Assessment of the Potential Economic Impact of the Rollout of Broadband in the Western Cape

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Executive Summary

The Provincial Government of the Western Cape is investigating the possible rolling out the provision of broadband infrastructure to selected areas of the Western Cape. This report looks at the economic consequences of that initiative. It concentrates on the four major projects in that rollout. These are:

- Project 1: Connecting Government throughout the province.
- Project 2: Connecting the communities of Mitchells Plain and Khayelitsha and Saldanha Bay. This project is analysed as two sub-projects.
- Project 3: Connecting to the World. In this project excess international connectivity is made available to selected businesses in the Western Cape. The film industry is used to illustrate the impact of this project.
- Project 4: Connecting businesses in the proposed Fringe district in Cape Town to broadband internet and more specifically to Cloud Services.

International Experiences

Three types of impacts from broadband have been identified:

- *first, the acceleration of innovation resulting from the introduction of new applications and services;*
- *second, the improvement of productivity as a result of the adoption of more efficient business processes enabled by broadband (e-business processes);*
- *third, the possibility of attracting employment from other regions as a result of the ability to process information and provide services remotely (Fornefeld et al. 2008).*

Broadband can have both a labour creating and saving impact. On the one hand, broadband creates new jobs by accelerating innovation in services and providing new business opportunities, on the other hand greater labour productivity can undermine employment.

A critical factor to estimating broadband investment impacts on output and employment is the current percentage of the population that already has access to the internet. The network effect of broadband becomes more significant the higher the percentage of penetration.

Productivity Gains

There is a growing body of empirical studies that substantiate the contribution of broadband to productivity. Studies have found that:

- ICT investments accounted for 80% of labour productivity growth in the US between 1996 and 2004;
- ICT contributed over 40% of labour productivity among EU countries between 1980 and 2006;
- Internet business solutions added $600bn to business revenue growth and cost-savings and contributed 0.43 percentage points to productivity in the US.
- Broadband has the ability to lower costs and raise productivity at the firm level.
- British Telecommunications was able to increase productivity by between 15% and 31% as a result of integrating broadband into its business processes.
- US insurance companies productivity surged as a result of broadband availability, as measured by a 25% increase in the number of claims processed daily.
- A recent study on 27 developed and 66 developing countries found that a 1 percentage point increase in the number of internet users correlated with a 4.3 percentage point increase in exports.
- Broadband is also associated with growth in the ICT sector. While Korea's ICT industry hovered around 2% of GDP in 1992, the current global average, it has now more than doubled to 4.6%.
- Broadband-enhanced trade facilities have had a major impact on improving Ghana's competitiveness by substantially increasing the speed, reliability and transparency of the clearing process and revenue accrual.
- Broadband also has the ability to increase the returns to agriculture and boost rural incomes by empowering farmers through providing timely and regular access to useful information, thereby improving the marketing and sales of their products.

Employment

The literature distinguishes between two effects of broadband on job creation: First, employment created by the effect of capital spending on network construction and deployment. Second, the additional employment generated once the network is in place. This is known as network externalities. The first impact uses standard econometric modelling based on input-output analysis, the second has been captured using multivariate regression analysis

Economic Growth

A study of 120 countries – mostly in the developing world, tested the impact of broadband penetration on the average growth rate of per capita GDP between 1980 and 2006. A 10% increase in broadband penetration is correlated with a 1.21% increase in GDP per capita in high income countries and a 1.38% increase in GDP per capita in low to middle income countries.

When growth across 21 OECD countries between 1970 and 1990 was compared it was found that around a third of the per capita GDP growth (0.59% of the 1.96% per year growth rate) was attributable to telecommunications infrastructure investments, albeit not broadband by itself.

Individual studies on developed economies reveal a similar pattern. A study by the Allen Consulting Group (2002) commissioned by Australia's National Office for the Information Economy projected a 0.6% increase in Australia's GDP growth rate as a result of broadband. In the US, several studies estimated that next generation broadband would contribute between $300bn and $500bn of GDP by 2006, compared to between $300bn and $400bn in Europe.

Broadband Access: International and South Africa

According to the latest Organization for Economic Development report on broadband access, the average penetration rate in OECD countries grew to 24.9 subscriptions per 100 inhabitants, up from 23.3. The countries with the highest wireless broadband penetration, measured as subscribers per 100 inhabitants, in 2010 were Korea (89.9%), Finland (84.8%), Sweden (82.9%), Norway (79.9%), Japan (76.7%) and Portugal (63.8%).

South Africa, with a current broadband penetration rate of around 7%, has significant potential for growth in broadband. The current penetration is made up mainly of 2 million Vodacom subscribers, 700 000 Telkom ADSL users, and 700 000 MTN broadband users. The country's fixed line broadband penetration rate of 1.4% is even lower by comparison to the OECD's 24.9%, and still multiple times lower than the lowest ranked OECD countries such as Turkey (9.8%), Mexico (10.4%) and Chile (10.4%).

Cloud Computing

Cloud computing is an emergent general purpose technology (GPT) which could significantly boost the efficiency of the private and public sectors, as well as promoting economic growth, employment, competition and business creation. It is an internet-based technology, where

information is stored remotely on servers and provided on-demand to both households and companies. Consumers are able to store and access all of their documents and data from any device. For consumers, cloud computing will enhance their lifestyle; for firms it will have a substantial impact on their cost-structures and reduce barriers to entry in many industries, especially those that are IT intensive. Cloud computing can therefore have a profound indirect impact on business creation and the macroeconomic performance of countries.

There are a number of ways in which cloud computing affects macroeconomic performance. In the public sector, it can greatly reduce costs, in areas such as hospitals and health care (by providing information to poor and remote locations) and education (e-learning), as well as government agencies that experience intermittent periods of high usage (such as government revenue and tax services). In the private sector, cloud computing can provide substantial cost savings by reducing or eliminating the need to invest in both hardware and software to run business applications. Cloud computing could save companies from 30% up to 50% in fixed ICT spending.

Studies have found that cloud computing could generate additional GDP growth of between 0.05% and 0.15% in the short term and between 0.1% and 0.3% in the medium term. Sectors which are relatively ICT intensive as well as dominated by SMMEs will likely benefit the most from renting computing power.

Results of the Cost Benefit Analysis

The results of the cost benefit analysis are shown in the table below.

Project Description	**NPV (Rm)**	**BCR**	**IRR**
Project 1: Public sector benefits only	1 038	1.4	13%
Project 1: Public and private sector benefits	17 494	7.5	42%
Project 1: Including the City of Cape Town rollout	69 751	9.8	79%
Project 2: Mitchell's Plain and Khayelitsha	1 425	14.1	1004%
Project 2: Saldanha Bay	84	6.6	197%
Project 3	374	4.5	215%
Project 4	106	12.7	70%

When evaluating project 1 purely on the benefits to the government sector alone (outside of Cape Town) the NPV is R1 038m, the BCR 1.4 and the IRR 13%. These results indicate that the project is marginal from an economic efficiency point of view. However, when the benefits to the private sector are included the NPV increases to R17 494m, the BCR to 7.5 and the IRR to 42%. These results indicate that the project is now economically beneficial and robust. If the City of Cape Town's broadband rollout project are included then the NPV increases even further to R69 751m, the BCR to 9.8 and the IRR to 79%. This indicates that from a province wide perspective the project is economically robust.

The results for both parts of project 2 suggest that they are both economically robust and should be pursued. Mitchell's Plain and Khayelitsha, with its higher BCR, is more efficient than Saldanha. The reason for the higher benefits in Mitchell's Plain and Khayelitsha is its much higher and denser population that can be reached by the broadband services. It will however be realised that the key to success is ensuring families purchase computers and that the assumed penetration rates materialise. Without this the project would fail. For these projects to break-even (i.e. have a BCR of 1) Mitchells Plain and Khayelitsha require a penetration rate of 8.7% (currently 5.6%) and Saldanha a penetration rate of 17.6% (currently 12.0%). Clearly the higher the penetration rate the better the project. Strategies would need to be put in place to ensure that these penetration rates are exceeded. Such strategies might include adult education programmes, advertising in local schools and the bulk purchase of entry level computers to help make these more affordable.

Project 3 looks at the impact of providing international connectivity to the film industry. With a BCR of 4.5 and an NPV of R374m the results indicate that this project is economically efficient.

The last project analysed is project 4, which looks at the impact of providing broadband internet services and more specifically cloud computing services to businesses in the proposed Fringe district in the eastern CBD of Cape Town. The NPV of R106m and BCR of 12.7 indicate that this project is also economically efficient and robust.

The conclusion to the cost benefit analysis is that all four projects are economically viable and are worthy of implementation. While the public sector benefits of Project 1 only just cover the costs of that project it is really the benefits to the rest of society, most notably the business sector, which result in the project becoming economically robust.

The four projects are clearly economically efficient in their own right. The synergies between the projects make for a compelling and convincing case

Macroeconomic Analysis

The results of the macroeconomic analysis are as follows (all amounts are expressed in 2011 prices):

- Project 1 (20 year analysis period) excluding Cape Town:
  - The overall contribution to GDP is expected to total R335m in 2012, R787m in 2013, R1.47bn in 2014 and R1.27bn in 2015. From 2016 onwards, when the broadband network becomes active, the total contribution to GDP is expected to increase from R1.0bn to a significant R20.8bn by 2031.
  - The cumulative contribution to GDP is expected to total R3.86bn by the end of 2015, when the broadband network has been fully rolled out. By 2031 the cumulative contribution to GDP can be expected to exceed R150bn.
  - Total direct and indirect jobs are expected to amount to 335 in 2012, 787 in 2013, 1 465 in 2014, and 1 272 in 2015. Once the productivity gains from the broadband network begin to be felt it is expected that as many as 1 006 direct and indirect jobs would be created in 2016 and increasing to 20 873 by 2031.
  - Total tax generation is expected to increase from R32m in 2012 to over R1.7bn in 2031. When the capital expenditure is complete in 2015 a cumulative total of R376m in taxes would have been generated by the project. The cumulative contribution to taxes by 2031 is expected to exceed R12.5bn.
  - The contribution to indirect household income increases from R91m in 2012 to R5.85bn in 2031. By 2031 it is expected that the project will have added over R42bn to indirect household income.
- Project 1 including Cape Town:
  - The overall contribution to GDP is expected to total R850m in 2012 from the city's capital and operating expenditure and R335m from the province's capital and operating expenditure. Productivity gains from the city are expected to amount to R3 948m. It would be too early in this year for the province to contribute to productivity gains.
  - Total contribution to GDP in 2012 is expected to amount to R5.1bn. Thereafter it is expected to increase to R84.3bn in 2031.
  - The cumulative contribution to GDP over twenty five years is expected to exceed R706bn
  - Total direct and indirect jobs are expected to amount to 12 706 in 2012 and to increase to 173 308 in 2031.
- Project 2 (Mitchells Plain and Khayelitsha – 5 year analysis period):

  - The overall contribution to GDP is expected to total R31m in 2012 from capital and operating expenditure. Thereafter it increases to R490m in 2013 and R1 678m in 2016.
  - The cumulative contribution to GDP over five years is expected to exceed R4.4bn
  - Total direct and indirect jobs are expected to amount to 83 in 2012, 1 205 in 2013, 2 265 in 2014, 3 251 in 2015 and 4 144 in 2016.
- Project 2 (Saldanha Bay – 5 year analysis period):
  - The total contribution to GDP amounts to R16m in 2012 and then increases to R30m in 2013 and R115m by 2016.
  - The cumulative contribution to GDP over five years is expected to amount to R306m.
  - Total direct and indirect jobs are expected to amount to 39 in 2012, 73 in 2013, 142 in 2014, 212 in 2015 and 283 in 2016.
- Project 3 (10 year analysis period):
  - The overall contribution to GDP is expected to total R39m in 2013, then increasing from R73m in 2014 to R361m in 2022 as a result of increased business to the film industry.
  - The cumulative contribution to GDP is expected to exceed R1.9bn by the end of 2022.
  - Total direct and indirect jobs are expected to amount to 74 in 2013 and then increase each year, indicating the sustainable nature of the job creation, until they total 543 in 2022.

No macroeconomic analysis was performed for project 4 because of the limited amount of information available at the time of writing this report.

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List of Abbreviations

BCR	Benefit Cost Ratio
GDP	Gross Domestic Product
IaaS	Infrastructure as a service
ICT	Information and Communication Technology
IRR	Internal Rate of Return
NPV	Net Present Value
PaaS	Platform as a service
PER&O	Provincial Economic Review and Outlook
PGWC	Provincial Government of the Western Cape
PV	Present Value
SaaS	Software as a service
SAM	Social Accounting Matrix
SES	Strategic Economic Solutions

Introduction

The Provincial Government of the Western Cape is considering rolling out the provision of broadband infrastructure to selected areas of the Western Cape. To this end it has appointed BMI-T to do the planning and develop the business case for this rollout. As with all such infrastructure proposals they must ensure that economic benefits to society outweigh the economic costs. As a result BMI-T appointed Strategic Economic Solutions (SES) to undertake this economic evaluation. SES is a specialist in this type of analysis. SES, in conjunction with partner company EiS, has recently completed the analysis for The Fringe, a creative cluster to the east of the Cape Town CBD; the Mozambican national road between Komatipoort and Maputo and the rollout of integrated public transport systems throughout South Africa. SES also undertook the economic evaluation of the broadband rollout in the city of Cape Town.

This report has six sections.

- Section 1 gives a brief description of the project.
- Section 2 explains the nature of the economic analysis and how to interpret the results.
- An international review of the economic benefits is presented in Section 3.
- Section 4 uses the results of the international review to set up the analysis of the Western Cape.
- The results are reported in Section 5.
- Section 6 concludes the report.

1 Project Description

The Western Cape Broadband Rollout consists of a number of projects, four of which are evaluated in this economic analysis. These are:

- Project 1: Connecting Government.
- Project 2: Connecting the communities of Mitchells Plain and Khayelitsha and Saldanha Bay. This project is analysed as two sub-projects.
- Project 3: Connecting to the World.
- Project 4: Connecting businesses in the proposed Fringe district in Cape Town to broadband internet and more specifically to Cloud Services.

The projects are not described in detail here because they are done elsewhere by BMI-TechKnowledge and Kaiser & Associates. The majority of the costs are associated with project 1 and it is the key focus of the analysis. Projects 2 and 3 have lower costs but unlock significant economic potential. Although the projects have been analysed separately they unlock greater benefits to society considered as a suite of projects.

2 Understanding Economic Analysis

There are a variety of different types of economic analysis, some of which can be quantified and some of which cannot. The analyses that can be quantified include cost benefit analysis, microeconomic costs and benefits, and macroeconomic analysis. For the purposes of undertaking an economic analysis of the Western Cape Broadband Rollout macroeconomic and cost benefit analysis are the appropriate tools. The purpose of this section is to describe these two types of analyses and explain how to interpret the results of the analysis.

2.1 Economic Cost Benefit Analysis

Cost Benefit Analysis (CBA) treats the national economy, or a provincial economy, as an entity in and of itself. It assumes, with some important caveats, that what is demonstrably good for the economy as a whole is a reasonable approximation of what would be good for the majority of the people living and working in that area.

When investments like the proposed Western Cape Broadband Rollout are contemplated, decision makers need to know what impact the new, or improved, infrastructure would have on the economy as a whole and hence how much benefit can be assumed to accrue to the people of the province. The main linkage is through the changes in productivity that occur when improvements take place. These transmit changes in the level of economic activity in areas benefiting from the new infrastructure.

The methodological approach in a cost benefit analysis is to compare the proposed project to the base case or “do nothing” case. In this particular instance the “do nothing” is literally that: there is no Western Cape Broadband Rollout and life for the people of the Western Cape continues as normal.

The costs of the project relate to the set-up, connection and operation of the network. The benefits relate to the increased productivity and economic output from businesses and households throughout the province as well as the cost savings or transfers from the PGWC spending less on communication. There are potential social benefits which have not been quantified.

The analysis period incorporates all the costs over a 20 year period (5 years for project 2 and 10 years for project 3) and values are discounted to present day values by using a social discount rate of 8%. This corresponds to the rate prescribed by the South African National Treasury and the Provincial Department of Transport of the Western Cape Government. The cost benefit analysis was developed based on best practice and in

consultation with the guidelines of the Manual for Cost Benefit Analysis in South Africa (Conningarth, 2007). Although all the costs and the benefits are concentrated within the Western Cape the analysis has been conducted from a country wide, i.e. South African, perspective.

The outcome of the analysis is the reporting of a net present value (NPV), a benefit cost ratio (BCR) and an internal rate of return (IRR) for those cases where the project is compared to a do minimum alternative. A NPV shows the total value of future costs and benefits reduced to a present day value. The BCR measures the changes in benefits and costs that would result from an investment. BCRs are typically used when there are many competing alternatives and projects need to be funded from a limited set of resources. Finally, the IRR is the discount rate that returns a NPV of zero and shows the likely economic returns to society of a project in relation to other investment opportunities.

If the evaluated benefits of a project are indeed greater than the overall project costs then the BCR ratio would be greater than 1. A BCR greater than 1 indicates that the completed project would constitute an economic asset; a BCR less than 1 implies that the project would be an economic liability. The higher the BCR the less risk there is that the proposed investment could turn out to be less than beneficial economically. Low BCR's, even if greater than 1, provide a warning that a project could be risky and may turn out to become an economic liability instead of an asset.

A high BCR is usually a good indicator that it would be possible to raise finance to implement a project. In the case of a private sector investment the good BCR would be part of the business case to funders. If it is a public infrastructure project, a high BCR should give confidence that it is worth funding the project directly from its Treasury or, alternatively, to make suitable institutional arrangements for the involvement of the private sector in the project's funding.

An economic analysis includes all costs to society. This is done by adjusting for shadow prices and wages and removing the distortions caused by taxes and subsidies.

The cost benefit analysis focuses purely on direct costs and benefits and does not take any indirect costs and benefits into account. Indirect costs and benefits would include those costs and benefits obtained through multiplier effects. For example, the civil engineering work of digging trenches and laying down the broadband network would have spin off effects for the construction industry and the building materials supply industries. These, in turn,

would have backward linkages with other commodity suppliers and retail industries. These lie in the realm of macroeconomic analysis.

2.2 Macroeconomic Analysis

The size of a national or regional economy is measured in terms of the total of all economic activities taking place within the area concerned, both in the public and private sectors. For countries like South Africa, this necessarily includes measures of informal sector activity as well. The name given to the measure of the size of the economy is Gross Domestic Product (GDP) for the country as a whole or Gross Geographic Product (GGP) for a province or other sub division of the nation.

Underlying the measurement of GDP or GGP is the understanding that all economic activity is dependent on the physical and institutional support systems that enable an economy to operate effectively. These include the various levels of governmental structure, the legal system, and the administrative, financial and educational infrastructure in the country. In terms of physical infrastructure, all economic activity depends on water supply, telecommunication and transport infrastructure. Without all of these systems being in place the economy could not operate.

While there are a number of different types of macroeconomic effects, the two most important are contribution to GDP and creation of jobs. The importance of job creation is obvious. Increases in GDP are synonymous with increases in peoples' economic standards of living. Increased GDP – i.e. increased production – is experienced in the form of more jobs, higher wages and reduced economic hardship. It is clearly an important measure.

The effects of any infrastructure project on the size of GDP arise as a result of the myriad ways in which businesses, public service providers and ordinary people find their normal daily activities affected, hopefully for the better, by the changes brought about by the new infrastructure.

The actual task of calculating the macroeconomic impact of the proposed project demands a detailed and multifaceted approach not least because of the so-called multiplier effects. It is well recognised that the simple act of spending – constructing a network operating centre, for example, - leads to other economic effects. Demand for steel and cement can lead to increased production in those industries. Increased demand for steel and cement, in turn, leads to increased demand for mining output which uses wood, water, electricity and so on. These are the so-called multiplier effects. While this process unfolds, each industry employs people and pays wages. Employees, in turn, spend their wages and cause further multiplier

effects through the economy. Measuring this is further complicated by the fact that different industries demand different types of skills. This leads to different wage structures across the various industries. People earning different wages have different spending patterns. Thus, the change in overall spending patterns is dependent on which industries are affected.

Input-output analysis was largely used for the measurement of the macroeconomic impact of the Western Cape Broadband Rollout. Input output tables were developed from a South African Social Accounting Matrix (SAM) and converted into industry multipliers. This approach demands that all expenditure in and around the project be identified and estimated. This expenditure, in turn, needs to be linked to the 43 SAM economic sectors for South Africa. In addition, if employment is part of the expenditure then estimates must be made of the likely items of expenditure as a result of wage payments. Allowances must also be made for the fact that workers at different income levels have different spending patterns.

The following items were included in the macroeconomic analysis

- Capital Expenditure: the amount spent on the type of capital expenditure (e.g. fibre and passive infrastructure, the microwave systems, electronic equipment, building improvements, etc.) was provided by the research team.
- Operating Expenditure: operating expenditure was developed by the research team based on the anticipated requirements of the Western Cape Broadband Rollout. This included office costs, professional fees, lease costs and maintenance costs.

Four steps are required to measure the overall economic impact of the Western Cape Broadband Rollout

- First, to identify the appropriate costs and benefits.
- Second, to determine the relative proportions of profit, labour, plant and material for each cost line item.
- Third, to assign each item of material and plant to the appropriate SAM code.
- Finally, all the SAM coded items are brought together. The total multiplier effect is calculated as the aggregate product SAM coded spending on plant and material, as well as SAM coded spending by workers multiplied through the industry multipliers.

Therefore the macroeconomic estimates that are made in this report relate directly to the capital and operating expenditure and the productivity increases and economic growth due to the Western Cape Broadband Rollout. Included in the macroeconomic calculations are all the backward economic linkages from this expenditure and the forward economic linkages that occur when workers spend their salaries.

Direct jobs were calculated with the use of the Social Accounting Matrix (SAM) for South Africa. From the SAM it is possible to calculate both the average salary that is paid in any one sector and the proportion of salaries to overall turnover in that sector. This was then used to calculate direct jobs based on the amount of spending in each economic sector resulting from the Western Cape Broadband Rollout.

Indirect jobs are determined through a similar process as the calculation for GDP described above and makes use of industry multipliers developed from the SAM.

3 International Experiences

The purpose of this section is to outline a selection of international experiences on the economic contribution of broadband to productivity, job creation and economic growth. The availability of a broadband network can have a profound and permanent impact on productivity, employment and economic growth. Broadband changes the way individuals perform their jobs, communities interact, firms run their businesses and government provides services. Table 1 provides a summary of a growing empirical data base and consensus in the literature on the main benefits of deploying broadband networks.

Table 1: Summary of the Economic Contribution of Broadband

Summary of economic impacts of broadband substantiated by academic research

Impact Area	Benefits
Productivity	Higher labour productivity in ICT intensive (financial,) and ICT non-intensive industries
	Higher productivity in supply chain and distribution functions
Firm location	Relocation of firms in search for labour pool
	Relocation of functions resulting from value chain decomposition
	Enhancement of quality of life which attracts educated labour force
Employment	Enhancement of self-employed workforce enabled by the availability of broadband
	Employment created by development of ICT industries
	Wider radius of tele-commuting, allowing for tapping into additional labour pools
	Creation of new firms/services requiring additional labour force
	Higher labour productivity results in negative employment, through capital/labour substitution.
Economic (GDP) Growth	Strengthening of industries with high transaction costs (trade, finance, etc.)
	Consumer surplus derived from new telecommunications services, travel time savings, etc.

Source: Katz (2009)

A review of the literature reveals two approaches to estimating the impact of broadband: the first, is a top-down approach which estimates a “network multiplier”; the second, is a bottom-up approach which models the micro-economic impact of broadband on firms. Pocsiak (2002) and Atkinson et al. (2009) estimate a “network effect” multiplier of 4.1 and apply it to network construction employment estimates. Atkinson et al. (2009) calculated a network effect job multiplier of 1.17. So far only one study has attempted to isolate the effects of broadband at firm-level by creating and depicting a complex causality chain. Fornefeld et al. (2008) identified three types of impacts of broadband:

- *first, the acceleration of innovation resulting from the introduction of new applications and services;*

- *second, the improvement of productivity as a result of the adoption of more efficient business processes enabled by broadband (e-business processes);*

- *third, the possibility of attracting employment from other regions as a result of the ability to process information and provide services remotely (Fornefeld et al. 2008).*

Broadband can have both a labour creating and saving impact. On the one hand, broadband creates new jobs by accelerating innovation in services and providing new business opportunities, on the other hand greater labour productivity can undermine employment. As Lehr et al. (2006) have pointed out "broadband may facilitate capital-labour substitution, resulting in slower job growth". Thirdly, broadband enables tele-commuting and outsourcing of business functions in the service industry. Depending on the area this can create job opportunities or lead to a draining away of jobs to other regions. There are currently no studies that measure net or combined impact of these three employment impacts.

Another critical factor to estimating broadband investment impacts on output and employment is the current percentage of the population that already has access to the internet. The network effect of broadband becomes more significant the higher the percentage of penetration. In other words, broadband penetration has to have a "critical mass" before its beneficial impact on productivity, employment, innovation, business formation and growth can take place. As broadband becomes more ubiquitous and universal, additional investments in broadband infrastructure yield less return per unit of input. As Lehr et al. (2006) have found "because broadband will be adopted within a state first by those who get the greatest benefit (while) late adopters within a state will realize a lesser benefit" (pp.10).

3.1 Productivity Gains

There is a growing body of empirical studies that substantiate the contribution of broadband to productivity. A study by Crandall et al. (2003) found that ICT investments accounted for 80% of labour productivity growth in the US between 1996 and 2004. Similarly, Fornefeld et al. (2008) estimated that ICT contributed over 40% of labour productivity among EU countries between 1980 and 2006. Based on a survey of over 2 000 firms across the US economy, Varian et al. (2002) found that internet business solutions added $600bn to business revenue growth and cost-savings and contributed 0.43 percentage points to productivity in the US.

Aside from macroeconomic, country level studies, these productivity gains are also confirmed at the firm or micro-economic level. These studies reveal that most of the

productivity gains are experienced by economic sectors with a relatively high proportion of information requirements and transaction costs such as the services sector, and specifically in the financial, insurance, ICT and trade sector.

A substantial empirical base confirms the ability of broadband to lower costs and raise productivity at the firm level. Varian et al. (2002) estimated cost-savings of $155bn in the United States and $8.3bn collectively in France, Germany and the United Kingdom, as well as a total increase in revenue of $79bn for France, Germany and the United Kingdom.

The Broadband Stakeholder Group study (2004) found that British Telecommunications was able to increase productivity by between 15% and 31% as a result of integrating broadband into its business processes. It allowed around 8 500 of its employees to work from home. As a result the company saved accommodation costs; each employee took an average of only 3 days sick leave compared to the industry average of 12 days; there was total savings of more than £60m each year; home-working was extended to engineers and as a result service quality improved by 8% although they worked an average of two hours less per week. For BT, these cost savings cumulatively amounted to £60m annually.

A study on broadband economic impacts by Sprint (2006) found that the productivity of US insurance companies surged as a result of broadband availability, as measured by a 25% increase in the number of claims processed daily. Similarly, a study on broadband adoption in Australia's state of Victoria projected "the financial, insurance and business service sectors are expected to experience the fastest and greatest productivity gains from broadband use" (ACIL Tasman: 2004: vii).

Research on the impact of broadband for business is available in the Australian context (ACIL Tasman 2004:13). The Pacific Internet's Broadband Barometer (as published in January 2004) estimated "that broadband penetration among Internet enabled small businesses has increased from 23% in June 2002 to 47% in January 2004." 85% of those businesses which had adopted broadband reported that they saw "an increase in efficiency and productivity. A reduction in costs due to broadband was reported by 47% of broadband users. The report also noted that "21% of narrowband small businesses surveyed [intended] to migrate to broadband within the next six months." Of those businesses with narrowband, the main reasons for not adopting broadband were cost and lack of availability (EiS 2011).

The impact of broadband on lowering telecommunication costs can have a significant impact on improving a firm's export competitiveness. According to a recent study on 27 developed and 66 developing countries (Clarke and Wallsten, 2006) a 1 percentage point increase in

the number of internet users correlated with a 4.3 percentage point increase in exports. Although the report was based on internet usage as a whole, broadband would likely have an even more significant impact.

Broadband is also associated with growth in the ICT sector. Korea is perhaps the prime example of how broadband can shape and push an economy into high gear as a basic enabling technology which can not only lower costs but create new and innovative products and services. The rapid and almost ubiquitous deployment of broadband (90% of Koreans have broadband access) has given a major boost to Korea's ICT industry. While Korea's ICT industry hovered around 2% of GDP in 1992, the current global average, it has now more than doubled to 4.6%. Over 300 000 ICT jobs have been created and the sector is growing three times faster than GDP. This accelerated growth is fuelled by the development of search engines and local content. Korea has also developed a highly competitive niche industry in online gaming. Broadband has also contributed to the more than doubling of the e-commerce market between 2002 and 2006, from $178bn to $414bn (Qiang, 2009:41).

Broadband-enhanced trade facilities have had a major impact on improving Ghana's competitiveness by substantially increasing the speed, reliability and transparency of the clearing process and revenue accrual. A private fibre-optic broadband between the network office (GCNet) and the Customs, Excise and Preventive Services Department forms the system's backbone. The system enables 24 hour submission of customs documents and streamlines processing and verification of trade documents, as well as allowing systematic monitoring of consignment movements. In less than two years, the broadband network increased customs revenues by 49% (Qiang, 2009:44).

Broadband also has the ability to increase the returns to agriculture and boost rural incomes by empowering farmers through providing timely and regular access to useful information, thereby improving the marketing and sales of their products. In Burkina Faso, Songtaaba, an organisation manufacturing skin care products, employs more than 3 100 women in 11 villages. It set up telecentres in two villages. These telecentres are managed by rural women and are equipped with cell phones, a GPS system and computers with broadband connections linked to a website that provides information about opportunities and places to sell their products. After two years of setting up the telecentres and the website in 2005, orders increased by 70% and members' profits doubled (Qiang, 2009:40).

The findings in this section are summarised in Table 2.

Table 2: Broadband economic impact studies: Key quantitative findings

Broadband economic impact studies: Key quantitative findings

Broadband impact	Country/Firm	Impact	Source
Productivity	USA	ICT = 80% of labour productivity growth	
Productivity	EU	ICT contributes 42 % to labour productivity	
Productivity	USA	Broadband contributes 0.43% to future productivity growth	Varian and others (2002)
Productivity	Kenya	50% increase in micro and small business revenues	Lewin & Sweet (2005): 35
Productivity	British Telecommunications	15 - 31% increase in productivity; 8500 working from home; 3 instead of 12 days sick leave	Qiang (2009) World Bank study
Productivity	US insurance companies	25% more claims processed each day (Sprint 2006)	Qiang (2009) World Bank study: 38
Export competitiveness	27 developed; 66 developing countries	1 % increase in internet penetration increases exports by 4.3%	Clarke & Walston (2006) quoted in (Qiang (2009) World Bank study: 37
Firm location	USA	Broadband added 0.6-1.2% to share of firms in IT-intensive sectors	Gillett and others (2006)
Firm location	USA	Broadband reduced share of small firms with less 10 employees by 1.3% to 1.6%	Gillett and others (2006)
Firm location	USA	added 0.5 - 1.2% to growth rate in number of firms	Gillett and others 2006
Employment	USA	Availability of residential broadband added 1.0-1.4% to job growth b/n 1998-2002	Gillett and others (2006)
Employment	USA (lower 48 states)	1% increase in broadband penetration increases employment by 0.2% - 0.3%	Crandall and others (2007)
Employment	South Dundas (Ontario, Canada)	Businesses with broadband are more likely to create jobs (54%), than those with dial-up (27%) or no internet (5.6%)	Strategic Networks Group (2003)
Employment	USA	Network effects multiplier calculated to be 4.1 times direct employment in network construction	Posciak (2002)
Employment	USA	Network effects multiplier calculated to be 1.17 times direct employment in network construction	Atkinson and others (2009)
GDP growth	35 countries	10% increase in penetration = 2.8% increase in GDP; 24% critical mass	Roeller & Waverman (2001)
GDP growth	21 OECD countries	Telecom investment responsible for 1/3 of GDP growth; 30% critical mass	Roeller & Waverman (1996)
GDP growth	Germany	10% increase in broadband yields 0.26% incremental growth	Katz et al. (2010)
GDP growth	22 OECD countries	10% increase in broadband penetration yields 0.25% incremental growth	Koutroumpis (2009)
GDP growth	High income countries	10 % increase in broadband penetration yields 1.21% increase in GDP per capita	Qiang (2009) World Bank study
GDP growth	Low/Middle income countries	10% increase in broadband penetration yields 1.38% increase in GDP per capita	Qiang (2009) World Bank study
GDP growth	Australia	Broadband would add 0.6% to GDP growth rate	Allen Consulting Group (2002) quoted in Qiang (2009) World Bank study
GGP growth	Lake County, Florida	County with broadband had 100% greater economic growth; did not study jobs effects	Ford & Koutsky (2005)
Property values	USA	More than 6% higher rents (proxy for property values) where broadband available	Lehr et al. (2006):4

3.2 Employment

In general, the literature distinguishes between two effects of broadband on job creation: First, employment created by the effect of capital spending on network construction and deployment. Second, the additional employment generated once the network is in place, known as network externalities or "spill-over" effects. The first impact uses standard economic modelling based on input-output analysis, the second set of effects has been captured using multivariate regression analysis.

It is obvious that network construction creates jobs *directly* and immediately in firms that are involved in the building and deploying the infrastructure. Additional jobs will be created or retained *indirectly* within other firms and industries that supply products and services to the main companies involved in network construction. Finally, the additional household spending generated by the additional direct and indirect employment creates further *induced* employment throughout the economy. The relationship between capital spending and direct, indirect and induced employment generation is estimated using standard econometric input-output analysis which computes two types of multipliers, Type 1 and Type 2. The former measures the number of direct and indirect jobs created per unit of spending; the latter measures the total number of jobs generated, including induced spending.

There have been several empirical studies on the capital spending impact of broadband deployment on national economies, including the United States (Crandall et al. 2001; Crandall et al. 2003), the UK (Liebenau et al. 2009), Australia (Allen Consulting Group, 2002), Switzerland (Katz, 2009), Germany (Katz et al. 2009b) and several regional studies, one in Ontario, Canada (Strategic Networks Group, 2003), the other in Lake County, Florida (Ford and Koutsky, 2005). These studies have all used standard input-output analysis and computed Type 1 multipliers for employment multipliers for direct, indirect and induced employment. A summary of these results is presented in Table 3.

Table 3: Summary of network construction multiplier effects: Direct, Indirect and Induced

Direct, indirect and induced employment

Geography	Employment multipliers		Study
	Type 1	Type 2	
US		2.17	Crandall et al. (2003) *
Canadian county	2.03	3.42	Strategic Networks Group (2003)
Switzerland	1.40		Katz and others (2008) **
US		3.60	Atkinson and others (2009)*
US	1.83	3.43	Katz and others (2009a)
UK		2.76	Liebenau and others (2009)*
Germany	1.45	1.93	Katz and others (2009b)

** This study does not distinguish between indirect and induced effects*

*** induced effects were not calculated*

Source: Katz (2009)

Pocsiak (2002) and Atkinson et al. (2009) estimate a "network effect" multiplier and apply it to network construction employment estimates. Both studies relied on an estimated "network effect" multiplier, which is applied to the network construction employment estimates. For example, Pocsiak relied on two multiplier estimates (an IT multiplier of 1.5 to 2.0 attributed to a think tank and another multiplier of 6.7, attributed to Microsoft) and calculated an average of 4.1. Similarly, Atkinson et al. (2009) derived a multiplier of 1.17 from Crandall et al. (2003).

Several studies, using regression analysis, have demonstrated the positive impact of broadband penetration on employment:

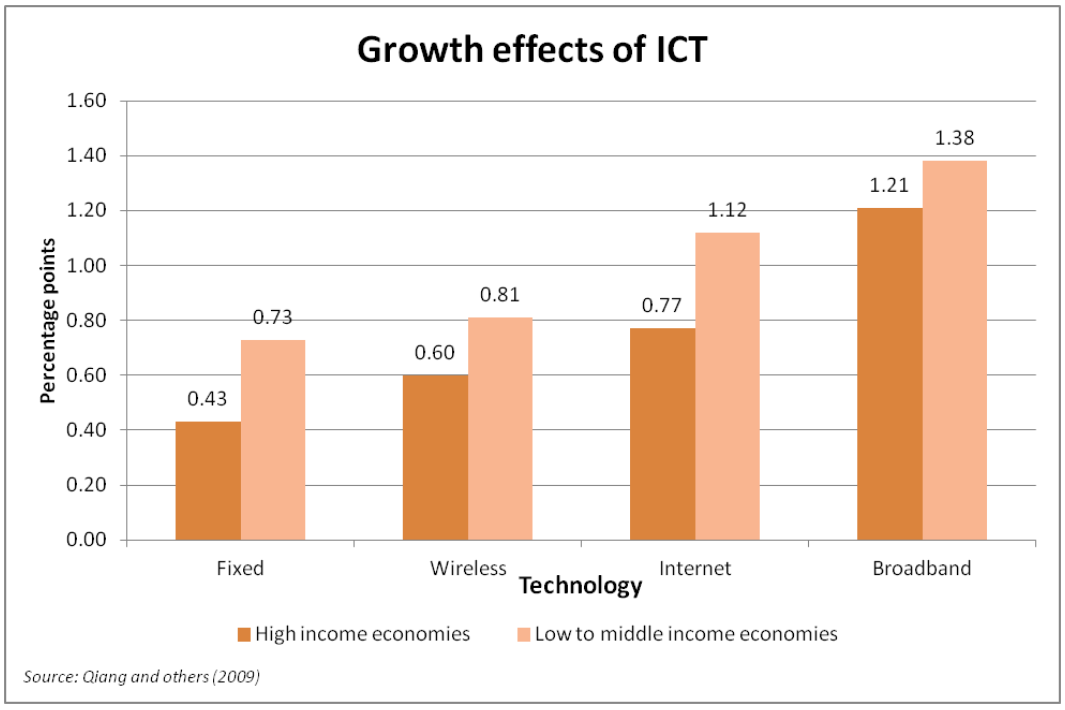
- Crandall et al. (2007) analysed United States FCC data on broadband penetration for 48 states over the 2003-05 period and found that for a "one percentage point increase in broadband penetration in a state, employment is projected to increase by 0.2 to 0.3 percent per year. For the entire U.S. private non-farm economy, this suggests an increase of about 300 000 jobs, assuming the economy is not already at full employment" (2007:2). They found that employment growth associated with network deployment was especially pronounced in manufacturing and the services sector, specifically in finance, education and health care (2007:2).
- The Strategic Networks Group (2003) found that a CAD1.3m investment on fibre optic network in South Dundas County, Ontario generated 207 person years of

employment. Furthermore, the data revealed a correlation between broadband adoption and job creation: 54% of companies using broadband experienced employment growth, compared to 27% of firms with only dial-up connection and 5.6% of enterprises with no internet.

3.3 Economic Growth

Qiang et al. (2009), in a study of 120 countries – mostly in the developing world, tested the impact of broadband penetration on the average growth rate of per capita GDP between 1980 and 2006. Using per capita GDP as the dependent variable, they regressed this against the ratio of investment to GDP, proxy variables for human capital stock (percentage of primary school enrolment) and technological progress (average penetration of broadband other than telecommunications services). They found that broadband not only provided a significant growth dividend to both high and low to middle income economies but that it was significantly higher for developing countries. It was also higher compared to other ICT technologies such as fixed, wireless and internet as illustrated in Figure 1.

Figure 1: Growth effects of ICT



All else being equal, a 10% increase in broadband penetration is correlated with a 1.21% increase in GDP per capita in high income countries and a 1.38% increase in GDP per capita in low to middle income countries. This is a substantial growth benefit considering that the average annual growth rate in GDP between 1980 and 2006 was 2.1% (Qiang et al., 2009)

Roller and Waverman (2001) compared growth across 21 OECD countries between 1970 and 1990 and found that around a third of the per capita GDP growth (0.59% of the 1.96% per year growth rate) was attributable to telecommunications infrastructure investments, albeit not broadband itself.

Individual studies on developed economies reveal a similar pattern. A study by the Allen Consulting Group (2002) commissioned by Australia's National Office for the Information Economy projected a 0.6% increase in Australia's GDP growth rate as a result of broadband. In the US, several studies estimated that next generation broadband would contribute between $300bn and $500bn of GDP by 2006 (Crandall and Jackson 2001; Saksena and Whisler 2003), compared to between $300bn and $400bn in Europe.

Katz et al. (2009b), in a regression analysis of county level data for Germany between 2000 and 2006, found a strong and highly significant correlation between broadband penetration and GDP growth. However, the impact seems to diminish over time. They split the national territory into counties with high average broadband penetration and counties with low average broadband penetration of and found that the type of network effects of broadband varies by region. They found that in low broadband regions broadband deployment and uptake resulted in higher and stable GDP growth over time, but also lower employment initially because of capital-labour substitution which only recovers once the region catches up. Regions with higher initial broadband penetration experienced an immediate surge in innovation and spike in new business formation and job creation although this tapered off over time.

Several regional studies confirm the real impact of broadband on economic growth. Key findings for the period June 2001 to April 2003 were that "economic effects can be directly attributed to the fibre network in South Dundas" (Strategic Networks Group, 2003:3). A significant finding was that 79.2% of companies "reported an increase in business or a decrease in costs due to their use of the optic fibre network" (2003:12). In particular $2.8m in commercial / industrial expansion was experienced (EiS 2011). In Kenya, broadband adoption led to a 50% increase in revenues for small and medium enterprise (Lewin and Sweet, 2005:35).

3.4 Broadband Access: International and South Africa

According to the latest Organization for Economic Development report on broadband access, there were 306 million fixed broadband subscriptions in December 2010 in the

OECD area, up from 283 million in December 2009. The average penetration rate grew to 24.9 subscriptions per 100 inhabitants, up from 23.3.

Fibre's share of fixed broadband technologies keeps growing. Fibre accounted for over half of all broadband connections in Japan (58%) and Korea (55%). Other leading countries include the Slovak Republic (29%), Sweden (26%), Estonia (23%), Norway (16%), Slovenia (16%) and Denmark (13%).

DSL is the most prevalent broadband technology in the OECD, and accounts for 57% of all lines, followed by cable (29%) and fibre based connections (12%).

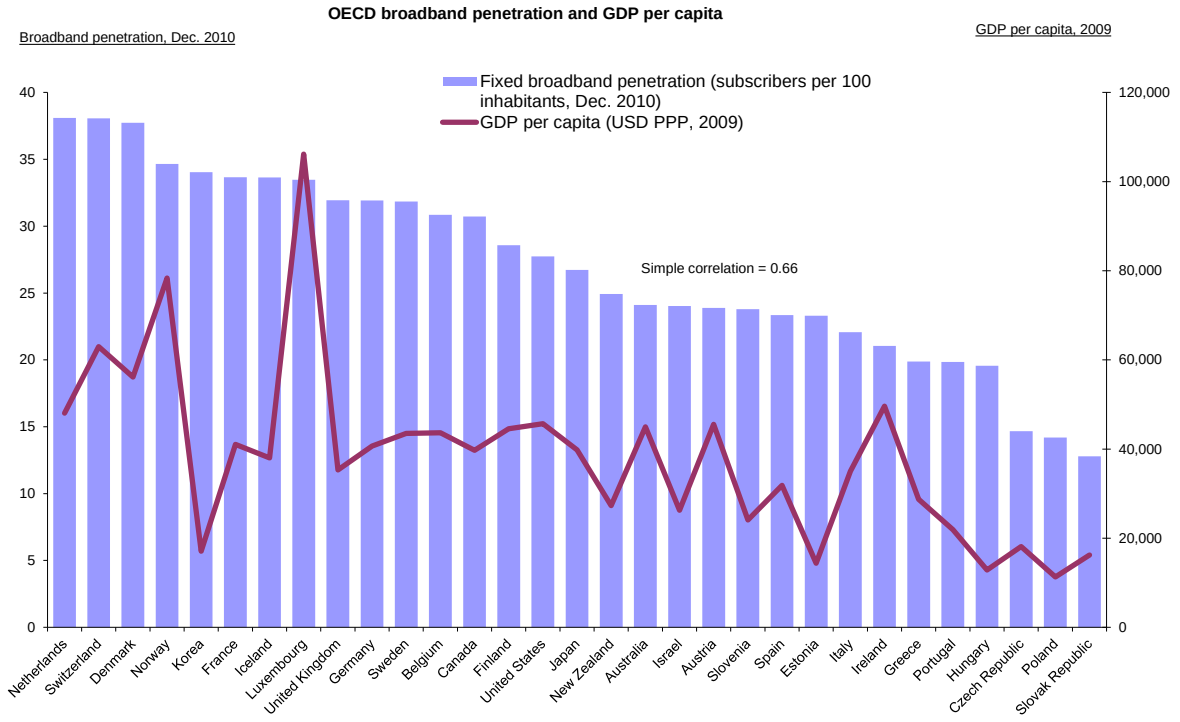
The OECD's first wireless broadband penetration indicator developed in 2010 captures satellite, terrestrial fixed wireless and mobile broadband subscriptions[1]. The countries with the highest wireless broadband penetration, measured as subscribers per 100 inhabitants, in 2010 were Korea (89.9%), Finland (84.8), Sweden (82.9%), Norway (79.9%), Japan (76.7%) and Portugal (63.8%). Standard mobile broadband subscriptions usually comprise the majority (65.3%) of wireless broadband connections.

Fixed wireless subscriptions - both satellite and terrestrial – represent only a small share of wireless broadband subscriptions. Only the Czech Republic (56.7%), Estonia (13.4%), the Slovak Republic (10.9%), Poland (4.2%) and Ireland (3.6%) have relatively higher rates of penetration.

South Africa with a current broadband penetration rate of around 7% has significant potential for growth in broadband. The current penetration is made up mainly of 2 million Vodacom subscribers, 700 000 Telkom ADSL users, and 700 000 MTN broadband users (My Broadband website). The country's fixed line broadband penetration rate of 1.4% is even lower by comparison to the OECD's 24.9%, and still multiple times lower than the lowest ranked OECD countries such as Turkey (9.8%), Mexico (10.4%) and Chile (10.4%). South Africa's broadband penetration is also very low for to its US$10 518 GDP per capita (IMF, 2010). As illustrated in Figure 2 even Poland and the Slovak Republic with comparable per capita incomes have penetration rates close to 15%.

[1] *http://www.oecd.org/document/54/0,3746,en_2649_34225_38690102_1_1_1_1,00.html*

Figure 2: OECD broadband penetration and GDP per capita



Source : OECD

Source: http://www.oecd.org/document/54/0,3746,en_2649_34225_38690102_1_1_1_1,00.html

The Department of Communications and ICASA are now trying to address the issue by considering Local Loop Unbundling (LLU). This unbundling of the fixed-line local loop would give rivals of the incumbent local exchange operator, Telkom, access to the company's "last mile" of copper cable infrastructure. This would promote broadband penetration by increasing competition, supply of bandwidth and lowering costs to end-users. Furthermore, the Minister of Communications, Roy Padayachie, the Department of Communications and ICT industry leaders signed an ICT Industry Competitiveness and Job Creation Compact in June 2011 that commits to 100% broadband penetration by 2020 and the creation of one million additional jobs throughout the ICT industry[2].

[2] [2] *MyADSL website article: "Hundred % broadband penetration in SA by 2020, Department of Communication". http://mybroadband.co.za/news/broadband/30550-100-broadband-penetration-in-sa-by-2020-doc.html*

3.5 Economic Impact of Cloud Computing

Cloud computing is an emergent general purpose technology (GPT) which could significantly boost the efficiency of both the private and public sectors, as well as promoting economic growth, employment, competition and business creation. It is an internet-based technology, where information is stored remotely on servers and provided on-demand to both households and companies. Consumers are able to store and access all of their documents and data from any device, similar to email and social networks. Cloud computing allows firms to rent computing power –both hardware and software - and storage from a service provider on demand, in a similar way that they purchase other inputs such as energy and electricity. For consumers, cloud computing will enhance their lifestyle; for firms it will have a substantial impact on their cost-structures and reduce barriers to entry in many industries, especially those that are IT intensive. Cloud computing can therefore have a profound indirect impact on business creation and the macroeconomic performance of countries.

There are a number of ways in which cloud computing affects macroeconomic performance. In the public sector, it can greatly reduce costs, in areas such as hospitals and health care (by providing information to poor and remote locations) and education (e-learning), as well as government agencies that experience intermittent periods of high usage (such as government revenue and tax services). In addition, cloud computing can result in significant positive externalities in terms of energy savings, by reducing both the use, production and required storage of hardware. The information and communication sector is responsible for around 2% of carbon emissions in Europe (Etro 2009).

In the private sector, cloud computing can provide substantial cost savings as well. By reducing or eliminating the need to invest in both hardware and software to run business applications such as customer relationship management and enterprise resource management companies can operate leaner and more efficiently. Cloud computing can range from providing just hardware, i.e. servers, known as infrastructure as a service (IaaS), to platform as a service (PaaS) to a full package which includes everything including software as a service (SaaS). Recent studies have estimated that cloud computing could save companies from 30% (Dubey & Wagle, 2007) up to 50% in fixed ICT spending (Carr 2003; IDC 2008). This has both a multilateral network effect between businesses that supply or service each and within businesses.

The effect on an entire economy can therefore be profound as described in a recent study on the economic impact of cloud computing on the of GDP European countries, employment and business creation (Etro 2009). Etro found that it boosts GDP, as well as creates new

jobs and businesses. Depending on how quickly companies adopt cloud computing, it could generate additional GDP growth of between 0.05% and 0.15% in the short term and between 0.1% and 0.3% in the medium term. Therefore, unemployment is likely to drop between 0.5% and 0.6% in the short term and between 0.2% and 0.3% in the medium term. Most of this growth in output and jobs can be attributed to a predicted surge in new businesses in Europe– up to 430 000 over the next five years, especially SMEs - as cloud computing significantly lowers fixed ICT costs and barriers to entry. Sectors which are relatively ICT intensive as well as dominated by SMMEs such as wholesale and retail trade, real estate and other business services will likely benefit the most from renting computing power.

4 Methodological Approach

This section presents the methodological approach that was adopted for the economic analysis. The process is described separately for of the projects.

4.1 Costs and Benefits

The study took the following costs into account:

- The capital costs associated with the project. These costs include the laying of the fibre and the passive infrastructure, the microwave systems, electronic equipment, building construction and improvements and radio and other communication systems. Where relevant these also include the costs of individuals or business needing to purchase computer hardware in order to take advantage of the proposed broadband rollout.
- The operating costs associated with the project. These costs include office running costs, staff salaries and wages, professional fees, lease costs, maintenance costs, support costs and staff technical training.

Benefits include:

- Increased productivity for the various business sectors. These productivity increases are based on the analysis presented in Section 3 and particularly the ACIL Tasman study (2004).
- Increased economic activity based on an uptake of broadband usage by households. This is based on the analysis of Qiang (2009) of low to middle and upper income countries. For every 10% household penetration rate GDP has been found to increase by 1.38% for low to middle income countries and 1.21% for upper income countries.
- Cost savings and transfers from an improved communication infrastructure. The cost saving is valued at R200m per annum (based on BMI-T calculations) for Project 1 and on the cash flow savings provided for Project 3.

It will be appreciated that not all the benefits could be quantified. There are some benefits, such as new business to the city or lost business as a result of not implementing a broadband network that can be speculated on but not quantified with any degree of certainty. These benefits have not been included in the analysis but are no less important than those that have been included. It will be shown that the projects remain economically viable despite not being able to quantifying all the benefits.

4.2 Valuing the Benefits

The methodology used to value the benefits for each of the projects is presented below.

4.2.1 Project 1: Connecting Government

Two of the three categories of benefits discussed earlier (increased productivity and cost savings) have been used for this project. The increased productivity has been disaggregated into government and private business productivity gains. This has been done so that the benefits to government can be determined separately from private sector benefits and is reported as part of the cost benefit analysis in section 5.1.1. Productivity gains accruing to households are included in Project 2 not in Project 1.

The productivity gains from ACIL Tasman (2004) have been used as a basis for determining productivity gains for each economic sector. These are presented in Table 4 and have been applied to the Western Cape based on the GGP composition of the province.

Table 4: Sectoral Productivity Gains

Sector	% Increase
Agriculture, forestry and fishing	0.06%
Mining	0.10%
Manufacturing	0.19%
Electricity & water	0.12%
Construction	0.19%
Wholesale & retail trade; catering & accommodation	0.27%
Transport & communication	0.33%
Finance and business services	0.44%
Community, social and other personal services	0.26%
General government services	0.27%

Source: ACIL Tasman (2004)

While these productivity gains might appear to be low, they provide significant benefits when compounded over the twenty year analysis period. The size and composition of the Western Cape Economy was sourced from PER&O (2011:145) and is presented in Table 5.

Table 5: Size and Composition of the Western Cape Economy

From PER&O (R billion, 2005 prices)	2004	2005	2006	2007	2008	2009
Agriculture	8.382	8.876	8.37	8.504	10.007	9.457
Mining	0.445	0.469	0.443	0.446	0.415	0.417
Manufacturing	36.767	38.773	41.157	43.3	44.203	40.276
Electricity	3.279	3.477	3.546	3.63	3.491	3.51
Construction	6.849	7.691	8.514	9.801	10.609	11.261
W & R Trade	29.533	32.236	33.926	35.758	35.779	34.781
Transport, Storage & Communication	19.168	20.897	21.775	23.292	23.817	23.991
Finance, Real Estate & Business Services	57.856	60.411	66.09	71.511	76.886	77.307
Community & Social Services	10.663	11.122	11.596	12.228	12.732	12.672
General Goverment	19.971	20.751	21.295	22.15	23.083	23.982
Total	**192.913**	**204.703**	**216.712**	**230.62**	**241.022**	**237.654**

Source: PERO&O (2011:145)

The projected growth rates for each economic sector to 2015 was also sourced from PER&O (2011:34). These are given in Table 6.

Table 6: Projected Sectoral Growth Rates for the Western Cape Economy

From PER&O	2010	2011	2012	2013	2014	2015
Agriculture	0.7%	3.1%	2.0%	2.7%	3.3%	3.5%
Mining	-8.8%	4.4%	1.0%	0.9%	1.1%	1.1%
Manufacturing	3.9%	3.5%	3.5%	3.5%	3.6%	3.4%
Electricity	3.2%	1.3%	3.3%	3.2%	3.3%	3.2%
Construction	1.6%	2.1%	5.0%	6.2%	6.5%	6.7%
W & R Trade	2.6%	4.2%	3.7%	4.1%	4.0%	4.0%
Transport, Storage & Communication	3.0%	5.3%	5.4%	5.8%	5.8%	5.5%
Finance, Real Estate & Business Services	1.9%	4.5%	5.0%	4.8%	5.1%	5.2%
Community & Social Services	0.6%	3.2%	2.8%	3.0%	3.0%	3.1%
General Goverment	2.4%	2.2%	2.3%	2.4%	2.0%	2.0%
Total	**2.4%**	**3.9%**	**4.1%**	**4.2%**	**4.3%**	**4.3%**

Source: PERO&O (2011:34)

In the absence of further information the growth rates for 2015 were kept constant for the remainder of the analysis period. The productivity increases shown in Table 4 were combined with the growth rates shown in Table 6 to determine how government and the private sector would grow as a result of the broadband rollout.

One of the important issues that had to be dealt with is that this project is a province wide initiative but does not include Cape Town because Cape Town already has a broadband network. In order to do this the size and composition of the Western Cape District Municipalities needed to be sourced which was done using PER&O (2004:217, 241, 252, 257, 261, 265, 269).

Table 7: Size and Composition of the Western Cape District Municipality Economies

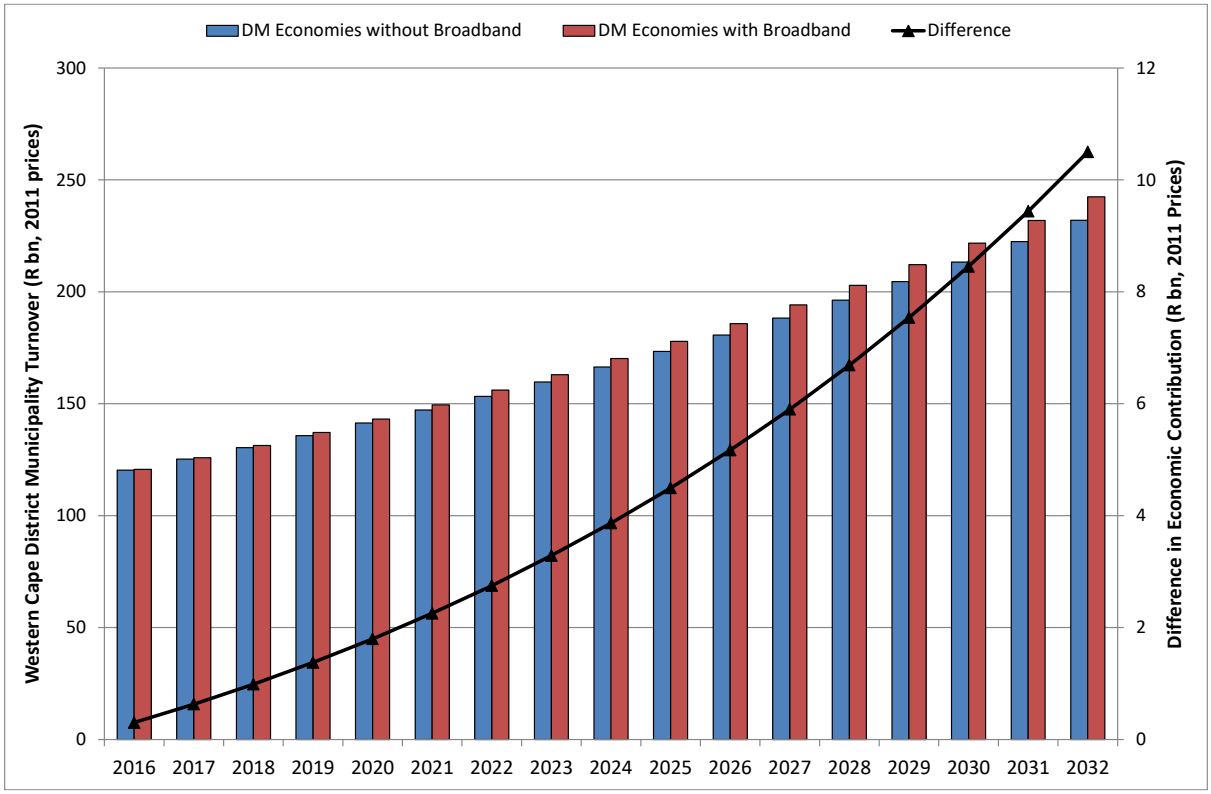
Economic Sector	Cape Town	Cape Winelands	Eden District	West Coast District	Overberg District	Central Karoo
Agriculture, Forestry & Fishing	1.6%	14.2%	6.9%	18.9%	20.6%	10.1%
Mining & Quarrying	0.2%	0.2%	0.6%	1.0%	0.1%	0.1%
Manufacturing	17.8%	22.0%	16.6%	20.5%	15.1%	9.0%
Electricity & Water	1.7%	0.6%	3.2%	1.7%	1.8%	1.4%
Construction	3.5%	3.3%	6.2%	4.1%	5.6%	5.4%
Wholesale & Retail Trade	16.9%	15.0%	18.6%	15.9%	18.4%	16.9%
Transport & Communication	11.9%	8.3%	8.6%	9.4%	7.7%	21.4%
Financial & Business Services	31.7%	20.3%	22.5%	13.4%	15.1%	18.3%
CSP Services	5.3%	4.7%	5.4%	6.0%	6.1%	5.6%
General Government Services	9.5%	11.3%	11.4%	9.0%	9.6%	11.8%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
% Contribution to WC Economy	76.6%	10.5%	6.1%	4.0%	2.4%	0.5%

It can be seen from the last row of Table 7 how Cape Town dominates the Western Cape economy and that the five district municipalities combined contribute less than a quarter to the total provincial economy. As can be expected the other notable feature is the increase in the importance of the agricultural sector to the overall district municipality economies (1.6% for Cape Town, increasing to as much as 20.6% for Overberg).

The resultant contribution to turnover is illustrated in Figure 3. These results are used later in the report for the purposes of the cost benefit analysis. The blue columns show the expected economic growth of the Western Cape District Municipality (excluding Cape Town) without broadband and red the expected growth with broadband. The black line is the difference between the two. Although the difference is initially small this increases steadily over time so that by 2032 the difference has a value of R10.5bn. This equates to a 4.5% increase in the size of the economy in that year compared to what it would have been in the absence of the broadband network.

In a study conducted by CEGR (2003) on the impact of broadband on the UK economy, it was estimated that after 10 years the productivity benefits of broadband could be as much as 2.5%. This would result in an annual increase to UK GDP of £21.9bn (infoDev, 2006). By comparison this analysis indicates that there would be an increase of 2.9% in the economies of the Western Cape District Municipalities 10 years after the rollout of broadband.

Figure 3: Impact of Broadband Rollout on District Municipality Economies of the Western Cape



The final benefit that has been factored into the analysis is that of cost savings or cost transfers from current expenditure on communication. In the business case developed by BMI-T this has been conservatively estimated as R200m per annum for the Provincial Government of the Western Cape.

4.2.2 Project 2: Connecting Communities

Project 2 is aimed at providing high speed broadband services to the communities of Mitchells Plain, Khayelitsha and Saldanha Bay. The following costs, time periods, benefits and penetration rate assumptions were used:

- Capital and operating costs for the project were provided by BMI-T. To this was added the cost to households of purchasing a computer so they could benefit from the broadband rollout. Only half the affected households were apportioned this cost.
- The analysis period is limited to five years because this is the duration of the project and the costs provided by BMI-T all relate to the five year period.
- Benefits were based on the following calculation:
    - In a World Bank study it was found that a 10% increase in the penetration of broadband would result in a 1.38% annual increase in GDP growth in low to

middle income countries (Qiang et al., 2009) and 1.21% for high income countries. The benefits for project 2 are therefore determined as increased economic activity (GDP) as a result of improved household penetration rates. According to the World Bank, South Africa is classified as an upper middle income country so the more conservative figure of 1.21% was used.

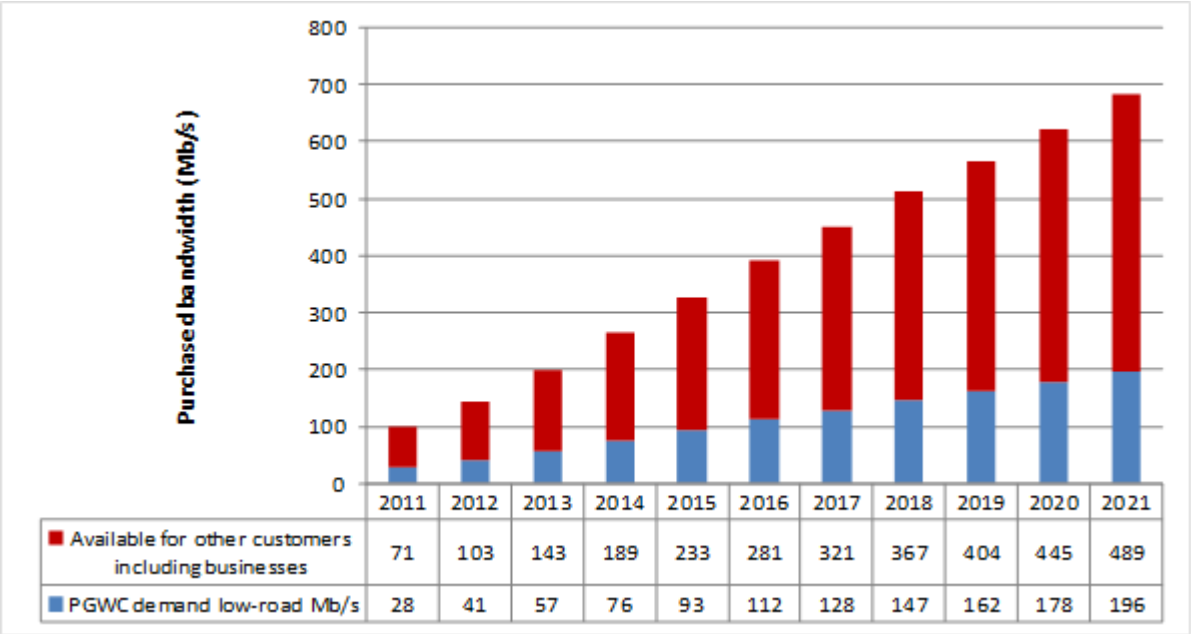
- Mitchells Plain and Khayelitsha currently have a penetration rate of 5.6% while Saldanha Bay has a rate of 12%. As a result it was assumed that Mitchells Plain and Khayelitsha would have a penetration rate of 20% after five years and Saldanha Bay a 40% penetration rate.
- The penetration rates were converted to population numbers using the 2001 census and increasing the population to 2011 using the growth rate between the 2001 census and the 2007 Community Survey.
- At this point the 1.21% increase in GDP per 10% penetration was applied to determine the contribution to provincial GGP.
- However since these benefits include benefits to businesses, which have been valued as part of Project 1, the business benefits need to be removed. This was done by using the sectoral composition of Cape Town for Mitchells Plain and Khayelitsha, and the West Coast profile for Saldanha.

4.2.3 Project 3: Connecting to the World

The intention of Project 3 is to use the PGWC as a demand aggregator to reduce international bandwidth costs to the Western Cape. Surplus international capacity bought by the PGWC would be sold to targeted businesses in the Western Cape to grow productivity and competitiveness. The film industry has been identified as one example of an industry that would benefit from cheaper international connectivity.

Table 8 shows the bandwidth that is available under scenario B1 of the BMI-T (2011) business case. The blue columns indicate the projected requirements by the PGWC over the next ten years while the red indicates the connectivity available for other users.

Table 8: Bandwidth Available to Targeted Businesses in the Western Cape



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Available for other customers including businesses	71	103	143	189	233	281	321	367	404	445	489
PGWC demand low-road Mb/s	28	41	57	76	93	112	128	147	162	178	196

As mentioned above while there are potentially a number of different types of industry that would benefit from less expensive and faster international connectivity a prime example of such an industry is the film sector. The sector is characterised by data intensive demand for bandwidth and one that has the potential to grow significantly with faster less expensive bandwidth. As a result the economic analysis for this project uses only on the film sector for purposes of illustration.

There are two potential areas where the sector would benefit. These are in the production of long form features and in the post production of service commercials. The following approach was followed:

- Long form features:
  - The feature film industry was valued at R934m in 2005 (SES, 2007).
  - In the absence of additional information the size of the industry was increased to 2011 values using GDP growth.
  - The productivity gains for the Finance and Business Services sector presented in Table 4 were then applied to determine the increase in growth over a ten year period. In reality it can be expected that the productivity gains would be higher for the film sector.

- Service Commercials:
    - Service Commercials are filmed in South Africa in partnership with international production companies. Most post production on these service commercials then takes place offshore, representing lost business to South Africa. The availability of cheaper and faster broadband would help to address this situation. To illustrate, 7.3% of a local commercial's budget is spent on post-production compared to only 0.9% of the service commercials (SES, 2007). The difference of 6.3% represents business lost to the industry and country.
    - The Service Commercials industry was valued at R632m in 2005. This was again increased to 2011 levels using GDP growth.
    - In the absence of any better information the industry was then grown in accordance with the projections for the Financial and Business Services sector made in PER&O (2011).
    - For want of additional information it was assumed that only 25% of the service commercials would end up with this process being done in South Africa. This 25% take-up was built up in 5% increments over a period of 5 years.
    - The benefit is therefore calculated as 6.3% (which is the current business lost to South Africa) multiplied by the 25% industry take-up.

4.2.4 Project 4: Cloud Services

Project 4 proposes providing broadband internet and cloud services to creative industries in the planned Fringe district in Cape Town. The economic analysis for this project included savings in IT and data costs as well as potential economic efficiencies.

The following approach was followed:

- Potential businesses at the Fringe were quantified and categorised according to whether they are likely to be Animation and Post Production, Film, IT, Design, Music, Media or Call Centre businesses. This was done based on a recently completed study on the Fringe by EiS (2011), a partner company of SES.
- These businesses were then grown annually at 3% in real terms for 20 years. This 3% growth is in line with general expected provincial economic growth and excludes growth from clustering.
- Different types of businesses have different mixes of data and IT costs. These proportions were sourced from the Kaiser & Associates business plan.

- According to Dubey et al (2007) there are large fixed cost savings for ICT of up to 30%. The International Data Corporation suggests that fixed ICT cost savings could be as high as 50%. Consequently a 20% reduction in cost savings in the ICT bill of firms has been assumed.
- According to Etro (2009) cloud computing could result between 0.05% and 0.15% additional GDP growth in the short term (1 year) and 0.1% to 0.3% in the medium term (over 5 years). The analysis has taken the mid-point of 0.1% increase in GDP growth in the first year, increasing to 0.2% by the fifth year and remaining constant thereafter. This is within the increases in GDP growth highlighted by Iansiti et al of 0.82% to 0.89% for developed countries and 0.85% to 1.0% for developing countries.

5 Results of the analysis

This section presents the results of the economic analysis. The first results are for the cost benefit analysis. The second are the results of the macroeconomic analysis. In each set a distinction is made between the four projects. As mentioned above, relatively little information is known for Project 4 and, as a result, a macroeconomic analysis was not done for this project.

5.1 Cost Benefit Analysis

The results from the cost benefit analysis explain the economic efficiency of a project. If the BCR is greater than 1 a project is economically efficient and if less than 1 then it is no longer economically efficient. However a BCR of between 1 and 1.5 would be considered marginal in this case due to the number of assumptions involved in the analysis.

5.1.1 Project 1

The results of the cost benefit analysis for Project 1 are shown in Table 9 and Table 10. Table 9 shows the results when taking only public sector benefits into account. Table 10 includes both public and private sector. The benefits are district municipalities of the Western Cape excluding Cape Town. The tables include the present value (PV) of all the costs and the benefits of the project. They also report the Net Benefits (Net Present Value – NPV), the Benefit Cost Ratio (BCR) and the Internal Rate of Return (IRR).

Table 9: Project 1 Cost Benefit Analysis (Rm) – Public Sector Benefits

Project 1	**PV**
Costs	
Capital Costs	2 158.5
Operating Costs	530.7
Total Costs	**2 689.1**
Benefits	
Public Sector Gains	2 461.6
Cost Savings	1 265.4
Total Benefits	**3 727.0**
NPV	1 037.9
BCR	1.4
IRR	13%

The following results can be seen in Table 9:

- Total Costs have a PV of R2 689m.
    - Capital costs have a PV of R2 158m.

  - Operating costs have a PV of R531m.
- Total Benefits have a PV of R3 727m.
  - The public sector productivity gains equate to R2 462m.
  - The PGWC cost savings of the improved communications network has a PV of R1 265m.
- The project has a positive NPV of R1 038m.
- The BCR is 1.4.
- The IRR is 13%.

It is concluded that based on the narrow benefits presented in Table 9 the project is economically beneficial, although only marginally so. What are not included in the analysis are the productivity gains resulting from the improved communication between Cape Town and the rest of the Western Cape District Municipalities. These could not be valued but would clearly exist and, in reality, boost the benefits and the BCR.

Table 10: Project 1 Cost Benefit Analysis (Rm) – Public and Private Sector Benefits

Project 1	**PV**
Costs	
Capital Costs	2 158.5
Operating Costs	530.7
Total Costs	**2 689.1**
Benefits	
Public Sector Gains	2 461.6
Cost Savings / Transfers	1 265.4
Private Sector Gains	16 455.8
Total Benefits	**20 182.9**
NPV	17 493.7
BCR	7.5
IRR	42%

The following results can be seen in Table 10:

- Total Costs are the same as before with a PV of R2 689m.
- Total Benefits now have a PV of R20 183m.
  - The public sector productivity gains are the same as before with a PV of R2 462m.
  - The PGWC cost savings are also the same as before with a PV of R1 265m.
  - Private sector gains have a PV of R16 456m.
- The project now has a positive NPV of R17 494m.
- The BCR is 7.5.
- The IRR is 42%.

The conclusion that is drawn is that when private sector benefits are included in the analysis Project 1 is not just viable but economically robust.

As is well known the City of Cape Town has implemented its own broadband rollout project. This would result in synergies between the city and the rest of the province. The project becomes even more efficient when the costs and benefits of the Cape Town project are included.

Table 11: Project 1 Cost Benefit Analysis (Rm) – Including City of Cape Town Rollout

Project 1 Expanded	PV
Costs	
Provincial Costs	2 689.1
Cape Town Metro Costs	5 200.3
Total Costs	**7 889.5**
Benefits	
Provincial Benefits	20 182.9
Cape Town Benfits	57 457.8
Total Benefits	**77 640.7**
NPV	69 751.2
BCR	9.8
IRR	79%

The results of including the City of Cape Town broadband are presented in Table 11:

- Total Costs have now increased to a PV of R7 890m. This is an increase of R5 200m from the rollout costs of the City.
- Total Benefits have now increased to a PV of R77 641m made up of the previous benefits and the benefits to the City estimated at R57 458m.
- The NPV is now R69 751m.
- The BCR has increased to 9.8.
- The IRR is 79%.

It can be concluded that including the City of Cape Town broadband rollout has a major and positive impact on the economic efficiency of the project.

5.1.2 Project 2

The results of the cost benefit analysis of Project 2 are presented in Table 12.

Table 12: Project 2 Cost Benefit Analysis (Rm)

Project 2	Mitchells Plain & Khayelitsha	Saldanha Bay
Costs		
Capital Costs	19.0	7.5
Operating Costs	7.0	3.1
Computer Costs	82.5	4.4
Total Costs	108.4	15.0
Benefits		
Economic Growth	1 533.7	98.5
Total Benefits	1 533.7	98.5
NPV	1 425.2	83.5
BCR	14.1	6.6
IRR	1004%	197%

The following results can be seen in Table 12:

- For Mitchells Plain and Khayelitsha:
  - Total costs have a PV of R108.4m
  - Total Benefits have a PV of R1 534m.
  - The project has a positive NPV of R1 425m.
  - The BCR is 14.1.
  - The IRR is 1004%.
- For Saldanha Bay:
  - Total costs have a PV of R15.0m
  - Total Benefits have a PV of R98.5m.
  - The project has a positive NPV of R83.5m.
  - The BCR is 6.6.
  - The IRR is 197%.

The BCRs for both parts of this project suggest that it is economically robust and should be pursued. It will however be realised that the key to success is ensuring families purchase computers. Without this the project would fail. For these projects to break-even (i.e. have a BCR of 1) Mitchells Plain and Khayelitsha require a penetration rate of 8.7% (currently 5.6%) and Saldanha a penetration rate of 17.6% (currently 12.0%). Clearly the higher the penetration rate the better the project. Strategies would need to be put in place to ensure that these penetration rates are exceeded. Such strategies might include adult education programmes, advertising in local schools and the bulk purchase of entry level computers to help make these more affordable.

It will be noted that although the project in Mitchells Plain and Khayelitsha is more expensive to implement that in Saldanha Bay the economic potential is far higher. This is seen from the

higher BCR and IRR for Mitchells Plain and Khayelitsha. These BCRs occur despite the relatively low penetration rates assumed for the project (20% for Mitchells Plain and Khayelitsha compared to 40% for Saldanha). The reason for this is that Mitchells Plain and Khayelitsha both have higher populations and are more densely populated than Saldanha Bay.

5.1.3 Project 3

Project 3 focuses on connecting the broadband network to the rest of the world and targeting specific businesses with inexpensive and fast broadband connectivity. The results are presented in Table 13. The costs are the full costs while the benefits are only those accruing to the film industry.

Table 13: Project 3 Cost Benefit Analysis (Rm)

Project 3	PV
Costs	
Capital Costs	1.3
Operating Costs	106.5
Total Costs	**107.8**
Benefits	
Feature Films	235.0
Service Commercials	94.0
Cost Savings / Transfers	152.8
Total Benefits	**481.8**
NPV	374.0
BCR	4.5
IRR	215%

The following results can be seen in Table 13:

- Total costs have a PV of R108m:
  - Capital costs have a PV of R1.3m.
  - Operating costs have a PV of R107m.
- Total benefits have a PV of R482m:
  - Feature films have a PV of R235m.
  - Service Commercials have a PV of R94m.
  - Cost savings or transfers have a PV of R153m.
- The project has a positive NPV of R374m.
- The BCR is 4.5.
- The IRR is 215%.

This project is economically efficient and would bring significant economic benefits for the targeted businesses and the economy of the Western Cape.

5.1.4 Project 4:

Project 4 aims at providing broadband internet and Cloud Computing services for businesses in the proposed Fringe district in Cape Town. The results are shown in Table 14.

Table 14: Project 4 Cost Benefit Analysis (Rm)

Project 4	PV
Costs	
Capital Costs	6.6
Operating Costs	2.5
Total Costs	**9.0**
Benefits	
Cost Savings	62.4
Productivity Gains	52.2
Total Benefits	**114.6**
NPV	105.5
BCR	12.7
IRR	70%

The following results can be seen in Table 14:

- Total costs have a PV of R9.0m:
  - Capital costs have a PV of R6.6m.
  - Operating costs have a PV of R2.5m.
- Total benefits have a PV of R114.6m:
  - Cost savings in the IT and data bills have a PV of R62.4m
  - Productivity gains have a PV of R52.2m.
- The project has a positive NPV of R105.5m.
- The BCR is 12.7.
- The IRR is 70%.

These results are based on a 20% savings in the IT and data costs of the businesses. If savings were 10% then the BCR would reduce to 3.5 and the NPV to R22.2m. However, even at this low saving rate the project is still economically viable. The switching value (i.e. where the project switches from being economically beneficial to no longer being beneficial and the BCR is 1) is a 2.9% saving in the IT cost. For a BCR of 2 the savings would need to be 5.8%. These results rate are in the absence of any productivity gains. Such gains would clearly make the project more economically efficient.

5.1.5 Conclusion of Cost Benefit Analysis

The conclusion to the cost benefit analysis is that all four projects are economically viable and should be implemented. While the public sector benefits of Project 1 (excluding the City of Cape Town) only just cover costs it is really the benefits to the rest of society, most notably the business sector, which makes the project notably efficient. Including Cape Town in the analysis further increases this efficiency.

The four projects are clearly economically efficient in their own right. The synergies between the projects make for a compelling and convincing case

5.2 Macroeconomic Analysis

This section reports on the expected macroeconomic contribution of Projects 1, 2 and 3 of the Western Cape Broadband Rollout. The results for Project 1 are reported for a twenty year period, Project 2 is reported for a five year period and Project 3 for a ten year period. Detailed macroeconomic results are reported for Project 1 while only the contribution to GDP and job creation are reported for projects 2 and 3.

5.2.1 Project 1

The macroeconomic contribution of Project 1 is reported in Table 15 to Table 20. The results are in real terms (2011 prices), where inflation is excluded from the analysis. In the tables the contribution is given for each of the years from 2012 to 2016. Thereafter it is given in five year increments (2021, 2026 and 2031) to make the tables more readable. The cumulative totals, however, take the interim years into account so that by 2031 the cumulative total is for the full 20 years.

In the diagrams and tables that follow the communication cost savings for government have been excluded. The reason for this is that these cost savings would either be used to fund operating costs or would be re-deployed to other government projects, which in turn would have their own macroeconomic effect. This section takes only the costs and benefits accruing to the Western Cape outside of Cape Town. The following section includes the cost and benefits to the City.

5.2.1.1 Gross Domestic Product

Gross Domestic Product is the total value of all final goods and services produced in the country. It is clearly fundamental to the economic quality of life of people in the country. It is also the most important and all-encompassing measure of the macroeconomic effect of Project 1 of the Western Cape Broadband Rollout.

Table 15 and Figure 4 report on the contribution to GDP. During the first four years the capital costs contribute the most to GDP, increasing from R188m in 2012 to R1.39bn in 2014 and R1.17bn by 2015. From 2016 the contribution from capital expenditure is expected to remain constant at an annual amount of R214m. Operating costs, on the other hand, total R147m in 2012 and then drop to R82m in 2013. Between 2014 and 2031 the contribution from operating costs fluctuates between R72m and R137m.

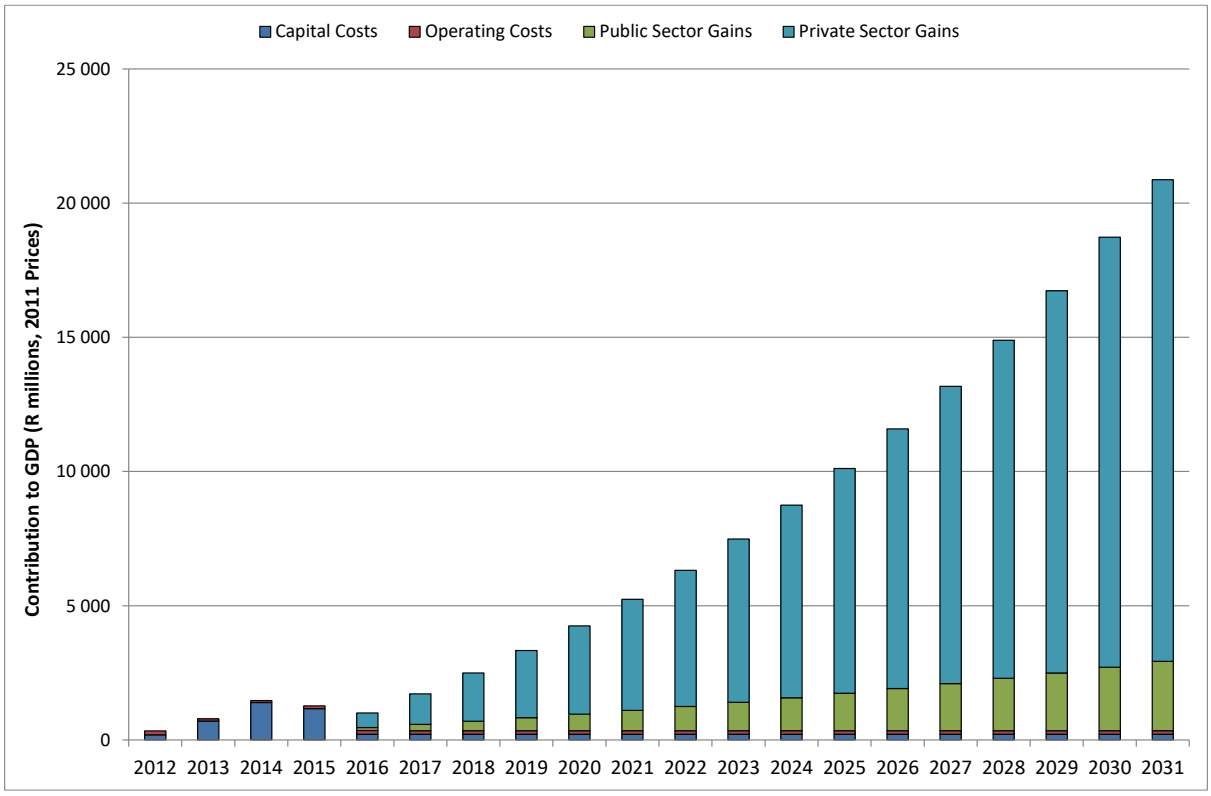
The public sector productivity gains increase from a modest R112m in 2016 to around R2.59bn by 2031. Private sector productivity gains show a similar pattern, increasing from R543m in 2016 to R17.94bn by 2031.

Table 15: Contribution to Gross Domestic Product for Project 1

Contribution to Gross Domestic Product - South Africa								
Rand million, 2011 prices	**2012**	**2013**	**2014**	**2015**	**2016**	**2021**	**2026**	**2031**
Capital Costs	188	705	1 394	1 166	214	214	214	214
Operating Costs	147	82	72	106	137	128	129	129
Public Sector Gains	0	0	0	0	112	759	1 573	2 588
Private Sector Gains	0	0	0	0	543	4 142	9 669	17 942
Total Contribution	**335**	**787**	**1 465**	**1 272**	**1 006**	**5 242**	**11 585**	**20 873**
Cumulative Contribution	335	1 122	2 588	3 860	4 866	21 902	66 154	150 553

The overall contribution to GDP is expected to total R335m in 2012, R787m in 2013, R1.47bn in 2014 and R1.27bn in 2015. From 2016 onwards, when the broadband network becomes active, the total contribution to GDP is expected to increase from R1.0bn to a significant R20.8bn by 2031.

Figure 4: Detailed Contribution to GDP for Project 1



The detailed contribution to GDP is illustrated in Figure 4. It can be seen from the diagram that the main contributor is the private sector productivity gains (the light blue columns). GDP is important not just because it is income but also because income has the capacity to

add to wealth. Based on these projections, the proposed Western Cape Broadband Rollout is expected to make a cumulative contribution to GDP of R3.86bn by the end of 2015, when the broadband network has been fully rolled out. By 2031 the cumulative contribution to GDP can be expected to exceed R150bn.

5.2.1.2 Direct and Indirect Jobs

The Western Cape Broadband Rollout would create two types of jobs. The first are the direct jobs that would be created as a result of the project. These are jobs directly on infrastructure development and from the increased growth in business. The second are the so-called indirect jobs that are due to multiplier effects of both the capital and operating spending and the increased business activity from productivity gains.

Table 16 reports on direct jobs, Table 17 on indirect jobs while Table 18 sums the two.

Table 16: Contribution to Direct Jobs in the Western Cape for Project 1

Contribution to Direct Jobs - Western Cape	**2012**	**2013**	**2014**	**2015**	**2016**	**2021**	**2026**	**2031**
Capital Costs	118	597	1 286	1 025	130	130	130	130
Operating Costs	41	25	27	49	69	66	67	67
Public Sector Gains	0	0	0	0	82	557	1 161	1 923
Private Sector Gains	0	0	0	0	259	1 967	4 581	8 485
Total Contribution	**159**	**621**	**1 314**	**1 074**	**539**	**2 719**	**5 939**	**10 605**

Table 16 indicates that at the height of construction in 2014 up to 1 286 people could be employed on a full time basis on the project. Operating expenditure would create 41 direct jobs in 2012, 25 in 2013 and then 27 in 2014. This increases to around a sustainable 67 operating jobs from 2016 onwards.

The number of additional people employed due to the public sector productivity gains would total 82 in 2016, increasing to 1 923 by 2031. The private sector productivity gains would increase from 259 in 2016 to 8 485 by 2031.

Total direct job numbers are set to peak at 1 314 in 2014 during the height of the broadband rollout. They are then expected to reduce slightly to around 539 in 2016 but then increase each year thereafter until they total 10 605 in 2031.

Table 17 illustrates the potential indirect job creation. Indirect jobs as a result of construction and development are expected to vary between 70 in 2012 and 141 in 2015 and then stabilise at 85 from 2016 onwards. The number of indirect jobs due to the operating costs is expected to total 107 in 2012, 58 in 2013, 44 in 2014 and 57 in 2015. They are then

expected to increase and to stabilise at 62 thereafter. Indirect jobs in 2031 are expected to total 665 for public sector productivity gains and 9 456 for private sector productivity gains.

Overall, total indirect jobs are set to increase from 176 in 2012 to over 10 000 in 2031.

Table 17: Contribution to Indirect Jobs for Project 1

Contribution to Indirect Jobs - South Africa	2012	2013	2014	2015	2016	2021	2026	2031
Capital Costs	70	108	107	141	85	85	85	85
Operating Costs	107	58	44	57	68	61	62	62
Public Sector Gains	0	0	0	0	30	202	411	665
Private Sector Gains	0	0	0	0	284	2 175	5 088	9 456
Total Contribution	**176**	**166**	**152**	**198**	**467**	**2 523**	**5 646**	**10 268**

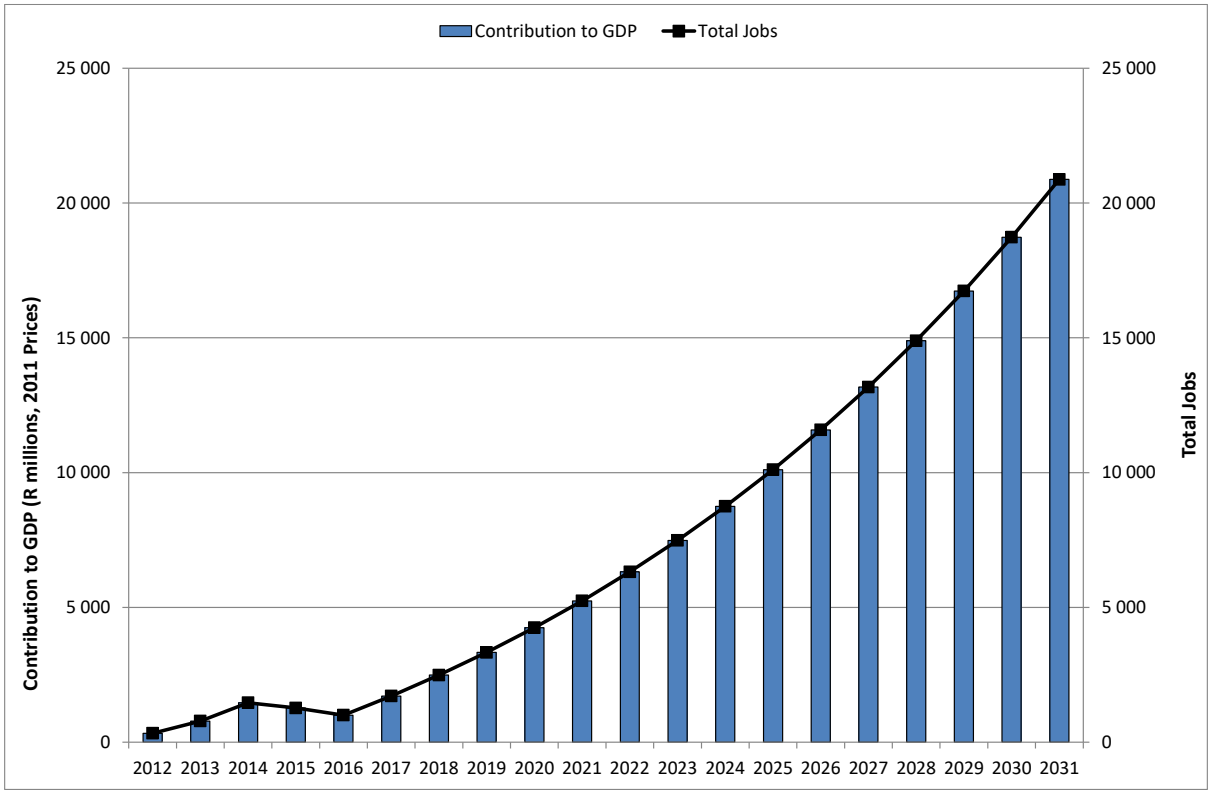
Total direct and indirect jobs, as illustrated in Table 18, are expected to amount to 335 in 2012, 787 in 2013, 1 465 in 2014, and 1 272 in 2015. Once the productivity gains from the broadband network start being felt it is expected that as many as 1 006 direct and indirect jobs would be created in 2016 and increasing to 20 873 by 2031.

Table 18: Contribution to Total Jobs for Project 1

Contribution to Total Jobs - South Africa	2012	2013	2014	2015	2016	2021	2026	2031
Capital Costs	188	705	1 394	1 166	214	214	214	214
Operating Costs	147	82	72	106	137	128	129	129
Public Sector Gains	0	0	0	0	112	759	1 573	2 588
Private Sector Gains	0	0	0	0	543	4 142	9 669	17 942
Total Contribution	**335**	**787**	**1 465**	**1 272**	**1 006**	**5 242**	**11 585**	**20 873**

The contribution to South African GDP and total jobs is illustrated in Figure 5. As with Figure 4, the values are shown in constant 2011 Prices.

Figure 5: Contribution to GDP and Total Jobs for Project 1



The increase in sustainable jobs can be seen from 2016 onwards.

5.2.1.3 Other Macroeconomic Effects

Apart from the key macroeconomic effects discussed above, there are many other macroeconomic effects that would flow from the Western Cape Broadband Rollout. These include the generation of income tax, company tax and indirect household income. Table 19 reports on total income tax that would be generated and Table 20 on the indirect generation of household income.

Table 19: Contribution to Taxes for Project 1

Contribution to Taxes - South Africa								
Rand million, 2011 prices	**2012**	**2013**	**2014**	**2015**	**2016**	**2021**	**2026**	**2031**
Capital Costs	20	71	135	116	24	24	24	24
Operating Costs	12	7	7	10	13	12	12	12
Public Sector Gains	0	0	0	0	8	53	110	181
Private Sector Gains	0	0	0	0	46	350	817	1 516
Total Contribution	**32**	**78**	**142**	**125**	**90**	**439**	**963**	**1 732**
Cumulative Contribution	32	110	251	376	467	1 904	5 587	12 593

Total tax generation is expected to increase from R32m in 2012 to over R1.7bn in 2031. When the capital expenditure is complete in 2015 a cumulative total of R376m in taxes

would have been generated by the project. The cumulative contribution to taxes by 2031 is expected to exceed R12.5bn.

Table 20: Contribution to Indirect Household Income for Project 1

Contribution to Indirect Household Income - South Africa								
Rand million, 2011 prices	**2012**	**2013**	**2014**	**2015**	**2016**	**2021**	**2026**	**2031**
Capital Costs	54	209	419	348	61	61	61	61
Operating Costs	37	20	18	28	37	35	35	35
Public Sector Gains	0	0	0	0	42	285	590	970
Private Sector Gains	0	0	0	0	145	1 105	2 579	4 786
Total Contribution	**91**	**229**	**437**	**376**	**285**	**1 485**	**3 265**	**5 853**
Cumulative Contribution	91	320	757	1 133	1 418	6 251	18 746	42 454

The project will also contribute to indirect household income. The contribution to indirect household income increases from R91m in 2012 to R5.85bn in 2031. By 2031 it is expected that the project will have added over R42bn to indirect household income.

5.2.2 Project 1 Including the City of Cape Town Impact

Clearly including the broadband rollout of the City of Cape Town increases the economic impact. The macroeconomic effect of including the City of Cape Town is presented in this section.

The results from the economic study of the City of Cape Town rollout performed in 2007 were used. Three changes were made to those results. First the costs and benefits were increased to 2011 values. Second the analysis period was extended by 5 years in order to synchronise with this study. Third the indirect job multipliers were scaled down based on the latest available information.

5.2.2.1 Gross Domestic Product

The contribution to GDP for the combined provincial and city rollout is shown in Table 21.

Table 21: Contribution to GDP for Project 1 with the City of Cape Town Rollout

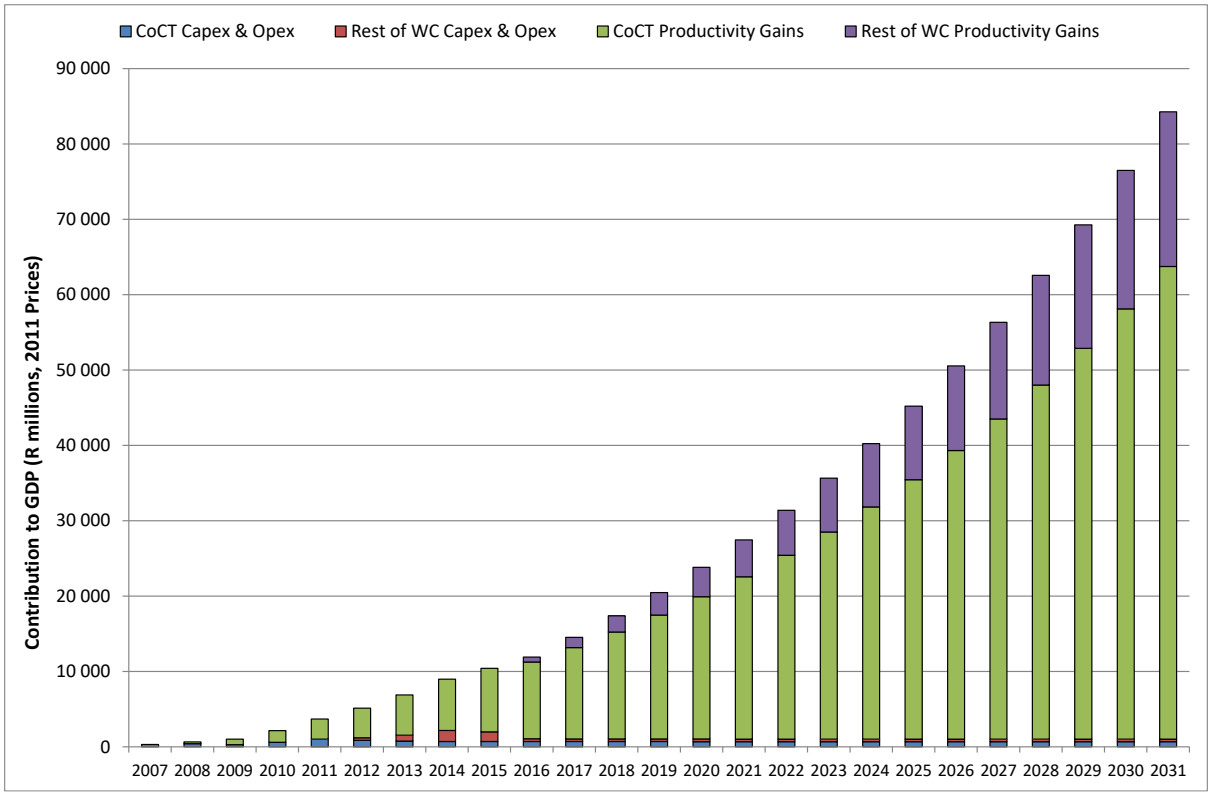
Contribution to Gross Domestic Product - South Africa												
Rand million, 2011 prices	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2021**	**2031**
CoCT Capex & Opex	296	412	267	601	1 003	850	759	704	706	702	683	675
Rest of WC Capex & Opex						335	787	1 465	1 272	351	342	343
CoCT Productivity Gains	0	235	737	1 543	2 693	3 948	5 317	6 809	8 432	10 196	21 526	62 708
Rest of WC Productivity Gains						0	0	0	0	655	4 901	20 530
Total Contribution	**296**	**647**	**1 004**	**2 144**	**3 695**	**5 133**	**6 863**	**8 979**	**10 410**	**11 904**	**27 452**	**84 256**
Cumulative Contribution	296	943	1 947	4 091	7 786	12 920	19 783	28 762	39 172	51 076	154 713	706 589

The contribution to GDP due to the City of Cape Town's capital and operating expenses increases from R296m in 2007 to R1 003m in 2011. This then tapers off to R850m in 2012

but that is the first year of contribution from the provincial capital and operating expenses, which amount to R335m. The contribution to GDP from the City of Cape Town's capital and operating expenses then fluctuates over time until in 2031 it is expected to contribute R675m. The contribution from the provincial government's capital and operating expenses is expected to total R343m in the same year.

The productivity gains in Cape Town are expected to amount to 235m in 2008. By 2016, the first year expected productivity gains in the province, increased productivity in Cape Town will already be contributing R10.2bn to GDP. In 2031 the City of Cape Town's productivity gains will contribute R62.7bn to GDP and the rest of the province R20.5bn. The relative contributions to GDP are shown in Figure 6. Here the relative contributions between the City of Cape Town productivity gains (the green column) and the rest of the Western Cape productivity gains (the purple bar) can be seen.

Figure 6: Detailed Contribution to GDP of Project 1 Including the City of Cape Town Rollout



Based on these projections the combined City of Cape Town and Provincial Government of the Western Cape projects are estimated to contribute over R706bn to GDP by 2031, 25 years after the first investment by the City of Cape Town.

5.2.2.2 Direct and Indirect Jobs

Table 22 reports on the total direct jobs that could potentially be created by combining the City of Cape Town and the Provincial Government of the Western Cape Broadband Projects. Table 23 does the same for indirect jobs while Table 24 reports on both direct and indirect jobs.

Table 22: Project 1 Direct Jobs (Including City of Cape Town Broadband Rollout)

Contribution to Direct Jobs - Western Cape	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2021	2026	2031
CoCT Capex & Opex	479	628	389	747	990	1 084	917	851	854	850	829	824	820
Rest of WC Capex & Opex						159	621	1 314	1 074	199	196	197	197
CoCT Productivity Gains	0	277	865	1 801	3 127	4 562	6 115	7 793	9 606	11 562	23 867	41 570	66 774
Rest of WC Productivity Gains						0	0	0	0	340	2 524	5 742	10 409
Total Contribution	**479**	**905**	**1 254**	**2 548**	**4 116**	**5 806**	**7 654**	**9 958**	**11 533**	**12 951**	**27 415**	**48 332**	**78 199**

Table 22 indicates that as many as 1 084 direct jobs could be created in Cape Town as a result of the city's broadband capital and operational expenditure. This would occur in 2012, the same year of first capital and operational expenditure by the province. It is estimated that as many as 1 314 capital and operational expenditure jobs (in 2014) would be created by the provincial network. For the city and province these jobs are expected to total 820 and 197 respectively in 2031.

However, it is really the productivity gains that would lead to increased economic growth that would create the most jobs. For the city's rollout these are expected to have amounted to 277 in 2008 and to have increased to 4 562 by 2012. By 2016, the year in which the first productivity gains would be felt in the province, as many as 11 562 jobs would have been created in the city. In 2031 the city could have created as many as 66 774 direct jobs and the province 10 409 from their respective productivity gains.

Total direct job numbers are set to increase from 479 in 2007 to 5 806 in 2012. They are then set to increase each year thereafter until in 2031 they are set to total 78 199.

Table 23: Project 1 Indirect Jobs (Including City of Cape Town Broadband Rollout)

Contribution to Indirect Jobs - South Africa	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2021	2026	2031
CoCT Capex & Opex	483	663	427	974	1 638	1 372	1 234	1 144	1 146	1 140	1 110	1 103	1 098
Rest of WC Capex & Opex						176	166	152	198	152	146	147	147
CoCT Productivity Gains	0	320	1 003	2 096	3 654	5 352	7 201	9 212	11 397	13 769	28 944	51 293	83 743
Rest of WC Productivity Gains						0	0	0	0	315	2 377	5 500	10 121
Total Contribution	**483**	**983**	**1 430**	**3 070**	**5 292**	**6 900**	**8 600**	**10 507**	**12 741**	**15 375**	**32 577**	**58 042**	**95 109**

Table 23 illustrates the potential indirect job creation[3]. Indirect jobs as a result of the city's capital and operational expenditure are expected to have increased from 483 in 2007 to 1 372 in 2012. They are then expected to settle down to 1 098 in 2031. The province's capital and operational expenditure is estimated to create 176 indirect jobs in 2012 and to eventually settle down at 147 in 2031.

In a similar manner to direct jobs it is really the increased growth from the productivity gains that would result in more indirect jobs being created. For the city's project this is expected to amount to 83 743 in 2031 and from the province to 10 121.

Overall, total indirect jobs are set to increase from 483 in 2007 to over 95 000 in 2031.

Table 24: Project 1 Total Jobs (Including City of Cape Town Broadband Rollout)

Contribution to Total Jobs - South Africa	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2021	2026	2031
CoCT Capex & Opex	963	1 291	817	1 721	2 628	2 456	2 151	1 995	2 000	1 990	1 939	1 927	1 918
Rest of WC Capex & Opex						335	787	1 465	1 272	351	342	343	343
CoCT Productivity Gains	0	597	1 867	3 897	6 780	9 914	13 316	17 005	21 003	25 330	52 811	92 863	150 516
Rest of WC Productivity Gains						0	0	0	0	655	4 901	11 242	20 530
Total Contribution	**963**	**1 888**	**2 684**	**5 618**	**9 409**	**12 706**	**16 254**	**20 466**	**24 274**	**28 326**	**59 992**	**106 374**	**173 308**

Direct and indirect jobs combined, or total jobs, are shown in Table 24. Total jobs are set to equal 9 63 in 2007 and to increase to 12 706 in 2012. The majority of total jobs in this year are due to the increased economic growth due to the productivity gains in Cape Town. Total jobs are estimated to equal 173 308 in 2031.

5.2.3 Project 2

The macroeconomic contribution of Project 2, connecting communities, is reported Table 25 to Table 28. As before all values are in real terms (2011 prices). In the tables that follow the detailed contribution is given for each of the years from 2012 to 2016, the five year analysis period for this project. The contribution of Mitchells Plain and Khayelitsha are given in the first half of the table and Saldanha Bay in the second half.

5.2.3.1 Gross Domestic Product

Table 25 and Figure 7 report on the contribution to GDP. During the first year of the project the capital costs contribute the most to GDP for both communities. This contribution totals R29m for Mitchells Plain and Khayelitsha and R15m for Saldanha. The contribution to GDP

[3] Indirect Jobs have been reduced since the initial report on the Cape Town Broadband was written. This is to reflect updates in the multiplier information that have been developed in the intervening period.

by the operating costs is more modest. For Mitchells Plain and Khayelitsha this equates to R2m in 2012 and 2013, increasing to R8m in 2016. For Saldanha Bay the contribution from operating expenditure equals R1m in each of 2012 and 2013, R2m in 2014 and 2015 and R3m in 2016. Computer purchase costs equate to R35m annually between 2013 and 2016 for Mitchells Plain and Khayelitsha and R2m annually between 2013 and 2016 for Saldanha.

Economic growth due to increased household penetration is more marked for Mitchells Plain and Khayelitsha because of its higher and denser population. This contribution amounts to R452m in 2013 and increases to R1 634m in 2016. The contribution for Saldanha Bay equates to R27m in 2013 and increases to R111m in 2016.

Table 25: Contribution to Gross Domestic Product for Project 2

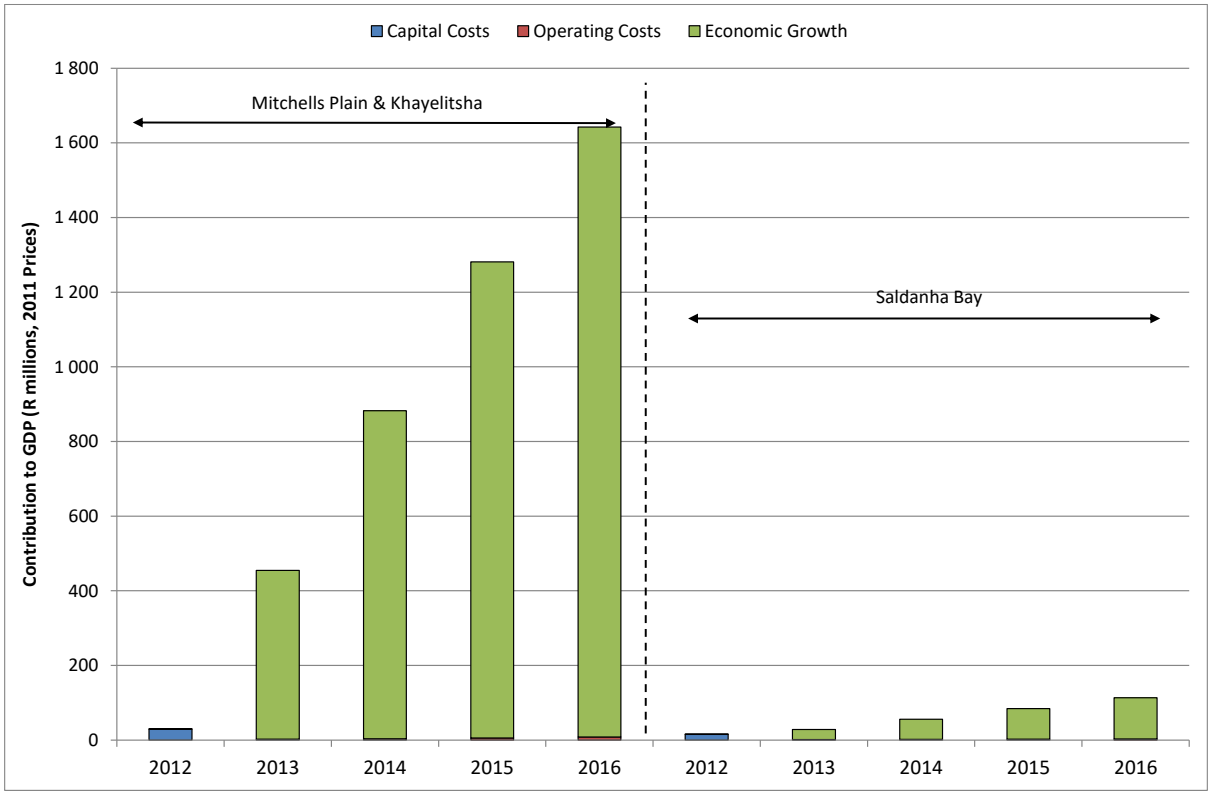
Contribution to Gross Domestic Product - South Africa										
Rand million, 2011 prices	Mitchells Plain & Khayelitsha					Saldanha Bay				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
Capital Costs	29	0	0	0	0	15	0	0	0	0
Operating Costs	2	2	4	6	8	1	1	2	2	3
Computer Costs	0	35	35	35	35	0	2	2	2	2
Economic Growth	0	452	879	1 275	1 634	0	27	54	82	111
Total Contribution	**31**	**490**	**918**	**1 316**	**1 678**	**16**	**30**	**58**	**86**	**115**
Cumulative Contribution	31	520	1 438	2 755	4 432	16	46	104	190	306

For Mitchells Plain and Khayelitsha the overall contribution to GDP is expected to total R31m in 2012 from capital and operating expenditure. Thereafter it increases to R490m in 2013 and R1 678m in 2016. For Saldanha Bay the total contribution to GDP amounts to R16m in 2012 and then increases to R30m in 2013 and R115m by 2016.

The detailed contribution to GDP is illustrated in Figure 7. Two patterns are immediately apparent. The first is the relative size of the impact of Mitchells Plain and Khayelitsha compared to that of Saldanha Bay and the second is the dominance of economic growth over other forms of expenditure.

Based on these projections, project 2 of the proposed Western Cape Broadband Rollout is expected to make a cumulative contribution to GDP of R4.4bn by the end of 2016 for Mitchells Plain and Khayelitsha and R306m for Saldanha Bay.

Figure 7: Detailed Contribution to GDP for Project 2



5.2.3.2 Direct and Indirect Jobs

Table 26 reports on direct jobs, Table 27 on indirect jobs while Table 28 sums the two. Table 26 indicates that 24 people and 10 people could be employed during the development period in 2012 for Mitchells Plain and Khayelitsha and Saldanha Bay respectively. Operating expenditure would add a further 7 jobs by 2016 for Mitchells Plain and Khayelitsha and another 3 jobs for Saldanha Bay. Computer purchases from Mitchells Plan and Khayelitsha would sustain 9 jobs from 2013 onwards but no jobs from Saldanha. The number of additional people employed due to the households in Mitchells Plain and Khayelitsha having access to the broadband network would total 292 in 2013 and increase to 1 056 in 2016. For Saldanha Bay the similar expenditure would amount to 17 additional jobs in 2013, increasing to 71 in 2016.

Table 26: Contribution to Direct Jobs in the Western Cape for Project 2

Contribution to Direct Jobs - Western Cape										
	Mitchells Plain & Khayelitsha					**Saldanha Bay**				
	2012	**2013**	**2014**	**2015**	**2016**	**2012**	**2013**	**2014**	**2015**	**2016**
Capital Costs	24	0	0	0	0	10	0	0	0	0
Operating Costs	3	3	4	5	7	2	2	2	3	3
Computer Costs	0	9	9	9	9	0	0	0	0	0
Economic Growth	0	292	568	824	1 056	0	17	35	53	71
Total Contribution	**27**	**304**	**580**	**838**	**1 072**	**12**	**20**	**38**	**56**	**75**

Total direct job numbers for Mitchells Plain and Khayelitsha would increase from 27 in 2012 to 1 072 in 2016. For Saldanha Bay total jobs would amount to 12 in 2012 and then increase steadily to 75 in 2016.

Table 27 illustrates the potential indirect job creation. Indirect jobs as a result of construction and development are expected to amount to 55 in 2012 for Mitchells Plan and Khayelitsha and 26 for Saldanha Bay. The number of indirect jobs due to the operating costs is expected to increase from 1 in 2012 to 7 in 2016 for Mitchells Plain and Khayelitsha and from 1 in 2013 to 2 in 2016 for Saldanha Bay. Computer purchases would result in 71 indirect jobs being sustained for Mitchells Plain and Khayelitsha and 4 indirect jobs for Saldanha. Increased economic growth would result in as many as 828 indirect jobs being created in 2013 in Mitchells Plain and Khayelitsha and 49 in Saldanha Bay. These numbers are estimated to increase to 2 994 and 203 in 2016 respectively.

Table 27: Contribution to Indirect Jobs for Project 2

Contribution to Indirect Jobs - South Africa										
	Mitchells Plain & Khayelitsha					**Saldanha Bay**				
	2012	**2013**	**2014**	**2015**	**2016**	**2012**	**2013**	**2014**	**2015**	**2016**
Capital Costs	55	0	0	0	0	26	0	0	0	0
Operating Costs	1	1	3	5	7	0	1	1	2	2
Computer Costs	0	71	71	71	71	0	4	4	4	4
Economic Growth	0	828	1 610	2 337	2 994	0	49	99	150	203
Total Contribution	**56**	**901**	**1 684**	**2 413**	**3 072**	**27**	**53**	**104**	**156**	**208**

Overall, total indirect jobs are set to increase from 56 in 2012 to 3 072 in 2016 for Mitchells Plain and Khayelitsha and from 27 to 208 for Saldanha Bay.

Table 28: Contribution to Total Jobs for Project 2

Contribution to Total Jobs - South Africa										
	Mitchells Plain & Khayelitsha					**Saldanha Bay**				
	2012	**2013**	**2014**	**2015**	**2016**	**2012**	**2013**	**2014**	**2015**	**2016**
Capital Costs	79	0	0	0	0	37	0	0	0	0
Operating Costs	4	5	7	10	14	2	3	3	4	5
Computer Costs	0	80	80	80	80	0	4	4	4	4
Economic Growth	0	1 120	2 178	3 161	4 050	0	66	134	203	274
Total Contribution	**83**	**1 205**	**2 265**	**3 251**	**4 144**	**39**	**73**	**142**	**212**	**283**

Total direct and indirect jobs, as illustrated in Table 28, are expected to amount to 83 in 2012, 1 205 in 2013, 2 265 in 2014, 3 251 in 2015 and 4 144 in 2016 for Mitchells Plain and Khayelitsha. The corresponding total job numbers for Saldanha Bay are 39, 73, 142, 212 and 283 respectively.

5.2.4 Project 3

The macroeconomic contribution of Project 3, connecting to the rest of the world, is reported in Table 29 to Table 32. The analysis for this project was limited to ten years.

5.2.4.1 Gross Domestic Product

Table 29 and Figure 8 report on the contribution to GDP. For this project the capital costs contributed very little to the overall costs. Consequently they do not contribute much to GDP. Operating costs, on the other hand, contribute between R27m and R44m to GDP over the ten year analysis period.

Table 29: Contribution to Gross Domestic Product for Project 3

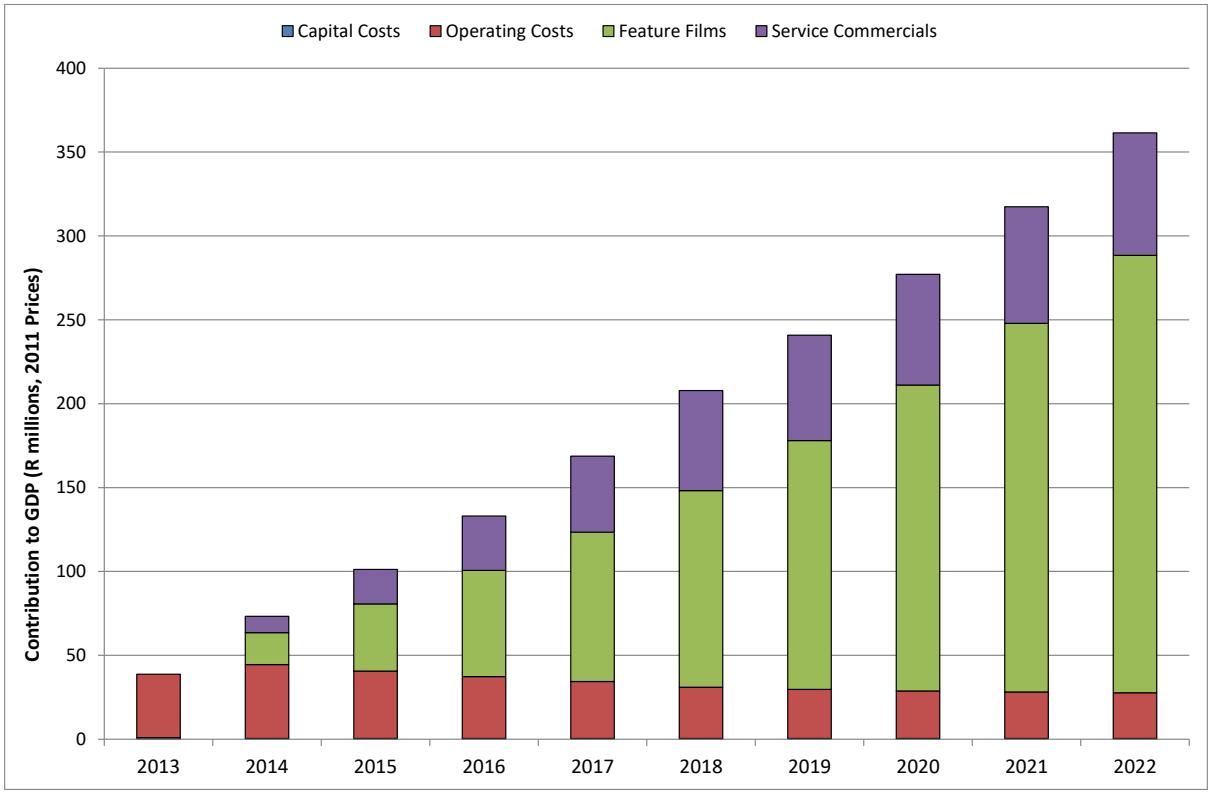
Contribution to Gross Domestic Product - South Africa										
Rand million, 2011 prices	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Capital Costs	1	0	0	0	0	0	0	0	0	0
Operating Costs	38	44	40	37	34	31	29	28	28	27
Feature Films	0	19	40	63	89	117	148	182	220	261
Service Commercials	0	10	20	32	45	60	63	66	69	73
Total Contribution	**39**	**73**	**101**	**133**	**169**	**208**	**241**	**277**	**317**	**361**
Cumulative Contribution	39	112	213	346	515	723	964	1 241	1 558	1 919

The productivity gains for the feature films results in them contributing R19m in 2014 and increasing to R261m in 2022. The service commercials are expected to contribute R10m in 2014, increasing to R73m in 2022.

The overall contribution to GDP is expected to total R39m in 2013, then increasing from R73m in 2014 to R361m in 2022 as a result of increased business to the film industry.

The detailed contribution to GDP is illustrated in Figure 8. The main contributor is the productivity gains for the feature film industry (the light green columns). Based on these projections, project 3 is expected to make a cumulative contribution to GDP of over R1.9bn by the end of 2022.

Figure 8: Detailed Contribution to GDP for Project 3



5.2.4.2 Direct and Indirect Jobs

Table 30 reports on direct jobs, Table 31 on indirect jobs while Table 32 sums the two.

Table 30 indicates that as many as 20 people could be employed on a full time basis on the project as a result of the operating expenditure. This number is expected to reduce gradually over the 10 years until 10 people are employed in 2022. Capital expenditure would create one job in 2013.

Table 30: Contribution to Direct Jobs in the Western Cape for Project 3

Contribution to Direct Jobs - Western Cape										
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Capital Costs	1	0	0	0	0	0	0	0	0	0
Operating Costs	17	20	18	16	14	12	12	11	11	10
Feature Films	0	5	10	16	22	29	37	45	54	64
Service Commercials	0	2	5	8	11	15	15	16	17	18
Total Contribution	**18**	**28**	**33**	**40**	**48**	**56**	**64**	**73**	**82**	**93**

The number of people employed due to the feature films would increase from 5 in 2014 to as many as 64 in 2022. Similarly, an increase in the service commercials industry would increase from 2 in 2014 to around 18 in 2022.

Total direct job numbers are set to increase from 18 in 2013 to 93 in 2022.

Table 31: Contribution to Indirect Jobs for Project 3

Contribution to Indirect Jobs - South Africa	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Capital Costs	2	1	1	1	1	1	1	1	1	1
Operating Costs	54	64	58	52	48	42	40	39	38	37
Feature Films	0	23	50	78	110	145	183	226	272	322
Service Commercials	0	12	25	40	56	74	78	82	86	90
Total Contribution	**56**	**100**	**133**	**172**	**215**	**262**	**302**	**347**	**396**	**451**

Table 31 illustrates the potential indirect job creation. Indirect jobs as a result of capital costs would total 2 in 2013 and 1 from 2014 onwards. The number of indirect jobs due to the operating costs is expected to total 54 in 2013 and 64 in 2014. They are then expected to reduce gradually over the following years until they total 37 in 2022. Indirect jobs as a result of feature films would increase from 23 in 2014 to 322 in 2022 while those from the service commercials would increase from 12 in 2014 to 90 to 2022.

Overall, total indirect jobs are set to increase from 56 in 2013 to 451 in 2022.

Table 32: Contribution to Total Jobs for Project 3

Contribution to Total Jobs - South Africa	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Capital Costs	3	1	1	1	1	1	1	1	1	1
Operating Costs	71	84	76	69	62	55	52	49	48	47
Feature Films	0	28	59	94	132	174	220	270	326	386
Service Commercials	0	14	30	48	67	88	93	98	103	108
Total Contribution	**74**	**128**	**167**	**212**	**263**	**319**	**366**	**419**	**479**	**543**

Total direct and indirect jobs, as illustrated in Table 32, are expected to amount to 74 in 2013 and then increase each year, indicating the sustainable nature of the job creation, until they total 543 in 2022.

6 Conclusion

The Provincial Government of the Western Cape is considering rolling out the provision of broadband infrastructure to selected areas of the Western Cape. This report looked at the economic consequences of rolling out this broadband infrastructure and concentrated on four projects that form part of the rollout. These are:

- Project 1: Connecting Government.
- Project 2: Connecting the communities of Mitchells Plain and Khayelitsha and Saldanha Bay. This project is analysed as two sub-projects.
- Project 3: Connecting to the World. In this project excess international connectivity is made available to selected businesses in the Western Cape and in this analysis the impact on the film industry is examined.
- Project 4: Connecting businesses in the proposed Fringe district in Cape Town to broadband internet and more specifically to Cloud Services.

The cost benefit analysis indicated that all the projects were beneficial to society. The specific results for the cost benefit analysis of each project were as follows:

- When evaluating project 1 purely on the benefits to the government sector alone (and outside of Cape Town) the NPV was R1 38, the BCR 1.4 and the IRR 13%. These results indicate that the project is marginal from an economic efficiency point of view. When the benefits to the private sector were included, however, the NPV increased to R17 494m, the BCR to 7.5 and the IRR to 42%. These results indicate that the project is now economically beneficial and robust. When the costs and benefits from the City of Cape Town's broadband rollout project are added then the project becomes even more economically beneficial. The NPV increases further to R69 751m, the BCR to 9.8 and the IRR to 79%.
- The results for both parts of project 2 (Mitchells Plain and Khayelitsha - - BCR of 14.1 - and Saldanha Bay – BCR of 6.6) suggest that it is economically robust and should be pursued. It will however be realised that the key to success is ensuring families purchase computers and that the assumed penetration rates materialise. Without this the project would fail. For these projects to break-even (i.e. have a BCR of 1) Mitchells Plain and Khayelitsha require a penetration rate of 8.7% (currently 5.6%) and Saldanha a penetration rate of 17.6% (currently 12.0%). Clearly the higher the penetration rate the better the project. Strategies would need to be put in place to ensure that these penetration rates are achieved and exceeded. Such strategies

might include adult education programmes, advertising in local schools and the bulk purchase of entry level computers to help make these more affordable.

- Project 3 looked at the impact of providing international connectivity to the film industry. With a BCR of 4.5 and an NPV of R374m the results indicate that this project is economically efficient.
- The last project analysed was project 4, which looked at the impact of providing broadband internet services and more specifically cloud computing services to businesses in the proposed Fringe district in the eastern CBD of Cape Town. The NPV of R106m and BCR of 12.7 indicate that this project is also economically efficient and robust.

The conclusion to the cost benefit analysis is that all four projects are economically viable and are worthy of implementation. While the public sector benefits outside of Cape Town of Project 1 only just cover the costs of that project it is really the benefits to the rest of society, most notably the business sector, which result in the project becoming more economically efficient. If Cape Town is added to the analysis then the project becomes even more beneficial to society.

As a suite of projects they would all combine well to reinforce the other's efficiency and it could well be the case that synergies would develop to further enhance the benefits to society.

The results of the macroeconomic analysis were as follows (all amounts given in 2011 prices):

- Project 1 (20 year analysis period) excluding Cape Town:
    - The overall contribution to GDP is expected to total R335m in 2012, R787m in 2013, R1.47bn in 2014 and R1.27bn in 2015. From 2016 onwards, when the broadband network becomes active, the total contribution to GDP is expected to increase from R1.0bn to a significant R20.8bn by 2031.
    - The cumulative contribution to GDP is expected to total R3.86bn by the end of 2015, when the broadband network has been fully rolled out. By 2031 the cumulative contribution to GDP can be expected to exceed R150bn.
    - Total direct and indirect jobs are expected to amount to 335 in 2012, 787 in 2013, 1 465 in 2014, and 1 272 in 2015. Once the productivity gains from the broadband network begin to be felt it is expected that as many as 1 006 direct and indirect jobs would be created in 2016 and increasing to 20 873 by 2031.

  - Total tax generation is expected to increase from R32m in 2012 to over R1.7bn in 2031. When the capital expenditure is complete in 2015 a cumulative total of R376m in taxes would have been generated by the project. The cumulative contribution to taxes by 2031 is expected to exceed R12.5bn.
  - The contribution to indirect household income increases from R91m in 2012 to R5.85bn in 2031. By 2031 it is expected that the project will have added over R42bn to indirect household income.
- Project 1 including Cape Town:
  - The overall contribution to GDP is expected to total R850m in 2012 from the city's capital and operating expenditure and R335m from the province's capital and operating expenditure. Productivity gains from the city are expected to amount to R3 948m. It would be too early in this year for the province to contribute to productivity gains.
  - Total contribution to GDP in 2012 is expected to amount to R5.1bn. Thereafter it is expected to increase to R84.3bn in 2031.
  - The cumulative contribution to GDP over twenty five years is expected to exceed R706bn
  - Total direct and indirect jobs are expected to amount to 12 706 in 2012 and to increase to 173 308 in 2031.
- Project 2 (Mitchells Plain and Khayelitsha – 5 year analysis period):
  - The overall contribution to GDP is expected to total R31m in 2012 from capital and operating expenditure. Thereafter it increases to R490m in 2013 and R1 678m in 2016.
  - The cumulative contribution to GDP over five years is expected to exceed R4.4bn
  - Total direct and indirect jobs are expected to amount to 83 in 2012, 1 205 in 2013, 2 265 in 2014, 3 251 in 2015 and 4 144 in 2016.
- Project 2 (Saldanha Bay – 5 year analysis period):
  - The total contribution to GDP amounts to R16m in 2012 and then increases to R30m in 2013 and R115m by 2016.
  - The cumulative contribution to GDP over five years is expected to amount to R306m.
  - Total direct and indirect jobs are expected to amount to 39 in 2012, 73 in 2013, 142 in 2014, 212 in 2015 and 283 in 2016.

- Project 3 (10 year analysis period):
    - The overall contribution to GDP is expected to total R39m in 2013, then increasing from R73m in 2014 to R361m in 2022 as a result of increased business to the film industry.
    - The cumulative contribution to GDP is expected to exceed R1.9bn by the end of 2022.
    - Total direct and indirect jobs are expected to amount to 74 in 2013 and then increase each year, indicating the sustainable nature of the job creation, until they total 543 in 2022.

No macroeconomic analysis was performed for project 4 because of the scarcity of information available at the time of writing this report.

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