Infrastructure Funding & Delivery: A KwaZulu-Natal Case Study

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ABSTRACT

The funding of provincial infrastructure needs to change to ensure that the infrastructure necessary for South Africa and KwaZulu-Natal to compete globally is in place, and planned and improved over the short, medium and longer term. At present, infrastructure on a provincial level are primarily financed through the provincial fiscus. This means there is limited capacity for government to pay for infrastructure. This is acknowledged by the National Treasury that stated (2012 Budget Review) that South Africa's critical infrastructure needs are in part the outcome of two decades of underinvestment.

Given South Africa's and KwaZulu-Natal's economic under-performance and massive social development needs, the national and provincial governments launched the National Development Plan and the Provincial Growth and Development Strategy. Both of these policy documents focus significantly on accelerating infrastructure delivery. Kessides (1993) work, which examines a wide range of evidence on the impacts of infrastructure on economic development, states that infrastructure contributes to economic growth, through both supply and demand channels, by reducing costs of production, contributing to the diversification of the economy and providing access to the application of modern technology, thus raising the economic returns to labour.

The article, therefore, acknowledges that South Africa and KwaZulu-Natal suffers from an infrastructure deficit and that this deficit needs to be eradicated in order to support sustainable growth and reduce poverty. The limiting factor, especially from a provincial point of view, is the current funding model that is in place. This article will, therefore, focus on developing a number of hypothetical funding models (including utilising development finance institutions) that can potentially be used to accelerate infrastructure delivery on a provincial level. Emphasis will be placed on the costs and benefits of using the various models. The article will primarily employ a literature review and a comparative funding analysis approach.

1. INTRODUCTION

The Development Bank of Southern Africa (DBSA) in its 2012 “The State of South Africa’s Economic Infrastructure: Opportunities and Challenges” report stated that governments around the world rank infrastructure policy among their greatest concerns. The World Economic Forum (WEF) in their 2012 “Strategic Infrastructure Steps to Prioritize and Deliver Infrastructure Effectively and Efficiently” report stated that infrastructure investment, whether it is maintaining existing networks or building new assets, is critical to economic progress. Most countries are not investing enough, which is hampering their growth prospects and deferring an ever increasing burden to the years ahead.

The WEF report states further that most countries’ actual investment is well below the required levels, with the global infrastructure gap (the difference between investment needs and actual spending) estimated at about US$ 1 trillion (1.25% of global GDP). The 2013 “Infrastructure Productivity: How to Save $1 Trillion a Year” report from the McKinsey Global Institute and McKinsey’s infrastructure practice estimates that the world needs $57,000bn in infrastructure investment between now and 2030. The $57 trillion required investment is more than the estimated value of today’s infrastructure and is just for keeping pace with projected global GDP growth.

Mills (2012) in his article “The Global Infrastructure Investment Deficit” estimated that the global economy was running an infrastructure deficit of anywhere from US$ 40 trillion to $70 trillion. Mills based his estimate on a 2007 Booz Allen Hamilton report that estimated that investment needed to “modernize obsolescent systems and meet expanding demand” for infrastructure worldwide between 2005 and 2030 was around US$ 41 trillion. Norman Anderson, chief executive of Washington DC-based CG/LA Infrastructure, quoted in Mills’ article, stated that the OECD’s estimated $71 trillion of needed infrastructure.

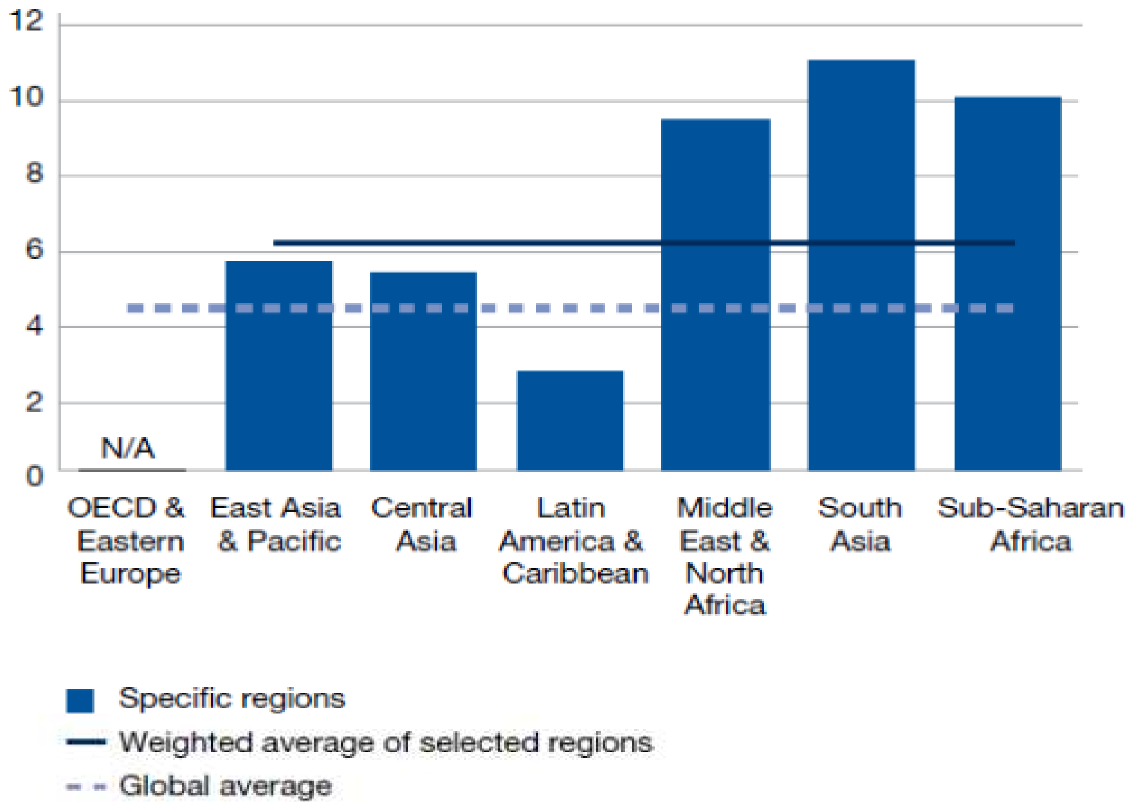
Most emerging Asian countries - for example China, India, and the Association of Southeast Asian Nations (ASEAN) - also continue to suffer from underdeveloped infrastructure, according to a 2011 article published by McKinsey. In India, for example, electricity generation is 16 percent to 20 percent short of what is needed to meet peak demand, thanks to persistent underinvestment and poor maintenance. In Indonesia, infrastructure investments dropped from 5 percent to 6 percent of GDP in the early 1990s to 2 percent to 3 percent of GDP for much of the last ten years. McKinsey estimates that the consequent deterioration in energy, transport, housing, communications, and water facilities has restrained economic growth by 3 to 4 percentage points of GDP.

DeLoittes in their “Addressing Africa’s Infrastructure Challenges” report stated that one of sub-Saharan Africa’s top developmental challenges continues to be the shortage of physical infrastructure. Greater economic activity, enhanced efficiency and increased competitiveness are hampered by inadequate transport, communication, water and power infrastructure. The world is eager to do business with Africa, but finds it difficult to access African markets, especially in the interior, due to poor infrastructure. The Programme for Infrastructure Development in Africa stated that closing the infrastructure deficit (around $360 billion between 2011 and 2040) is vital for Africa’s economic prosperity and sustainable development. Improved infrastructure would facilitate increased intra-regional and international trade, reduce the cost of doing business and enhance Africa’s competitiveness within itself and in the global economy as well as act as a catalyst to Africa’s economic transformation and diversification through industrialisation and value addition and sustainable and inclusive growth (African Development Bank, 2012)

Infrastructure deficits impose many problems for economies all over the world. Many studies, including recently from the Grattan Institute, point to the negative productivity impacts of ailing infrastructure. Any constraint on this key long-term growth driver should be of paramount concern to governments. This paper makes four contributions: First, it constructs a new dataset of provincial public capital stock and attempts to estimate the required provincial public fixed capital formation. Second, following the literature it investigates the current and potential funding options for provincial public infrastructure. Third, the study categorizes the funding options between funding and financing, and fourthly, the study attempts to conduct a cost benefit analysis of each of the proposed funding options for the provincial government.

2. LITERATURE OVERVIEW

The World Economic Forum (WEF) in their "Strategic Infrastructure; Steps to Prioritize and Deliver Infrastructure Effectively and Efficiently" report (2012) states that numerous economic studies conclude that over the medium to longer term, well-planned investment can play a central role in improving competitiveness and economic growth. It is estimated that a dollar spent on infrastructure generates an economic return of between 5%-25%. The report includes the following graphic that illustrates the proportion of gross domestic product (GDP) that economies need to invest in economic infrastructure (both to build new infrastructure and maintain existing assets) to enable prolonged economic growth.



The graph suggests that most countries' actual investment (solid and dash lines) is well below these levels (bars), with the global infrastructure gap (the difference between investment needs and actual spending), according to the WEF, estimated at about US$ 1 trillion (1.25% of global GDP). To address the infrastructure gap and secure the benefits that well-planned functional infrastructure can generate, there is a need for governments to increase the amount they invest into infrastructure and for more infrastructure to be paid for by users. As many governments are under tight fiscal constraints, additional government investment is often difficult. It is therefore crucial that investments are strategic in nature to maximize value for money for the taxpayer and society as a whole, according to the WEF report (2012).

The WEF report further states that many public and private sources of finance can be used individually or in combination to finance a project, as illustrated in the graph below. The WEF also states that whatever the project, it is worth noting that:

- Public assets do not have to be financed by public finance, and private finance (as used in BOT and other PPP deals) may have a role, either in part or in whole.
- While it is generally thought that governments have a lower cost of capital than private-sector sources, this assumption is not always true and should be tested for individual circumstances.
- There may be a wider choice of funding routes available than initially thought
- While private assets are generally financed from private sources, the availability of government loans or grants may be useful to kick-start projects in new "*riskier*" areas.

	Ways of financing the build	Examples	Who can own the asset? Public sector	Private sector	Cost of the funds
Private Finance	Existing cash resources	Some large companies are able to fund investments from existing cash flows, e.g. mobile telecommunications firms often pay for the cost of installing transmitter masts from their cash flows	●	●	**Private sector cost of capital**
Private Finance	Asset sales	Companies can sell parts of their firm, or can dispose of surplus assets to finance the construction of the new infrastructure	●	●	Private sector cost of capital
Private Finance	Vendor financing	Large supply chain companies may be prepared to deliver the materials and also offer financing to cover the cost	●	●	Cost of vendor financing
Private Finance	Corporate debt	Corporates can utilize the funds they borrow for their company's general operations, with the debt backed by the company's balance sheet	●	●	Cost of debt to the corporate
Private Finance	Project finance	Many options – see Figure 52 in Appendix 12	●	●	Cost of project finance
Private Finance	Government bond issues	Government uses bond receipts to fund the building of the assets	●		Cost of issuing government debt
Private Finance	Government asset sales	Government privatizes companies or sells land to finance new infrastructure	●		Government cost of capital
Private Finance	Existing cash reserves	Some governments running a fiscal surplus may have spare cash reserves	●		Government cost of capital

Siemens in their "Public Infrastructures and Private Funding, Financial Solutions for the Energy, Industry and Healthcare Sectors" report (2007) states that European

Governments have limited financial resources to devote to increased capital expenditure and improved public services, and face restrictions (including those of the Maastricht criteria) on their ability to raise debt. Modelling work by Siemens, based on private-customer data and research by Global Insight, estimates that this need over the next 20 years is likely to be in the area of EUR 15 trillion worldwide and some EUR 4 trillion in Europe. The report then states that because of the mentioned situation, an increasing number of public-services infrastructure developments in Europe are being financed through public private partnerships.

Other forms of financing are also increasing in popularity; for instance, steady growth was observed in the leasing sector, where the lessor bears risk in that the lessor retains ownership of the equipment, while the lessee pays for its usage (and often maintenance and support) over a given period. Then there seems to be the question of privatization as an option since more and more rationally viewed public goods are viewed as private goods, because of technology predominantly.

In its Infrastructure Delivery Update (2013) the United Kingdom (UK) Government states that the UK faces a challenge in attracting the investment it needs in infrastructure. To help meet this financing gap the UK Government is:

- providing guarantees for infrastructure projects through the UK Guarantees Scheme, which could provide up to £40 billion in guarantees to ensure that priority projects in the infrastructure pipeline can raise the finance they need despite challenging credit market conditions.
- supporting pension fund investment in infrastructure. The Government, the National Association of Pension Funds (NAPF) and Pension Protection Fund (PPF) signed a memorandum of understanding to create the Pension Investment Platform (PIP).
- working with the Insurers' Infrastructure Investment Forum to provide members of the Association of British Insurers (ABI) with a clear line of communication with Government's infrastructure teams.
- continuing to encourage and generate inward investment through the UK Trade & Investment's Strategic Relations Team initiatives with overseas institutional investors.

The Development Bank of Southern Africa (DBSA) in its “Options for Financing Infrastructure Development” report states that the public sector infrastructure delivery is driven by government with emphasis on socio-economic infrastructure to achieve development impact. On the other hand the Private sector infrastructure delivery is driven by the need to maximize financial returns with minimum risks. The market failure consists of projects which cannot attract finance due to increased risks and public sector legislative and financial constraints. To accommodate the broad infrastructure finance market the following generic options could be pursued, according to the DBSA:

- Pure public sector infrastructure financing through taxes.
- Pure private sector financing entered into between the client and financial institution.
- Hybrid funding structures such as public private partnerships and build operate transfer projects.
- The formation of Trusts to facilitate public/private sector co-operation such as infrastructure Growth Funds.

Ruiters (2013) in his article “Funding Models for Financing Water Infrastructure in South Africa: Framework and Critical Analysis of Alternatives” suggests new or modified funding models that could take the form of one or a combination of the following:

- Existing water infrastructure funding models:
  - Funding by the National Revenue Fund (on-budget)
  - Funding through grants (Municipal Infrastructure Grant (MIG), Regional Bulk Infrastructure Grant (RBIG), Conditional Grants) from the National Revenue Fund (on-budget)
  - Funding through the development of a tariff model (via balance sheet)

- New paradigm – Alternative and innovative water infrastructure models:
  - Fundraising on financial markets (off-budget)

- Funding through public-private partnerships (PPPs) (hybrid of on- and off-budget)
- Funding from private sector markets (e.g. build-own- operate-transfer schemes)
- Demand risk funding model
- Financial institutions for funding water infrastructure.

Ruiters (2013) the offers the following evaluation criteria for alternative and innovative funding models for water infrastructure.

Funding model	**Evaluation criteria**					**Impact on funding and project delivery: Drivers and principles**
	Efficiency	**Effectiveness**	**Equity**	**Appropriateness**	**Sustainability**	
I. Existing water infrastructure funding models						
National Revenue Fund (NRF) (on budget)	Not efficient in setting price signals for best value infrastructure provision.	Simple and effective to manage as part of the funding (MTEF) measures.	Assumes the funding of a wholly public good and not a shared private benefit.	Well suited to fund components of the water infrastructure value chain.	Long-term sustainability impacts on the integrity and functionality of the water infrastructure.	Unlikely to be sufficient funds for socio-economic needs.
Conditional grants: Water services infrastructure	Not efficient in setting price signals for best value infrastructure provision.	Simple and effective to manage as part of the funding (MTEF) measures.	Poor linkage and interface between payment and infrastructure.	Broadly understood and supported mechanisms but depend on political trade-offs with core other public services or extra funding from the NRF through taxation foreshadowed.	Non-payment for water infrastructure service provision a major risk.	High dependency on the NRF.

Balance-sheet funding (tariff model)	Country-wide model more efficient due to targeted benefit areas and users paying into a hypothecated fund (or paying an infrastruc-ture bond). Disconnected from price signals since it is not efficient in ensuring that the right assets are delivered at the right price.	If the appropriate water tariff is set for the new water infrastructure value, it would be sufficient to fund the water infrastructure and surrounding land needed. Difficult to implement water-use charges for historically disadvantaged and/or poor communities at a local scale.	Contributions of infrastructure in poor communities or slow growth areas, where funds are not necessarily spent in a manner that recognizes a spatial or temporal nexus, must view as a social infrastructure provision.	Especially appropriate where dispersed but identifiable beneficiaries are likely to achieve a windfall gain from water infrastructure. Well suited to be locked into funding a securitized cost and revenue stream. Appropriate as a distinct element of the funding mix, and support the recurrent costs associated with the use of the water infrastructure being charged.	Long-term sustainability to secure the integrity and functionality of the water infrastructure.	Unlikely to be a dominant part of the development water infrastructure mix but plays an important role in funding recurrent costs and costs mostly linked to the water user. NT enabling the project to be implemented via SPV through explicit govern- ment guarantee.
II. New paradigm: Alternative and innovative water infrastructure funding models						
Financial markets (off-budget)	Debt under-written by NT can use very low interest rates.	Potentially able to raise large funds subject to fiscal management (NT) imperatives of the country (appropriate ratings). Effective controlling of the risks, including interest rate costs and levels of debt.	Sharing of costs over time amongst contemporary and future-generation beneficiaries.	Appropriate where supported by a secure revenue stream from a funding source.	Non-payment for water infra-structure service provision a major risk.	Operates subject to securing a revenue stream (e.g. water tariffs, water-use charges). Charge commercial tariffs, and/ or block tariffs as allowed for in the raw water pricing strategy.
Public-private partnerships (PPPs)	Can optimise provision of water infra-structure and land by having the party most suited to man- age the risks. Enables private innovation on delivery of needed infra-structure pro- jects according to agreed specifications.	PPP binds all the parties to their agreed responsibilities, especially where agencies or parties expected to make long-term infra- structure funding commitments. PPPs for infra-structure develop- ment are complex and place a burden on the govern- ment and the agencies involved.	Most equitable where an agreement also ties down arrangements for the broader community to contribute to any public good being produced by the infrastructure development.	Agreements needed to clearly describe how they fit with other related funding arrangements (cf. NT, 2000).	Reduction of water infra-structure risk management.	NT's risk on providing the guarantee is limited to periods of shortfalls and not full exposure of the loans.

Private sector markets (built- own-operate and transfer - BOOT)	Most efficient where cost of managing risks does not exceed benefits of getting access to private infrastructure funding capital.	Able to access large infrastruc- ture funds but at higher interest rate costs.	Spreading of costs amongst the different water users.	Appropriate where risks are to be managed by the private sector, otherwise require significant government underwriting (surety) and contractual controls.	Operations and maintenance to be planned and implemented on a long-term period and sustain-able benefits to beneficiaries.	Not a funding source but a model, a financial management tool to smooth out peaks and troughs in costs and revenue, and ensure that costs are spread out a longer period of time.
Demand (market) risk funding	High-cost scheme due to complexity. Not efficient as a funding mechanism due to potential high revenue risks.	Unlikely to be sustained for long term or diffuse water infrastructure period. Effective at delivering outcome where strategic water infrastructure assets are acquired and/or developed.	Payment unlikely to be equitable where beneficiaries are remote and where levels of payment are not sensitive to benefit received or capacity to pay (e.g. flat rate for agriculture water- use across the country, etc.).	Useful in establishing a new or independent source of targeted funds to achieve a specific result. Especially valu-able to fund regional benefits without upsetting other funding regimes (e.g. De Hoop Dam; Mokolo- Crocodile water projects for Eskom; Lesotho Highlands Water Project, etc.). Contribute to broad- ening funding base by directly targeting raw water user and land value.	Long-term sustainability impacts on the integrity and functionality of water infra-structure, e.g. frequent disruptions in supply, etc.	May have role to fund backlogs and network connections (regional bulk infrastruc-ture) or specific programme with measurable results. Most value as a supporting measure to lock in place outcomes as well as inciden-tally earned return on investment.
Special banks or financial institutions	Efficient means of providing of infrastructure demands.	Least effec-tive where fund accrues at a slow or irregular rate, not well-matched with expenditure needs. Least effective where funds are exposed to escala- tion risks.	Equitable where contributions plan establishes reasonable nexus and accurately apportions costs between new and existing water infrastructure developments.	Appropriate to deliver local water infrastructure in high growth areas with high water demands for socio-economic developments where new developments are greatest bene- ficiaries and where contributions income is most predictable.	Long term viability of built- own-operate and transfer (BOOT), i.e. economic viable projects.	Preference shares issued by development finance institution(s), i.e. IDC, DBSA, etc. to address cash flow mismatches. Provide comfort and support to the issuer in terms of the PFMA due to the strategic nature of infra-structure

Ruiters (2013) concludes by saying there are ways to incentivise the private sector to partner with the public sector and at the same time mitigate the impact of demand risks and allow both parties to share in the upside. Such new thinking is needed to get the next wave of infrastructure assets off the ground. If the public sector is unable to fund the required infrastructure spending and the private sector is unwilling to take on the entire burden itself, new and imaginative means of generating private investment will need to be developed.

Meaney and Hope in their report “Alternative Ways of Financing Infrastructure Investment Potential for ‘Novel’ Financing Models” (2012) states that the up-front, sunk cost profile of infrastructure investment, as well as its long-term nature, leads to market and government failures. Government intervention following private sector provision of infrastructure leads to an inherent problem, namely the time-inconsistency problem. This describes the potential for the government to initially provide a guarantee to investors ensuring recovery of costs associated with the investment, only to renege subsequently and to expropriate rent from the private sector.

They state that the Private Public Partnership (PPPs) and the Regulated Asset Base (RAB) model both represent a way in which the time-inconsistency problem may be mitigated. Benefits of PPPs over traditional procurement process arise from (potential) efficiency gains associated with the private sector managing the construction and operation of the infrastructure asset. The main issue concerning the PPP model relates to its inflexibility. This lack of flexibility is necessary in order to mitigate the time-inconsistency problem, but can be a constraint, especially when projects involve very uncertain prospects over the long term. The RAB model overcomes this problem by having a regulator to periodically assess the performance of the private sector provider. However, the RAB model itself has several issues which mean that it does not always represent a superior alternative to PPPs

Platz in his article “Infrastructure Finance in Developing Countries—the Potential of Sub-Sovereign Bonds” (2009) poses the following question: How can public providers raise funds for these capital investments? Platz then suggests that theoretically, they have five options.

- First, those fortunate enough, where current receipts exceed their costs for consecutive periods, may save in advance for investments.
- Second, providers may only use current receipts (“pay as you go”). In that scenario, they would not borrow or save, but just limit capital investment to what they collect in a given period.
- Third, providers could take out a loan and pay later with current receipts, (hereafter referred to as ‘financing mechanisms’).
- Fourth, they may rely on grants or intergovernmental transfers.
- Finally, public providers may choose to privatize part of their operations.

Platz concludes by stating that outside the US, sub-sovereign bonds continue to fulfill a less important role for infrastructure investment than they have done for American cities and town. However, the data show that the market for sub-sovereign bonded debt has deepened significantly over the periods under consideration in terms of total volume of issuance, average issuance sizes and extended maturities. Conversely, there were very few issuances of municipalities in developing countries, which face the most urgent financing needs. Nevertheless, recent successful experiences in Mexico, South Africa and India show that this form of finance has some potential in less developed economies.

Coetzee (2013) in his article” The Municipal Bond Market as a Viable Option for KwaZulu-Natal Based Municipalities” concludes by stating that unfortunately, the vast majority of municipalities in KZN will not find it desirable or viable to issue municipal bonds simply because of their creditworthiness and inability to generate “own” revenue. Although most of these municipalities could, in theory, improve their creditworthiness they simply will not be in a position to generate sufficient “own” revenue to participate in the municipal borrowing market. These municipalities simply do not have the asset base and the economic base to generate “own” revenue. These municipalities will continue to be dependent on national government capital transfers. However, in theory, the greater the borrowing activity from those municipalities that can afford to borrow, the bigger the portion of the national government capital grants that can potentially be transferred to the non-borrowing municipalities.

Coetzee recommends that the municipal bond be afforded greater prominence and urgency; that the current regulatory framework be strengthened to support both the primary and secondary municipal bond markets and that National Treasury investigate the possibility of tax incentives. There also needs to be greater coordination and alignment of the municipal finance system and transparency between the three spheres of government. Municipalities than can issue municipal bonds should be encouraged to avail themselves of a credit rating by a recognized rating agency and to actively participate in the municipal bond market. There is, for example, no reason why the Msunduzi municipality cannot issue a municipal bond to finance their electricity upgrade programme. It makes both financial and economic sense, depending on the municipalities ability to obtain a “good” credit rating.

A research study by Deloitte titled “Closing America’s Infrastructure Gap: The Role of Public-Private Partnerships” indicates that traditionally, government agencies have had two main options for financing their infrastructure needs: pay-as-you-go financing and debt financing. With pay-as-you-go financing, government accumulates revenues sufficient to pay for the new infrastructure before beginning construction or as construction occurs, thereby lengthening the construction period. Given the challenges associated with generating such savings and securing approvals from the multiple authorizing bodies, there can be considerable lag time between when an infrastructure need arises and when it actually gets met. Public bonding (that is, obtaining a loan to pay for infrastructure), on the other hand, allows infrastructure needs to be met when sufficient public funds aren’t immediately available. Each option, according to the study, comes with its own set of pros and cons. The study then set outs a case for PPP’s as a best alternative option for public infrastructure delivery and specifically focuses on the various PP models, i.e.,

- Build-Transfer
- Build-Lease-Transfer
- Build-Transfer-Operate
- Build-Operate-Transfer
- Build-Own-Operate-Transfer
- Build-Own-Operate

- Design-Build-Finance-Operate/Maintain

Other models mentioned as possible alternatives include the following:

- Lease: The government grants a private entity a leasehold interest in an asset. The private partner operates and maintains the asset in accordance with the terms of the lease.
- Concession: The government grants private entity exclusive rights to provide, operate and maintain an asset over a long period in accordance with performance requirements set out by the government. The public sector retains ownership of the asset, but the private operator retains ownership over any improvements made during the concession period.
- Divestiture: The government transfers all or part of an asset to the private sector. Generally, the government includes certain conditions on the sale to require that the asset be improved and services be continued.

Labson (2010) published an article titled “Funding Public Infrastructure – Overview of Funding Approaches with Selected Case Studies” stating that the funding of public infrastructure is unique from purely private infrastructure and lists the following four options for public infrastructure delivery. The article also evaluates each funding option in terms of sustainability and efficiency as indicated in the table below.

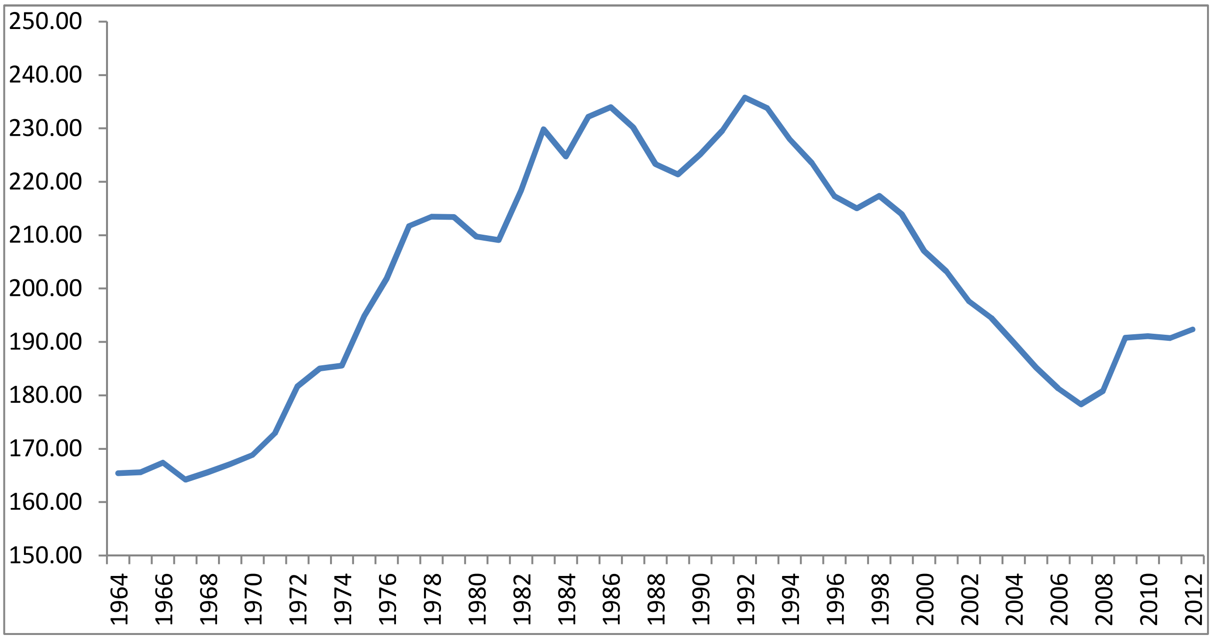
Funding Components	Sustainability	Efficiency
Debt Finance	Medium	Medium/High
Equity Injection	Low/Medium	Medium
Government Grants	Low	Low/Medium
Regulated Revenue and Tariffs	High	High

3. REAL FIXED CAPITAL STOCK IN SOUTH AFRICA AND KWAZULU-NATAL

An estimate of the capital stock refers to a value that is attached to the total physical capital in existence at a specific point in time in an economy. The value of capital stock reflects the actual physical capacity available for repeated use in the production of other goods and services. In practice, it is usually calculated as gross or net capital stock in real terms and the "perpetual inventory method" is used to produce estimates of the stock of tangible reproducible assets (Prinsloo and Smith, 1997).

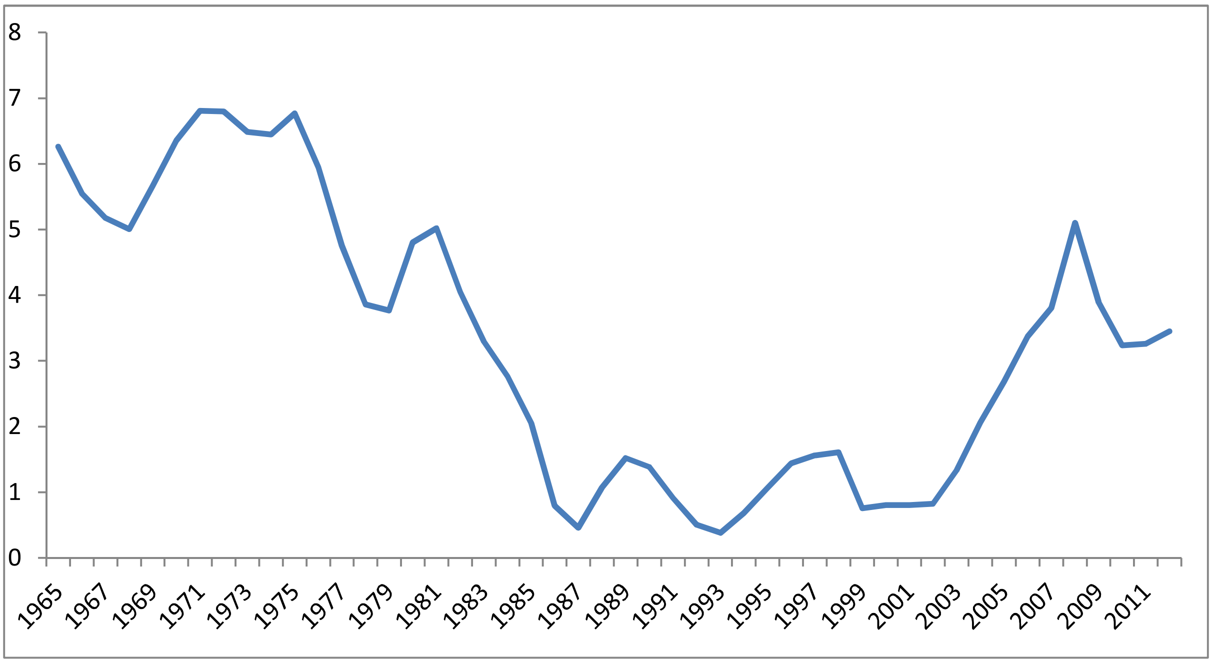
Total real fixed capital stock as a percentage of gross domestic product (GDP) in South Africa increased substantially from 1964 to 1986 (graph 3.1). However, the average rate of increase in the real fixed capital stock collapsed to about 1 percent from 1987 to 2003 (graph 3.2). Although the average rate of increase in the real fixed capital stock from 2003 to 2009 increased significantly, it was still less than the rate of increase in the GDP (graph 3.3). Subsequently the real fixed capital stock as a percentage of GDP decreased significantly from about 230 percent to about 180 percent. The slowdown in the increase in the real fixed capital stock during the global recession is also evident.

Graph 3.1: Total Fixed Capital Stock as a Percentage of GDP (%)



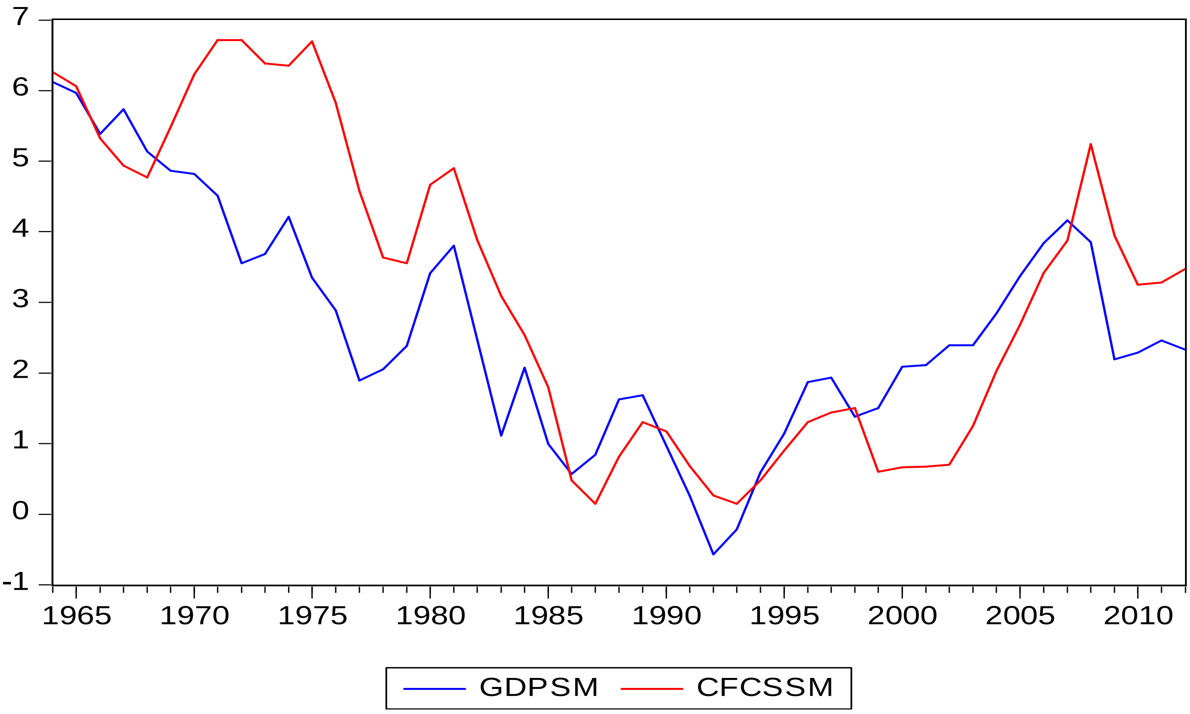
(SA Reserve Bank)

Graph 3.2: Rate of Increase in the Total Fixed Capital Stock (% pa)



(SA Reserve Bank)

Graph 3.3: Rate of Increase in the Total Fixed Capital Stock and National GDP (%, pa)



(SA Reserve Bank)

Table 3.1 indicates that it is predominantly the public corporations that have been responsible for the significant increases or decreases in the rate of increase in the real fixed capital stock. General Government has consistently decreased its contribution towards the real fixed capital stock whilst the contribution of private business has stayed fairly constant.

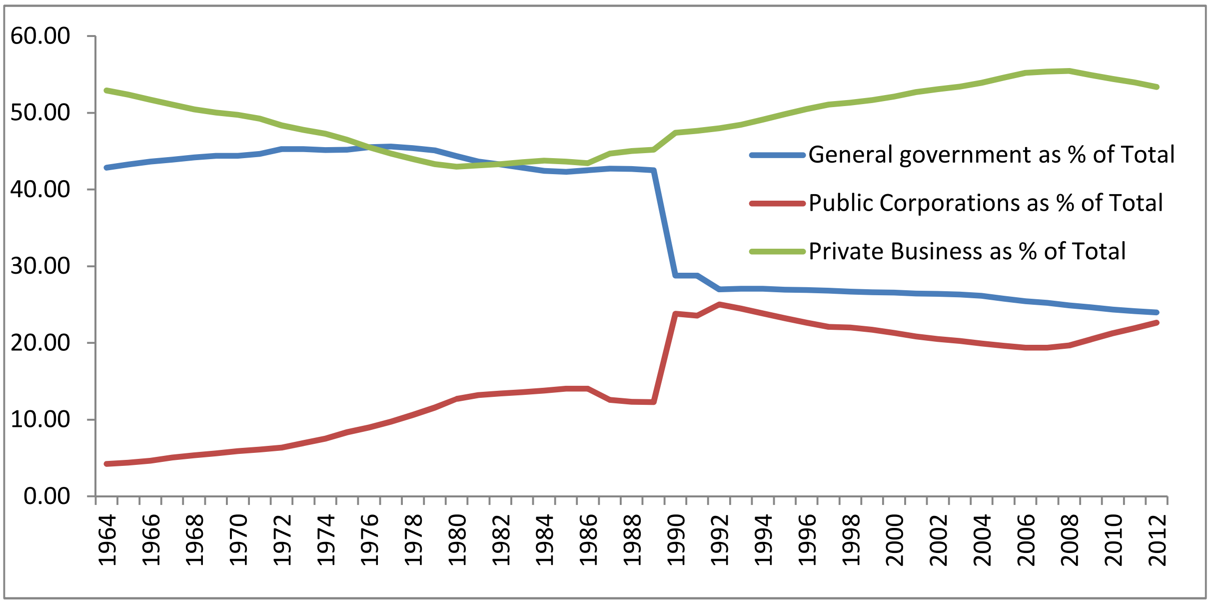
Table 3.1: Average Rate of Increase in the Total Fixed Capital Stock per Decade per Entity (average %)

Average % Change per Decade	Growth in Total Fixed Capital Stock	Growth in Total Fixed Capital Stock General Government	Growth in Total Fixed Capital Stock Public Corporations	Growth in Total Fixed Capital Stock Private Business
1960	5.53	6.28	11.58	4.35
1970	5.80	5.98	13.80	4.29
1980	2.58	1.97	3.38	3.02
1990	1.03	-0.88	1.00	2.40
2000	2.47	1.67	1.90	3.09
2010	3.36	2.62	6.70	2.35

(SA Reserve Bank)

Graph 3.4 indicates that private business is the largest contributor to the total fixed capital stock in South Africa. It also shows the change in the contribution between government and the public corporations that occurred during 1990.

Graph 3.4: Contribution to Total Fixed Capital Stock (% pa)



(SA Reserve Bank)

Capital stock on a provincial level (provincial public capital stock) in SA is not available or easily observable. Against the background of the considerable efforts to construct a provincial public capital stock dataset it is not too surprising that no attempt has yet been made to generate a provincial public capital stock dataset. This attempt will rely on applying the Perpetual Inventory Method (PIM), a methodology which is also most often used in statistical offices. Examples include Griliches (1980), Nehru and Dhareswhar (1993) Domenech and De La Fuente (2000), Kamps (2006) and Derbyshire, Gardiner and Waights (2010).

The basic idea of the PIM is to interpret an economy`s capital stock as an inventory. The stock of inventory increases with capital formation (investments). Once an investment enters the economy's inventory, it remains there forever and provides services to the inventory's owner. The quantity of services the investment provides is at its maximum directly after the investment has been made and decreases in the course of time. The amount by which the capital stock falls per period is the depreciation rate. However, while the value of the investment decreases in the course of time, it never falls to zero. Thus, an investment principally has a perpetual use. The perpetual inventory method uses the following formula:

$$K_t = K_{t-1} - \delta K_{t-1} + GFK_t = (1-\delta)\,K_{t-1} + GFK_t$$

Here, K_t is the time t level of capital stock, GFK_t is the time t level of gross fixed capital formation and δ is the rate of depreciation (assumed constant over time). In order to calculate the capital stock series, it's clear that three pieces of information are needed, i.e:

- a time series on gross fixed capital formation (in constant rand value),
- an assumption on the rate of depreciation, and
- an estimate of the initial capital stock level.

Over the years, various researchers have used the PIM to construct capital stock data. While the basic technique is quite similar and follows the idea outlined in the previous section, the specific implementation of the PIM differs to some extent. Methodological differences especially exist with respect to the method to estimate the initial capital stock. The three different approaches used most frequently in the literature are:

- Steady State Approach
- Disequilibrium Approach
- Synthetic Time Series Approach

This paper will not employ any of the above three approaches but rather a national disaggregation approach. Since reliable provincial public gross fixed capital formation data is only available from 2001, we need to estimate the total provincial public capital stock in 2001. This will be done using the total national government gross capital stock as published by the SA Reserve Bank and disaggregating the data to a provincial level. Calculating the total provincial public capital stock is based on the following three steps and illustrated in table 3.2.

- Step 1. The total national public capital stock (General government) based on the SA Reserve Bank statistics was R719 billion in 2001 (constant 2005 prices).
- Step 2. National government distributes on average about 32 percent of its resources to the nine provinces through the equitable share system and therefore it's estimated that the total provincial public capital stock was R230 billion in 2001 (constant 2005 prices).
- Step 3. Of this 32 percent the province of KwaZulu-Natal receives about 21 percent and therefore the estimated total provincial public capital stock (KwaZulu-Natal) was R48 billion in 2001(constant 2005 prices).

Table 3.2: Estimated Fixed Capital Stock of the KZN Provincial Government in 2001

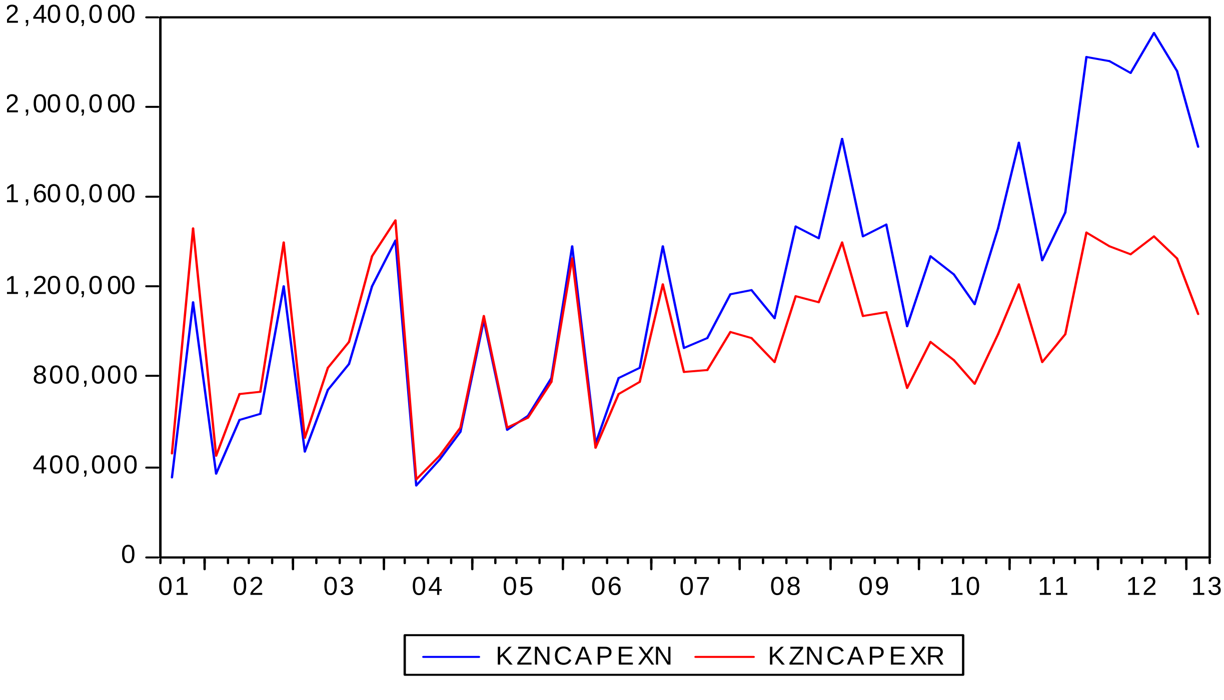
	Fixed capital stock : KZN Provincial Government
	Fixed capital stock : General government
2001	R 718 963 000 000
	Provincial Equitable Share
32%	R 230 068 160 000
	KZN Provincial Equitable Share
21%	**R 48 314 313 600**

(Source: SA Reserve Bank, National Treasury, own calculations)

The rate of depreciation is assumed at 5 percent since the majority of total fixed provincial government capital stock consists of long service lives capital.

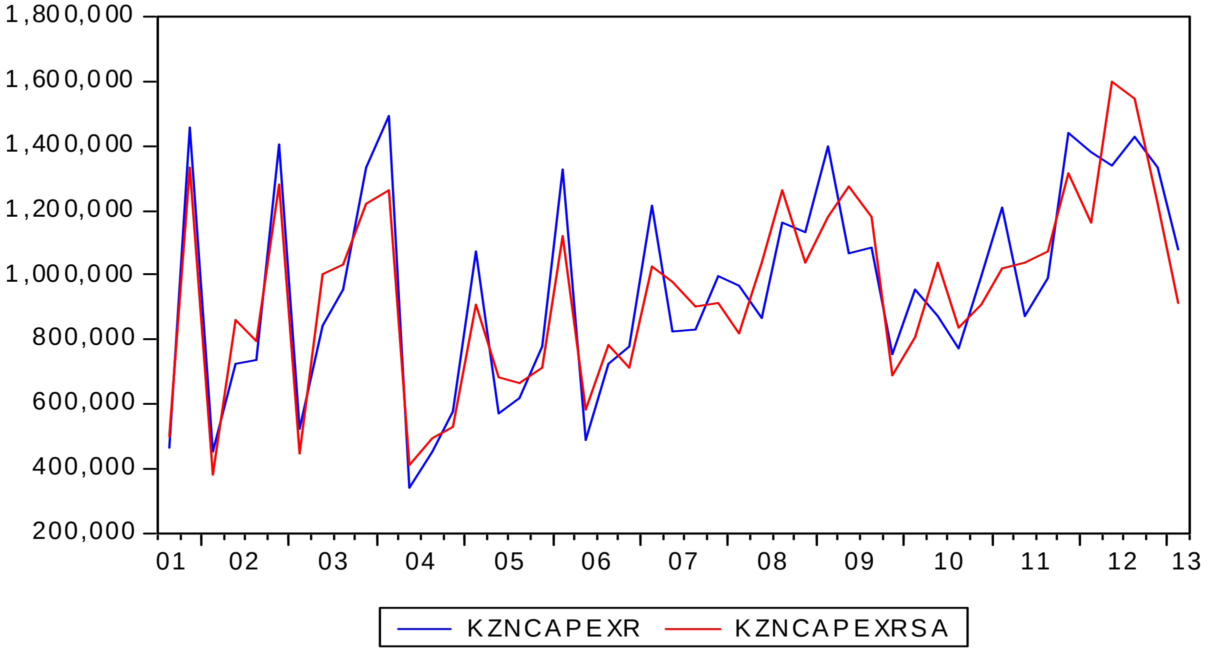
Gross fixed capital formation is defined as the acquisition, less disposals of tangible and intangible fixed assets plus major improvements to, and transfer costs on, land and other non-produced assets. The assets acquired may be new or they may be used assets that are traded on second-hand markets. The assets disposed of may be sold for continued use by another producer, they may be simply abandoned by the owner or they may be sold as scrap and be broken down into reusable components, recoverable materials, or waste products. Graph 3.5 displays the provincial public gross fixed capital formation in both nominal and real terms. The GDP deflator was used to calculate the real provincial public gross fixed capital formation. Graph 3.6 displays the non-season and seasonal adjusted real provincial public gross fixed capital formation. The seasonal adjusted real provincial public gross fixed capital formation was determined using the ratio to moving average method in EViews.

Graph 3.5: Nominal and Real Provincial Public Total Capital Expenditure (R'000)



(Source: KZN Provincial Treasury)

Graph 3.6: Real Provincial Public and Real Seasonal Adjusted Provincial Public Total Capital Expenditure (R'000)

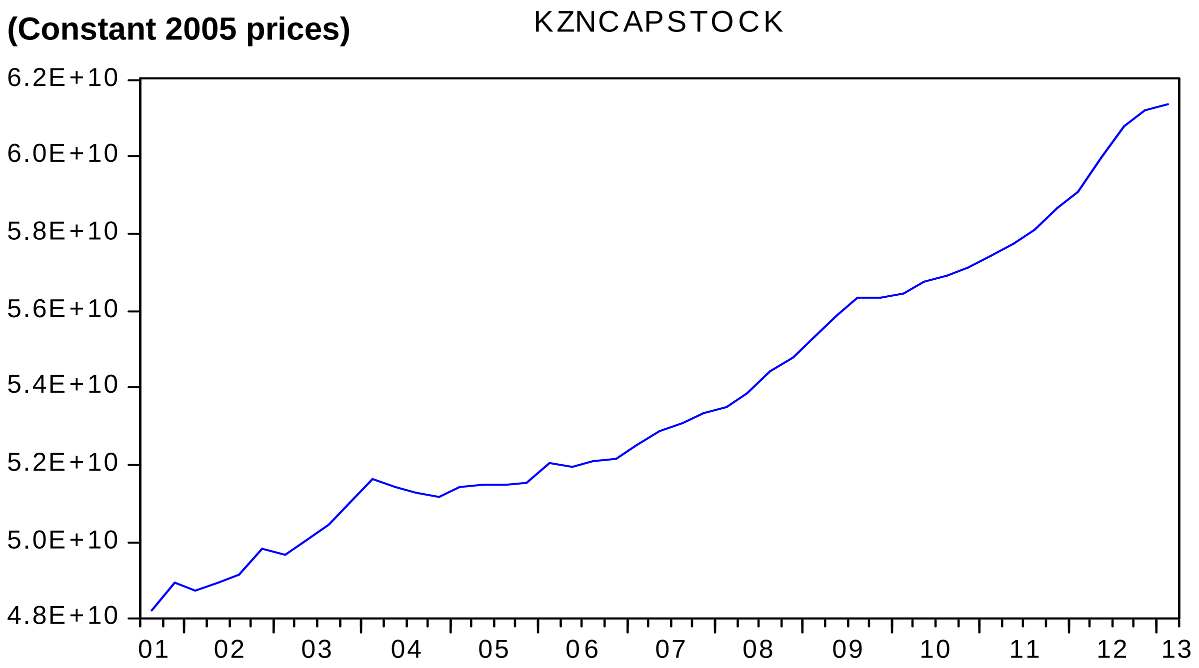


(Source: KZN Provincial Treasury)

Graph 3.7 displays the real net seasonal adjusted fixed provincial public capital stock applying the perpetual inventory method where;

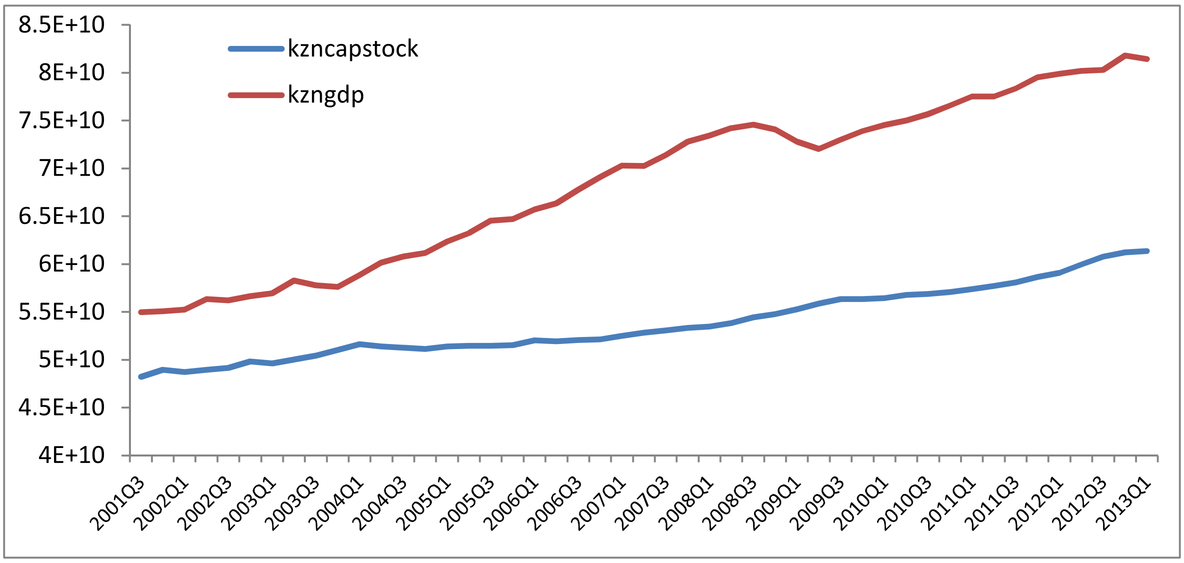
- K_{2001} = **R 48 314 313 600**
- GFK_{2001} = **R500 124 400**
- δ = **5%**

Graph 3.7: Real Net Seasonal Adjusted Fixed Provincial Public Capital Stock (Constant 2005 prices)



Graph 3.7 displays the behaviour of the provincial gross domestic product and the provincial public total capital stock from the 3rd quarter of 2001 until the 2st quarter of 2013. The increasing divergence between the two series is evident.

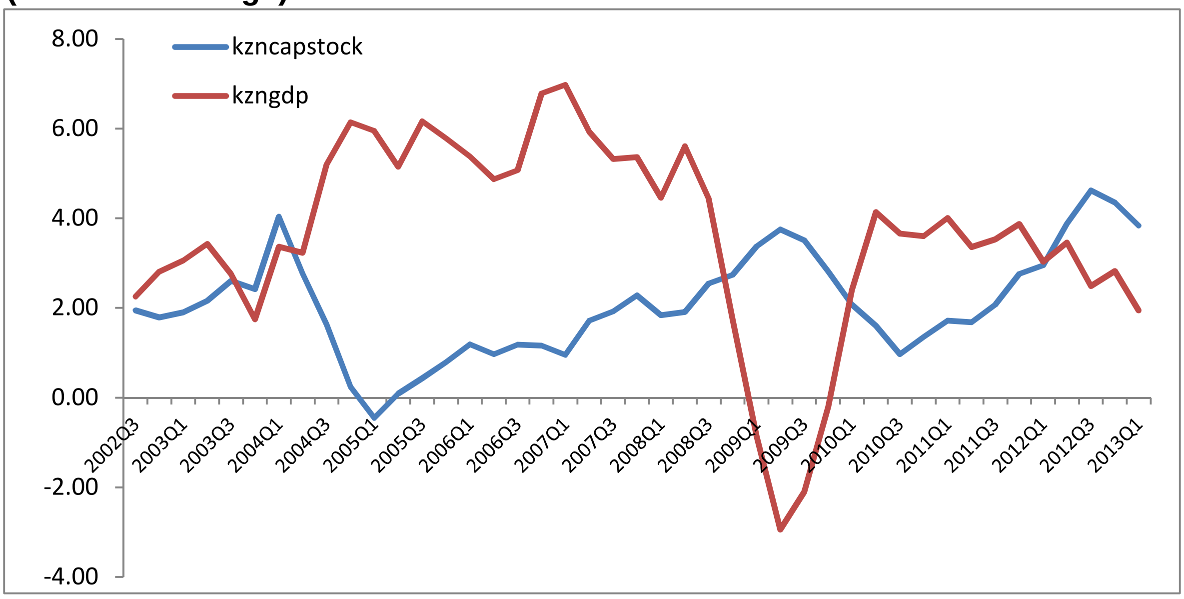
Graph 3.7: KZN Provincial Public Capital Stock and Gross Domestic Product (R, 2005 prices)



(Source: KZN Provincial Treasury)

Graph 3.8 displays the growth rates in the two series over the period indicating that provincial total capital stock in general increased at a slower rate than the provincial economy over the period.

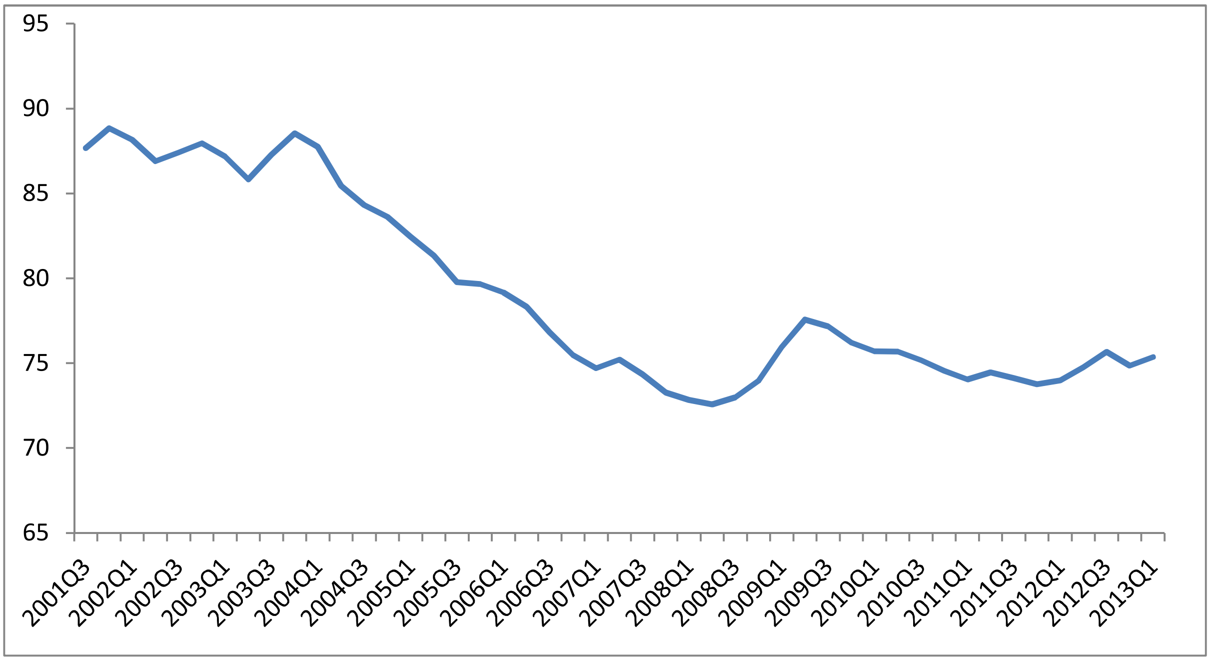
Graph 3.8: KZN Provincial Public Capital Stock and Gross Domestic Product (% annual change)



(Source: KZN Provincial Treasury)

Graph 3.9 displays the provincial public total capital stock as a percentage of the provincial gross domestic product indicating a decreasing trend over the period.

Graph 3.9: KZN Total Public Capital Stock as a Percentage of KZN GDP (%)



(Source: KZN Provincial Treasury)

4. ESTIMATING THE PROVINCIAL PUBLIC INFRASTRUCTURE GAP

This section attempts to estimate the required provincial public gross fixed capital formation and provincial public fixed capital stock for the period 2014 to 2021 using five different approaches. These approaches are based on international examples and case studies. For example in 2009 sub-national governments' public investment equalled 2.3% of OECD GDP (**http://dx.doi.org/10.1787/reg_glance-2011-en**).

The table and two graphs below supply percentage change statistics with regards to the four economic variables on an average quarterly and annual basis. The statistics shows that the provincial economy (g) on average expanded at a faster rate than the provincial public capital stock (cs). The table also shows the provincial public net fixed capital formation rate (nfcf) which is the difference between the provincial public gross fixed capital formation rate (gfcf) and the depreciation rate (de).

Table 4.1: Average Quarterly and Average Annual % Change in the Variables, 2002 to 2013

Average % change	de	cs	g	gfcf	nfcf
Quarterly	1.25	0.61	0.76	4.97	3.72
Annual	5.00	2.58	3.46	10.74	5.74

where;

de = rate of depreciation

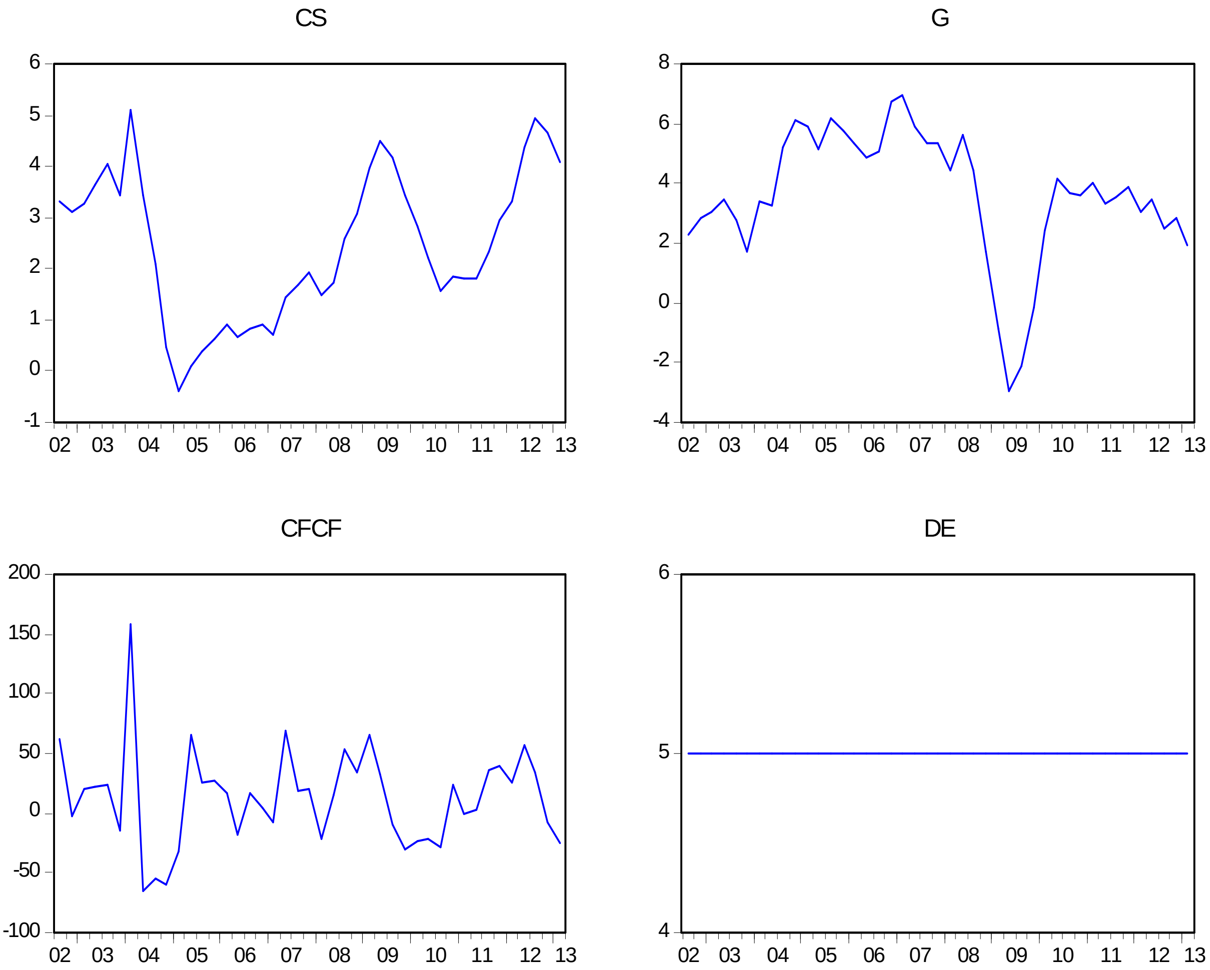
g = provincial economic growth rate

cs = provincial public capital stock accumulation

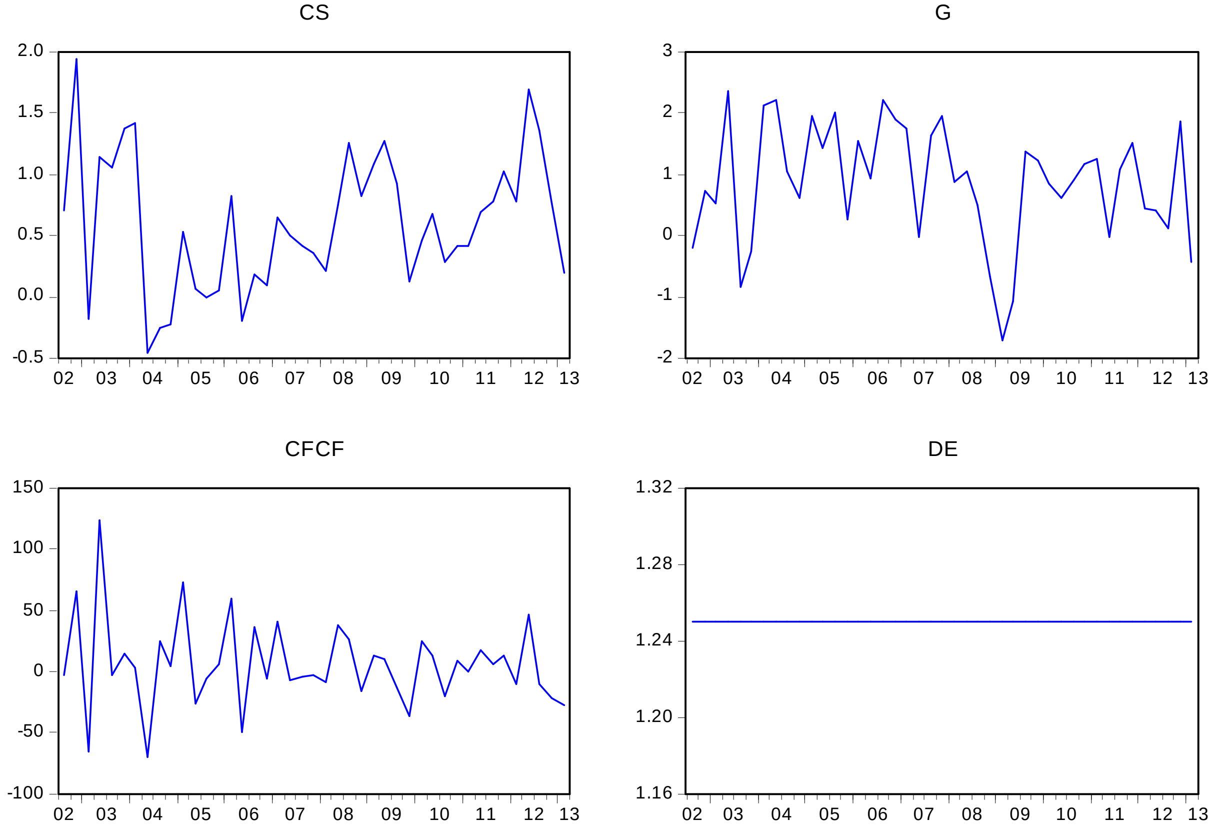
gfcf = provincial public gross fixed capital formation

nfcf = provincial public net fixed capital formation

Graph 4.1: Average Annual % Change in the Variables, 2002 to 2013



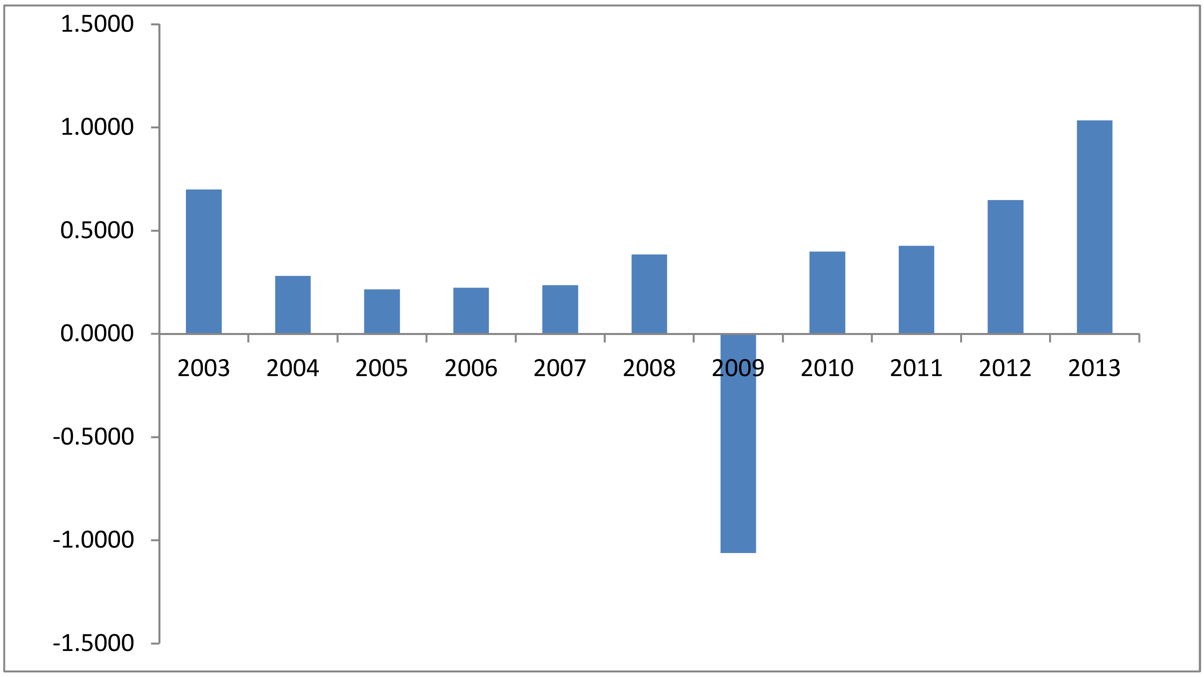
Graph 4.2: Average Quarterly % Change in the Variables, 2002 to 2013



The incremental capital output ratio (ICOR) is a metric that assesses the marginal amount of investment capital necessary for an entity to generate the next unit of production. In the "Harrod-Domar framework", an economic model, the calculation of ICOR is based on certain assumptions such as there is no diminishing return to capital, there is no lag between investment and production and there is full capacity utilization. "While these assumptions overlook the rigidities as well as flexibilities in the real world, the overall framework is a reasonable tool for providing overall benchmarks for assessing investment requirements. In India for example, it's suggested that for a growth rate of 8%, the investment rate (gfcf) at market price would need to be at 30.5%, while for a growth rate of 9.5%, an investment rate (gfcf) of 35.8% would be required.

The ICOR for the province is displayed in the graph below. It shows that the ICOR stayed fairly constant from 2003 to 2008 where after it decreased significantly because of the economic recession. The ICOR for the province increased fairly substantially since 2009. This indicates that the provincial economy required increasing amounts of gross fixed capital formation to sustain a constant growth rate.

Graph 4.3: Provincial ICOR (value)



If the capital output ratio is a known constant or varies with a specific trend, then this exercise of estimating required investment for a predetermined growth target becomes easy. Unfortunately in practice there has been considerable instability in the capital-output ratio. The average ICOR for the province is 0.38, thus by assuming that this value is constant it is possible to estimate the required provincial public gross fixed capital formation for a predetermined growth target (5 percent as targeted in the provincial growth and development strategy).

The required provincial public gross fixed capital formation (gfcf) for a 5 percent provincial growth rate (as per the ICOR approach) is displayed in the table below. Using this approach (ICOR = 0.38), applying a depreciation rate of 5 percent per annum and using the perpetual inventory method, it's possible to calculate the total fixed provincial public capital stock and provincial public gross fixed capital formation. Under this approach and assumptions, the capital stock gdp ratio will continue to decline (depreciation rate > gross fixed capital formation rate) which seems highly problematic and undesirable. Using an ICOR of 0.38 therefore seems not ideal.

Table 4.2: Estimated Variables using the Constant ICOR approach (average value per quarter)

	kzngdp	gfcf	kzncapstock	capitalgdpratio
2002	56 112 491 796	1 004 756 211	49 880 777 848	88.89
2003	57 654 090 936	1 077 607 429	51 676 216 964	89.63
2004	60 238 894 867	725 008 627	53 094 192 162	88.14
2005	63 709 208 526	746 563 387	53 184 024 456	83.48
2006	67 232 857 360	787 569 233	53 622 770 088	79.76
2007	71 189 846 999	934 791 702	54 393 563 796	76.41
2008	74 068 813 985	1 109 866 560	55 599 299 943	75.06
2009	72 937 182 610	1 202 204 792	57 834 478 460	79.29
2010	75 452 664 104	1 004 816 979	59 050 353 451	78.26
2011	78 237 883 117	1 187 376 358	60 367 861 857	77.16
2012	80 543 675 302	1 494 106 281	62 984 076 424	78.20
2013	81 436 994 262	1 523 988 407	64 157 391 066	78.78
2014	85 508 843 975	1 538 885 018	62 488 406 530	73.08
2015	89 784 286 173	1 615 829 269	60 979 815 473	67.92
2016	94 273 500 482	1 696 620 732	59 627 445 431	63.25
2017	98 987 175 506	1 781 451 769	58 427 524 928	59.03
2018	103 936 534 282	1 870 524 357	57 376 673 039	55.20
2019	109 133 360 996	1 964 050 575	56 471 889 962	51.75
2020	114 590 029 045	2 062 253 104	55 710 548 568	48.62
2021	120 319 530 498	2 165 365 759	55 090 386 898	45.79

An alternative approach to the constant ICOR approach is the constant capital-output ratio approach. The average capital-output ratio for the province is 81.09, thus by assuming that this value is constant it is possible to estimate the required provincial public gross fixed capital formation for the 5 percent predetermined growth target.

The required provincial public gross fixed capital formation (gfcf) for a 5 percent provincial growth rate (as per the capital-output ratio approach) is displayed in the table below. Using this approach (capital-output ratio = 81.09), applying a depreciation rate of 5 percent per annum and using the perpetual inventory method it's possible to calculate the total fixed provincial public capital stock and provincial public gross fixed capital formation. Under this approach and assumptions, the gross provincial public fixed capital formation will have to increase from about R1.5bn per quarter to about R60bn per quarter or by 3700% which also seems highly problematic and unrealistic.

Table 4.3: Estimated Variables using the Constant Capital-Output Ratio approach (average value per quarter)

	kzngdp	gfcf	kzncapstock	capitalgdpratio
2002	56 112 491 796	1 004 756 211	49 880 777 848	88.89
2003	57 654 090 936	1 077 607 429	51 676 216 964	89.63
2004	60 238 894 867	725 008 627	53 094 192 162	88.14
2005	63 709 208 526	746 563 387	53 184 024 456	83.48
2006	67 232 857 360	787 569 233	53 622 770 088	79.76
2007	71 189 846 999	934 791 702	54 393 563 796	76.41
2008	74 068 813 985	1 109 866 560	55 599 299 943	75.06
2009	72 937 182 610	1 202 204 792	57 834 478 460	79.29
2010	75 452 664 104	1 004 816 979	59 050 353 451	78.26
2011	78 237 883 117	1 187 376 358	60 367 861 857	77.16
2012	80 543 675 302	1 494 106 281	62 984 076 424	78.20
2013	81 436 994 262	1 523 988 407	64 157 391 066	78.78
2014	85 508 843 975	8 778 411 125	69 339 121 579	81.09
2015	89 784 286 173	17 099 105 715	72 806 077 658	81.09
2016	94 273 500 482	24 741 541 469	76 445 332 779	81.09
2017	98 987 175 506	32 386 074 745	80 267 599 417	81.09
2018	103 936 534 282	40 412 834 687	84 280 979 388	81.09
2019	109 133 360 996	49 683 742 421	88 495 028 358	81.09
2020	114 590 029 045	56 763 344 689	92 919 779 776	81.09
2021	120 319 530 498	66 519 921 564	97 565 768 764	81.09

Another approach is to use an international acceptable per annum average gross capital formation growth rate. Based on the World Bank statistics, it appears that the per annum average gross capital formation growth rate amongst the listed countries is about 20 percent. By assuming that this value is constant it is possible to estimate the required provincial public gross fixed capital formation irrespective of the 5 percent predetermined growth target.

The required provincial public gross fixed capital formation (gfcf) based on the 20 percent international average is displayed in the table below. Using this approach, applying a depreciation rate of 5 percent per annum and using the perpetual inventory method, it’s possible to calculate the total fixed provincial public capital stock and provincial public gross fixed capital formation. Under this approach and assumptions, the gross provincial public fixed capital formation will have to increase from about R1.5bn per quarter to about R6bn per quarter or by 265% which also seems somewhat problematic and but not necessary unrealistic

Table 4.4: Estimated Variables using the per annum average Gross Capital Formation growth rate approach (average value per quarter)

	kzngdp	gfcf	kzncapstock	capitalgdpratio
2002	56 112 491 796	1 004 756 211	49 880 777 848	88.89
2003	57 654 090 936	1 077 607 429	51 676 216 964	89.63
2004	60 238 894 867	725 008 627	53 094 192 162	88.14
2005	63 709 208 526	746 563 387	53 184 024 456	83.48
2006	67 232 857 360	787 569 233	53 622 770 088	79.76
2007	71 189 846 999	934 791 702	54 393 563 796	76.41
2008	74 068 813 985	1 109 866 560	55 599 299 943	75.06
2009	72 937 182 610	1 202 204 792	57 834 478 460	79.29
2010	75 452 664 104	1 004 816 979	59 050 353 451	78.26
2011	78 237 883 117	1 187 376 358	60 367 861 857	77.16
2012	80 543 675 302	1 494 106 281	62 984 076 424	78.20
2013	81 436 994 262	1 523 988 407	64 157 391 066	78.78
2014	85 508 843 975	1 828 786 088	62 778 307 601	73.42
2015	89 784 286 173	2 194 543 306	61 833 935 526	68.87
2016	94 273 500 482	2 633 451 967	61 375 690 717	65.10
2017	98 987 175 506	3 160 142 360	61 467 048 541	62.10
2018	103 936 534 282	3 792 170 832	62 185 866 946	59.83
2019	109 133 360 996	4 550 604 999	63 627 178 598	58.30
2020	114 590 029 045	5 460 725 998	65 906 545 666	57.52
2021	120 319 530 498	6 552 871 198	69 164 089 581	57.48

Another approach is to use an international acceptable per annum average gross public capital formation as a percentage of GDP. Based on the Eurostats statistics (http://epp.eurostat.ec.europa.eu/statistics_explained/index.php?title=File:Investment,_2001,_2006_and_2011_(%25_share_of_GDP).png&filetimestamp=20121204110902), it appears that the per annum average gross public capital formation as a percentage of GDP amongst the listed countries is about 3 percent. By assuming that this value is constant, it is possible to estimate the required provincial public gross fixed capital formation irrespective of the 5 percent predetermined growth target.

The required provincial public gross fixed capital formation (gfcf) based on the 3 percent international average is displayed in the table below. Using this approach, applying a depreciation rate of 5 percent per annum and using the perpetual inventory method, it's possible to calculate the total fixed provincial public capital stock and provincial public gross fixed capital formation. Under this approach and assumptions, the gross provincial public fixed capital formation will have to increase from about R1.5bn per quarter to about R3.5bn per quarter or by 130% which also seems fairly realistic and achievable.

Table 4.5: Estimated Variables using the average Gross Public Capital Formation as a percentage of GDP approach (average value per quarter)

	kzngdp	gfcf	kzncapstock	capitalgdpratio
2002	56 112 491 796	1 004 756 211	49 880 777 848	88.89
2003	57 654 090 936	1 077 607 429	51 676 216 964	89.63
2004	60 238 894 867	725 008 627	53 094 192 162	88.14
2005	63 709 208 526	746 563 387	53 184 024 456	83.48
2006	67 232 857 360	787 569 233	53 622 770 088	79.76
2007	71 189 846 999	934 791 702	54 393 563 796	76.41
2008	74 068 813 985	1 109 866 560	55 599 299 943	75.06
2009	72 937 182 610	1 202 204 792	57 834 478 460	79.29
2010	75 452 664 104	1 004 816 979	59 050 353 451	78.26
2011	78 237 883 117	1 187 376 358	60 367 861 857	77.16
2012	80 543 675 302	1 494 106 281	62 984 076 424	78.20
2013	81 436 994 262	1 523 988 407	64 157 391 066	78.78
2014	85 508 843 975	2 565 265 319	63 514 786 832	74.28
2015	89 784 286 173	2 693 528 585	63 032 576 076	70.20
2016	94 273 500 482	2 828 205 014	62 709 152 286	66.52
2017	98 987 175 506	2 969 615 265	62 543 309 937	63.18
2018	103 936 534 282	3 118 096 028	62 534 240 469	60.17
2019	109 133 360 996	3 274 000 830	62 681 529 275	57.44
2020	114 590 029 045	3 437 700 871	62 985 153 683	54.97
2021	120 319 530 498	3 609 585 915	63 445 481 914	52.73

Another approach is to use a constant capital population ratio. The 2012 provincial public gross fixed capital formation population ratio was 146. By assuming that this value is constant it is possible to estimate the required provincial public gross fixed capital formation for a 2 percent predetermined population growth target.

The required provincial public gross fixed capital formation (gfcf) based on the 2 percent provincial population growth rate is displayed in the table below. Using this approach, applying a depreciation rate of 5 percent per annum and using the perpetual inventory method, it's possible to calculate the total fixed provincial public capital stock and provincial public gross fixed capital formation. Under this approach and assumptions, the gross provincial public fixed capital formation will have to increase from about R1.5bn per quarter to about R1.7bn per quarter or by 17%. Under this approach and assumptions, the total fixed provincial public capital stock will continue to decline (depreciation rate > gross fixed capital formation rate) which seems highly problematic and undesirable.

Table 4.6: Estimated Variables using a constant Gross Public Capital Formation as a percentage of Population approach (average value per quarter)

	kznpop	gfcf	kzncapstock	capitalpopratio
2002	9 308 565	1 004 756 211	49 880 777 848	107.94
2003	9 761 032	1 077 607 429	51 676 216 964	110.40
2004	9 665 875	725 008 627	53 094 192 162	75.01
2005	9 651 100	746 563 387	53 184 024 456	77.36
2006	9 924 000	787 569 233	53 622 770 088	79.36
2007	10 014 500	934 791 702	54 393 563 796	93.34
2008	10 105 500	1 109 866 560	55 599 299 943	109.83
2009	10 449 300	1 202 204 792	57 834 478 460	115.05
2010	10 645 400	1 004 816 979	59 050 353 451	94.39
2011	10 267 300	1 187 376 358	60 367 861 857	115.65
2012	10 267 300	1 494 106 281	62 984 076 424	145.52
2013	10 456 900	1 523 988 407	64 157 391 066	145.74
2014	10 666 038	1 554 468 175	62 503 989 688	145.74
2015	10 879 359	1 585 557 538	60 964 347 742	145.74
2016	11 096 946	1 617 268 689	59 533 399 044	145.74
2017	11 318 885	1 649 614 063	58 206 343 154	145.74
2018	11 545 263	1 682 606 344	56 978 632 341	145.74
2019	11 776 168	1 716 258 471	55 845 959 195	145.74
2020	12 011 691	1 750 583 640	54 804 244 875	145.74
2021	12 251 925	1 785 595 313	53 849 627 945	145.74

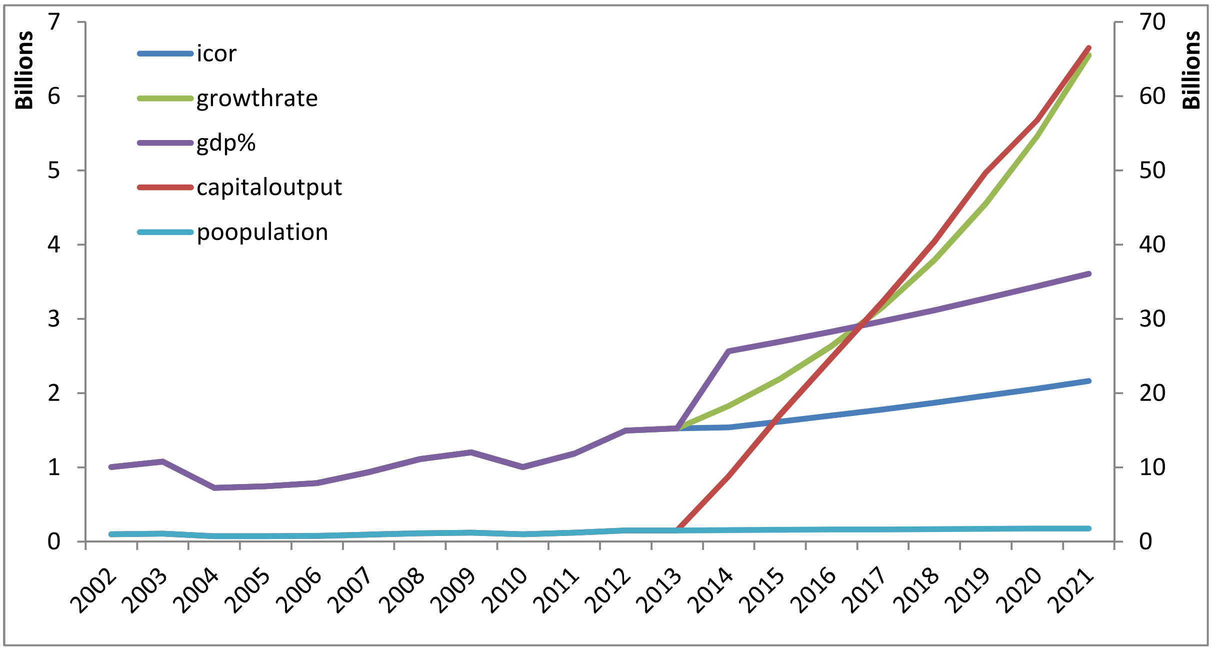
The table (table 4.7) and graph (graph 4.4) below displays the estimated provincial public gross fixed capital formation based on the above five approaches. It seems evident that the constant capital-output approach seems totally unrealistic and unachievable. Graph 4.5 displays the average estimated provincial public gross fixed capital formation based on the above five approaches.

Table 4.7: Provincial Public Gross Fixed Capital Formation Estimates (R' average per quarter)

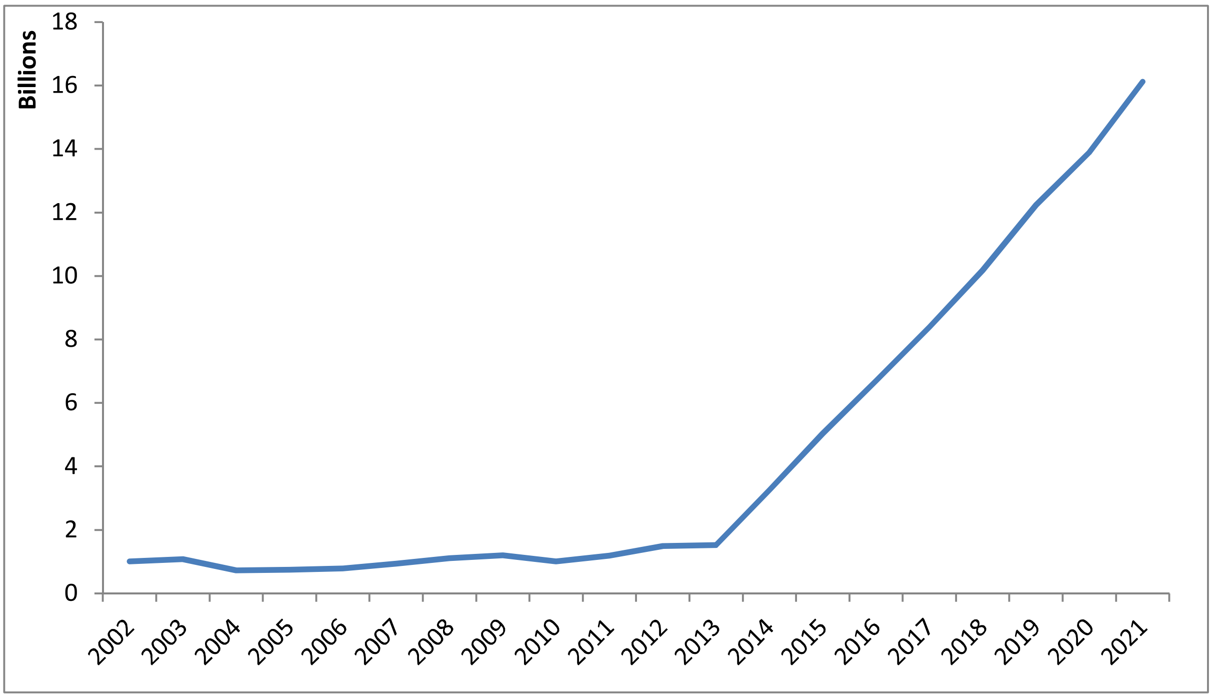
Estimates	icor	capitaloutput	growthrate	gdp%	population
2002	1 004 756 211	1 004 756 211	1 004 756 211	1 004 756 211	1 004 756 211
2003	1 077 607 429	1 077 607 429	1 077 607 429	1 077 607 429	1 077 607 429
2004	725 008 627	725 008 627	725 008 627	725 008 627	725 008 627
2005	746 563 387	746 563 387	746 563 387	746 563 387	746 563 387
2006	787 569 233	787 569 233	787 569 233	787 569 233	787 569 233
2007	934 791 702	934 791 702	934 791 702	934 791 702	934 791 702
2008	1 109 866 560	1 109 866 560	1 109 866 560	1 109 866 560	1 109 866 560
2009	1 202 204 792	1 202 204 792	1 202 204 792	1 202 204 792	1 202 204 792
2010	1 004 816 979	1 004 816 979	1 004 816 979	1 004 816 979	1 004 816 979
2011	1 187 376 358	1 187 376 358	1 187 376 358	1 187 376 358	1 187 376 358
2012	1 494 106 281	1 494 106 281	1 494 106 281	1 494 106 281	1 494 106 281
2013	1 523 988 407	1 523 988 407	1 523 988 407	1 523 988 407	1 523 988 407
2014	1 538 885 018	8 778 411 125	1 828 786 088	2 565 265 319	1 554 468 175

2015	1 615 829 269	17 099 105 715	2 194 543 306	2 693 528 585	1 585 557 538
2016	1 696 620 732	24 741 541 469	2 633 451 967	2 828 205 014	1 617 268 689
2017	1 781 451 769	32 386 074 745	3 160 142 360	2 969 615 265	1 649 614 063
2018	1 870 524 357	40 412 834 687	3 792 170 832	3 118 096 028	1 682 606 344
2019	1 964 050 575	49 683 742 421	4 550 604 999	3 274 000 830	1 716 258 471
2020	2 062 253 104	56 763 344 689	5 460 725 998	3 437 700 871	1 750 583 640
2021	2 165 365 759	66 519 921 564	6 552 871 198	3 609 585 915	1 785 595 313

Graph 4.4: Provincial Public Gross Fixed Capital Formation Estimates (R' average per quarter)



Graph 4.5: Average Provincial Public Gross Fixed Capital Formation Estimates (R' average per quarter)



Graph 4.5 shows that the average quarterly provincial public gross fixed capital formation will have to increase from R1.5bn in 2013 to R16bn in 2021 or by 958 percent over the period.

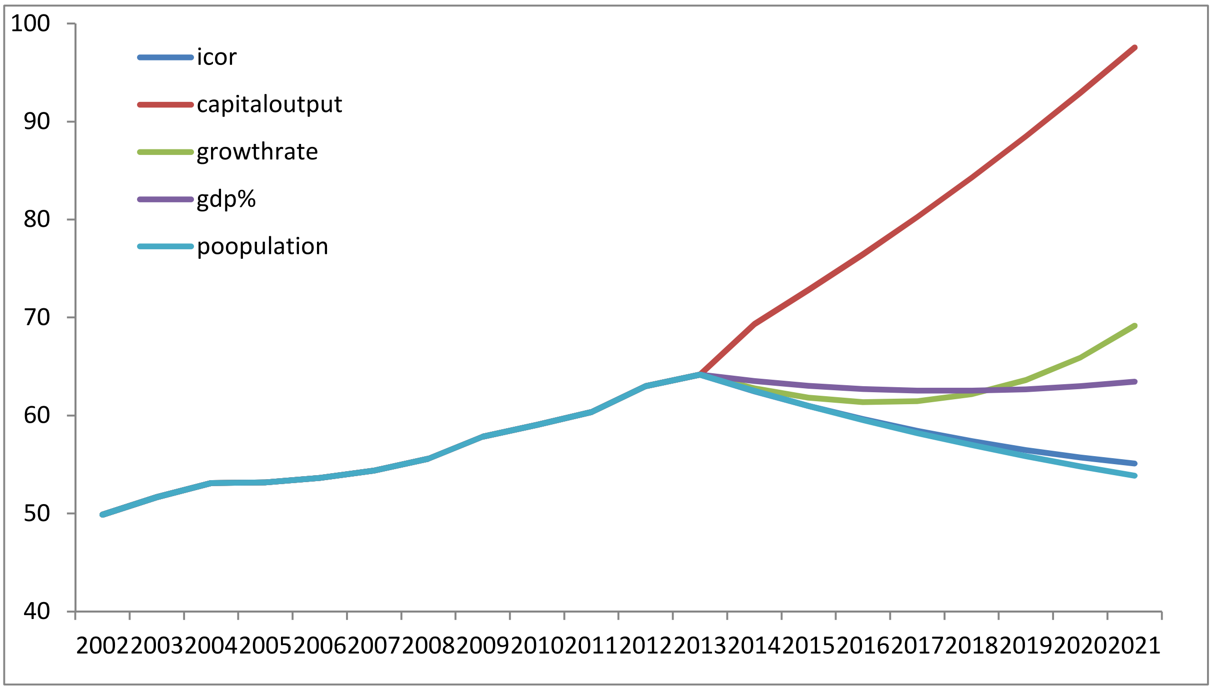
The table and graph below displays the estimated fixed provincial public capital stock based on the above five approaches. It seems evident that provincial public fixed capital stock actually decreases based on the ICO and population approaches, which is highly undesirable and counterproductive.

Graph 4.7 displays the average of the five approaches. It shows that the average quarterly provincial public gross fixed capital formation will increase from R50bn in 2013 to R68bn in 2021 or by 5.8 percent over the period.

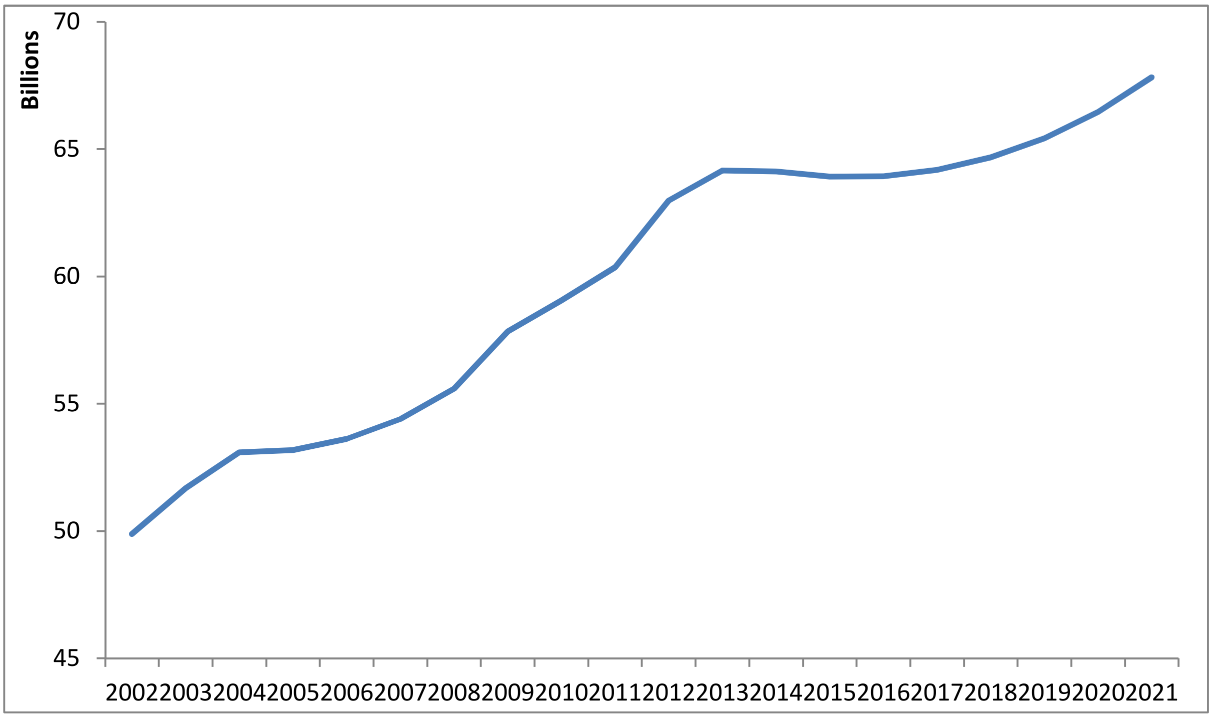
Table 4.8: Provincial Public Fixed Capital Stock Estimates (R'million average per quarter)

Estimates	icor	capitaloutput	growthrate	gdp%	population
2002	49 881	49 881	49 881	49 881	49 881
2003	51 676	51 676	51 676	51 676	51 676
2004	53 094	53 094	53 094	53 094	53 094
2005	53 184	53 184	53 184	53 184	53 184
2006	53 623	53 623	53 623	53 623	53 623
2007	54 394	54 394	54 394	54 394	54 394
2008	55 599	55 599	55 599	55 599	55 599
2009	57 834	57 834	57 834	57 834	57 834
2010	59 050	59 050	59 050	59 050	59 050
2011	60 368	60 368	60 368	60 368	60 368
2012	62 984	62 984	62 984	62 984	62 984
2013	64 157	64 157	64 157	64 157	64 157
2014	62 488	69 339	62 778	63 515	62 504
2015	60 980	72 806	61 834	63 033	60 964
2016	59 627	76 445	61 376	62 709	59 533
2017	58 428	80 268	61 467	62 543	58 206
2018	57 377	84 281	62 186	62 534	56 979
2019	56 472	88 495	63 627	62 682	55 846
2020	55 711	92 920	65 907	62 985	54 804
2021	55 090	97 566	69 164	63 445	53 850

Graph 4.6: Provincial Public Gross Fixed Capital Stock Estimates (R'million average per quarter)

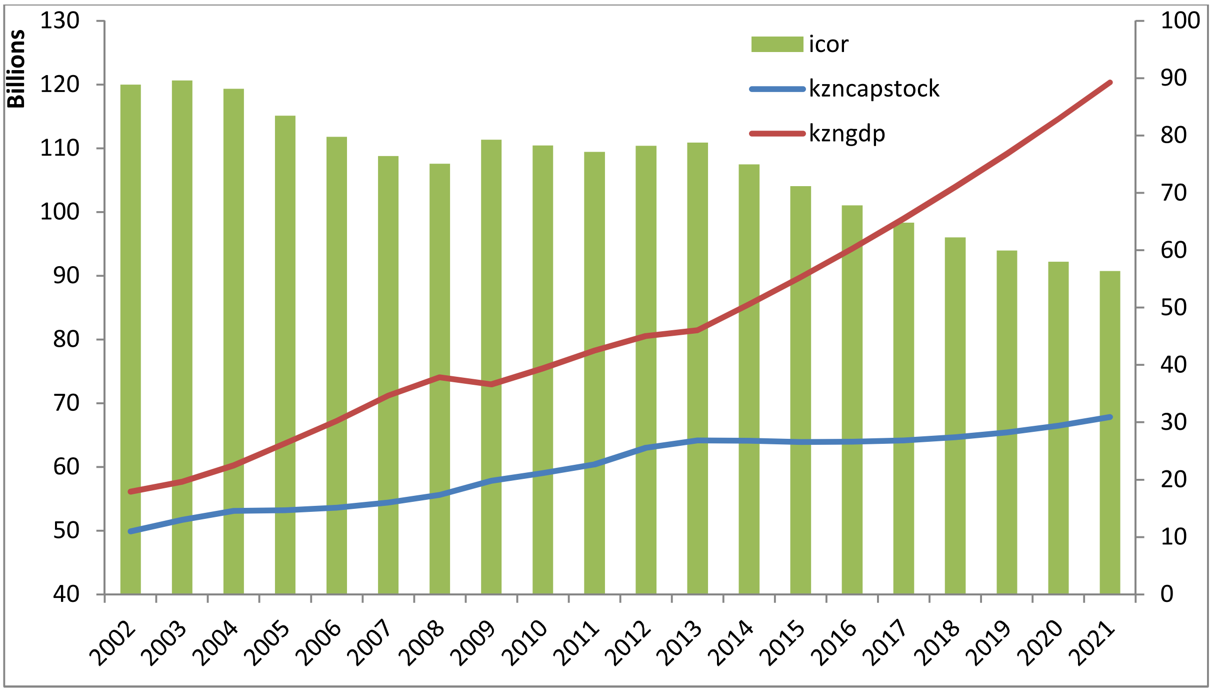


Graph 4.7: Average Provincial Public Gross Fixed Capital Stock Estimates (R'million average per quarter)



The graph below (graph 4.8) displays the projected GDP for the province, the estimated average fixed provincial public capital stock based on the above five approaches and the associated ICOR. It's clear that the infrastructure "gap" is growing over the period. This is a cause for concern, but not necessarily a problem as long as the replacement or maintenance of the capital stock is sufficient to compensate for the depletion of the capital stock and not become a constraint for economic growth and development. At an ICOR level of more than 50, the capital stock theoretically should be sufficient, but not optimal. However an ICOR level below 50 will be a significant constraint to the provincial economy.

Graph 4.8: Projected Provincial GDP, Estimated Average Provincial Public Gross Fixed Capital Stock and the Associated ICOR (average per quarter)



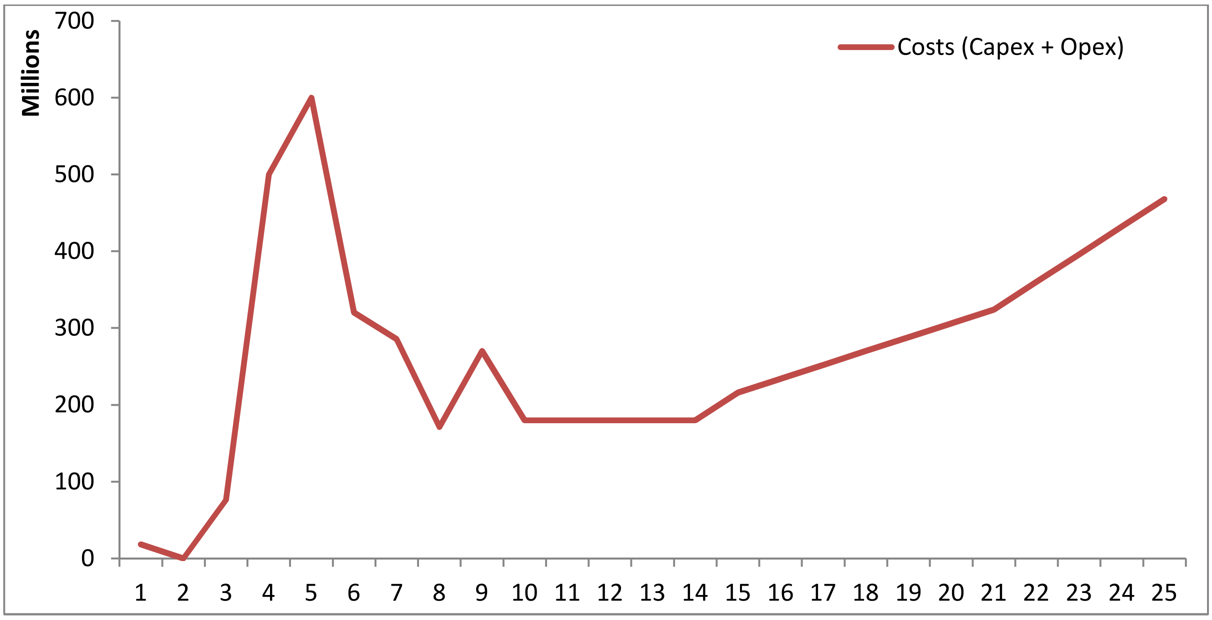
5. FUNDING MODELS FOR PROVINCIAL PUBLIC INFRASTRUCTURE

Section 4 suggests that the current provincial public fiscal infrastructure allocations (gross capital fixed formation) will be insufficient and that the provincial public infrastructure gap will continue to increase over the following number of years. It is therefore reasonable to urge that the provincial public's ability to finance the infrastructure gap is very limited. This is already very evident given the costs pressure faced by the provincial departments of health, education and transport.

The provincial government therefore essentially faces two options: the infrastructure gap is allowed to continue or alternative models are developed to finance the infrastructure gap. Given the social pressures and the need to grow the economy at above 4 percent levels per annum, option one seems undesirable and counterproductive. The provincial government thus has only one option and that is to develop and implement alternative funding models to address the infrastructure gap.

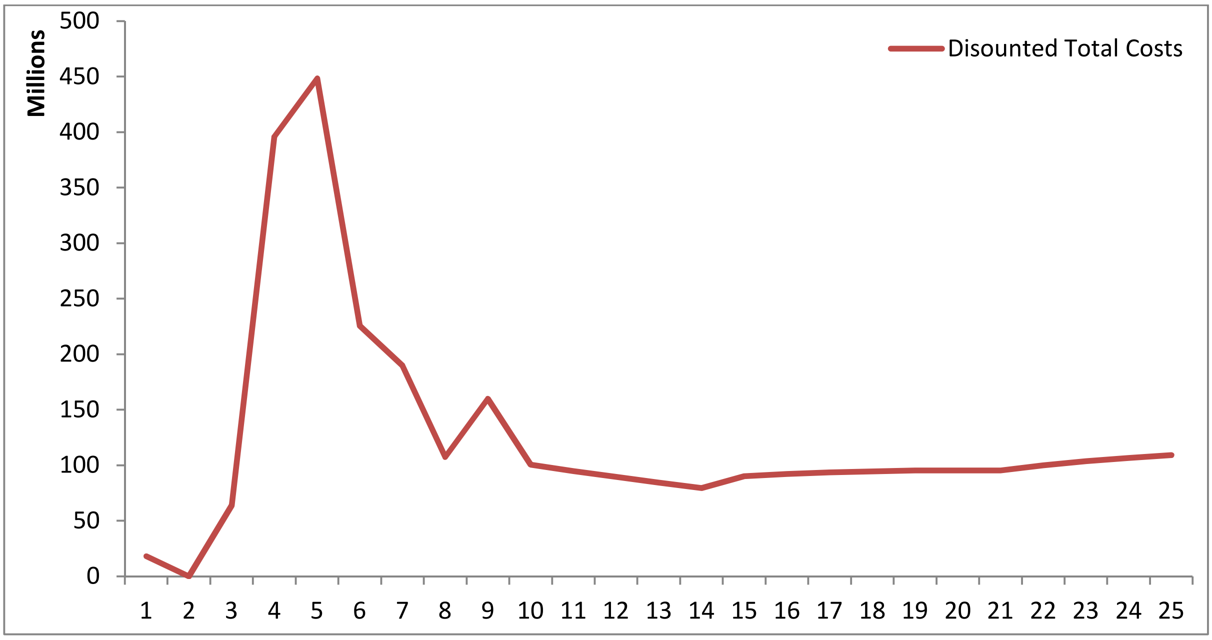
Let's look at the following example, i.e., Dr John Dube Memorial Hospital. The hospital is planned to be located in the eThekwini (Durban) metropolitan region with a capacity of 450 beds. The construction period is estimated at 5 years with a total construction cost of R1.8 billion. This hospital is in the design phase, but will most probably not continue into the implementation phase because of the lack of funds. The projected budget per year is displayed in the graph below. The significant budget increase during the first three years of the construction phase is very evident. The budget for the last two years of the construction phase is less than the first three years, especially compared to years two and three. The operational budget is displayed from years eight onwards and is calculated as a percentage of the total cost of the hospital, with the percentage decreasing from years eight to fourteen and the increasing from years fifteen to twenty-five.

Graph 4.9: Estimated Total Budget for the Hospital (25 years)



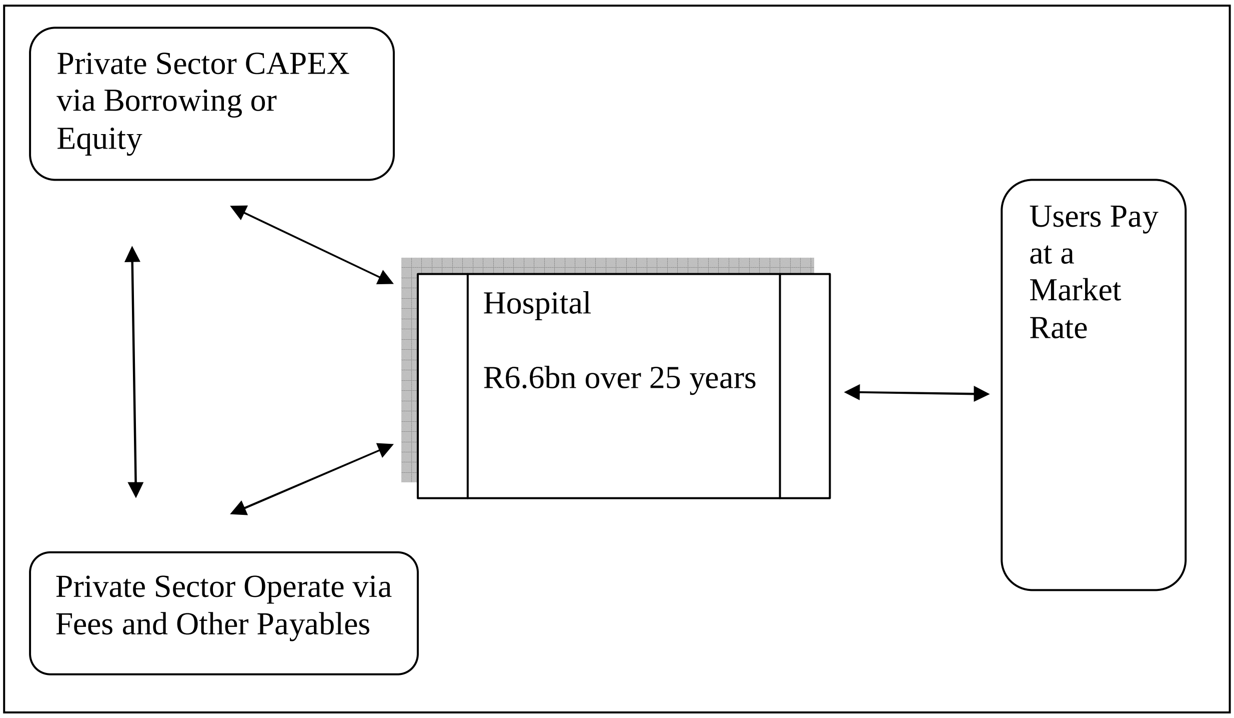
The total discounted cash flow (based on a 6 percent per annum discount rate) for the hospital is displayed in the graph below.

Graph 4.9: Estimated Discounted Cash Flow for the Hospital (25 years)



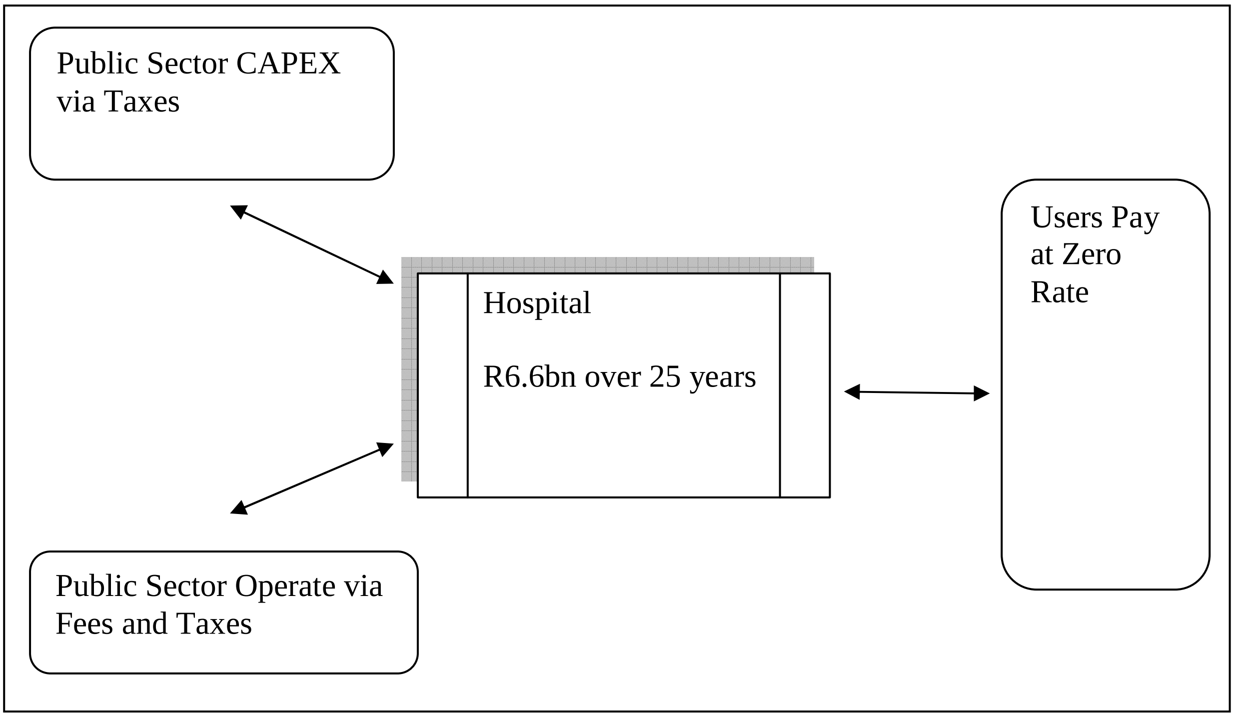
The traditional private sector model is displayed in the below illustration.

Illustration 5.1: Private Sector Model



The traditional public sector model is displayed in the below illustration.

Illustration 5.2: Public Sector Model



The private and public models as illustrated above are displayed in a financial sense in the table below.

Table 5.1: Public and Private Sector Models

	Total Costs	Public Model		Private Model	
		Government Fund Capex and Opex	Users Pay	Government Fund Capex and Opex	Users Pay
1	18 230 000	18 230 000	0	0	18 230 000
2	0	0	0	0	0
3	76 270 000	76 270 000	0	0	76 270 000
4	500 000 000	500 000 000	0	0	500 000 000
5	600 000 000	600 000 000	0	0	600 000 000
6	320 000 000	320 000 000	0	0	320 000 000
7	285 500 000	285 500 000	0	0	285 500 000
8	171 300 000	171 300 000	0	0	171 300 000
9	270 000 000	270 000 000	0	0	270 000 000
10	180 000 000	180 000 000	0	0	180 000 000
11	180 000 000	180 000 000	0	0	180 000 000
12	180 000 000	180 000 000	0	0	180 000 000
13	180 000 000	180 000 000	0	0	180 000 000
14	180 000 000	180 000 000	0	0	180 000 000

15	216 000 000	216 000 000	0	0	216 000 000
16	234 000 000	234 000 000	0	0	234 000 000
17	252 000 000	252 000 000	0	0	252 000 000
18	270 000 000	270 000 000	0	0	270 000 000
19	288 000 000	288 000 000	0	0	288 000 000
20	306 000 000	306 000 000	0	0	306 000 000
21	324 000 000	324 000 000	0	0	324 000 000
22	360 000 000	360 000 000	0	0	360 000 000
23	396 000 000	396 000 000	0	0	396 000 000
24	432 000 000	432 000 000	0	0	432 000 000
25	468 000 000	468 000 000	0	0	468 000 000
Total	6 687 300 000	6 687 300 000	0	0	6 687 300 000

In the private model the capex and opex costs are carried by the private sector. With the private model the fees payable by the users are sufficient to offset the capital expenditure (capex) or investment and the operational expenditure over the 25 years, i.e., revenue > capex + opex over the 25 years. However with the public model the fees payable by the users are insufficient to offset the capital expenditure (capex) or investment and the operational expenditure over the 25 years, i.e., revenue < capex + opex over the 25 years.

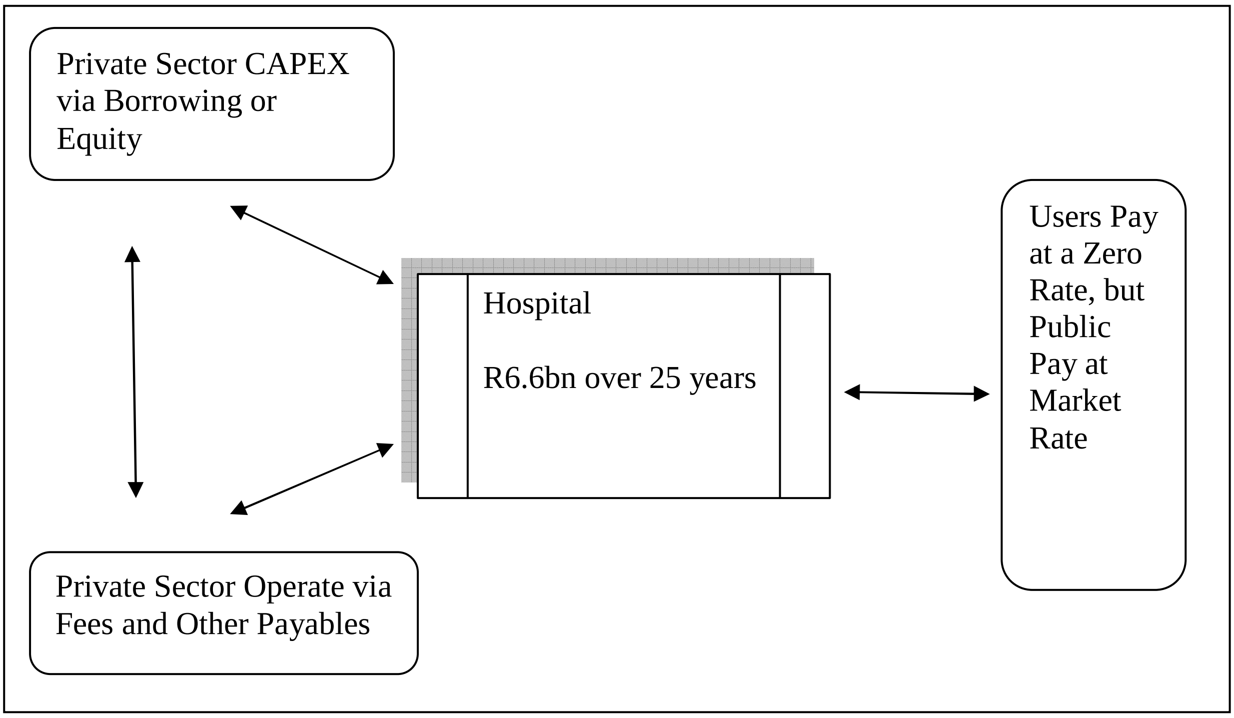
Therefore the public (provincial government) has two options, i.e., to finance the capex and opex from taxes so that the costs to the users are zero or close to zero (capex + opex to the users = 0, tax payers pay) or to finance the users directly so that the fees payable increases to the market rate (revenue > o, tax payers pay). In both instances the tax payers pay; however in the first option the capex and opex is financed compared to the second option where the users are directly financed. In the second option the private sector will be responsible to build, operate, etc the facility so the capex and opex to the public is zero.

In theory, costs to the public should be equal between the two options. However, in practice, there may be significant differences in costs depending on efficiencies, for example:

- if the private sector is more efficient in capex and opex than the public then the costs to the public should decrease, i.e., capex + opex decrease = market price decrease

- if the public is more efficient to finance the users than the private then the costs to the public should decrease, i.e., market prices for a collective < market price for individuals = costs to the public decrease

Illustration 5.3: Hybrid Sector Model – Users Subsidy



The first option is very much a continuation of the current public sector model (illustration 5.2). However option two (illustration 5.3) is a hybrid model relying on the private sector to build and operate the facility in the name of efficiency, i.e., capex and opex will be lower than if the public build and operate. However the users will not be able to pay the marker rate and therefore will pay a rate close to zero. The public will subsidize the zero rate to a market rate so that revenue > capex and opex. In theory the public sets up a medical insurance entity that will be responsible to finance the users through taxes. The public then uses its collective power to negotiate a lower market price per individual than if the users individually had to negotiate a market price.

The second option also affords the private sector the opportunity to make use of the facility in a purely private capacity; for example, derive 80 percent of the total revenue from public funded users and 20 percent from private funded users. This will further lower the costs to the public. Financing the users rather than the capex and opex on a theoretical level therefore seems to make sense from a public perspective.

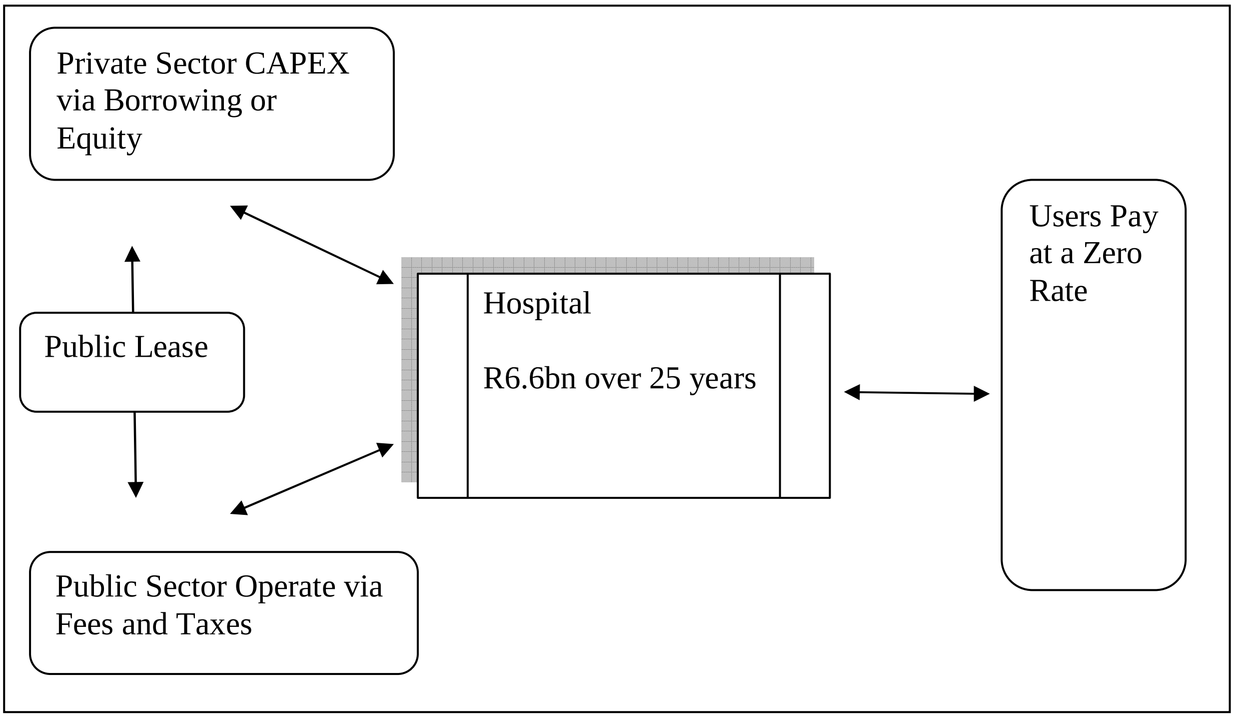
An average private medical insurance policy seems to cost about R66 000 per annum for two adults and two children. The budget for the provincial Department of Health during the 2013/14 financial year is estimated at R28 billion. Given that there is about two million uninsured households (public users) in the province, the estimated potential medial subsidy per household is about R14 000, which is significantly less than the R66 000. Or given the R66 000 value, an estimated 425 000 household can be subsidized. There seems to be a significant disjuncture between the private rate and the public rate, i.e., R66 000 vs. R14 000. So the next question is how to bridge this private vs public rate disjuncture.

Table 5.2: Department of Health Estimates

	Audited Outcome			Main Appropriation	Adjusted Appropriation	Revised Estimate	Medium-term Estimates		
R thousand	**2009/10**	**2010/11**	**2011/12**	**2012/13**			**2013/14**	**2014/15**	**2015/16**
1. Administration	1 159 694	463 648	576 425	397 670	418 090	559 494	591 078	628 340	661 600
2. District Health Services	9 095 886	9 729 299	10 692 335	11 953 719	11 986 929	12 156 931	13 063 776	14 211 182	15 188 621
3. Emergency Medical Services	762 479	822 618	1 070 387	1 045 888	973 431	949 390	972 362	1 063 938	1 126 728
4. Provincial Hospital Services	5 002 719	5 584 757	7 058 831	7 568 389	7 827 233	7 753 449	8 326 401	8 845 275	9 395 878
5. Central Hospital Services	2 059 124	2 103 382	2 512 654	2 659 359	2 742 074	2 741 097	2 922 125	3 098 392	3 288 335
6. Health Sciences and Training	773 998	832 279	860 457	998 051	960 723	934 894	992 246	1 022 500	1 075 603
7. Health Care Support Services	117 127	111 756	125 030	15 170	15 170	133 869	143 286	153 359	162 823
8. Health Facilities Management	1 378 249	1 087 247	1 894 999	1 917 104	2 367 280	2 367 280	1 636 603	1 422 738	1 358 628
Total	**20 349 276**	**20 734 986**	**24 791 118**	**26 555 350**	**27 290 930**	**27 596 404**	**28 647 877**	**30 445 724**	**32 258 216**
Unauth. exp. (1st charge) not available for spending	(758 000)	-	-	-	-	-	-	-	-
Baseline available for spending after 1st charge	**19 591 276**	**20 734 986**	**24 791 118**	**26 555 350**	**27 290 930**	**27 596 404**	**28 647 877**	**30 445 724**	**32 258 216**

Another possible option is displayed in the illustration below (illustration 5.4). In this model the private sector builds the facility using borrowed or equity finance. Thus, the facility is owned by the private sector and therefore the private sector will also be responsible for the maintenance of the facility. However the public leases the facility from the private sector and operates the facility using taxes. In this model, the users pay a zero rate. In this model, public lease value will cover the capex and maintenance; however there is no infrastructure outlay from the public required and in theory the capex under the private sector model should be less than the public sector model. This model can work if the opportunity costs of the public sector infrastructure layout (if the public was to build or maintain the facility) are greater than the lease value.

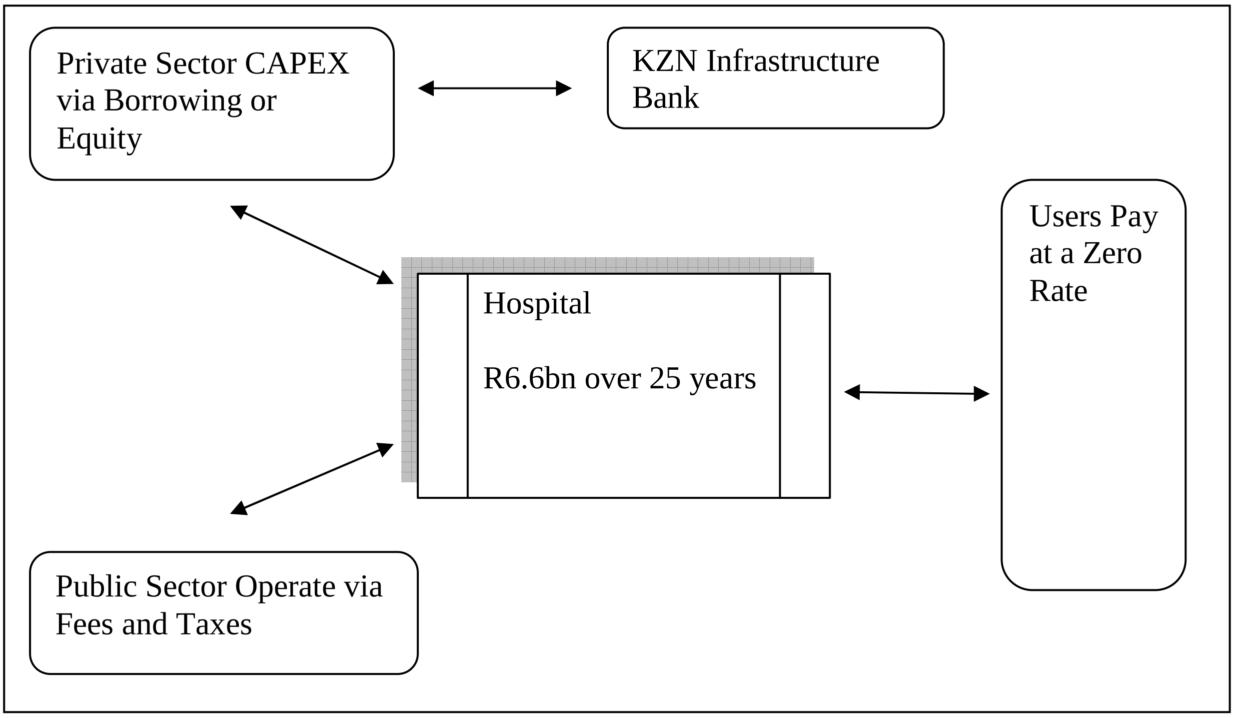
Illustration 5.4: Hybrid Sector Model – Public Lease



Another possible option is displayed in the illustration below (illustration 5.5). In this model the private sector builds the facility using the KZN Infrastructure Bank. However the facility is owned by the public sector, since the infrastructure bank is a public entity. In this model the users pay a zero rate and the public operate and maintain the facility. The big issue here is the financing of the infrastructure bank so that the bank can fund the capex, and given the constraints of the public to fund large scale capex.

In theory the KZN Infrastructure Bank will be finance based on the "stockvel" principle. It's a collective scheme with both the public and the various private sector companies contributing x amount every year to the Bank. It will be a voluntary participation in the infrastructure bank. These x amounts may be standardized or individual. The private sector is incentivized through tax incentives, CSI incentives and some "guarantee" of work to participate in the bank. The infrastructure bank should be managed via a PPP. In short, the infrastructure bank will finance the hospital on behalf of the public and allocate the work to one or more of the participating private entities on a rotational basis.

Illustration 5.5: Hybrid Sector Model – Infrastructure Bank



The above highlights a number of alternative approaches or models that in theory has some potential to deliver the facility and at a zero rate or cost to the users. The current and above approaches or models can be summarized as follows.

Table 5.1: Summarized Funding Models

Funding Model	Model Type	Who Finance	Who Pay	Probability of Delivery
Current Taxes	On budget	Provincial Government	Tax payers	Low
Borrowing - Bonds	On budget	Provincial Government	Savers	Low
Borrowing - Corporate	On budget	Provincial Government	Savers	Low
PPP - Equity	On and Off Budget	Owner Entity and Provincial Government	Shareholders and Tax payers	Medium
PPP - BOOT	On and Off Budget	Owner Entity and Provincial	Shareholders and Tax payers	Medium

		Government		
PPP - Lease	On and Off Budget	Provincial Government	Shareholders and Tax payers	High
Asset Sales	Off Budget	Provincial Government	Buyers	High
Finance the Users	On Budget	Provincial Government	Tax payers	High
Investment Bank/Fund	On and Off Budget	Provincial Government	Tax payers and Savers	Medium

The above is by no means an exhaustive list. However these are models that have a proven track record internationally. The models above are also not stand-alone models and can be used in some sort of combination, i.e., these models are not mutually exclusive.

The current taxes model is clearly not an option since the fiscus does not have the ability to fund the hospital. The borrowing model is also severely limited given the borrowing powers of provincial government. The pay-as-you-go model is a viable option from a financial point of view, but not necessarily from a social or political viability point of view. However if the market price is subsidized to a level that is non-exclusive then the model can work. For example the private sector can build-own-operate and then transfer the hospital (BOOT PPP model) whilst the users pay for the service but at a subsidized rate or the provincial government finances the users directly.

On the other hand the private sector can build-own-operate the hospital whilst the provincial government leases the hospital on an as-and-when basis, paying the hospital directly for its use by the users. Therefore the hospital is essentially private, built on provincial government land, giving the provincial government a preferential lease agreement. The users pay on a pay-as-you-can principle (affordability) with the provincial government effectively subsidizing the deficit. The private owner bills the provincial government at the same rates as a patient that has medical insurance.

Or the provincial government borrows the funds, builds the hospital and then leases the hospital to the private sector on condition that the provincial government users (traditional public hospital users) are billed at some predetermined marginal rate. The private operators are then responsible to operate the hospital and fund the hospital through the users with medical insurance.

6. SUMMARY AND CONCLUSIONS

The analysis or results of this study support the argument of a long run provincial public infrastructure gap. At the same time it's almost undeniable that the provision of public infrastructure is economically and socially desirable and needed. The study also suggests or points out that the current model of on-budget finance is inadequate and outdated.

It is therefore vital that new and innovative models of public infrastructure finance are explored, discussed and considered. The big issue or uncertainty in this debate is how to incentivise the private sector to pay or finance the predominantly social public infrastructure? Fortunately there are a number of various approaches or models practiced internationally. It is therefore recommended or suggested that these and other models be further studied and interrogated. It is evident that given the ever-increasing disjuncture between the demand and supply for provincial public infrastructure, the time for innovative and practical solutions to finance the growing public infrastructure gap is now and urgent.

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