878.65	R 2,258,760.08
2002	R 16,614,171.63	R 250,000.00	R 18,600,293.67	R 2,988,597.00
2003	R 19,394,812.39	R 1,567,833.00	R 24,716,153.21	R 2,429,768.00
2004	R 21,934,729.92	R 1,699,566.51	R 30,181,046.36	R 4,545,194.95
2005	R 24,222,593.11	R 2,688,172.76	R 36,842,710.77	R 7,056,465.99
2006	R 27,141,560.65	R 464,336.42	R 46,255,551.28	R 657,798.46
2007	R 27,996,512.72		R 50,236,387.49	

Eden

	Electricity		Water	
Year	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending
1997	R 152,162.44	R 894,797.00	R 327,969.64	R 92,374.00
1998	R 1,039,351.31	R 2,868,363.00	R 403,945.16	R 7,800,788.00
1999	R 4,656,434.71	R 939,058.00	R 8,253,103.80	R 11,637,716.57
2000	R 8,463,867.85	R 1,014,730.66	R 26,207,837.58	R 6,119,950.38
2001	R 12,156,583.21	R 0.00	R 45,641,638.96	R 5,054,292.35
2002	R 14,406,106.80	R 14,406,106.80	R 63,451,354.41	R 5,351,944.00
2003	R 17,854,357.01	R 1,069,015.00	R 78,722,508.09	R 7,808,775.00
2004	R 20,438,695.89	R 571,141.00	R 93,259,573.86	R 7,119,213.41
2005	R 21,702,405.31	R 0.00	R 105,359,995.01	R 7,905,998.11
2006	R 21,413,737.16	R 0.00	R 115,624,276.67	R 7,765,771.18
2007	R 20,170,214.01		R 123,754,438.59	
	Roads and Transport		Sanitation	
Year	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending
1997	R 61,860.81	R 0.00	R 217,786.92	R 0.00
1998	R 58,767.77	R 3,210,085.00	R 206,897.57	R 4,256,563.00
1999	R 3,263,122.91	R 832,814.90	R 4,443,288.06	R 13,040,744.66
2000	R 6,680,115.66	R 320,000.00	R 20,894,043.61	R 4,569,480.00
2001	R 9,449,271.82	R 175,876.03	R 37,818,064.64	R 9,212,309.06
2002	R 11,295,404.51	R 877,723.00	R 58,234,955.33	R 2,558,250.00
2003	R 12,965,434.46	R 2,700,683.00	R 72,889,748.34	R 4,183,529.00
2004	R 16,184,089.93	R 5,836,815.12	R 83,662,778.45	R 3,973,829.15
2005	R 23,347,022.36	R 5,051,994.92	R 90,600,516.96	R 17,297,279.13
2006	R 31,746,100.09	R 2,818,865.03	R 107,740,275.84	R 5,724,262.41
2007	R 38,006,498.21		R 118,339,731.23	

West Coast

	Electricity		Water	
Year	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending
1997	R 31,721.90	R 181,824.00	R 88,504.70	R 0.00
1998	R 211,959.80	R 1,449,776.00	R 84,079.46	R 11,446,588.00
1999	R 1,813,802.52	R 200,000.00	R 11,522,469.72	R 5,200,214.16
2000	R 3,296,492.30	R 864,417.00	R 25,953,550.23	R 3,229,122.00
2001	R 5,203,744.77	R 3,333.00	R 39,639,200.00	R 1,452,466.00
2002	R 6,422,686.14	R 6,422,686.14	R 49,699,400.90	R 1,665,044.00
2003	R 7,021,585.75	R 0.00	R 56,274,646.96	R 473,827.00
2004	R 7,088,740.39	R 0.00	R 58,526,481.16	R 2,722,101.30
2005	R 6,778,855.14	R 922,845.44	R 59,816,171.23	R 3,606,163.11
2006	R 7,167,452.82	R 0.00	R 61,244,352.17	R 2,528,144.75
2007	R 7,041,747.97		R 61,565,384.01	
	Roads and Transport		Sanitation	
Year	Capital Stock Estimate	Capital Spending	Capital Stock Estimate	Capital Spending
1997	R 29,750.74	R 0.00	R 120,421.47	R 50,000.00
1998	R 28,263.20	R 400,000.00	R 164,400.39	R 6,607,291.32
1999	R 425,507.54	R 1,519,999.55	R 6,803,162.68	R 6,508,633.49
2000	R 2,264,819.08	R 672,000.00	R 18,663,546.84	R 5,427,274.75
2001	R 4,321,708.87	R 702,465.80	R 32,818,001.28	R 5,052,792.52
2002	R 6,399,671.33	R 1,441,075.00	R 47,182,340.76	R 2,124,553.00
2003	R 9,048,256.12	R 4,815,236.00	R 57,506,886.19	R 2,009,036.00
2004	R 15,260,684.86	R 3,402,752.84	R 63,850,593.02	R 4,889,242.26
2005	R 22,021,855.61	R 3,314,770.76	R 69,755,850.35	R 4,678,827.80
2006	R 28,496,757.46	R 1,405,304.26	R 74,668,670.58	R 6,270,042.22
2007	R 32,353,986.76		R 80,146,766.22	