Potential drivers of growth and employment in Mpumalanga province: An assessment of inter-industry linkages using input-output analysis

By

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DECLARATION

I,_______Jabulani Easmouth Sithole______________________,declare that this research study is my own unaided work. It is submitted in partial fulfilment of the requirements for the degree of _____Masters of Commerce in Development Theory and Policy________________at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

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Abstract

This study investigates the potential drivers of growth and employment in Mpumalanga's economy using input-output (I-O) analysis as a contribution to industrial policy research and development for the province. Since 1995 to 2011, the Mpumalanga economy has been dominated by the tertiary sector (Quantec, 2011). Mohamed (2010) argues that in South Africa, while there had been growth in services, this growth has generally not been in productive services but instead has been driven by acceleration in debt-driven consumption, outsourcing and growth in private security services. The unemployment rate in the province was at 30.9 percent and labour absorption 52.0 percent in 2011, which made Mpumulanga the 6th largest contributor to the unemployment rate in the country that year (Quantec, 2011). The fifth iteration of the Industrial Policy Action Plan, 2013/14 – 2015/16 aims to promote a labour absorbing industrialisation path, with the emphasis on the systematic building of economic linkages that create employment. While being aware of potential weaknesses associated with this method, I-O analysis is one of the tools used frequently in the literature for identifying sectors to be supported in the industrial policy. The results of this study shows that the manufacturing sector in the province has a stronger stimulatory power to directly stimulate output in most sectors and drive industrial development, provided that local imports and available skills can be used appropriately to fill the existing gaps. This study forms the basis for the Mpumalanga Province's policymakers to further conduct sector analysis through other refined supplementary methods such as value chain analysis with the purpose to confirm linkages of the sectors and determine key sectors that have the potential to drive industrialisation in the province.

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ABBREVIATIONS

ANC	–	African National Congress
BEA	–	Bureau of Economic Analysis
BLS	–	Bureau of Labour Surveys
CSID	–	Corporate Strategy and Industrial Development
CSP	–	Community, Social and Personal Services
EU	–	European Union
GDP-R	–	Regional/Provincial Gross Domestic Product
GDP	–	Gross Domestic Product
GVA	–	Gross Value Added
GVC	–	Gross Value Chain
I-O	–	Input - Output
LQ	–	Location Quotient
MEC	–	Minerals Energy Complex
MEGDP	–	Mpumalanga Economic Growth and Development Path
NDP	–	National Development Plan
NGP	–	New Growth Path
RIDS	–	Regional Industrial Development Strategy
SA	–	South Africa
SIC	–	Standard Industrial Classification
SIMS	–	State Intervention
SNA	–	Systems of National Accounts
StatsSA	–	Statistics South Africa
the dti	–	Department of Trade and Industry
US	–	United States
USSR	–	Union of Soviet Socialist Republic
WWII	–	World War II

1. Introduction

Persistent income inequalities, the high unemployment rate and poverty in South Africa and/or Mpumalanga province (province) oblige us to recognise that economic growth can be non-inclusive and unsustainable. StatsSA (2012) reveals that the unemployment rate, poverty and inequality stand at 25.5 per cent, 30.4 per cent and 40.0 per cent respectively in South Africa. The unemployment rate in the province was at 30.9 percent and labour absorption 52.0 percent in 2011, which made the Province the 6th largest contributor to the unemployment rate in the country during that year (Quantec, 2011). The youth of 15 to 34 years of age contributed 72.8 per cent to total unemployment levels. The majority of the unemployed is unskilled labour force (StatSA, 2011). The fifth iteration of the Industrial Policy Action Plan (IPAP, 2013/14 – 2015/16) aims to promote a labour absorbing industrialisation path, with the emphasis on the systematic building of economic linkages that create employment.

This study investigates the potential drivers of growth and employment in the Mpumalanga economy using input-output (I-O) analysis as a contribution to industrial policy research and development for the province. Chang (2013) states that industrial policy entails coordination of complementary investments, creating linkages through starting off chain reactions by stimulating sectors with particularly strong inter-dependence with others, and facilitation of structural change by temporarily shielding ‘losing’ sectors from full market forces. The aim of this study is to assess the inter-industry linkages of the province with the aim of identifying the interconnectedness between and/or among the industrial sectors of the Mpumalanga provincial economy. Furthermore, the study seeks to highlight key sectors that can drive growth and development in the province on the basis of strong backward and forward linkages.

The study shows that, during the 1995 to 2011 period, the economic structure of the province has been dominated by the tertiary sector, although mining and quarrying and manufacturing still played a critical role in the provincial economy (Quantec, 2011). Furthermore, the results of this study show that the manufacturing sector has a stronger stimulatory power to directly stimulate output in most sectors and drive industrial development of the province, provided that local imports and available skills can be used appropriately to fill the existing gaps. Palma (2005) argues that growth in services which are largely concentrated in low value added; low pay personal services may have had adverse consequences on future prospects for industrial development.

Similarly, Mohamed (2010) argues that in South Africa, while there has been growth in services, this growth has generally not been in productive services. Instead, it has been driven by acceleration in debt-driven consumption, outsourcing and growth in private security services. As a result, such growth could have been the wrong kind of economic growth. For example, between 1995 and 2011, the Mpumalanga Gross Domestic Product (GDPR) as Gross Value Added (GVA) at basic prices grew at an average annual rate of 2.8 per cent, but contributions by the secondary industry to GVA grew at an average of 0.29 per cent annually. The share of intermediate transactions to total industry gross output from secondary sector experienced growth from 1996 to 2011 of 1.1 per cent from 26.5 per cent while the tertiary sector grew by 5.5 per cent from 44.9 per cent for the same period. These measures broadly show how the structure of the Mpumalanga economy is reliant on the tertiary sector rather than manufacturing for growth. The question then is how the key sectors that can drive pro-poor growth in the province can be identified? Put differently, how can we ensure that additional investment in the economy can be directed to the productive sectors that can stimulate growth and development? This question is important because policymakers need to know not only what the growth impact will be of their investment but also the impact on poverty, unemployment and other social determinants.

Input-output (I-O) analysis is one way of assessing each sector's potential to contribute to growth and development. It allows us to study the structural changes in the economy. It provides the tools necessary to evaluate industries, including their relationships to the rest of the economy. Backward and forward linkages are used as a measure to test the possible stimulatory effects a sector has on its upstream and downstream sectors respectively. It has been said that I-O analysis is one of the major contributions to economics in the 20th century that accomplished the mutual support that theory, data and application have come to provide to one another (Guo and Planting, 2000).

The term “key sector” thus refers to a sector which, on one hand is largely dependent on the other industries, that is, it utilises the products of other sectors in its production process, and on the other hand, other sectors use its output as an intermediate product in their production process (Temurshoev, 2004). What is the relevance of a key sector? In times of crisis, accurate answers are demanded by government agencies for policy-making and the planning of the distribution of funds in the most efficient way. Thus, investment in key sectors would justify the best use of funds as it would initiate economic development due to the economic stimulatory impact of their strong linkages to other productive sectors.

Fine and Rustomjee (1997) assert that the South African path of accumulation was still very much characterised by what they call the minerals-energy complex (MEC). The dynamic nature of the South African economy, that is, its increasing complexity, the growing intensity of both domestic and international competition should then lead all tiers of government to consider certain scientific and proven techniques for economic analysis to inform their strategic planning. Since it’s readmission to the global economy in the early 1990’s, the South African economy has seen a number of structural changes (Newman et al, 2010). For example, over a 20 year period the employment in manufacturing has declined in South Africa, indicating deindustrialisation of the economy (Mohamed, 2010). The National government should familiarize itself with recent economic interrelationships within provincial economies, which are integral parts of the national economy.

It is important to note that, while I-O analysis is useful for the purpose of identifying key sectors, this tool has some limitations. Except that, the I-O model does not take into account the technological progress, institutional and political dynamics. Moreover, the I-O model cannot also fully explain the extent to which linkages are local nor can it expound to what extent domestic linkages can be realised (CSID, 2010). Hence, Newman (2010) asserts that key sectors identified through the use of I/O analysis would need to be further refined through supplementary methods such as value chain analysis.

The global value chain literature as depicted in Gereffi and Fernandez-Stark (1999) suggests that industrial upgrading at the national level requires a move from simple assembly of imported inputs to more integrated forms of production involving greater use of both forward and backward linkages. Another intriguing paradigm, which the province needs to consider as revealed in contributions to the emerging works on the Global Production Network, is the importance of local business linkage as a determinant of value retention or value capture (Na-Allah, 2011).

This study demonstrates [1] that the I-O method, even with its limitations, still provides a useful tool for identification of interdependences and interconnectedness of sectors in an economy. Inter-industry linkage analysis was introduced to the field of input-output analysis in the pioneering work of Chenery and Watanabe (1958), Rasmussen (1956) and Hirschman (1958). Since then, backward and forward linkages measures have widely been used for the analysis of both interdependencies between economic sectors, and for the formation of development strategies (Hirschman, 1958). These inter-industry linkages are created as a consequence of a sector's role as a supplier of intermediates to and receiver of inputs from other sectors of the economy.

This analysis is timely because of the important role industrial policy plays towards achieving the objectives of the New Growth Path (NGP) and National Development Plan (NDP). The primary objective of the Mpumalanga Economic Growth and Development Path (MEGDP) is to foster economic growth that creates jobs with the aim to reduce poverty and inequality in the province. The MEGDP identifies key sectors of the province. However, this study contends that the approach used to identify key sectors in the MEDGP did not give an account of the impact of subsectors on value add and employment in the provincial economy and thus, this study uses a different approach and methodology to identify key sectors.

[1] The I-O Model allows this report to study the structural changes in the Mpumalanga economy by evaluating industries and their relationships to the rest of the economy. See Empirical Findings of the report (Section 5).

There is on-going research and practical interest in South Africa with regard to identifying of key economic sectors and clusters that could drive economic growth and development. The advantage of I-O analysis is that it provides a breakdown of the economic structure on a sectoral base, whereas the macro-econometric model emphasises relationships between macro-economic aggregates, as depicted in the national accounts of a country. While the findings of this study may be useful for economic development strategy discussions of the province, this study also argues that the empirical literature on inter-industry linkages in South Africa tended to focus on the national sectoral linkages and that the provincial sectoral linkages analysis have been neglected. This study thus also aims to fill this gap in the literature.

Section 2 provides sector analysis overview of the province. The purpose of this section is to unpack the economic structure of the province with the aim to understand the performance of Mpumalanga economic sectors, focusing on their relative performance at the sub-sector level in terms of value added, employment and international trade. Section 3 of this study reviews the literature on growth and development and the uses of input-output analysis as a tool to identify key sectors to be supported in the industrial policy. Section 4 discusses the methodology. This section will provide detailed information on how the study is going to be conducted and the rationale for the choice of the approach used in the study. Sub-section 4.1 presents the actual Mpumalanga Input-output tables. It explains the technicalities behind the Input-output tables based on the 1993 Systems of National Accounts (SNA). Section 5 provides analysis of the results. Section 6 offers concluding observations.

2. Sector Analysis of Mpumalanga Economy: An Overview

This section of the study looks closer at the Mpumalanga economy structure between 1995 and 2011. It provides an overview of the performance of Mpumalanga economic sectors, focusing on their relative performance at the sub-sector level in terms of value added, employment and international trade.

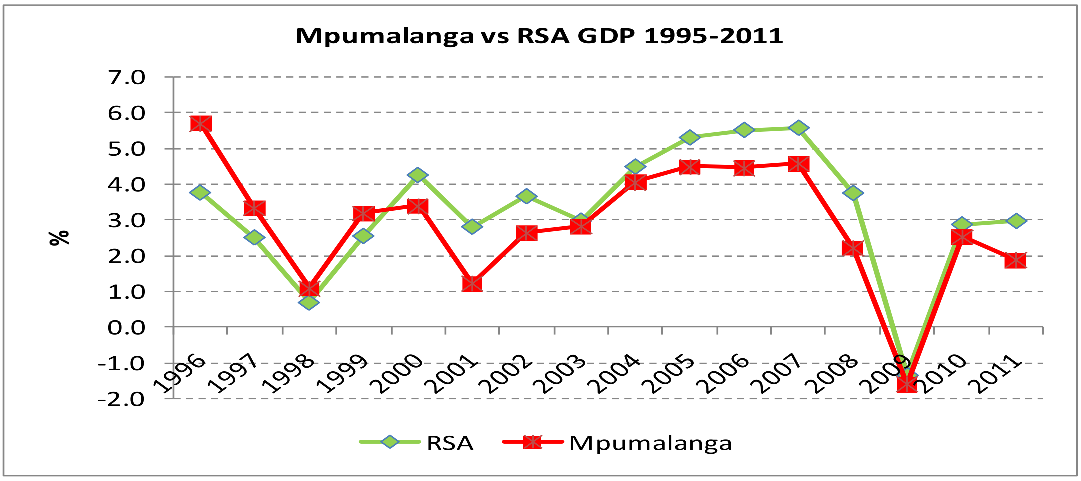
The first section analyses growth and employment of 23 sub-sectors over the 1995 to 2011 period. i.e. a full business cycle, including a historic long expansion phase (2000-2007) and a downward phase (2008-2011). The growth in real value added and employment across the subsectors are also investigated. An analysis of the provincial sectoral composition and/or economic structure is critical towards the continuous deepening and strengthening of the industrial policy of the province.

A successful industrial policy has to be content specific. CSID (2010) argues that industrial policy must be informed, as well as shaped, by the prevailing political and economic structures and processes. By definition, the industrial policy is more than providing a conducive macroeconomic environment; it focuses on industrial sectors and their interconnectedness with the rest of the economy. The final part of this section discusses in more detail the individual subsectors/industries. This analysis is necessary to provide an insight on the economic structure and interconnectedness of the current drivers of growth and employment in the province.

2.1 Growth and Employment, 1995-2011

On average, since 1995 to 2011 period, the Mpumalanga economy has been growing below the national average economic growth. In 2011, the province's real Gross Domestic Product (GDP-R) was estimated at R106.8 billion. The GDP-R growth rate declined more than 3-fold from 5.7 per cent growth rate in 1996 to 1.9 per cent in 2011(figure1).

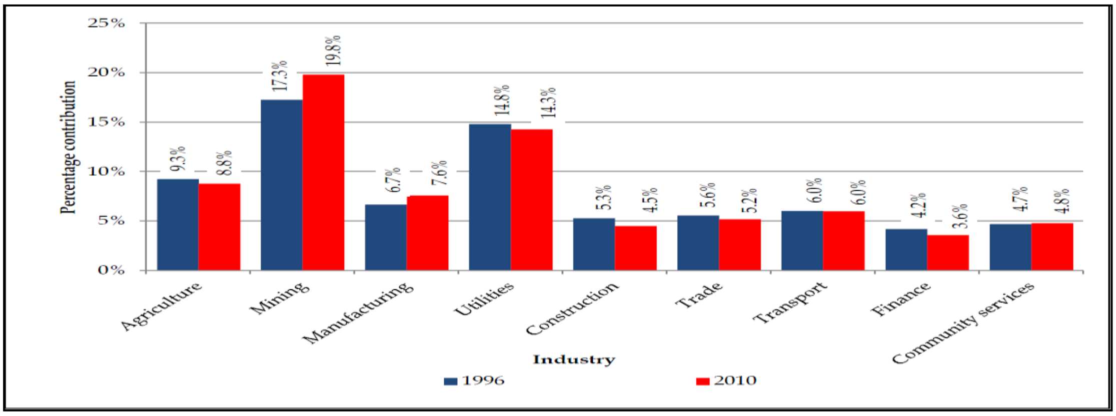
Figure 1: Comparison of Mpumalanga and National GDP (1995-2011)



Source: Quantec,2011

While the growth rate trend between the province and national is similar, the national economy decreased by only 0.8 per cent over the same period. It is critical to investigate the sources of this decline, particularly the sectors that were the major contributors to this decline, both in terms of real value add and employment.

Figure 2: Sector Contribution to the corresponding national sector (1996-2010)



Source: Pero(2011)

Figure 2 shows the contribution of each of the provincial industries to the corresponding national industry in 1996 and 2010. The economic industries are classified according to the Standard Industrial Classification of all Economic Activities (SIC). In 2010, the province was a substantial role player in the national mining and utilities (mainly electricity) industries, with respective shares of 19.8 per cent and 14.3 per cent. Interestingly, the contribution by mining (from 17.3 % to 19.8%), manufacturing (6.7% to 7.6%) and community services (4.7% to 4.8%)

increased between 1996 and 2010, whilst the other industries' contribution to the national growth declined.

Table 1: Contribution of the provincial sector to the provincial GDP (1995-2011)

Industry	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Primary sector	**28.5**	**28.3**	**28.4**	**28.1**	**28.4**	**28.3**	**27.4**	**26.9**	**26.8**	**26.4**	**25.8**	**24.3**	**23.5**	**22.5**	**22.1**	**22.3**	**21.9**
Agriculture	3.2	4.2	3.8	4.0	4.3	4.3	3.7	4.3	4.1	4.0	3.7	3.1	3.0	3.5	3.6	3.5	3.4
Mining	25.3	24.1	24.6	24.1	24.1	23.9	23.7	22.6	22.7	22.4	22.1	21.2	20.4	19.0	18.5	18.8	18.5
Secondary sector	**26.5**	**26.4**	**26.7**	**26.3**	**25.4**	**26.2**	**26.4**	**27.0**	**26.4**	**26.6**	**27.0**	**27.6**	**27.9**	**28.1**	**27.3**	**27.7**	**27.6**
Manufacturing	19.0	18.6	18.5	18.7	18.4	19.5	19.9	20.3	19.6	19.7	20.1	20.6	20.8	21.0	19.9	20.6	20.7
Electricity	5.4	5.9	6.1	5.6	5.0	5.3	4.9	5.0	5.1	5.1	5.0	5.0	5.0	4.7	4.9	4.7	4.5
Construction	2.1	1.9	2.0	2.0	2.0	1.4	1.6	1.7	1.7	1.8	1.9	2.0	2.2	2.3	2.6	2.5	2.4
Tertiary sector	**45.0**	**45.3**	**44.9**	**45.6**	**46.2**	**45.5**	**46.3**	**46.1**	**46.8**	**47.0**	**47.2**	**48.1**	**48.6**	**49.4**	**50.6**	**50.0**	**50.4**
Wholesale	10.8	10.6	10.4	10.4	10.8	11.1	11.3	11.2	10.8	10.8	10.9	11.1	11.1	11.0	11.2	11.2	11.3
Transport	6.5	6.7	7.0	7.4	7.7	7.8	8.0	8.4	9.0	9.0	9.0	9.1	9.2	9.5	9.7	9.6	9.7
Finance	10.3	10.9	11.0	11.1	11.2	10.2	10.7	10.6	10.8	11.2	11.6	12.2	12.6	13.1	13.4	13.2	13.3
Community	5.8	5.7	5.5	5.8	5.8	5.8	5.9	5.9	6.0	5.9	5.8	5.9	5.9	6.0	5.9	5.7	5.8
General	11.6	11.4	11.0	10.9	10.7	10.5	10.4	10.1	10.3	10.1	9.9	9.8	9.8	9.8	10.3	10.2	10.4
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

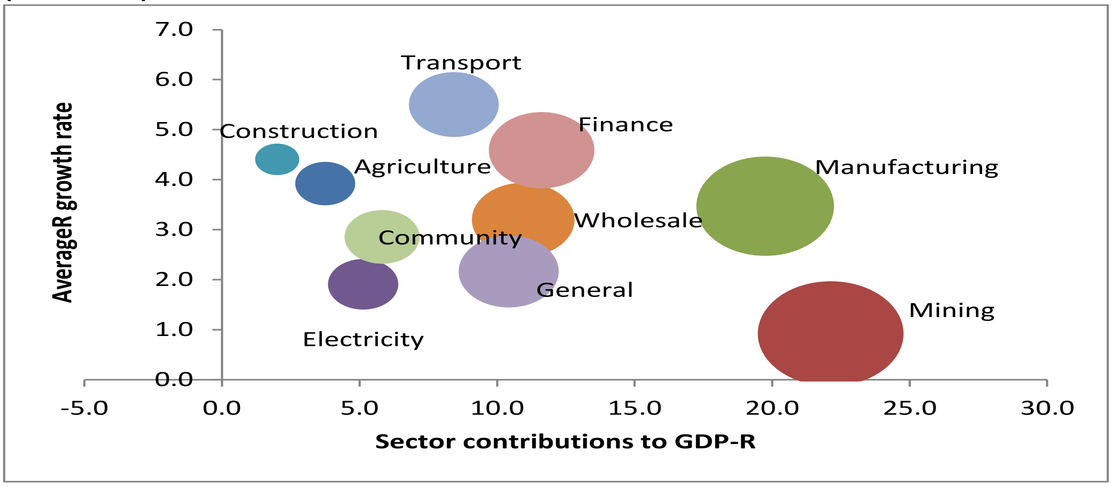
Source: Quantec, 2011

Table 1 depicts the contribution of each provincial sector of the economy to the provincial GVA between 1995 and 2011.It reveals that, while the tertiary sector (47. 2 % share to GVA) dominated the provincial economy's growth performance during the period under review, the mining and quarrying, and manufacturing industries remained critical to the provincial economy, contributing on average 22.1 per cent and 19.7 per cent to the provincial GVA respectively. In 2011, the primary sector in the province contributed 21.9 per cent, secondary sector 27.6 per cent and tertiary sector 50.4 per cent to provincial GVA.

While the mining continues to contribute significantly in the provincial economy, its contribution has been increasing at a decreasing rate. Since 1995 to 2007, the mining industry's contribution has been over 20 per cent to the provincial economy and has since been declining, contributing on average 18.7 per cent between 2008 and 2011.

The contribution to the provincial economy by the manufacturing and agriculture and fishing industries have been relatively constant with an average contribution of 19.7 per cent and 3.8 per cent respectively, between the 1995 and 2011 period. This buttresses the point that there is a need for the diversification of the manufacturing sector (figure 3). According to Seventer (1999), the economic growth of the Mpumalanga economy is largely driven by few industries with relatively low intraregional backward linkage.

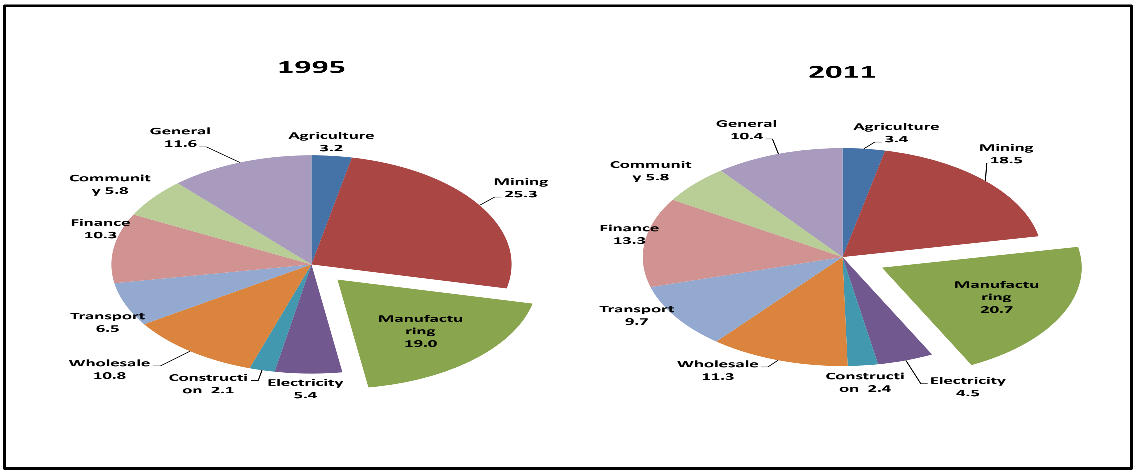
Figure 3: Mpumalanga aggregated Industry's Contribution to GDP-R and Growth Rate (1995-2011)



Source: Quantec, 2011

In 1995 , the largest contributors to the provincial economy were mining (25.3%), manufacturing (19.0%), and general government (11.6%). Similarly, in 2011, the main contributors to the provincial economy were mining (18.5%), manufacturing (20.7%), and wholesale (11.3%). This shows that the structure has remained relatively unchanged over 16 year period. However, a more disaggregated sector analysis will provide a better picture of the economic structure and performances of the industries in the economy.

Figure 4: Contribution to Mpumalanga GDP (Constant 2005 prices) by Industry, 1996 and 2011

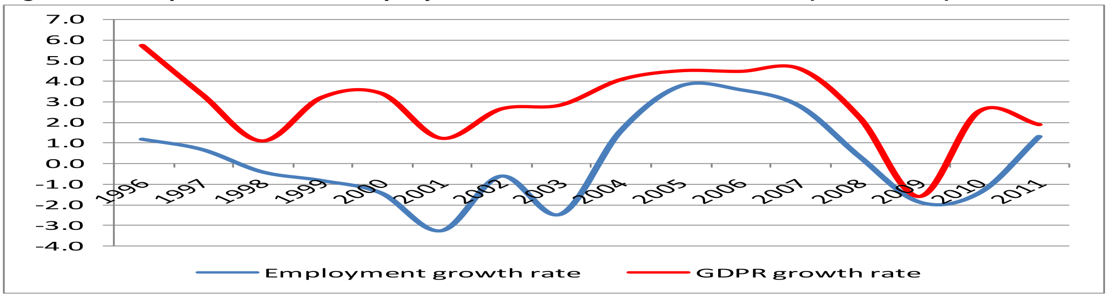


Source: Quantec,2011

2.2 Labour Market and Sector Productivity

Employment is a key determinant of household income and expenditure and important for growth and development. Key sector/s identified in the industrial policy must have high employment multiplier effect. The relationship between employment rate and GDPR by industry over the period 1995 to 2011 is portrayed in figure 5.

Figure 5: Comparison of the Employment and GDP-R Growth Rate (1996-2011)



Source: Quantec, 2011

Between 1996 and 2011, employment in Mpumalanga increased by an average of 0.2 per cent and rate of economic growth was 2.9 per cent. This means that on average, every 1 per cent increase of real GDPR has a potential to create on average 0.1 per cent employment opportunities. Between 2004 and 2007 the GDPR grew on average at around 4.6 per cent with the employment growth rate declining from 3.8 per cent in 2005 to 2.8 per cent in 2007.

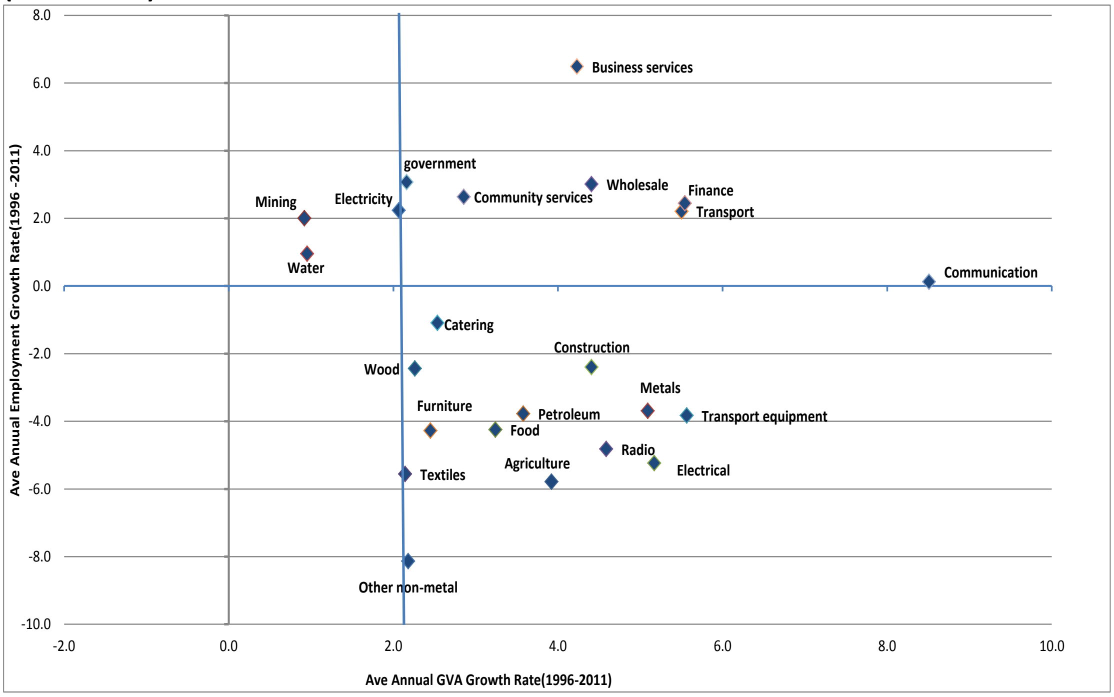
Similarly, in South Africa the gross domestic product (GDP) grew at around 5 per cent during the same period. Mohamed (2010), however, argues that, although this growth was accompanied by increased employment and investment, not all growth in GDP, investment and employment is good for a country. Mohamed (2010) further argues that manufacturing employment actually declined in South Africa over a 20 year period, indicating deindustrialisation of the economy. Although employment in services grew, this was not in productive services but was instead driven by acceleration in debt-driven consumption, outsourcing and growth in private security services.

The question then is, which sectors of the economy are labour intensive and thus create more job opportunities and which are relatively more capital intensive and thus contribute to this weak employment elasticity to change in growth? The sectors responsible for growth and employment creation become clearer when the analysis is done at a disaggregated level.

Figure 6 depicts 23 sub-sectors of the Mpumalanga economy plotted depending on the growth in real value add for the 2011 period on the horizontal axis and its rate of employment growth over the corresponding period on the vertical axis. The figure can be divided into four quadrants, i.e. four groups of subsectors/industries.

Firstly, the top left quadrant including sub-sectors displaying below average real GDPR growth (i.e. less than 2.9% per annum, at which rate the regional economy grew) but creating jobs on a net basis (i.e. positive average employment growth between 1995 to 2011 period). This quadrant contains the leading employment growth sectors, albeit sectors exhibiting below average real GDPR growth. The leading employment growth sectors included in this quadrant are the mining and quarrying, electricity and water.

Figure 6: Disaggregated Sector's Employment and GVA Annualised Average Growth Rate (1995 -2011)



Source: Quantec,2011

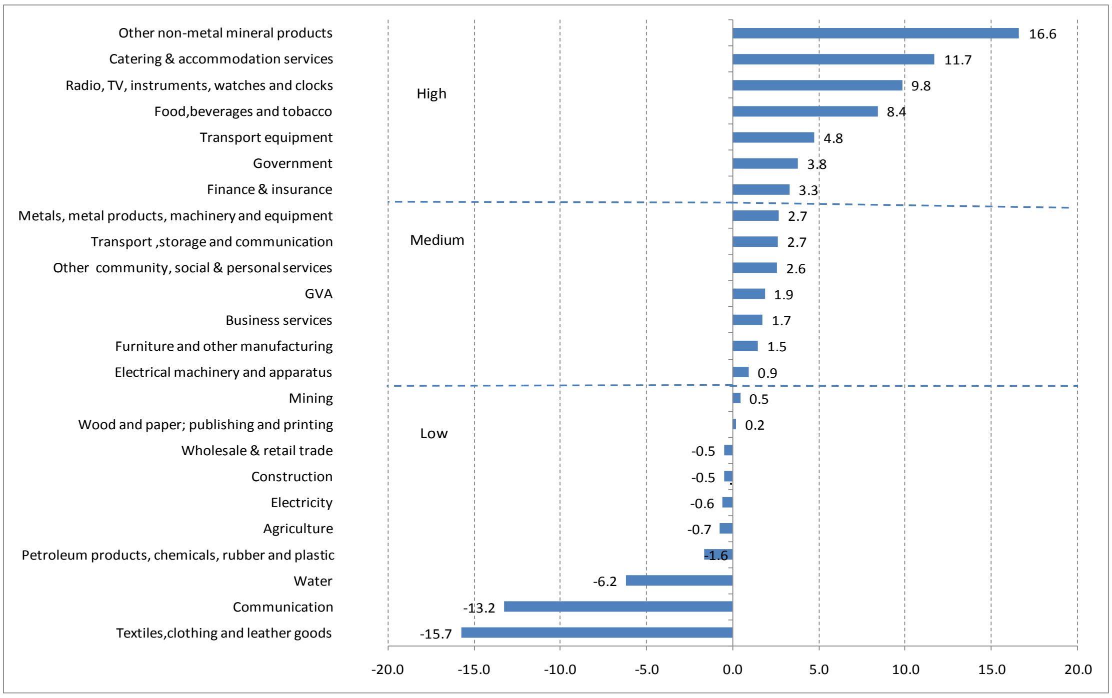
Secondly, the top-right quadrant includes sub-sectors exhibiting above average real GDP-R growth as well as creating jobs on a net basis. These sub-sectors are general government; transport and storage; business services; communication; finance and insurance; wholesale and retail trade and broad community, social & personal services (CSP) sector (including medical & health services, other CSP services). Of these seven sectors, only business services and government displayed reasonable employment growth (at rates of 6.5%; 3.1% and 3.0% per annum, respectively). All three other sectors only showed marginal positive employment growth even though real GDP-R expanded exceptionally robustly. These sectors have low employment elasticity requiring exceptionally favorable business conditions in order to generate new employment opportunities.

Thirdly, the bottom-left quadrant where jobs were shed on balance and real GDP-R growth was below average. Sub-sectors included here are petroleum products, chemical, rubber and plastics; wood and paper, publishing and printers; and Agriculture. The latter two mentioned sectors are labour intensive and shed jobs on a grand scale, despite positive real GDPR growth. Therefore, low growth and job-shedding characterize sub-sectors in this group.

Fourthly, the bottom-right quadrant contains the high growers that also shed jobs. Sub-sectors classified in this quadrant include, metals, metal products, machinery and equipment; electrical machinery and apparatus; water; radio, tv, instruments, watches and clocks; furniture and other manufacturing; food, beverages and tobacco; transport equipment; textiles, clothing and leather goods; and other non-metal mineral products.

Figure 7 shows a ranking of the 23 sub-sectors in terms of real GDPR growth over the 1995 to 2011 period. This figure will be divided in figure 8 into two periods; namely, 1995-2003 and 2004 to 2011 periods. The aim of this split is to identify whether the economic structure of the province has changed over this period.

Figure 7: Ranking of the 23 Sub-sectors in Terms of Real GDP-R Growth rate over the 1995 to 2011 Period



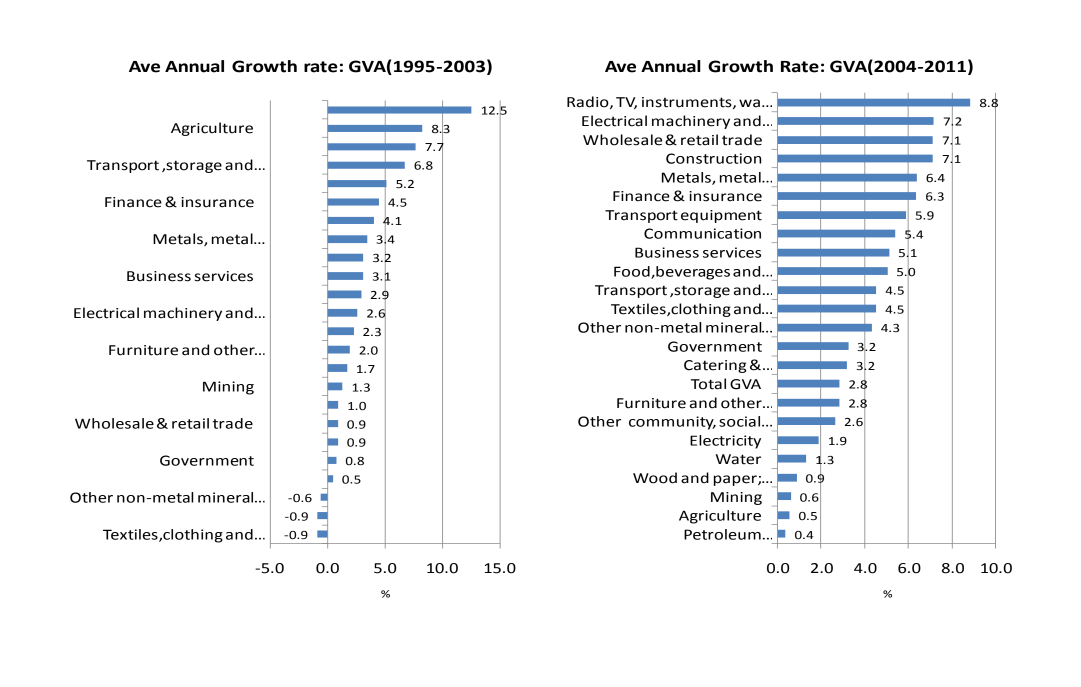
Source: Quantec,2011

Between 1995 and 2011,the high growth sectors, including other non-metal mineral products (16.6%); catering and accommodation services (11.7%); radio, tv, instruments, watches and clocks (9.8%); food, beverages and tobacco (8.4%); transport equipment(4.8%); government (3.8%); and finance and insurance(3.8%). These sub-sectors all reside in the top right and bottom right quadrants of figure 6. It follows that a characteristic of high-growth subsectors in the Mpumalanga is that they have a poor contribution to employment growth.

In figure 8, between 1995 and 2003, the agriculture grew (8.3%) on average, while, between 2004 and 2011 it decreased drastically (0.5%). Except electrical machinery, construction; metals, metal products, machinery and equipment and transport equipment, the largest share of manufacturing industries have not been performing well since 1995. The manufacturing value added accelerated in 2000, recording 9.4 percent annual growth rate, although growth began to weaken from 2001 to 2003 and 2008 to 2009. This clearly shows the vulnerability of the manufacturing sector to the exogenous factors.

Secondly, the average growth sectors include: metals, metal products, machinery and equipment (2.7%); transport, storage and accommodation (2.7%), other community, social and personal services (2.6%), business services (1.7%), furniture and other manufacturing (1.5%), electrical machinery and apparatus (0.9%). It follows that the leading job-creating sectors in the province tend to be average growing industries.

Figure 8: Comparison of sectoral GVA growth rate (1995-2011)



Source: Quantec, 2011

Thirdly, the low-growth sub-sectors between 1995 and 2011 period include mining, wood, paper, printing & publishing and glass products ; agriculture, forestry & fishing; clothing & textiles ; electricity; construction; wholesale; communication; and water. This group of relative low growing sectors can be divided into those that either created or shed jobs.

Whilst Agriculture shed jobs, it remains a major contributor to job creation in the province. Except construction and wholesale which moved into a fast growing sector during the 2002 and 2011 period, the other sub-sectors in this group exhibiting low growth shed jobs at a high rate, led by agriculture and clothing & textiles. Whilst the economic structure of Mpumalanga is dominated by tertiary sector, mining and manufacturing remains the largest contributors to growth in the Mpumalanga economy.

2.3 International Trade

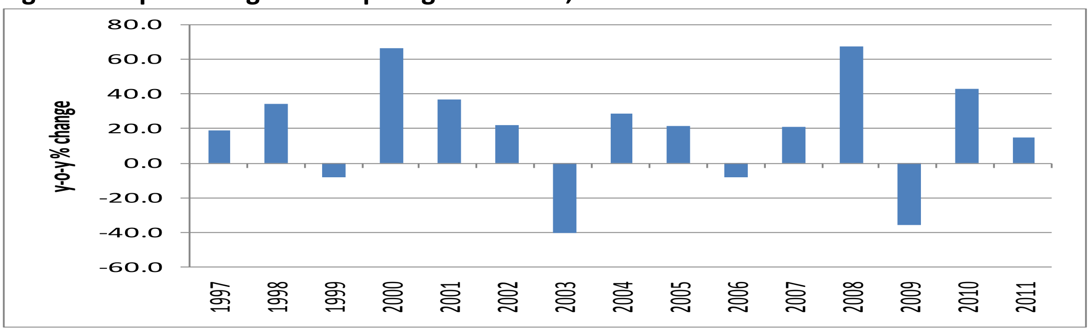
In 2011, exports from Mpumalanga to the world were dominated by manufactured goods (53.3 %) and primary products of mining activities (33.6 %). Exports of manufactured goods consisted primarily of metal products, machinery and household appliances, whilst exports of mining products consisted mainly of coal. The composition of exports was virtually similar to the national situation (Quantec, 2011).

Similarly, imports from the world to Mpumalanga were also dominated by manufactured goods (95.2 %) during the same period. These manufactured goods consisted primarily of metal products, machinery and household appliances and to a lesser extent fuel, petroleum, chemical and rubber products. The trade deficit presents high opportunities for the diversification of Mpumalanga manufacturing sector.

2.3.1 Exports

Mpumalanga real export growth averaged 18.9 per cent per annum over the period 1995 to 2011. The provincial economy's exports seems to be sensitive to developments in our trading partner economies as figure 9 shows export volumes contracted sharply during 2009 in the wake of the global financial crisis and subsequent recession, as well as a sharp decline in 2011.

Figure 9: Mpumalanga real export growth rate, 1995-2011



Source: Quantec, 2011

The Mpumalanga economic analysis show that the economic structure of the province has been dominated by the services sector, moving away from the productive sectors towards more tertiary sector over the 1995 to 2011 period. However, industrialisation as envisaged in the MEGDP cannot be realised with this economic trajectory. It is therefore, paramount that a proper analysis of sources of growth and employment for the Province is conducted.

3. Sources of growth and structural changes in Leontief system

This study uses I-O matrix to calculate the coefficients of linkage effect from Leontief inverse to determine the key sectors of growth and employment in Province.

The determinants of economic growth and development have been a subject of debate over many decades. In the 1940s and 50s, heterodox economists (such as Rosesnstein, Rodan, 1943; Lewis, 1954; Mrydal, 1957; Hirschman, 1958) attempted to understand the major sources of long-run economic growth and development. These pioneers of development economics formulated grand models and development strategies that involved structural transformation that emphasise extensive government involvement in development planning (Fine and Rustomjee, 1996).

According to Kuznets (1966), perception of modern economic growth in agriculture turns to lose its share both in terms of value added and work force in the process of economic growth. Kuznets also argues that, value added from the tertiary sector cannot be interpreted similar to the value added originating from the commodity producing sector. This is because the factor (labour) income and value added of the tertiary sector are not easily distinguishable in the activities of the commodity producing sector. Hence manufacturing productivity may be crucial for economic progress, enabling the low income regions to catch up with their high income counterparts within a finite time horizon (Kaldor 1966).

In Kaldor's growth theory, manufacturing has a greater contribution to economic growth of a country. Kaldor (1966) argued that the faster the rate of growth of manufacturing output, the faster will be the rate of growth of GDP, not simply in a definitional sense but in a fundamental causal sense. This is why manufacturing serves as the "engine of economic growth".

The main driving force behind the positive relationship between overall economic growth and manufacturing output growth is the dynamic increasing returns to scale associated with invention and innovation in manufacturing industries. The presence of increasing returns to scale in manufacturing activities was investigated by Verdoorn (1949) and the dynamic relationship between productivity growth and the output growth is generally known as Verdoorn's Law.

According to this law, the higher rate of growth of manufacturing output leads to higher rates of productivity growth, but not a faster rate of growth of manufacturing employment. Fisher (1935) and Clark's (1940) seminal studies in the early 1930s sparked interest in the patterns of economic development and structural change. Using statistical analysis, Fisher and Clark argue that the path to development takes place in a series of stages in which the sectoral composition of labour and output changes from primary (agriculture) to secondary (industry or manufacturing) and finally tertiary (services) due to changes in final consumption patterns resulting from a rise in income per capita.

Todaro (2000) argues that a scientific approach to development planning is to use input-output models, in which the activities of the major industrial sector of the economy are interrelated by means of a set of simultaneous algebraic equations expressing the specific production process. The extent of the interconnectedness of industry sectors and the multiplier effect would be of interest to policymakers developing industrial policy.

Since its introduction by Leontief in 1936, I-O tables are regarded as one of the twentieth century's major advances in economics (Stilwell and Minnitt, 2000). An Input-output table is a summarised version, in quantified terms, of all transactions that took place between the main economic stakeholders in a particular year. The main feature of an I-O table is that it divides economic transactions into the main sectors of the economy (Miernyk, 1965). The main economic decision makers who are responsible for the transaction activities contained in the I-O table are entrepreneurs, workers, households and governments at all levels(Miernyk,1965).

Drejer(2002) states that I-O table is nothing more than an extension of the National Accounts of a country – i.e. disaggregating it into the various sectors of the economy. In the main, the I-O table shows the commodity inputs that are used by each industry to produce its output, the commodities produced by each industry, and the use of commodities by final consumers (Horowitz and Planting, 2009). Horowitz and Planting (2009) states that Wassily Leontief developed Input-output tables as a tool for economic analysis. In fact, Leontief's input-output model was originally intended to functionalise Walras's general equilibrium and interdependence model (Miernyk, 1965).

I-O Tables received intense criticism from the politicians and economists in the United States(US), after it was noted that the Soviet Union used I-O tables as a tool for economic planning in the 1950s. However, the US government renewed its interest in the I-O framework in 1959(Horowitz and Planting, 2009). Rose and Miernyk (1989) characterised the I-O model as probably the most widely used method of regional analysis. Miernyk(1965) states that I-O tables are ideally suited for the simulation of economic development and where data permitted, the construction of tables for the measurement of income and employment multipliers.

Rose and Miernyk (1989) identified the following distinguishing features of input-output analysis:

- It is firmly grounded in the technological, measurable relationship of production which are empirically verifiable;
- It bridges the gap between economists,managers and engineers;
- The sectoral layout facilitates data collection and data organisation;
- I-O tables and Leontief multipliers greatly facilitate the analysis of the impact of private sector decisions and public-sector policies;
- I-O models are major tools of regional impact analysis in the United States. The US government through the efforts of Leontief is committed to massive data collection for this purpose;
- Because the basic formation of I-O tables is politically neutral, it is a popular modelling tool especially in developing countries and can be applied to different economic systems;
- It provides a full accounting for all inputs into production which express quantities only in terms of primary factors of production.

3.1 What is a key sector? Why is it useful?

Hirschman (1958) introduced the concept of the key sector for the very first time. This was a transposition of the logic of Schumpeter's (1912) concept of economic evolution to the sectoral level. It has been shown that economies are driven by innovative and adaptable firms, whose interaction explains the process of entry and exit of firms. This has been a source of long-term increases of productivity (Eliasson, 1991). At the sectorial level, such a scheme is represented by 'propulsive', 'leading' or 'key' sectors driving the economy to increases in interdependence and income levels (Cuello and Mansouri, 1992).

Obviously, the essence of the key sector concept relates itself to the concept of unbalanced development. Hirschman (1958) argues that the unbalanced development of main final demand sectors will drive the entire economy on the path of efficient growth like that of a competitive economy. According to Amores (nd), the countries that have followed Hirschman's strategy have been the most successful in their development policies (these include Japan, Taiwan, and South Korea) (Amores,nd). Amores further argues that, unfortunately, the countries for which the approach was first proposed (Latin American economies) enacted plans based on other concepts, such as the import substitution of basic industries and infrastructure projects.

Cuello and Mansouri (1992) however, argue that the key sectors are an issue, which are not only limited to developing countries. During a crisis, efficient budgeting for Keynesian policies may benefit from input-output information through the identification of narrow key sectors. Moreover, European Union (EU) regional development plans, essential for territorial cohesion policies, may be more efficient if the concept of key sectors is taken into account. Even Porter's (1990) concept of competitive advantage is closely related to the strategy of unbalanced development. Essential concepts for industrial policy, such as the cluster or value chain, are also closely related to the ideas of key sectors and linkages.

3.2 The uses of I-O Tables: An Overview

Stilwell and Minnitt (2000) states that many countries including South Africa utilise I-O analysis to analyse and manage their national economies. I-O analysis has been widely applied in the analysis and assessment of the structure of an economy and the interconnectedness between industries in order to identify sectors which can act as key sectors of growth and employment (Newman, 2010). While there is general agreement about the importance of linkages among the sectors of any economy in the promulgation of economic growth stimuli, there seems to be little consensus about the ways in which key sectors can be identified. Part of the confusion stems from difficulties in interpretation of such sectors as above average contributors to the economy from either an ex post or ex ante perspective.

There is a lengthy body of literature on the concept of key sector analysis (McGilvray, 1977). The work of Rasmussen (1956) and Hirschman (1958) led to the development of indices of linkage that have become part of generally accepted procedures for identifying key sectors in the economy. The notion of backward and forward linkages and their importance in the process of economic development was first advocated by Hirschman (1958) in his book *The Strategy of Economic Development*. Hirschman argued that sectors with relatively strong backward and forward linkages were of strategic importance in the process of industrial and economic development. Hirschman's approach, defines bij as a typical element of the Leontief inverse matrix, B; B^* as the average value of all elements of B, and if Bj and Bi are the associated typical column and row sums, then the indices may be developed as follows:

Backward linkage index, Uj, for sector j: $Uj = (Bj/n)/B^*$.

Forward linkage index, Ui, for sector i: $Ui = (Bi/n)/B^*$.

However, one of the criticisms of the Hirschman indices is that they do not take into consideration the different levels of production in each sector of the economy (McGilvray, 1977). Drejer (2002) states that Hirschman's original theoretical approach to linkages was not particularly concerned with the relation between interdependence on the one side and technological development and technology diffusion on the other, which has gained much interest in the past decade.

Drejer (2002) argues that Hirschman was rather focused on the demand and supply effects, searching for the industries or sectors that had the maximum effect on the total system through their demand and supply relations with other industries. Indeed, this could be seen in the light of the prevailing conditions after World War II (WWII). After WWII Keynesian demand stimulating policies dominated the economic policy agenda, making it a natural task for linkage studies to have as their main aim the identification of industries that are likely to have the most widespread demand stimulating effects (Horowitz and Planting, 2009).

Sonis et al (1995) explored various approaches to analyse linkages and key sector analysis of the Brazilian economy. A comparison of the results shows that in the Rasmussen and Hirschman linkage indices and in the field of influence approach, what is more important in defining which are the key sectors is the internal structure of the economy regardless of the value of the total production in the economy. For the Cella and Clements and for the pure linkage indices, not only is the internal structure important, but the level of production of each sector in the economy also needs to be considered. As a result, the definition and the determination of key sectors are quite different from the Rasmussen and Hirschman and field of influence approach.

Drejer (2002) argues that linkages have recently gained a new interest in relation to studies of clusters of industries. In the empirical literature, agglomeration is interpreted as a positive relation between a measure of the number of companies in a particular location and the probability that investors choose that location. The Cluster and Global Value Chain (GVC) approaches constitute a valuable analytical tool for the understanding the process by which value-added or surplus is created at different nodes in the supply chain and the way in which it is distributed along the supply chains. In this way, value chain analysis can identify challenges and constraints against deriving greater value added or the capture of higher value added sections of the supply chain through upgrading (CSID, 2010).

3.3 Political Economy Interests in I-O Analysis as a tool for Planning

According to Pecherskykh (2011) the discussion on methods of planning took center stage in Soviet economy literature in the 1920s. On the one hand, Marxists such as Strumilin, S.G; Milyutin, V.P; Smilga, I.T; and others advocated and insisted on method of inter-sectoral balance which Pecherskykh describes as a predecessor of I-O analysis. On the other side, Kondratiev, N.D; Makarov, N.P and Chayanov, A.V. insisted on the distinction between plan-forecasting and plan-directive as system of measures and tools of state influence on elemental development.

In the Mid-20th century economic literature proliferated with economic planning and growth theories such as the Harrod-Domar growth model and subsequently Solow's growth model. A similarity in some of the growth theories of that time was that in order to reach certain levels of investment industrial development was necessary. In that respect, Dobb (1959:7) asserted that economic growth theories could not ignore the interdependence of industries. External economies were seen as a necessary condition for growth to occur. In other words, Dobb (1959) saw growth as being dependent on the structural composition of the economy and thought that the structural relations between industries should be the focus of attention.

Planning the economy requires a country to take a number of issues into consideration and to draw on other development lessons. It is essential to critically examine the experience of other countries during their periods of development planning. Waterston (1970:400) contends that most countries consider their economic, political and social circumstances to be unique but in so doing they miss the lessons to be learnt in the experiences of other countries. Waterston (1970) considers one of the most important lessons to be the ability to differentiate between the idea of a plan and planning. While planning is a process that involves considering the choices that can be made from a set of feasible possibilities, a plan is the result of this process.

I-O has been used in economic planning for a number of years since its development by Wassily Leontief in 1936. I-O analysis is very useful in planning because it allows for the numerical representation of an economy (Rose and Miernyk, 1989:258). In this way the use of I-O raises the proportionality in economic plans. I-O analysis has been used in both planned and unplanned economies alike. For example, the United States still makes use of I-O especially for impact analysis (Drejer, 2002).

The use of I-O in economic planning allows the identification of key sectors by calculating the linkages between industries. The concept of linkages has been identified as a means of identifying key sectors in the analysis and planning of industrial development. Sectors with the highest linkages are chosen as the key ones because putting resources into these sectors should drive rapid growth in other sectors, provided there is sufficient capacity in terms of infrastructure, skills and capital equipment in the economy (Cella, 1984). By calculating backward and forward linkages, one seeks to assess the following:

a) which are the supplying industries for a particular industry;

b) which industries use the products of a particular industry as their intermediate inputs.

I-O was useful in identifying the key sectors because many of the methods previously used such as econometrics models were inconsistent (Cella, 1984) and did not fully take interdependency between industries into account. Furthermore, the backward and forward linkages could not be added to get total linkages because their definitions were inconsistent.

In the former Union of State Socialist Republic (USSR), I-O was used in planning to establish long-run plans. I-O model used in this regard was the dynamic I-O model (Klotsvog, 1980:56). The dynamic model is used to forecast growth rates and structure of the national economy. The dynamic model uses trends of technical progress to forecast the long-run coefficients of inputs of material resources, productive capital and labour. Another I-O approach used by the USSR was one that emphasised physical and value terms, i.e. the economy based on a system of state ownership of the means of production, collective farming and centralised administrative planning.

This model was used to get basic data for the dynamic I-O model and for short-term plans as the model could not forecast the behaviour of variables in the long run. The use of I-O for planning spawned a great deal of research and innovation e.g. computer programs used especially for I-O calculations. I-O tables in the USSR also refined methods of calculating basic indicators (Klotsvog, 1980). Therefore, I-O tables were useful for planning because they encompass the entire economy and thus they provided a method of fostering balanced economic development.

In India, the Planning Commission used I-O in the formulation of its 5-year plans. It had two general classes of planning models, those that were designed to yield consistent and feasible programmes and those that are designed to yield efficient outcomes (Desai, 1963:308). The first sets of models were mainly practical ones and based on empirical application while the second set were theoretical in nature. At the time, the static I-O model was the most widely used to yield consistent and feasible programmes. It was seen to be more practical and thus easier to use in the formulation of policy. I-O was seen to be particularly useful because it defined the choices that were open to an economy at any given time (CSID, 2010).

According to the Bureau of Economic Analysis (BEA, 2009) I-O accounts were used to analyse which economic conditions could contribute to full employment in the post-war years. In the USA which is a country that could be seen as the pioneer of the use of I-O for planning. The Air Force also used the I-O tables, especially when they were doing analysis and planning for the Korean War. The Air Force gave the Bureau of Labour Surveys (BLS) financial support for the preparation of the I-O table for 1947.

The US abandoned using the I-O framework when they learnt that the Soviet Union was using it for economic planning. They did not want to be associated with tools that were used by communist countries. The US government actually froze all funding for the preparation of I-O accounts in 1954. China also abandoned I-O because it was seen to be a tool of the West. The US resumed preparation of the I-O accounts and this responsibility was given to the BEA in 1964 and they have made improvements to the tables since then (BEA, 2009).

Now, the BEA still compiles I-O accounts but not for explicit planning purposes. The BEA (2009:1) now sees national accounts as the means to answer the following questions:

1. What are the size, composition and use of output in the economy?
2. What is the economic process or mechanism by which this output is produced?

The BEA sees the I-O accounts as having two main functions: to be the building blocks for other economic accounts e.g. GDP; to show the detail of economic processes and relationships. Their most important use is to analyse the effect, direct and indirect, of changes in final uses of commodities on industry, employment and income (CSID, 2010).

3.4 The application of I-O Models in South Africa

The choice of using an I-O model in this study was influenced by the fact that I-O modelling is frequently used to undertake analysis for the assessment of inter-industry linkages. The South African government has adopted and implemented industrial policy. I-O analysis was one of the tools used for identifying sectors to be supported in the industrial policy. Newman et al (2010) conducted an I-O analysis of the South African economy in order to identify sectors that have the potential to stimulate other sectors through physical interdependencies in terms of output, employment and exports.

Laubscher (2011) utilised I-O model and macro-econometric model for the assessment of Western Cape Economy's sectoral and industrial growth for 2010 to 2015, including an assessment of inter-industry linkages. CSID (2010) also used input-output analysis, but in conjunction with the global value chain analysis approach for the development of an Industrial Policy framework for Gauteng Province. The use of the input-output structure of a value chain allows the application of an accounting framework to be used to decompose price into value added in each of the sectors or countries which directly or indirectly contributed to the supply of a particular product, allowing changes in the distribution of surplus along these chains to be observed (Gereffi 1994).

Laubscher (2011) states that a regional I-O model is a powerful tool that can be used for a wide range of economic analyses including; the identification and measurement of the composition and level of economic activity in a region, the understanding of the inter-relationships between industries in a region and the rest of the economy. The studying of the effects of changes in supply and demand on a region and the rest of the economy, and the analyses of the flow of goods and services between industries and final users in the regions providing the basis for the calculation and measurement of Gross Value Added (GVA) by industry.

State Intervention in the Minerals Sector' (SIMS) 2011 report prepared for the African National Congress (ANC) to discuss state intervention in the minerals sector utilised I-O analysis as one of the tools to ascertain the linkages of minerals to other sectors of the economy.

Stilwell and Minnitt's (2000) paper on I-O analysis and its potential application to the mining industry concluded that unlike conventional cost and accounting systems, I-O analysis is a powerful tool, and there is no apparent reason why it cannot be used within the mining industry.

Bouwer (2002) conducted a study on the role of supply and use tables in South Africa as a tool for economic analysis. I-O tables, rearranges both supply and use information in a single table and either a product or an industry classification is used for both rows and columns. Bouwer concluded that the advantages of using supply and use tables for analysis is that the interrelationship between industries and products, and the interrelationship between the different products can also be seen, and not only the interrelationship between the different industries as in the traditional I-O tables. However, the compilation of supply and use tables for regional economies requires highly disaggregated data which is a problem to acquire. Hence, this study will use input-output tables.

4. The description of the Methodology

This section deals with the choice of the research methodology. The study uses traditional I-O methods of Chenery-Wantanabe (1958), Hirschman (1958), Rasmussen (1956) and Millar and Blair (1985), to determine the key sectors of Mpumalanga economy. The methodology taken involves a quantitative approach to answer the study's research objectives. The study will utilise the I-O tables for the province compiled by Quantec Research to analyse the structure of the Mpumalanga economy. The I-O tables consist of 43x43 industries. The I-O model describes the structure of relationships of sectors, that is, it shows how sectors are materially interconnected through their linkages with other sectors. These linkages are used as part of a process of identifying key sectors of growth and employment in

Mpumalanga provincial economy. What follows is a brief description of the methodology.

4.1 Economic Linkages and Multipliers

Generally, in the framework of the I-O model, industry production has two kinds of economic effects on other industries in the economy: Increased demand and supply. When industry *i* increases its production, there is increased demand for inputs from industries. In the I-O model, this demand is referred to as *backward linkage.* An industry with higher backward linkages than other industries means that expansion of its production is more beneficial to the economy in terms of causing other induced productive activities.

On the other hand, an increase in production by other industries leads to additional output required from industry *i* to supply inputs to meet the increased demand. This supply function is referred to as *forward linkage*. An industry with higher forward linkages than other industries means that its production is relatively more sensitive to changes in other industries' output. In this study, we derive both backward and forward linkages from the Leontief inverse matrix.

For example, Let $A = \{a_{ij}\} = X_{ij} / X_j$ be the direct requirements coefficient matrix, where X_{ij} is industry *j*'s direct input from industry *i*, and X_j is total output of industry *j*. Then the Leontief inverse matrix is expressed as $B = (b_{ij}) = [1 - A]^{-1}$. From $B = (b_{ij}) = [1 - A]^{-1}$, define $b_{.j} = \sum_{i=1}^{n} b_{ij}$ the sum of rows for column *j* from the total requirements matrix. Since $b_{.j}$ measures the total output from all industries generated from one unit final demand of product *j* , it is called the backward linkage of industry *j*.

Similarly, let's define $bi. = \sum_{j=1}^{n} b\,ij$, the sum of columns for row *i* from the total requirements coefficient matrix as the measure for forward linkage. Normally the impacts are calculated from Type I and Type II multipliers derived from I-O tables. Samuelson (1951) defines the multiplier concept as the number by which the change in investment must be multiplied in order to present us with the resulting change in income. Miernyk (1967) points out that the multiplier concept (in economic terms) was used for the first time in economic theory in 1931 by R.F Kahn in his article “The relations of Home Investment to Unemployment”. Keynes (1936) refined the concept and incorporated it as an integral part of his theory on income and employment.

The multiplier is calculated from Leontief Inverse denoted as: $(I-A)^{-1}$, and the technical coefficients matrix forms an integral part of the Leontief inverse. The Leontief inverse illustrates the interrelationships between industries and shows the total impact on the production process in the economy (Horowitz and Planting, 2009). Type I multiplier is the most elementary multiplier which can be measured with regard to individual sectors. This kind of multiplier can be calculated for each sector by aggregating the elements in each column of the Leontief inverse. The Type I multiplier does not provide a complete picture of the impact in instances in which an autonomous change in an exogenous factor has a dual, inter-linkage effect. An example of such an instance is where a direct change in production and hence in income causes a change in consumer consumption which in turn leads to a change in production and income via the consumption function. The impact of changes which accompany such interactive process can be effectively measured by applying a Type II industry multiplier.

Moore and Petersen (1955:376) use linear regression analysis to determine the employment-output ratio for each sector. This study however will use Lewis’smodel. Lewis (1968) calculated employment multipliers without the application of the traditional industry employment-output functions, which are determined from time series. Lewis’smodel is explained on the basis of a transaction matrix x; a final demand vector F; a total employment vector e and a total output vector X (Rose and Miernyk, 1989).

4.2 Regionalising Coefficients

The following methodological description of the procedure of deriving regional input-output coefficients from the national tables is adapted from various input-output studies including the Quantec (2011); CSID (2010); Laubscher (2011); and van Seventer (1999).

A regional input-output table provides a systematic base from which to understand the linkages between economic activities to assist in strategic planning and resource distribution and to assess the economic value of different projects and initiatives for a region. Also, regional input-output tables provide users with the ability to undertake regional economic impact assessments of capital formation and policy changes. Regional input-output tables can also be used to investigate the impact of new or existing economic activities on the local economy.

The national input-output table has been used to show the flows between sectors within a country. Each industry has produced a single output, using the products produced by other industries as inputs. These tables have not described the specific location of the industry within the country. However, a national input-output table can be disaggregated in regional tables, taking into account separately intraregional and interregional transactions (Fuentes Flores, 2002).

Two principal methodologies to regionalize a national I-O table can be found in the literature. The key to choose between them is the data availability. On one hand, survey techniques are based on particular data or samples, but it presents the disadvantage of a strongly, costly and slowly process.

On the other hand, the non-survey techniques do not need samples or particular census, because they use available annual data and economic census. Statistics techniques have been used to derive regional I-O tables from a National I-O table. Generally, these techniques have been employed to adjust a national technical coefficient to reflect the structure of regional production and their relationships with all the sectors of the economy. In respect to technology, the national I-O table represents the national average requirements of inputs to produce the outputs.

Those requirements are obtained from the sum of the companies of the regions. Instead, if a region is specialized in some activities, it could have a different technology compared with other regions. Another difference between the national and regional tables is that the regional tables contain the regional commerce. Additionally, the regional imports are defined by the goods and services that come from another region. They are fundamental to the analysis, because the regional intermediate consumption is considered as a regional import and regional intermediate sales are treated like a regional export, respectively.

In the literature there are a number of methodologies for estimating regional coefficients, one such method, which is well suited to accommodate the data set used in this study, will be described below. Following Millar & Blair (2009: 72), distinction can be made on the following:

- national input coefficients, a_{ij}^{N}, available from the national input-output table
- regional input coefficients, a_{ij}^{R},
- regional technical coefficients, a_{ij}^{RR}

Regional input coefficients, a_{ij}^{R}, are made up of a combination of local and regionally imported supply, whereas regional technical coefficient, a_{ij}^{RR} , reflect the locally supplied portion only.

The process of arriving at the regional technical coefficients, a_{ij}^{RR}, using the national input coefficients, a_{ij}^{N}, as a starting point, can thus be broken up into two steps.

Step 1 Determining the regional input coefficients, a_{ij}^{R} ***, from the national input coefficients,*** a_{ij}^{N} ***.***

The following relationship is used:

$$a_{ij}^{R} = \alpha_{ij}^{R}\, a_{ij}^{N} \qquad \text{...eq 1}$$

Where α_{ij}^{R} factor larger than zero, representing regional differences in production structure.

Step 2 Finding a factor β_{ij}^{R}

This factor is non-negative but smaller than unity, so that

$$a_{ij}^{RR} = \beta_{ij}^{R}\, a_{ij}^{R} \qquad \text{...eq 2}$$

Substitution of equation (1) into equation (2) shows that the relationship between the national coefficient and the regional technical coefficient is as follows:

$$a_{ij}^{RR} = \beta_{ij}^{R}\, \alpha_{ij}^{R} a_{ij}^{N} = \gamma_{ij}^{R}\, a_{ij}^{N} \qquad \text{…eq 3}$$

Millar & Blair (2009: 74) indicate that a number of methodologies are available to find values for the factor β_{ij}^{R} . The simple location quotient (LQ) method, which argues that if the relative position of a sector in a region (in terms of value added, employment or gross value of production) is larger than the position of that sector in national economy, the relevant sector will be able to supply all of its local demand (intermediate as well as final demand). If the relative position is smaller in the region compared to the nation as a whole, the relevant sector is assumed to import part of the local demand for its products in relation to the regional sector's relative position as captured by the location quotient.

$$LQ_i^R = \frac{X_i^R / X^R}{X_i^N / X^N} \qquad \text{…eq 4}$$

Where

X_i^R = net value of production of sectors *i* in region R

X_i^N = net value of production of the same sector at the national level

X^R = total sectoral value added in region R

X^N = the economy-wide sectoral value added

Regional technical coefficients a_{ij}^{RR} can now be determined as follows:

$$a_{ij}^{RR} = \begin{cases} LQ_i^R \ \ a_{ij}^R \ if\ LQ_i^R < 1 \\ a_{ij}^R \quad if\ LQ_i^R \ \geq 1 \end{cases} \qquad \text{…eq 5}$$

According to Millar & Blair (2009:74), the if-statement introduces an asymmetry in the process of adjusting the regional input coefficient. If the sector *i* is underrepresented in the region, the location quotient LQ_i^R will be smaller than unity. This reflects an import orientation which drives the adjustment made to the regional input coefficient. However, if the sector is better represented in the region compared to the nation as a whole, the regional input coefficient is not adjusted and will coincide with the regional technical coefficient, a_{ij}^{RR}.

4.3 Limitations of the methodology

While I-O analysis is useful in the identification of the key sectors of the economy, the extent to which the identified sectors can be regarded as key drivers of growth depends on a number of factors that are not captured in the I-O tables. First, I-O tables allows us to study the material interconnections between industrial sectors and highlights key sectors on the basis of strong backward and forward linkages and employment multipliers, but as a purely quantitative exercise, I-O is both limited to the availability of quantitative data and says nothing about the extent to which linkages are local, nor can tell us to what extent domestic linkages can be realised (CSID, 2010).

Secondly, the input-output model is a static tool based on fixed technical coefficients, yet the economy is a dynamic phenomenon with significant changes in demand and supply patterns. These changes are caused by technological progress, income growth and distribution, international events, and government policy directives which I-O does not take into account.

Thirdly, the study will be using input-output tables constructed by Quantec Research Institution which consists of 43 sectors. The sectors remain highly aggregated. Hence, in order for the results of the I-O model to be fully informed, they should be complemented with a study of the institutional structures of production along value chains in order to identify bottlenecks.

5. Empirical Findings

This section discusses the I-O results of Mpumalanga economy. As indicated in the literature review, I-O analysis is widely used to analyse the structure of an economy by assessing how sectors are materially interconnected as a means to identify the economy's key sectors. The strength of these interconnectedness and linkages are used as part of the process of identifying key sectors of growth. Therefore, if the key sector is stimulated, it can help stimulate growth and employment both in the key sector itself and in other sectors as well.

5.1 Linkages Effects

One can identify the key sectors on the basis of linkage effects. The impact of investment made on the sectors with high linkage effect on economic growth is higher than the impact of sectors with low linkage effects, provided conscious policy decision have been put in place to deal with the lack of necessary skills needed to drive the economy, restructuring of the importation by replacing imports with domestically produced products and this would build stronger linkages in the economy.

If the backward linkage coefficient is more than unity, a unit increase in final demand will enhance economic growth at a higher proportional rate. However, the benefit from investment made on the sectors with high linkages may not uniformly be distributed across all the sectors. The backward and forward linkage coefficients for the six highly aggregated sectors are shown in Table 2. The calculation of these linkages was based on the regional technical coefficient derived from the transaction matrix. The total backward linkages for the disaggregated sectors are discussed in details in subsection 4.1.1.

Table 2: Technical Coefficients, 2011

Sectors	2011			
	Backward Linkage Coefficients		Forward Linkage Coefficients	
	Mpumalanga economy	Rest of the economy	Mpumalanga economy	Rest of the economy
Agriculture, forestry & fishing	0.27	0.82	1.21	1.42
Mining	0.00	0.77	0.27	0.90
Manufacturing	0.41	0.83	0.26	0.39
Electricity, Gas & Water	0.26	0.87	0.07	0.17
Construction	0.50	0.79	0.03	0.36
Tertiary	0.23	0.75	0.48	0.97

Source: Quantec,2011

A sector that receives more inputs from a large number of sectors usually exhibits a higher backward linkage. The six sectors depicted in table 2 have low backward linkages to both provincial and the rest of the economy. Table 2 reveals that construction (0.50) has a stronger stimulatory power in the provincial economy followed by manufacturing (0.41). Other sectors including agriculture seem to have weak linkage effects in the provincial economy. This simple means that the Mpumalanga economy largely imports intermediate inputs from other provinces. This observation is in line with the empirical findings of the study conducted by van Seventer (1999) titled “The estimation of a system of provincial Input-Output tables for South Africa” which concluded that the economic growth in Mpumalanga is largely driven by few industries with relatively low intraregional backward linkage.

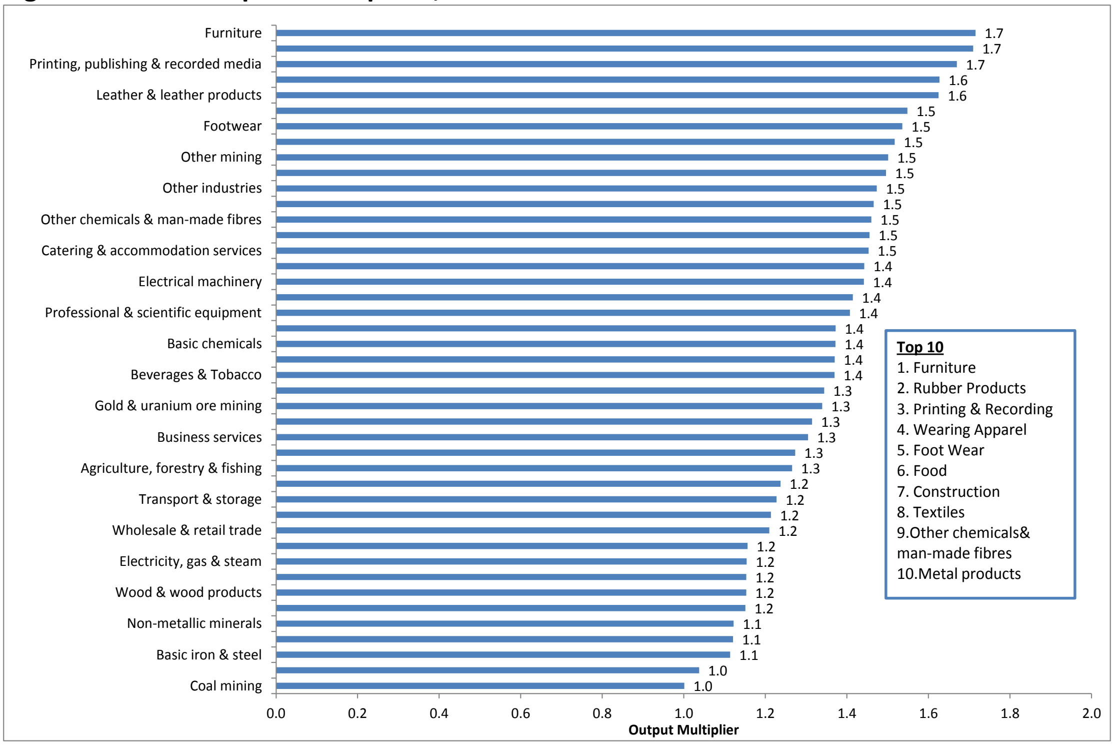
The stimulatory power of manufacturing (0.83) to the rest of the economy was stronger than the stimulatory potential of tertiary sector (0.75) on the economy. This suggests that the manufacturing demand may have more potential to directly stimulate output in most sectors of the economy, provided that local imports and available skills can be used to fill existing gaps. Also the growth enhancing effect of electricity, gas and water (0.87) agriculture (0.82), construction sector (0.79) and mining (0.77) seemed to be stronger than that of the tertiary sector.

The forward linkage effect, measuring the growth of a sector owing to the expansion of demand for other sectors, was significantly higher for the agriculture (1.42) including electricity, gas and water (1.17), tertiary sector (0.97 and mining (0.90).

5.1.1 Decomposition of Sectors

Ranking subsectors in terms of direct output multiplier per R1 million changes in final demand reveals that most of the subsectors contributing to economic growth were concentrated in the manufacturing sector. The top 10 subsectors with strong backward linkages depicted in the small box in the figure 10 include; furniture, rubber products, printing, publishing and recording media, wearing apparel, foot wear, food, construction, textile , other chemicals and man-made fibres and metal products. This is an industry that has not received sufficient attention as a subsector that has a potential to contribute significantly in the provincial economy. This is the first step towards the identification of sectors with potential stimulatory power to drive growth and employment in Mpumalanga.

Figure 10: Direct Impact Multipliers, 2011



Source:Quantec,2011

Table 3 analyses effect of a change in final demand on total output (GDPR), employment and labour remuneration. As names imply, output, employment and labour remuneration multipliers attempt to translate the impacts of final demand spending changes into changes in output, employment and labour remuneration during a given period. These multipliers give an indication of additional output, employment and labour remuneration created throughout the entire economy due to an increase in demand for a specific sector's products. The total impact of a change in final demand on the economy is a culmination of a series of waves of impacts including first round impact; initial impact; direct impact; indirect and induced impact.

The sectors with total backward linkage coefficient more than unity are conventionally treated as the key sectors in the process of economic growth (Das, 2007). To illustrate this linkage effect in the economy, the assumption is made that final demand for agricultural products will increase with R1 million which will lead to additional production of R1 million in the agricultural sector and therefore also an initial/first round increase of R 0.265 in output (GDPR) (see appendix table A3). The purchase from agriculture from its first round suppliers of intermediates will result in additional GDPR generation of R1.2655 while the indirect impact on GDPR for all other suppliers of intermediates will be R0.1126. Ultimately, an increase of R1 million in final demands for agricultural product will lead to additional GDPR of R1. 3731 as indicated in table 3.

As in figure 10, most of the key sectors contributing to economic growth were concentrated in the manufacturing. Within manufacturing the backward linkage effect was the highest for leather and leather products, wearing apparel, furniture, footwear, food, other chemicals and man-made fibres and textiles. The growth enhancing effect was the highest for electrical machinery. Another important manufacturing industry with highest proportional impact on overall growth was plastic and rubber products. The key sectors other than manufacturing were construction and electricity, gas and water supply.

However, sectors with higher employment multiplier effect were concentrated in primary sector and tertiary sector with the exception of electricity, gas and steam in the secondary sector. This implies that most growth sectors are largely capital intensive. In the primary sector, the direct and indirect impact of R1 million changes in final demand would increase output by R1.4 million on average and its impact on employment is higher than that on secondary and tertiary sectors. Similarly, the effect of R1 million changes in final demand had a relatively low impact on labour remuneration. Interestingly, the employment multiplier in manufacturing sector is pronounced more on unskilled labour which is good for labour absorption as the majority of the unemployed labour force in the province is concentrated on the unskilled labour force.

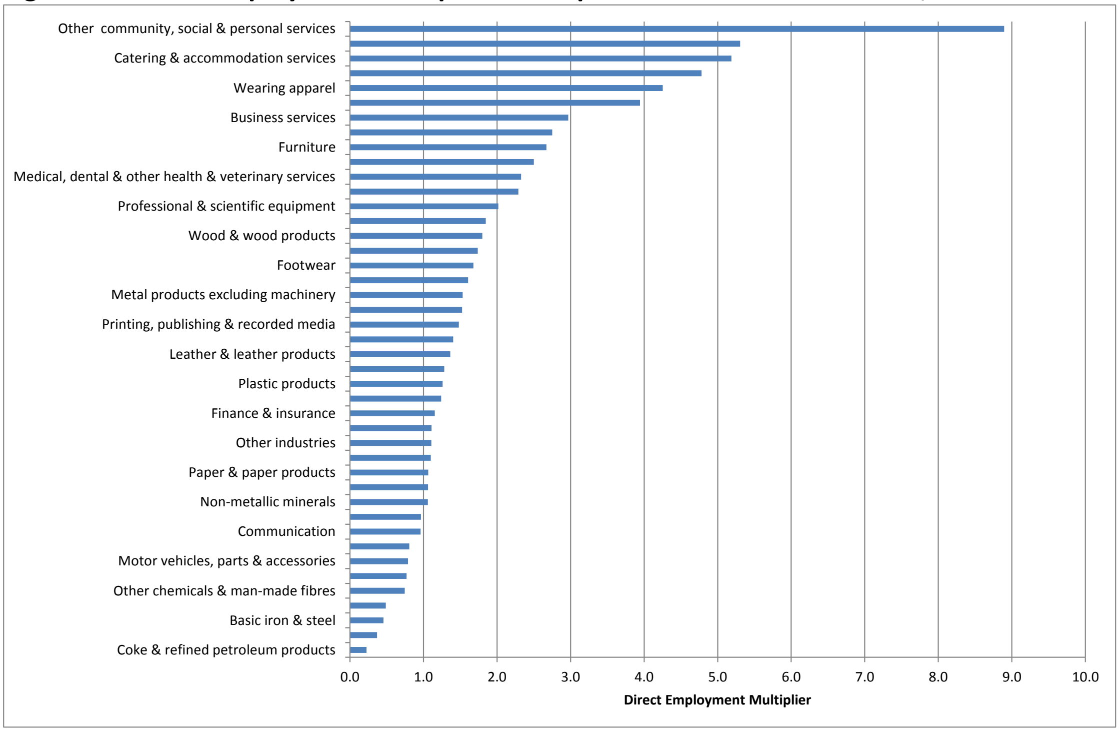
Table 3: Backward Linkages, Labour Remuneration and Employment Multipliers, 2011

Industries	Direct and Indirect Impact per R1 million Final Demand		
	Output multiplier	L Remuneration	Employment
Primary Sector	**1.3567**	**0.2339**	**0.6294**
Agriculture, forestry & fishing	1.3731	0.1691	0.5481
Coal mining	1.0045	0.2203	0.6888
Gold & uranium ore mining	1.4202	0.3339	0.6165
Other mining	1.6290	0.2123	0.6641
Secondary Sector	**1.5555**	**0.2387**	**0.4655**
Food	1.7409	0.2638	0.5489
Beverages & Tobacco	1.5360	0.2531	0.5919
Textiles	1.6380	0.2256	0.4073
Wearing apparel	1.8565	0.3618	0.5761
Leather & leather products	2.0131	0.2597	0.4452
Footwear	1.7754	0.1729	0.3566
Wood & wood products	1.1921	0.3606	0.4453
Paper & paper products	1.5964	0.2414	0.4301
Printing, publishing & recorded media	1.9995	0.3251	0.4998
Coke & refined petroleum products	1.0485	0.0461	0.3253
Basic chemicals	1.5414	0.1624	0.4021
Other chemicals & man-made fibres	1.6404	0.2374	0.4379
Rubber products	1.9584	0.2529	0.5348
Plastic products	1.7802	0.2564	0.4332
Glass & glass products	1.6253	0.3114	0.5164
Non-metallic minerals	1.1695	0.1568	0.4899
Basic iron & steel	1.1402	0.1941	0.2879
Basic non-ferrous metals	1.2679	0.1252	0.4756
Metal products excluding machinery	1.5522	0.3281	0.4367
Machinery & equipment	1.4285	0.2991	0.4679
Electrical machinery	1.5641	0.2607	0.3978
Television, radio & communication equipn	1.3571	0.2544	0.3866
Professional & scientific equipment	1.5402	0.2538	0.4789
Motor vehicles, parts & accessories	1.3101	0.1341	0.2318
Other transport equipment	1.4660	0.2539	0.3510
Furniture	1.8927	0.3418	0.4719
Other industries	1.6968	0.1861	0.6089
Electricity, gas & steam	1.1629	0.2898	0.8370
Water supply	1.5182	0.1701	0.6353
Construction	1.6553	0.1837	0.4580
Tertiary Sector	**1.3061**	**0.2723**	**0.5991**
Wholesale & retail trade	1.2744	0.2551	0.6155
Catering & accommodation services	1.6687	0.2209	0.7327
Transport & storage	1.2619	0.1778	0.5382
Communication	1.3947	0.1755	0.4812
Finance & insurance	1.1964	0.2551	0.5745
Business services	1.3948	0.2236	0.5684
Medical, dental & other health & veterinar	1.2013	0.1950	0.5932
Other community, social & personal servi	1.2089	0.4193	0.6581
Government	1.1540	0.5284	0.6303

Source: Quantec,2011

Figure 11 ranks the sectors according to their direct multiplier effect on employment. As in table 3 the sectors with higher employment multiplier effect are concentrated on tertiary and primary sectors.

Figure 11: Direct Employment Multiplier Effect per R1 million Final Demand, 2011



Source: Quantec,2011

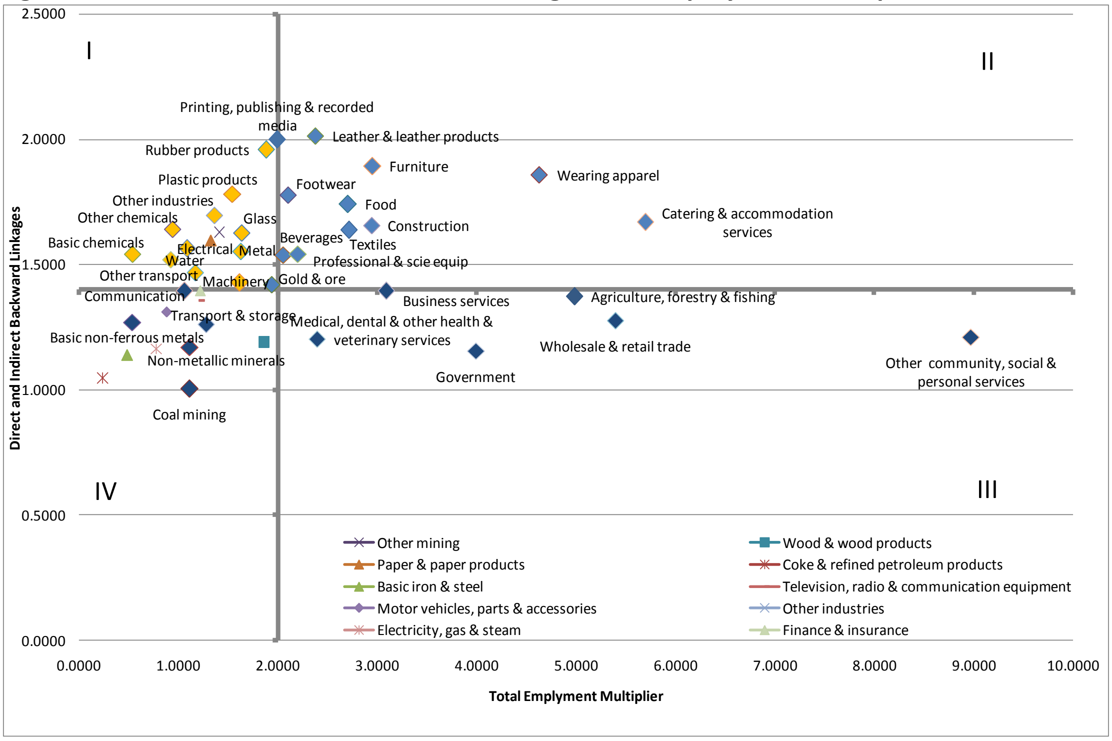
5.2 Potential Drivers of Growth and Employment in Mpumalanga

By analysing backward and forward linkage effects, the study observes few subsectors which may possibly warrant policy attention due to their strong backward as well as employment multipliers. This section will propose subsectors that may possible maximise backward linkages (and thus output) and employment linkages (and thus employment creation) by combining both the output and employment dimensions. Subsectors that maximise both dimensions may help to foster sustainable growth and employment creation.

Figure 12 depicts direct and indirect impact of both the output and employment as per R1 million increases in final demand. The figure shows the total backward linkages and employment dimension of each sector as a result of a R1 million changes in final demand. The vertical axes show the backward linkages while the horizontal axes depict employment multipliers. The 43 sectors in the Mpumalanga I-O Model were classified into four quadrants using the mean of the GDPR and employment multipliers. Sectors situated in the top right quadrant (II) reveal both above-average impacts on GDPR and employment in response to a unit change in final demand. Sectors in the top left quadrant (I) reveal an above – average impact on GDPR and a below-average impact on employment. Sectors in the bottom right quadrant (III) reveal a below-average impact on GDPR and above-average impact on employment. Sectors in the bottom left quadrant (IV) reveal both below-average impacts on GDPR and employment. On this basis sectors with strong backward linkages and employment multiplier can be identified.

This process enables the study to identify potential key sectors of the Mpumalanga economy. These are listed in table 4. The boundary of these quadrants should only act as a guide in terms of choice of key sectors. For this reason, sectors situated just outside the boundaries of the top right quadrant will be included in the list of potential growth drivers of the Mpumalanga economy and will be denoted with an*.

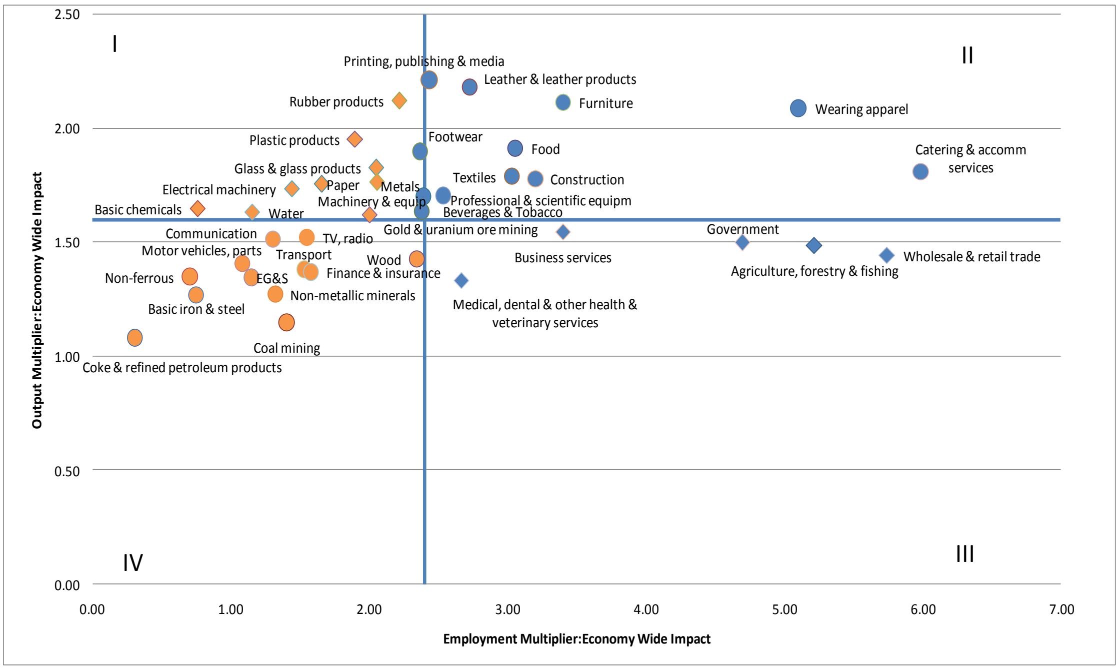
Figure 12: Direct and Indirect Backward Linkages and Employment Multipliers, 2011



Source: Quantec,2011

A notable feature in both figure 12 and 13 is the huge number of manufacturing industries in the quadrant IV. These sectors show weak value added and employment responses to a unit change in final demand. On both counts considered (Backward linkages and employment multipliers), these sectors will find it difficult to motivate industrial policy support. More importantly, service subsectors except catering and accommodation did not make the cut because they either have high employment absorption potential and low backward linkages.

Figure 13: Economy Wide Linkages and Employment Multipliers, 2011



Source: Quantec, 2011

Identified sectors with an above average impact on both backward linkages and employment include wearing apparel, leather & leather products, furniture, food, textiles, construction , professional & scientific equipment and catering and accommodation services are known to be relatively labour intensive. However, it must be emphasised that the task of picking winners does not begin and end here.

The results of this study provide just possibilities as the analysis is not informed by institutional setting which is in turn informed by the political economy from which these sectors arise. Therefore further research into the political economy both domestically and globally is necessary to either support or challenge the list that may be leveraged for growth and employment in the Mpumalanga economy.

Table 4: Potential Sectors for Policy Targeting Based on Backward Linkages and Employment Multipliers

1. Wearing Apparel	9. Footwear*
2. Leather & leather products	10. Printing, Publishing and Recorded me
3. Furniture	11. Beverages and Tobacco*
4. Food	12. Gold & Uranium ore mining*
5. Catering & Accommodation services	13. Machinery and Equipment*
6. Textiles	
7. Professional & Scientific equipment	
8. Construction	

6. Conclusion

The main objective of this study was to investigate the potential drivers of growth and employment in the province of Mpumalanga, using the I-O analysis. The analysis was undertaken at the relatively disaggregated level of industries. 43x43 sub-sectors were analysed.

This study is an attempt to empirically identify key sectors that can drive growth and employment in Mpumalanga. I-O analysis is widely used to analyse the structure of an economy by assessing how sectors are materially interconnected as a means to identify the economy's key sectors. The total significance of any sector in the economy can be estimated by examining the inter-industry linkage effects, i.e the effect of a one unit change in final demand on the level of production of each industry. The sector uses inputs from other industries in its production process. This reflects the sector's backward linkage. A sector may also supply inputs to other industries. This reflects the forward linkage of the sector with other industries to which it supplies inputs. Industries with large backward linkage and strong employment multipliers were identified as "Key" sectors.

The Regional Industrial Development Strategy (2011) asserts that the identification of regional opportunities for industrial development should be evidence-based and long-term in outlook. The Mpumalanga Government has expressed the policy aim through its MEGDP of shifting the Mpumalanga economy onto a new economic growth path (MEGDP,2011).

While the economic structure of the province has been dominated by the services sector, moving away from the productive sectors towards more tertiary sector over the 1995 to 2011 period, the results of this study show that the manufacturing sector including construction sector is critical in pulling up the overall economic growth and employment in the province. Table 4 provide a list of identified sectors of growth and employment in the province.

Noted on the list was that service subsectors except catering and accommodation displayed weak response to a one unit change in final demand interms of gross value addition in the economy. As Palma (2005) argues that growth in services largely concentrated in low value added, low pay personal services may have adverse consequences on future prospects for industrial development.

In summary, having analysed the various key subsectors, the report concludes that there is enough evidence to allow policy makers to make decisions which are aligned with the expansion of these subsectors. These subsectors generally, have increasing linkages with other sectors in the economy and most of them have the ability to absorb significant volumes of labour. Some of the sectors will also help alleviate the problem of unemployment amongst the unskilled because they tend to require less skilled labour market.

Therefore, these results may be used by policy makers in terms of which sectors of the economy to stimulate (for example, by means of creating extra final demand, decreasing taxes, or with the help of subsidizing) in order to gain better results in the sphere of economic development of Mpumalanga. However, it must be mentioned that, while useful, I-O analysis for the purpose of identifying key sectors, it has some limitations. Accordingly, the identification of key sectors would need to be further refined through supplementary methods such as value – chain analysis (Newman, 2010).

Reference List

Amores, A.F.(nd), Dynamics in Key sector Analysis. Department of Economics, Qualitative Methods and Economic History, Sevilla, Spain.

Baloyi,B, Pons-Vignon,N, Newman,S, Takala-Greenish, L, Gqwaru,U and Gwanoya,N (2009),Looking into South Africa's economic structure: Weak growth drivers and Need for industrialisation. Wits University, Johannesburg.

Bouwer, G. (2002), The Role of Supply and Use Tables in South Africa as a Tool for Economic Analysis, Statistics South Africa.

Cella, G. (1984), "The input–output measurement of interindustry linkages." *Oxford Bulletin of Economics and Statistics,* 46, pp. 73–84.

Chang, H. J. (2013), Presentation by Professor Chang at the dti Policy Economic Dialogue on the 3rd August 2013. Available at www.thedti.gov.za (thedti news letter to all editors and journals).

Chenery, H.B. (1975), "The Structuralist Approach to Development Policy". JSTOR: *The American Economic Review*, Vol.65, No.2, pp.310-316.

Chenery,H.B., and Watanabe,T.(1958), "International comparisons of the structure of production." *Econometrica* 26, 487-521.

Cuello, F.A. and Mansouri, F. (1992), "The identification of the structure at the sectoral level: are formulations of the Hirschman-Rasmussen key-sector indices." *Economic Systems Research*, 4 (4) 285-297.

CSID(2010), The Development of an Industrial Policy for Gauteng Province.Johannesburg: Wits University.

Desai, P. (1963). The development of the Indian economy. An exercise in economic planning. *Oxford Economic Papers,* 15(3):308-317.

Drejer, I. (2002), Input-Output Based Measures of Interindustry Linkages Revisited, paper presented at the 14th International Conference on Input-Output Techniques, Montreal, 10-15 October 2002.

Dobb, M. (1959), "An essay on economic growth and planning.*" London, Routledge & Kegan Paul.*

Eliasson, G. (1991), "Deregulation, innovative entry and structural diversity as a source of stable and rapid economic growth." *Journal of Evolutionary Economics, 1 (1), 49-63.*

Fuentes Flores, N.A.(2002), Matrices de Insumo-Producto de los estados fronterizos del norte deMéxico. Universidad Autónoma de Baja California, Plaza y Valdéz, México.

Fine, B. and Rustomjee, Z.(1997), South Africa's Political Economy: From Minerals Energy Complex to industrialisation, Johannesburg: Wits University Press.

Fine,B. and Rustomjee, Z. (1996) The Political Economy of South Africa: From Minerals Energy Complex to Industrialisation, Westview: Boulder, CO.

Fisher,R.A. and Pearson,K.(1935), "Statistical tests: A1935 Exchange from Nature." Available at http://www.jstor.org/stable/2685077.

Gereffi, G. (1994), "The Organization of Buyer-Driven Global Commodity Chains: How US Retailers Shape Overseas Production Networks." In G. Gereffi & M. Korzeniewicz (Eds.), *Commodity Chains and Global Capitalism* (pp. 95-122): Praeger Publishers.

Guo,J. and Planting,M.A.(2000), *Using Input-Output Analysis to Measure U.S. Economic Structural Change Over a 24 year period*. Macarata,Italy.

Hirschman, A.O (1958), *Interdependence and Industrialization, in The Strategy of Economic Development*, New Haven, Yale University Press.

Horowitz, K.J., and M.A. Planting. 2006 (updated 2009), *Concepts and Methods of the U.S. Input-Output Accounts.* Washington, D.C. Bureau of Economic Analysis, U.S. Department of Commerce.

IPAP (2013/14 – 2015/16), Available at www.the.gov.za

Kaldor, N. (1966), *Causes of the Slow Rate of Growth in the UK*, Cambridge University Press, London.

Keynes, J. M. (1936), The *General Theory of Employment, Interest and Money*. London:Mcmillan and Co., Ltd.

Klotsvog, F. (1980). "The use of input-output tables in planning." *Ekonomoka*, 1980(1):51-61.

Kuznetss, S. (1966), *Modern economic growth: rate, structure and spread*, New Haven, Yale University Press.

Laubscher, P. (2011), A Macro-Economics Assessment of the Western Cape economy's Sectoral and Industrial Growth Prospects: 2010 to 2015, including an assessment of inter-industry linkages available at www.westerncape.gov.za.

Leontief, W.(1986), *Input-Output Analysis in developing economics*, Second edition. Oxford University Press, Inc. New York.

Lewis, W.A. (1954), "Economic Development with unlimited suppliers of labour." *The Manchester School of Economic and Social Studies* 22(2):1-39.

McGilvray,J.(1977), Linkages, key sectors and development strategy, in Leontief, W. (ed), *Structure,System and Economic Policy*, pp.49-56. Cambridge University Press, Cambridge.

Miernyk,W. H. (1965), *The Elements of Input- Output Analysis*, Random House, Inc., New York.

Miller, R.E. and Blair, P.D.(1985), *Input-Output Analysis: Foundations and Extensions*. Englewood Cliffs, New Jersey: Prentice-Hall.

Mohamed, S. (2010), "The State of the South African Economy," R. Southall, D. Pillay, P. Naidoo and J. Daniel, *New South African Review 1: Development or Decline*, Wits University Press, Johannesburg.

Mpumalanga Provincial Government, 2011. Final Draft Mpumalanga Economic Growth & Development Path (2011) Available on www.mpg.gov.za.

Mpumalanga Economic Review and Outlook (PERO), 2011 Available on www.mpg.gov.za.

Mpumalanga Socio-Economic Review and Outlook(SERO), 2010 Available on www.mpg.gov.za.

Na-Allah, A.(2011), "Determinants of Industrial Embeddedness. Evidence from African Manufacturing Firms." Working Paper No.2011/08, UNU-WIDER.

Newman,S, Baloyi,B., and Ncube,P(2010), A new growth path for South African industrialisation: An input-output analysis. Unpublished CSID Document. Wits University Press, Johannesburg

Palma, G. (2005), "Four Sources of 'De-Industrialisation' and a New Concept of the 'Dutch Disease," *in* Ocampo, J.A., *Beyond Reforms: Structural Dynamics and Macroeconomic Vulnerability*, Stanford: Stanford University Press and World Bank.

Pecherskykh, N.A.(2011), Political Economy Interests in the Kern Input-Output Analysis. Paper presented at the 20th IIOA Conference in Bratislava, Slovakia.

Porter, M. (1990), *The Competitive Advantage of Nations*. London: MacMillan.

Quantec (2011), South African Standard Industrial Database. Pretoria: Quantec Research.

Rasmussen, P. N.(1956), *Studies in Intersectoral Relations* (Amsterdam: North-Holland PublishingCo.

Rigional Industrial Development Plan (2012). Available at www.thedti.gov.za

Rose, A and Miernyk, W. (1989), "Input-Output Analysis: The first fifty years, Economic Systems Research," *Journal of the International Input-Output Association*. Volume1, Number 2, 1989.

Rosesnstein, R and Paul, N. (1943). "Problems of Industrialisation of Eastern and South – Eastern Europe," *The Economic Journal* 53 (210/211): 202-11.

Samuelson, P.A.(1951), "Abstract of Theorem Concerning Substitutability in Open Leontief Model." In T.C. Koopmans(ed.). *Activity Analysis in Production and Allocation,* Londres: John Wiley and Sons,Ltd.

Schumpeter, J. (1912), "The Theory of Economic Development. Mexico." *Fondo de Cultura Económica.* (4th ed. 1968 in Spanish of the 1st ed. 1934 American Ed.).

SIMS (2011), Maximising the developmental impact of the people`s mineral assets: State Intervention in the Minerals Sector, Report prepared for the ANC Policy Institute, February [available from www.anc.org.za].

Sonis, M., Guilhoto, J., Hewings, G., and Martins, E.(1995), "Linkages,key sectors and structural change: some new perspectives." *Developing Economies* 23,233-270.

Statistics South Africa (2011): National Accounts, Statistical release P0441 on Gross Domestic Product, annual estimates 2002 – 2010.

Stilwell, L.C., and Minnitt, R.C.A. (2000), "Input-output analysis: its potential application to the mining industry." *The journal of the South African Institute of Mining and Metallurgy.*

System of National Accounts, SNA (1993), Commission of the European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, World Bank, Brussels/Luxembourg, New York, Paris, Washington D. C.

System of National Accounts, SNA (2008). Pre-edited version 1. Commission of the European Communities, International Monetary Fund, Organisation for Economic Cooperation and Development, United Nations and World Bank.

Temurshoev, U. (2004),Key sectors in the Kyrgyzstan Economy, discussion paper No. 2004, Charles university.

Todaro, M.P. (2000), *Economic Development* (7thed). Addison Wesley Longman,inc. New York University. New York, England.

United States Bureau of Economic Analysis (2009). Concepts and methods of the US I-O accounts.

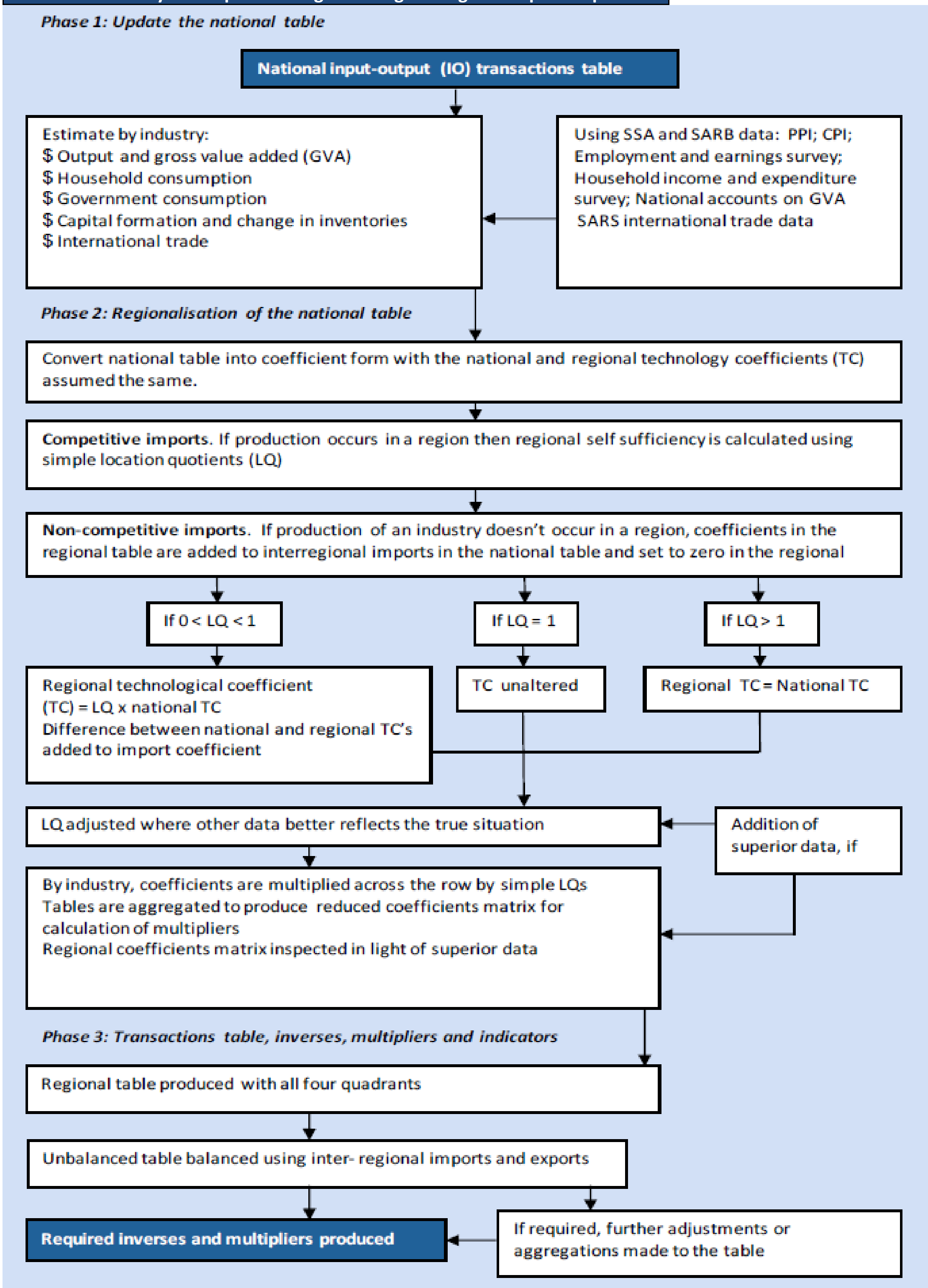
Van Seventer, D.E.N.(1999), "The Estimation of a System of Provincial Input-Output Tables for South Africa". *J.Stud.Econ.Econometrics*,1999,23(2).

Verdoorn, P.J.(1949), “Fattori che regolano lo sviluppo della produttivita del lavoro.” *L’Industria***,** 1, pp. 3-10.

Waterston, A. (1970), “A hard look at development planning.” *Economic Development: Readings in theory and practice (ed)* Morgan, T. and Betz, G. W. California, Wadsworth Publishing Company

Appendix A

Table A1: Summary of the process of generating the regional input-output table



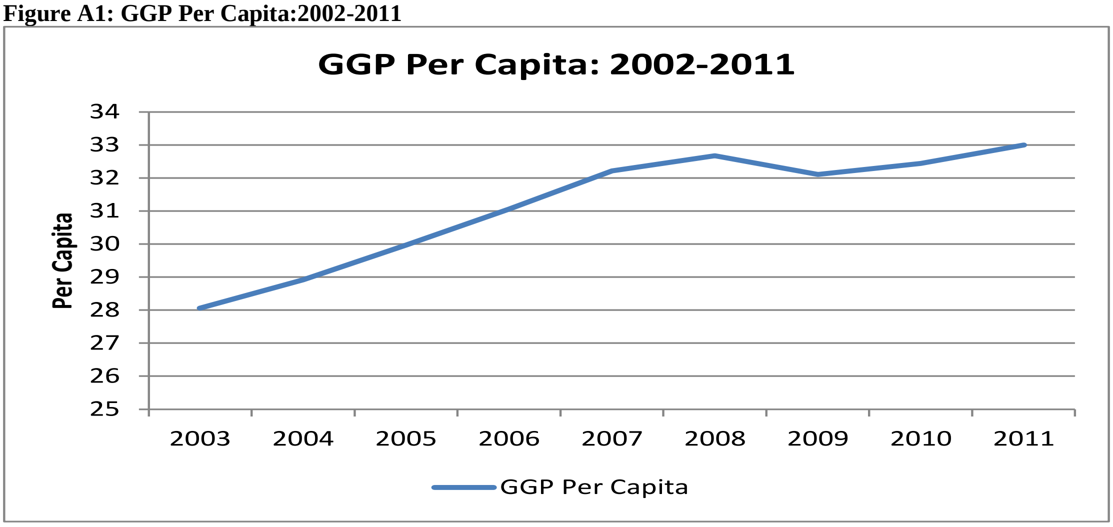
Appendix B

Table A2: GGP at Constant 2005 prices-percentage changes

GGP at Constant 2005 prices - percentage changes										
Province	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Western Cape	0.7	3.4	5.7	5.9	5.9	6.2	4.3	-1.3	2.7	3.6
Eastern Cape	1.6	2.6	3.6	4.9	5.4	5.4	3.7	-1.1	2.4	3.4
Northern Cape	1.4	3.6	2.5	3.6	4.1	3.9	1.7	-3.2	2.4	2.2
Free State	4.0	2.2	4.0	4.2	4.5	4.5	3.1	-2.1	2.3	2.5
KwaZulu-Natal	2.5	2.7	4.5	5.8	5.5	5.9	4.0	-1.5	3.5	3.6
North West	1.3	4.1	3.5	5.1	4.5	4.2	2.2	-2.6	2.9	2.7
Gauteng	5.0	2.9	5.2	5.5	6.4	6.0	4.0	-1.3	3.5	4.0
Mpumalanga	2.2	2.8	4.1	4.6	4.6	4.7	2.3	-1.7	2.7	2.5
Limpopo	4.4	2.4	3.1	4.3	4.8	4.5	2.6	-1.7	2.6	2.2
GDPR at market prices	**3.7**	**2.9**	**4.6**	**5.3**	**5.6**	**5.5**	**3.6**	**-1.5**	**3.1**	**3.5**

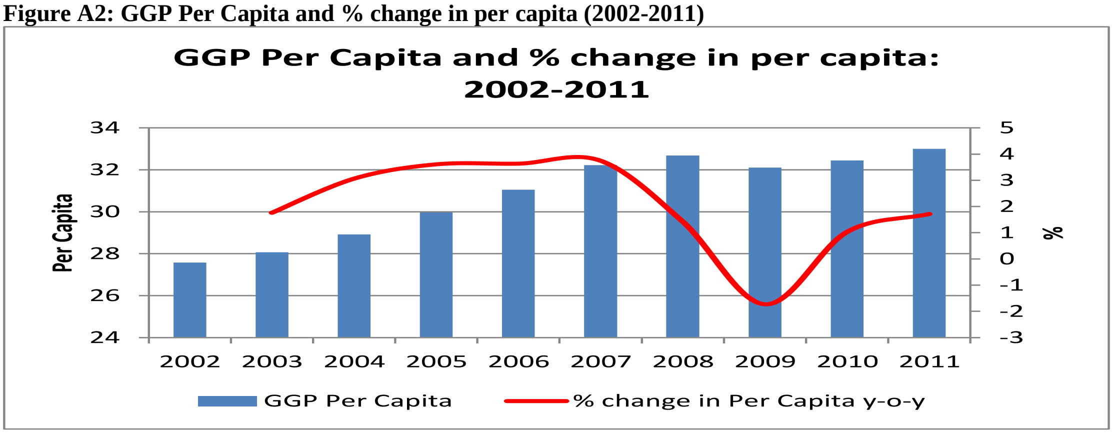
StatsSA,2012

Figure A1: GGP Per Capita:2002-2011



Quantec,2011

Figure A2: GGP Per Capita and % change in per capita (2002-2011)



Quantec,2011

Table A3: Technical coefficients

	Backward Linkage coefficients		forward Linkage coefficients	
	Provincial economy	Rest of the economy	Provincial economy	Rest of the economy
Agriculture, forestry & fishing	0.27	0.82	1.21	1.42
Coal mining	0.00	0.77	0.27	0.90
Gold & uranium ore mining	0.34	0.80	0.15	0.38
Other mining	0.50	0.93	0.67	0.83
Food	0.52	0.87	0.92	1.64
Beverages & Tobacco	0.37	0.83	0.13	0.36
Textiles	0.47	0.77	0.15	0.19
Wearing apparel	0.63	0.95	0.00	0.01
Leather & leather products	0.62	0.90	0.04	0.04
Footwear	0.54	0.65	0.00	0.00
Wood & wood products	0.15	0.64	0.75	0.82
Paper & paper products	0.41	0.80	0.83	1.22
Printing, publishing & recorded media	0.67	0.90	0.00	0.05
Coke & refined petroleum products	0.04	0.82	0.84	1.55
Basic chemicals	0.37	0.86	0.95	1.06
Other chemicals & man-made fibres	0.46	0.84	0.33	0.53
Rubber products	0.71	0.98	0.01	0.05
Plastic products	0.55	0.78	0.03	0.05
Glass & glass products	0.44	0.84	0.05	0.05
Non-metallic minerals	0.12	0.82	0.12	0.16
Basic iron & steel	0.11	0.71	0.94	1.07
Basic non-ferrous metals	0.21	0.88	0.56	0.63
Metal products excluding machinery	0.46	0.86	0.31	0.45
Machinery & equipment	0.34	0.90	0.03	0.08
Electrical machinery	0.44	0.81	0.12	0.22
Television, radio & communication equipment	0.27	0.84	0.01	0.03
Professional & scientific equipment	0.41	0.85	0.00	0.01
Motor vehicles, parts & accessories	0.24	0.59	0.00	0.17
Other transport equipment	0.37	0.77	0.00	0.01
Furniture	0.72	0.96	0.00	0.04
Other industries	0.47	0.97	0.01	0.07
Electricity, gas & steam	0.15	0.93	1.26	1.96
Water supply	0.37	0.80	0.30	0.38
Construction	0.50	0.79	0.03	0.36
Wholesale & retail trade	0.21	0.73	1.58	2.90
Catering & accommodation services	0.45	0.94	0.01	0.06
Transport & storage	0.23	0.75	1.43	2.23
Communication	0.31	0.74	0.13	0.24
Finance & insurance	0.15	0.65	0.12	0.28
Business services	0.30	0.74	0.50	1.10
Medical, dental & other health & veterinary services	0.15	0.73	0.08	0.65
Other community, social & personal services	0.16	0.77	0.44	1.31
Government	0.12	0.72	0.02	0.18

Table A4: Output Multipliers

	Output/ sales at basic value per R1 million final demand						
	Initial Impact	First Round	Direct Impact	Indirect Effect	Direct and Indirect Impact	Induced Impact	Economy-wide Impact
Agriculture, forestry & fishing	1.0000	0.2655	1.2655	0.1076	1.3731	0.1126	1.4857
Coal mining	1.0000	0.0014	1.0014	0.0031	1.0045	0.1437	1.1481
Gold & uranium ore mining	1.0000	0.3394	1.3394	0.0808	1.4202	0.2162	1.6364
Other mining	1.0000	0.5010	1.5010	0.1280	1.6290	0.1385	1.7675
Food	1.0000	0.5171	1.5171	0.2238	1.7409	0.1723	1.9132
Beverages & Tobacco	1.0000	0.3696	1.3696	0.1664	1.5360	0.1663	1.7023
Textiles	1.0000	0.4658	1.4658	0.1723	1.6380	0.1517	1.7897
Wearing apparel	1.0000	0.6272	1.6272	0.2293	1.8565	0.2324	2.0889
Leather & leather products	1.0000	0.6249	1.6249	0.3882	2.0131	0.1698	2.1829
Footwear	1.0000	0.5361	1.5361	0.2393	1.7754	0.1241	1.8995
Wood & wood products	1.0000	0.1530	1.1530	0.0391	1.1921	0.2360	1.4281
Paper & paper products	1.0000	0.4147	1.4147	0.1816	1.5964	0.1603	1.7567
Printing, publishing & recorded media	1.0000	0.6697	1.6697	0.3299	1.9995	0.2136	2.2131
Coke & refined petroleum products	1.0000	0.0374	1.0374	0.0111	1.0485	0.0337	1.0822
Basic chemicals	1.0000	0.3719	1.3719	0.1696	1.5414	0.1077	1.6492
Other chemicals & man-made fibres	1.0000	0.4598	1.4598	0.1805	1.6404	0.1564	1.7968
Rubber products	1.0000	0.7095	1.7095	0.2489	1.9584	0.1629	2.1213
Plastic products	1.0000	0.5484	1.5484	0.2318	1.7802	0.1732	1.9534
Glass & glass products	1.0000	0.4427	1.4427	0.1826	1.6253	0.2031	1.8285
Non-metallic minerals	1.0000	0.1223	1.1223	0.0472	1.1695	0.1036	1.2731
Basic iron & steel	1.0000	0.1138	1.1138	0.0263	1.1402	0.1298	1.2699
Basic non-ferrous metals	1.0000	0.2137	1.2137	0.0542	1.2679	0.0821	1.3500
Metal products excluding machinery	1.0000	0.4556	1.4556	0.0966	1.5522	0.2122	1.7644
Machinery & equipment	1.0000	0.3442	1.3442	0.0844	1.4285	0.1919	1.6204
Electrical machinery	1.0000	0.4416	1.4416	0.1225	1.5641	0.1718	1.7360
Television, radio & communication equipment	1.0000	0.2731	1.2731	0.0840	1.3571	0.1655	1.5225
Professional & scientific equipment	1.0000	0.4074	1.4074	0.1328	1.5402	0.1653	1.7055
Motor vehicles, parts & accessories	1.0000	0.2372	1.2372	0.0729	1.3101	0.0965	1.4066
Other transport equipment	1.0000	0.3724	1.3724	0.0937	1.4660	0.1698	1.6358
Furniture	1.0000	0.7153	1.7153	0.1774	1.8927	0.2214	2.1141
Other industries	1.0000	0.4732	1.4732	0.2236	1.6968	0.1200	1.8168
Electricity, gas & steam	1.0000	0.1542	1.1542	0.0087	1.1629	0.1829	1.3458
Water supply	1.0000	0.3700	1.3700	0.1482	1.5182	0.1133	1.6315
Construction	1.0000	0.4961	1.4961	0.1592	1.6553	0.1246	1.7799
Wholesale & retail trade	1.0000	0.2097	1.2097	0.0647	1.2744	0.1692	1.4436
Catering & accommodation services	1.0000	0.4530	1.4530	0.2157	1.6687	0.1424	1.8111
Transport & storage	1.0000	0.2273	1.2273	0.0346	1.2619	0.1201	1.3820
Communication	1.0000	0.3145	1.3145	0.0802	1.3947	0.1189	1.5136
Finance & insurance	1.0000	0.1510	1.1510	0.0454	1.1964	0.1736	1.3699
Business services	1.0000	0.3046	1.3046	0.0902	1.3948	0.1500	1.5448
Medical, dental & other health & veterinary services	1.0000	0.1533	1.1533	0.0480	1.2013	0.1314	1.3326
Other community, social & personal services	1.0000	0.1563	1.1563	0.0527	1.2089	0.2686	1.4776
Government	1.0000	0.1206	1.1206	0.0334	1.1540	0.3457	1.4997

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Table A5: Employment Multipliers

Employment Total Number per R1 million final demand							Employment Highly Skilled per R1 million final demand						
Initial Impact	First Round	Direct Impact	Indirect Effect	Direct and Indirect Impact	Induced Impact	Economy-wide Impact	Initial Impact	First Round	Direct Impact	Indirect Effect	Direct and Indirect Impact	Induced Impact	Economy-wide Impact
4.4871	0.2925	4.7796	0.2063	4.9859	0.2308	5.2167	0.1260	0.0229	0.1488	0.0103	0.1591	0.0178	0.1769
1.0838	0.3287	1.4125	0.0765	1.4890	0.3386	1.8276	0.0580	0.0284	0.0864	0.0073	0.0937	0.0259	0.1196
0.6837	0.7438	1.4275	0.2327	1.6602	0.3252	1.9854	0.0608	0.0437	0.1044	0.0153	0.1197	0.0250	0.1447
0.5835	0.2054	0.7889	0.0632	0.8521	0.3011	1.1532	0.1863	0.0390	0.2253	0.0113	0.2365	0.0230	0.2595
2.1367	0.6144	2.7511	0.1944	2.9455	0.2568	3.2023	0.0621	0.0445	0.1066	0.0149	0.1215	0.0199	0.1414
3.1693	0.3843	3.5536	0.1268	3.6804	0.3684	4.0489	0.4191	0.0408	0.4599	0.0087	0.4686	0.0283	0.4970
2.0240	**0.4282**	**2.4522**	**0.1500**	**2.6022**	**0.3035**	**2.9057**	**0.1520**	**0.0365**	**0.1886**	**0.0113**	**0.1999**	**0.0233**	**0.2232**

Employment Skilled per R1 million final demand							Employment Unskilled per R1 million final demand							Employment Informal per R1 million final demand						
Initial Impact	First Round	Direct Impact	Indirect Effect	Direct and Indirect Impact	Induced Impact	Economy-wide Impact	Initial Impact	First Round	Direct Impact	Indirect Effect	Direct and Indirect Impact	Induced Impact	Economy-wide Impact	Initial Impact	First Round	Direct Impact	Indirect Effect	Direct and Indirect Impact	Induced Impact	Economy-wide Impact
0.2033	0.0640	0.2673	0.0279	0.2951	0.0474	0.3425	3.2921	0.1252	3.4174	0.1201	3.5374	0.1016	3.6390	0.8658	0.0804	0.9461	0.0481	0.9942	0.0641	1.0583
0.2090	0.0876	0.2966	0.0219	0.3184	0.0684	0.3869	0.8168	0.0970	0.9138	0.0270	0.9408	0.1506	1.0915	0.0000	0.1157	0.1157	0.0204	0.1361	0.0936	0.2297
0.1493	0.1573	0.3066	0.0467	0.3534	0.0663	0.4197	0.3162	0.3172	0.6334	0.1086	0.7420	0.1438	0.8858	0.1575	0.2256	0.3831	0.0621	0.4452	0.0901	0.5353
0.1976	0.0674	0.2651	0.0200	0.2851	0.0605	0.3455	0.1668	0.0783	0.2451	0.0217	0.2668	0.1346	0.4014	0.0328	0.0207	0.0535	0.0102	0.0637	0.0831	0.1468
0.1926	0.1620	0.3546	0.0516	0.4061	0.0534	0.4595	0.7310	0.1997	0.9307	0.0661	0.9969	0.1120	1.1089	1.1511	0.2082	1.3593	0.0617	1.4210	0.0715	1.4926
1.0272	0.1184	1.1456	0.0256	1.1712	0.0753	1.2465	0.8855	0.0952	0.9807	0.0586	1.0393	0.1627	1.2020	0.8375	0.1300	0.9674	0.0339	1.0013	0.1022	1.1035
0.3298	**0.1095**	**0.4393**	**0.0323**	**0.4716**	**0.0619**	**0.5334**	**1.0347**	**0.1521**	**1.1868**	**0.0670**	**1.2539**	**0.1342**	**1.3881**	**0.5074**	**0.1301**	**0.6375**	**0.0394**	**0.6769**	**0.0841**	**0.7610**

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