

Human capital constraints in South Africa: A firm level analysis

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Abstract

This study examines human capital constraints in the South African economy, and the austerity these constraints have on firms in the country. The first part of the study identifies the main human capital constraints facing South Africa, and explains how these constraints influence an economy. An inadequately educated workforce along with restrictive labour regulations makes out the central components of these constraints. The second part explores all the relevant constraints individually, and determines the cause of their existence. The final part of this study consists of a firm level analysis that describes human capital constraints experienced by firms in South Africa. Regression analysis examines the determinants of increased output per worker in manufacturing firms. These determinants also indicate the cause of growth in output per worker. Human capital aspects such as education, labour regulation, compensation and competition are all shown to have a considerable influence on output per worker. Principal Component Analysis (PCA) on the explanatory variables achieved similar results. For this analysis, latent variables that incorporated education, training, region and Sector Education Training Authority (SETA) support and effectiveness explained the highest percentage of the total variance. However, this study found no evidence to suggest that human capital development initiatives like training programmes and SETA support have a positive relationship with increased levels of productivity.

Key words:

Human capital constraints, technological innovation, determinants of output per worker, survey analysis, regression analysis, South Africa.

Opsomming

Hierdie studie stel ondersoek in na beperkings in menslike kapitaal in die Suid-Afrikaanse ekonomie, en die impak wat dit op ondernemings in die land het. Die eerste deel van die studie identifiseer die mees algemene menslike kapitaal-beperkings, asook die rede vir hul bestaan. Hierdie beperkinge sluit in oortollige arbeids- mark wetgewing asook η swak opgeleide werksmag. Die finale deel van hierdie studie bestaan uit η ondernemings vlak analise wat menslike kapitaal-beperkings soos wat ondernemings dit ervaar, bespreek. η Dinamiese kruis-snit data regressie model word gebruik om maatstawwe van verhoogde uitset per werker in die vervaardigings sektor te bepaal. Die resultate toon dat verhoogde uitset per werker bepaal word deur die vlak van onderrig, arbeids- mark beperkings, vergoeding en kompetisie. Hierdie veranderlikes het η beduidende verband met die afhanklike veranderlike. η Prinsipaal Komponent Analise (PKA) bevestig ook die resultate verkry in die regressie-analise. Resultate vir hierdie analise toon dat ondeliggende veranderlikes wat onderrig, opleiding, ligging en owerheids ondersteuning en effektiwiteit insluit die grootste deel van die totale variansie bepaal. Die studie bevind ook verder dat menslike kapitaal ontwikkeling in die vorm van opleiding en owerheids ondersteuning geen beduidende invloed op produktiwiteit het nie.

Sleutelwoorde:

Menslike kapitaal-beperkings, tegnologiese innovasie, determinante van verhoogde uitset per werker, regressie-analise, Suid-Afrika.

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List of abbreviations

ANOVA	Analysis of Variance
BCEA	Basic Conditions of Employment Act
CCMA	Commission for Conciliation, Mediation and Arbitration
CIPRO	Companies and Intellectual property Registration Office
CLRM	Classical Linear Regression Model
COIDA	Compensations for Occupational Injury and Disease Act
DoE	Department of Education
DTI	Department of Trade and Industry
EEA	Equal Equity Act
GEAR	Growth Employment and Redistribution
IDZ	Industrial Development Act
LRA	Labour Relations Act
LBSC	Local Business Support Centres
MAC	Manufacturing Advice Centres
MBA	Masters of Business Administration
MHSA	Mine health and Safety Act
NAPTOSA	National Professional Teachers Organisation of South Africa
NBF	National Bargaining forum
NEDLAC	National Education Development and Labour Council
NLRA	New Labour Relations Act
NQF	National Qualification Framework
OBA	Outcome Based Assessment
OBE	Outcome Based Education
OECD	Organisation for Economic Co-operation and Development
ODMWA	Occupational Disease in Mines and Works Act
OHSA	Occupational Health and Safety Act
OLS	Ordinary Least Squares
PCA	Principal Component Analysis
SABS	South African Bureau of Standards
SACMEQ	Southern and Eastern African Consortium for Monitoring Educational Quality

SADTU	South African Democratic Teachers Union
SAIRR	South African Institute for Race Relations
SAO	Suid-Afrikaanse Onderwys Unie
SETA	Sector Education and Training Authority
SDA	Skills development Act
SDLA	Skills Development Levies Act
SMME	Small, Medium and Micro Enterprise
TAC	Tender Advisory Centre
TFP	Total Factor Productivity
TIMSS-R	Third International Mathematics and Science Study Report
UIA	Unemployment Insurance Act
VIF	Variance Inflation Factor

CHAPTER 1

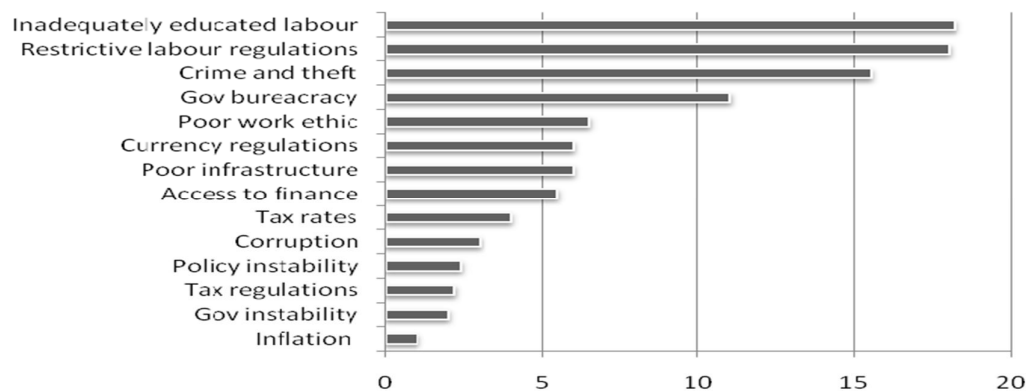
INTRODUCTION

1.1 Introduction

On 17 February 2010, the minister of finance allocated R165.1 billion to education in South Africa's annual budget. This is 10.9 per cent more than the previous year, and 18.3 per cent of the total national budget (National Treasury, 2010:2). Since 1998 the government has shown commitment to improve human resources in the country, and investment on education has since received more funding than any other function in government (National Treasury, 1998:11). From a distance one would assume that education in Africa's largest economy is in a healthy state. Budget allocations in the region of 20 per cent for the past decade and an increasing primary enrolment rate bode well for the ruling party. Along with increased allocations the Department of Education (DoE) also introduced a new outcome based education (OBE) curriculum in 1998, called Curriculum 2005 (Meyer *et al.*, 2010:4).

The Global Competitiveness Report (Figure 1) reveals that an inadequately educated workforce and restrictive labour regulations are the biggest threats to South Africa's competitiveness (World Economic Forum, 2006:334). Out of 117 countries in the report South Africa's primary education is ranked 103rd, while the overall country rank is 45th. Findings in more recent reports illustrate similar results, but none as comprehensive as the 2006 report (also see World Economic Forum, 2010-2011).

Figure 1: South African competitiveness constraints



Source: World Economic Forum, 2006:334.

The Third International Mathematics and Science Study Report (TIMSS-R) pointed out the complete lack of learner competitiveness in South Africa. The report indicates that grade 8 learners in South Africa scored on average 44 per cent below the mean scores in mathematics and science (Muller, 2004:238). Muller (2004:234) states that a pilot study conducted in 2002 revealed mean scores of 30 per cent for numeracy and literacy among grade 3 learners. A second study conducted in 2007 revealed a small improvement in 36 and 35 per cent for literacy and numeracy respectively. The Southern and Eastern African Consortium for Monitoring Education Quality (SAQMEQ) published a report in 2005, which found that South African learners displayed lower levels of literacy than most other African learners in the study. South African learners came ninth out of thirteen African participants (Barry & Taylor, 2006:2).

Edward and Alves (2006:473) found that the complexity of South African exports are mediocre compared to other similar developing countries. South African exports continue to focus on primary resource-based goods, and the manufacturing of value-added goods is relatively low compared to other developing economies. The problem here is that these resource-based goods are experiencing a decreasing share of world markets.

Fedderke (2006:26) states that there is a declining contribution from human capital accumulation towards economic growth, and that education plays a major role in this phenomenon. Fedderke (2005:38) states that human capital both influence and determine institutions of society, and that these institutions determine the long-run Total Factor Productivity (TFP) of a country. While in thriving developing economies such as, Hong Kong, Korea and the Czech Republic education seems to be contributing to economic development. In these countries mathematics and science scores are among the best in the world, and competitiveness in these countries is on the rise (World Economic Forum, 2006:262).

The neo-classical growth model (Solow growth model) also states that output is determined by technology, capital and labour (Colander & Gamber, 2002:129). This proves that human capital (labour) and technological progress have an influence on the economy in the long-run. Colander and Gamber (2002:151) explain that the

convergence hypothesis states that countries should converge to equal incomes per person over time. This phenomenon is evident in some developing countries as well as the above mentioned countries. The problem here is that South Africa's convergence to higher income is taking place at a slow speed, and improved education and training seems to be necessary to improve human capital in the country.

1.2 Problem statement

The reason for South Africa's low level of competitiveness and lack of convergence to higher growth is the country's under-achieving human capital. The quality of human capital as well as labour market distortions has a severe impact on the South African economy. The motivation for this study is to examine these constraints on a firm level, and to possibly gain insight into how human capital can be improved. It is this improvement in human capital that should assist the country to increase its level of competitiveness and converge to higher levels of income.

1.3 Objectives

One primary objective and four secondary objectives have been identified for this research study.

1.3.1 Primary objective

The primary objective of this study is to gain understanding of how human capital influences long-term growth in the South African economy. The influence that human capital constraints have on firms within South Africa will also receive attention, and will make out the empirical part of the study.

1.3.2 Secondary objectives

The following four secondary objectives will support the attainment of the primary objective. These objectives will also receive attention throughout the seven chapters of this study. The secondary objectives are to:

determine the importance of education in human capital formation.
discuss current labour market distortions in South Africa.
highlight human capital development and export complexity in South Africa.
determine the extent of human capital constraints among manufacturing firms in the South African economy.

1.4 Research method

The method of the study may be categorised as: a literature study and empirical analysis on firm level data in South Africa.

1.4.1 Literature study

A literature study will be compiled on the relevant areas of the study. This is done to provide better insight into the theory of the research problem, and to give a reasonable background of the problem. Most sources are research reports and articles from accredited academic journals that were published by international, as well as national institutions or departments. These institutions include the World Bank, United Nations (UN), and several national authorities. Other data sources include reports and releases from consortiums and groups specialising in certain fields, such as education, competitiveness and labour regulations.

1.4.2 Empirical investigation

Reviewing existing international empirical evidence on the relationship between human capital and economic growth will make out the empirical investigation. Data from an enterprise survey (World Bank, 2008) will be analysed to make conclusions on the relationship between human capital constraints and manufacturing output in South Africa.

1.5 Layout of the study

Chapter 1 will include an introduction, problem statement, objectives and explanation of the study method. Chapter 2 will explore the importance of human capital

development in economic growth. In Chapter 3 the importance of education on human capital will be examined. Chapter 4 will focus on labour market distortions in the South African economy. Chapter 5 will examine various national initiatives to promote human capital development as well as the complexity of South African exports. Chapter 6 will contain an analysis of enterprise survey data. In Chapter 7, regression analysis will summarise the survey results and concluding remarks will highlight the various findings of the study in Chapter 8.

CHAPTER 2

EXPLAINING ECONOMIC GROWTH

The motive behind human capital development is increased output and productivity. Firms and countries invest in this form of capital to ensure that their workforce is able to produce in greater quantity and quality. This chapter will explain the role human capital, in the form of technological innovation, has on national economies. This will be done to demonstrate that human capital development plays a pivotal role in economic development as well as economic growth. The idea of convergence is introduced in the first part of the chapter followed by the neo-classical growth model and empirical evidence. A summary will conclude the findings of this chapter, and explain how this chapter fits in with the rest of the study.

According to Colander and Gamber (2002: 151), the convergence hypothesis states that income per person in poor countries will eventually catch up to that of rich countries. In the subsequent chapter, Colander and Gamber suggest that one should go beyond the basic Solow growth model in order to explain this phenomenon. Due to the fact that all poor countries have not experienced this movement towards convergence, economic theory leaves one with the conditional convergence hypothesis. This states that the income per person will eventually converge to similar levels only if the countries share similar attributes (Colander & Gamber, 2002:157). Before accepting the theory of conditional convergence, one should consider the neo-classical growth model (Solow growth model). Due to the shortcomings in this model one will have to go beyond this model, to ultimately determine the causes of growth in an economy.

2.1 The Solow production function

The Solow production function explains the reasoning behind the Solow growth model. This model is a basic approach that explains the mechanisms involved in economic growth. The model assumes constant returns to scale and diminishing marginal product for capital and labour (Colander & Gamber, 2002:129). This neo-

classical production function represents the technological relationship between the input factors of labour and capital goods in the production process, relative to the production output (Koutsoyiannis, 1991:95). This relationship can be represented as:

$$Y=A \cdot F(K,L) \quad (2-1)$$

Where Y= Output

A= Technology

K= Capital

L= Labour

(Solow, 1956:66)

The model may go further and divides equation (2-1) by L (Labour = population) to derive the per person function in equation (2-3).

$$Y/L=A \cdot F(K/L,1) \quad (2-2)$$

Dividing output (Y) by labour (L) gives one output per person (y). Dividing capital (K) by labour (L) gives one capital per worker (k). Labour per worker equals one due to the fact that labour (L) divided by labour (L) equals one. The per person production function states that output per person is determined by capital per person and technological innovation as seen in equation (2-3). Technological innovation per person is specified by (A), this is due to the fact that technology is viewed as an exogenous variable in the model (Cowell, 2006:129). The model also assumes that technological innovation is equally distributed between countries.

$$y=A \cdot f(k) \quad (2-3)$$

Equation (2-3) indicates that the production function is a per person production function, also called a per capita production function. Forces that influence the model include savings (S), investment (I), population growth and depreciation. Both savings and investment increase capital per person because they are constant fractions of income. Population growth and depreciation decreases the quantity invested, and thus decreases the capital stock as well as the capital stock per person.

To account for savings and investment, the model sets investment (I) equal to savings (S). Due to the fact that savings and investment are both fractions of income, they are also equal to a fraction of output (α indicates a constant fraction).

$$I=S=\alpha Y \quad (2-4)$$

Dividing the above equation by labour (L) gives the per person relationships of investment (i) and savings (s) as seen in equation (2-5).

$$i=\alpha[A \cdot f(k)] \quad (2-5)$$

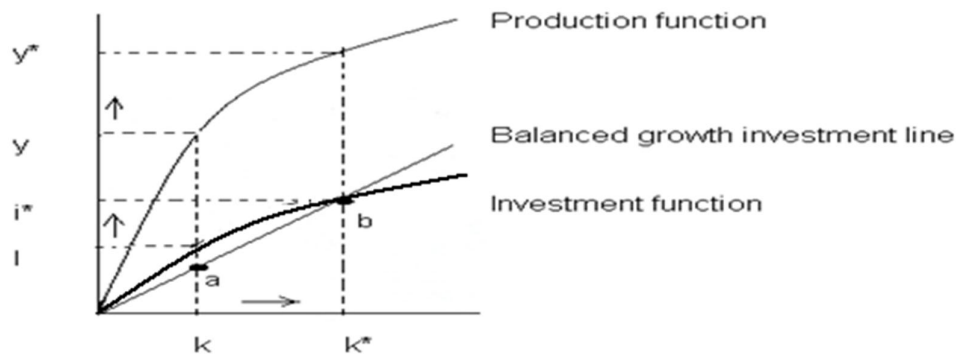
The balanced growth investment line indicates the amount of investment needed to keep the level of capital per person constant. This amount is also just sufficient to cover depreciation and population growth (Colander & Gamber, 2002:131). The balanced growth investment equation is also a per person equation where population growth (n) and depreciation (d) serve as a slope for capital per person. This can be seen in equation (2-6).

$$i=(n+d)k \quad (2-6)$$

Equilibrium or steady state in the Solow growth model occurs where the investment function intersects the balanced growth investment line. The model is graphically represented by means of three lines: the production function $y=A \cdot f(k)$, the balanced growth investment line $i=(n+d)k$ and the investment function $i=\alpha[A \cdot f(k)]$. These lines represent equations (2-3), (2-6) and (2-5) respectively.

This implies that if an economy is not at steady state (point (a) in Figure 2), extra investment will cause the level of capital per person to rise (Pindyck & Rubinfeld, 2008:198). This increase in investment will continue until the investment function intersects the balanced growth investment line, and steady state is achieved at point (b). At the steady state level there will be no more changes in capital, output or investment per person.

Figure 2: Steady state equilibrium



Source: constructed from Solow, 1956:78.

This is shown in Figure 2 as k moves to k^* , with (k^*) indicating capital per person at steady state. In this instance output and investment per person also increase to their respective steady state (*) values.

2.1.1 Implications of the Solow model

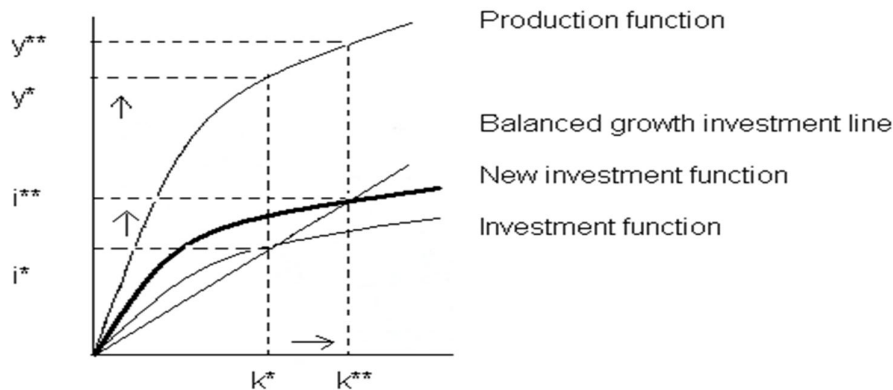
There are three implications in the Solow growth model. Each implication causes certain movements in capital, investment and output per person. The following section will explain these movements.

- **Increase in the savings rate:**

An increase in savings causes the economy to move towards new steady state equilibrium. As shown in equation (2-4) savings equals investment. Any increase in savings will lead to a similar increase in investment as well as the investment function.

The new investment function intersects the balanced growth investment line at a higher point due to the increase in savings. Capital per person increases to a new level equal to the population growth rate. This phenomenon is called the transition period, because the economy is moving towards a new equilibrium (Colander & Gamber, 2002:138).

Figure 3: Increase in savings



Source: Colander & Gamber, 2002:138.

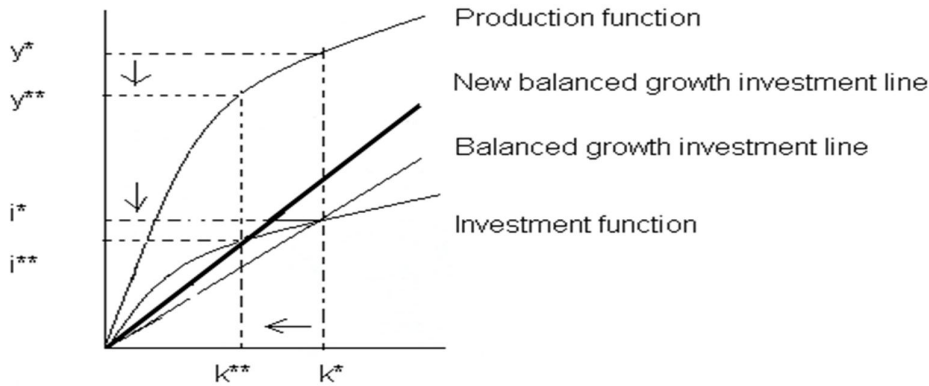
Capital per person moves from the previous steady state position (k^*) to a new steady state position (k^{**}). Output and investment also move to new steady state positions of y^{**} and i^{**} respectively as seen in Figure 3.

- **Increase in population growth:**

An increase in population growth causes the balanced growth investment line to swivel upwards. Equation (2-6) explains that population growth and depreciation serve as a slope for capital per person. Any change in population growth or depreciation leads to a change in capital, investment and output per person. Population growth in effect leads to lower capital per person because the balanced growth investment line intersects the investment function at a lower point, as seen in Figure 4. This implies a fall in steady state output, capital and investment per person. Figure 4 shows these movements as k^* moves to k^{**} , y^* moves to y^{**} and i^* moves to i^{**} . Note that the new steady state level is below the previous steady state level. This suggests that population growth has a negative influence on capital, output and investment per person (Solow, 1956:66).

One should note that in both the savings and population growth scenarios the economy moved to a new steady state position. The difference however is that an increase in savings causes the economy to move to a higher steady state. For the population growth scenario, the steady state moves to a lower steady state position.

Figure 4: Population growth



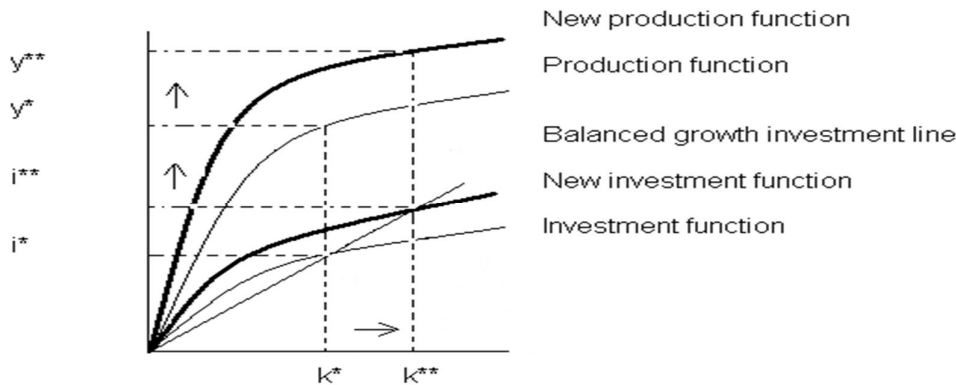
Source: Colander & Gamber, 2002:141.

This corresponds well with conventional thought on economic growth. If savings increase at a higher rate than population growth, capital per person increases. When population growth exceeds savings the opposite appears, and income per person decreases. Next, the effect of an exogenous variable (technological innovation) will be examined.

- **Technological innovation:**

The final implication in the Solow model involves technological innovation. An increase in technology rotates both the production and investment function upwards (Perloff, 2004:175). The reason for this is that both the production function ($y=A \cdot f(k)$) and the investment function ($i=v[A \cdot f(k)]$) contain a constant technological innovation factor (A) (Solow, 1956:67).

Figure 5: Technological innovation



Source: Colander & Gamber, 2002:142.

Again there is a changeover period until the economy reaches a new steady state, as seen in Figure 5. At this new steady state position, investment per person and capital per person increases. The reason for this is that the new investment function intersects the balanced growth investment line at a higher point. The production function also moves to a higher level that increases the level of output per person. The implied importance of technological innovation for economic growth highlights the importance of a highly trained labour force. A high level of human capital is necessary to facilitate new innovations and technological development.

From Figures 3 and 5 it was shown that increases in savings and technological innovation lead to higher levels of output, investment and capital per person. Figure 4 explained why population growth causes capital, output and investment per person to drop. The next part of this chapter will focus on reasons why one should go beyond the basic Solow production function to explain economic growth and also consider some other theories of economic growth relevant to this study.

2.2 Beyond the Solow growth model

From Figures 3 and 5 it was shown that increases in savings and technological innovation lead to higher levels of output, investment and capital per person. Figure 4 explained why population growth causes capital, output and investment per person to drop. The next part of this chapter will focus on reasons why one should go beyond the basic Solow production function to explain economic growth and also consider some other theories of economic growth relevant to this study.

2.2 Beyond the Solow growth model

2.2.1 Introduction: Inadequacies of the Solow model

This section will first consider problems with the Solow model and then consider expansions of the model as well as alternative theories. Attention will specifically be given to the Harrod-Domar model, the institutionalists, Myrdal's view of growth and development and finally endogenous growth. The aim of this dissertation is to determine the quality of human capital and its contribution to economic growth and

development. This section therefore focuses only on those theories and models that contribute to the understanding of the subject matter and provides instruments for further analysis. First consideration is given to the inadequacies of the Solow model and expansion of the model.

There are three reasons why the basic Solow model should be expanded. Firstly, the model does not always explain empirical evidence. Not all poor countries are catching up in terms of income per person, as seen in Figure 6. Secondly, the policy recommendation of increased savings and investment does not in all cases lead to higher income per person, as will be shown in Table 2. Thirdly, the basic model does not explain the origin of technology and assumes that technology is equally distributed between countries. Empirical evidence in Figure 6 suggests that not all countries converge unconditionally to equal incomes per person.

The basic Solow model does not explain the continual rise in output per person. The model points to technology as an exogenous force that fosters growth (Kleynhans & Naudé, 1999:86). The fact that technology is outside the model implies that one should go beyond the model to explain economic growth per person.

The Solow model, as explained above, points out that the reasons for differences in per capita income can be attributed to differences in the propensity to save (and to invest); and to population growth. The main features of the Solow model are thus that long-term growth only occurs when exogenous technological progress is present; in its absence the economy only reaches a static equilibrium situation. It emphasises the importance of savings and investment for a country's per capita income level. The model also implies that there will be an inability to increase economic growth in the long term by means of investment, and the possibility of non-convergence of per capita income between countries with the same savings rates and population growth rates (Cypher & Dietz, 2009:240).

From this the neo-classical theory makes the recommendation that if countries should desire to improve their standard of living (as measured against their per capita income) they should save and invest more. Greater investment leads to greater capital formation, and a higher capital labour relationship leads to greater

productivity and growth. This is, however, often not the case (see for example Todaro & Smith (2003:99-101)).

The following section expands the Solow model in an effort to improve it, known as the Harrod-Domar model.

2.2.2 The Harrod-Domar model

The Harrod-Domar model expands on the Solow model and is therefore also invested in the neo-classical tradition, but it has a macro-economic focus. According to the Harrod-Domar model the equilibrium economic growth rate in the economy is inherently unstable. This model also makes the assumptions that output growth is consistent with growth in the labour and output markets . and this instability leads either to unemployment or inflation. This might mean that there is a tendency in economies for their economic growth either to lead to hyper-inflation, or to unemployment (Todaro & Smith, 2003:113).

In order to achieve an equilibrium state (a steady-state) where such problems can be avoided, the Harrod-Domar model implies that state intervention is needed (Kleynhans & Naudé, 2003:72). The model specifically implies that such intervention should attempt to change savings tendencies in the economy as well as the effectiveness with which capital is used (Harrod, 1948:20).

The Harrod-Domar Model makes the assumptions that the labour market grows at a constant rate, savings and investments are a fixed proportion of total output, with savings related to the marginal propensity to save and equal to investment and in equilibrium. It also assumes a specified Leontief or fixed proportion production function, according to which, capital and labour are utilised in fixed proportions and are not substitutes for each other, but related to the incremental (marginal) capital output proportion and the marginal labour output proportion (Ghatak, 2003:54).

From these assumptions Harrod-Domar calculates the desired equilibrium growth rate, and the precondition for economic growth as: $\Delta y = s/v$, where Δy represents

the growth rate, s the marginal propensity to save and v the capital output ratio. Growth thus depends on the savings propensity of a region and the productivity of its capital. Should the real output growth be larger than s/v , inflationist growth will occur; and if real output growth is less than s/v , unemployment will occur. Only for a specific marginal propensity to save (s) and a marginal capital output ratio (v) will growth be in equilibrium.

Solow (1956) later showed that this instability (knife-edge equilibrium) of the Harrod-Domar model could be attributed to the fixed relationship production functions which are specified (Harrod, 1948:20). When a Cobb-Douglas production function, with positive substitution between capital and labour is used, the problem of instability disappears, without state intervention being needed.

Extensions of the neo-classical models like Solow and the Harrod-Domar model fail to explain what often happens in reality and various heterodox theories were designed in an effort to explain the absence of development and convergence. These theories attempted to break away from the orthodox models and focus on a broader scope of development. Examples are for instance Latin-American theories of development, dependency theories, various versions of Marxism and institutionalism (Kleynhans & Naudé, 2003:78). The following section gives some attention to institutionalism.

2.2.3 The Institutional School

The institutional school of thought in economics is particularly relevant to the current study and deserves some attention and may explain some of the problems of convergence (Todaro & Smith, 2003:709). The institutional school has a broader focus than merely development. They believe that institutions of an economy should be the proper objects of study in economics. Institutions or institutional factors are seen broadly in this sense as including all rules of play in the economy such as property rights, forms of production, ideologies, organisations and superstitions, which integrate the economic system and society. Because institutions change over time, the institutionalists believe that the process of studying the economy should be evolutionary. A particularly important institutionalists, which made special

contributions to the field and also won the Nobel Prize for economics in 1974 was Gunnar Myrdal.

Myrdal (1957:16) used the concept of cumulative causality to describe the reasons for his view that income inequality in less-developed countries will tend to increase as economic growth develops. Myrdal (1984:152) states that: ~~in~~ the absence of counteracting policies inequalities would tend to increase, both internationally and within a country+.

The reason for this is to be found in the dualism and/or inequality, which marks the structure of less-developed countries. Should less-developed countries experience an economic-growth stimulus, which will normally occur in the urban, industrial sector, the sector will develop and rise above the poorer rural regions.

This economic growth in the developed parts will cumulatively lead to greater inequality as a result of ~~the~~ negative backwash+ effects which occur as a result of the fact that ambitious, better-trained workers will migrate from the poorer sections to the growing regions. This will, as has been illustrated in South Africa, leave a population in the rural areas which will consist mainly of young people and old people (Kleynhans & Naudé, 2003:81). Divergence will also be due to the fact that the population growth rate in the people remaining behind will remain high, which will lead to greater dependency burdens for the small proportion of productive workers; and finally also the fact that greater production of urban or more prosperous regions will compete with the production methods which are used in poorer, rural areas, and which can adversely affect small-scale, rural production (Cypher & Dietz, 2009:183).

Although rural and marginalised regions can benefit by positive externalities due to the spill-over effects of a growth stimulus in the more prosperous region, Myrdal believes that this will be dominated by the negative backwash effects, mainly as a result of the pattern of production which established in less-developed countries during colonialism.

In order to counter the backwash effect, Myrdal saw the existence of a strong state in less-developed countries as essential Myrdal (1957:47). Such a strong state could

then formulate policies so that the advantages of economic growth could be experienced by the whole economy. Myrdal put special emphasis on the institutional factors and reforms needed for this.

The institutional views are important but often difficult to conceptualise past ideas. As the neo-classical and Keynesian model provide specific instruments to determine, what remains vague in other models, like the estimation of output growth, versions and extensions of that still remains in use. A model that expands those ideas and releases several of the restricting assumptions is the endogenous growth model. It gives particular hope to less developed regions with the promise of convergence because the assumption of diminishing marginal returns is not applied so strongly and the theory indicates that higher output growth rates are possible with the same inputs as before. This theory will receive attention in the following section.

2.2.4 The Endogenous Growth Theory

Empirical shortcomings of the Solow model which emerged especially in the 1980s were mainly motivated out of the observation that none of the predictions or implications of the model seemed to have realised in practice. Econometric and statistical studies also questioned the predictions or implications of the Solow Model (Ghatak, 2003:71).

It was indicated above that *the Solow model* had the following predictions for economic growth:

- Conditional convergence of different countries' per capita income. Under conditional convergence free mobility of capital will then be attracted to the profitable opportunities for investment in capital-poor countries (Todaro & Smith, 2003:146). The conditions for convergence of per capita incomes between rich and poor countries which were identified are:
 - a) access to the same technology;
 - b) the same savings and investment rates; and
 - c) the same population growth rates.

- Given certain assumptions about availability of technology and decreases in population growth, conditional convergence meant that developing countries had to increase their savings rates, and rates of capital creation in order to grow, and to increase per capita incomes. Should increases in domestic savings occur, but be inadequate as a result of low productivity savings, it was initially believed, adequate foreign funds should be obtained (Ghatak, 2003:70).
- As a result of decreasing marginal returns on investment in physical capital, there will be, for a given savings rate, an equilibrium level of per capita income for each country, where the growth rate will be in per capita income .

What the observations of countries' growth experience from the 1950s to the 1980s brought to light was that:

- when growth of less-developed countries are considered disaggregatedly, the prediction that countries with lower per capita incomes will grow more rapidly is not true. Among the less-developed countries with low per capita incomes, growth in sub-Saharan Africa over the period was consistently lower than economic growth in high-income countries. Only in East Asia was growth higher, in line with the Solow model (Cypher & Dietz, 2009:246).
- In regions of convergence there was rather divergence between poor regions such as Africa and the high-income countries.
- High-income countries did not experience decreases in their growth over time. In fact, the high-income countries could sustain growth over a long period of time, and there is still no sign that the high-income countries are approaching a stationary equilibrium level of per capita income.

Econometric studies into the causes of economic growth have also increased the level of doubt about the traditional Solow model. The Solow model was basically represented above by Cobb-Douglas production function, which indicates output as a function of capital goods and labour in the presence of existing ~~%~~ exogenous technology.

In time series econometric models the equation yield estimates, which typically found that increases in capital and labour could only explain about 50 per cent of a country's economic growth. This implies that half of the causes of economic growth can *not* be explained by neo-classical models like Solow (Kleynhans & Naudé, 1999:91). The size and significance of the residue is especially attributable to technological progress, better production methods and better quality production factors. The problem with this interpretation was dual in nature see Todaro & Smith (2003:146):

- It makes an economic analysis of technological progress impossible, because technology is exogenous to the model.
- The theory can not explain differences in economic growth between countries with similar technologies.

The purpose of these theories is to explain differences in economic growth between countries as emerge from econometric studies and try to explain the contribution of human capital to economic growth. The *endogenous growth theory*, or *new-growth theory* developed in the 1980s out of the theoretical and empirical shortcomings of the Solow neo-classical growth model, as well as the disappointing economic growth in sub-Saharan African in the 1970s and 1980s (Kleynhans & Naudé, 2003:82, and Ghatak, 2003:71).

The most important characteristics of endogenous growth theory are that it rejects the neo-classical assumption of decreasing marginal returns on capital investments; it allows increasing returns of scale which occur in production; and it also focuses on the role which externalities play in the returns on capital.

The results of these features are that endogenous growth theory differs from neo-classical and classical growth theories in that it does not see physical capital as the dominant factor for economic growth; and although technology is still important in the models, it is not indispensable to explain long-term economic growth.

The release of the assumption of diminishing returns, leads to a production function that does not eventually deliver marginal values of output, which starts to decline after a certain point of higher production output.

The endogenous growth theory differs from the Solow model in that inputs are defined more broadly in order to encompass accumulated capital supply and human capital. It takes technological innovation into regard and views it as to the economy (Todaro & Smith, 2003:146). The Solow model assumed that identical technology is available everywhere and views inputs in production as complementary to production - and not substitutes.

In the endogenous growth theory there is no decreasing returns to scale. Increases in inputs will always lead to increases in output. The effect of technological innovation, which the model regards as endogenous to the system, is that economic growth can occur without the amounts of capital and labour increasing. (Ghatak, 2003:70). The increase, however, is not exogenous to the economy, but is endogenous because the size of technological innovation in specific region is determined by:

- the level and kind of education and training in the labour market;
- the type of investment which the community makes in research and development;
- the state's policies with regard to research and development, education and training, intellectual property rights and patents
- the institutional capabilities of the economy in both the private and public sectors (Cypher & Dietz, 2009:251).

The above implies that:

- economic growth does not necessarily lead to convergence in per capita income between countries;
- a long recession in one country can lead to a permanent per capita income gap between itself and other countries;

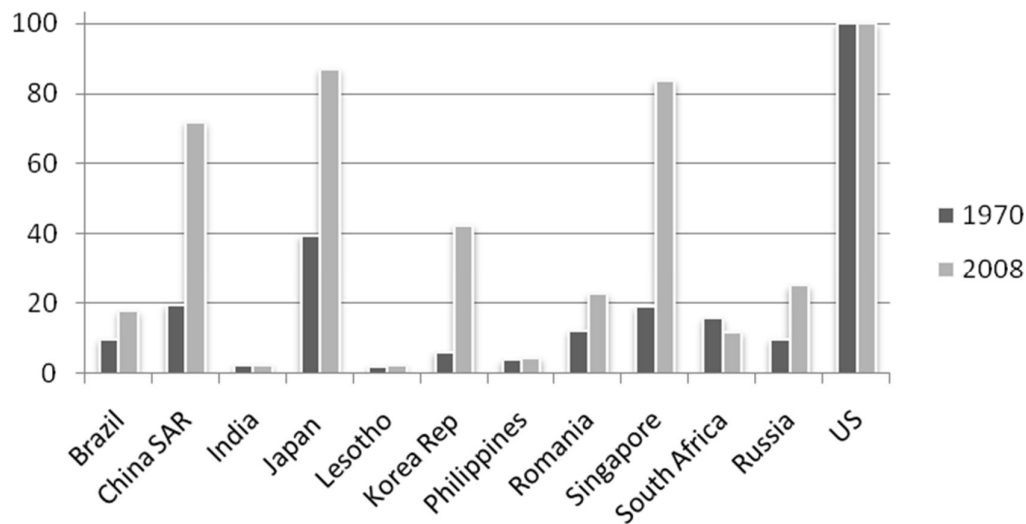
- countries where more research and development are done will experience more rapid economic growth compared to countries which do not invest in such;
- international financial capital can in fact flow from less-developed countries to developed countries, because complementary investment in human capital, research and infrastructure is higher in such countries (Cypher & Dietz, 2009:253). The high rates on (scarce) capital investment in less-developed countries are thus eroded by deficient complementary investment;
- purely market-based approaches to economic growth will be sub-optimal (Kleynhans & Naudé, 2003:85).

The latter conclusion is an important result in the endogenous-based literature. It is based on the fact that education and training, research and development and learning-through-doing experiences of workers, are all characterised by externalities and/or spill-over effects. Governments should, where possible, subsidise these activities. The following section discusses the practical experience of countries and some empirical evidence with regard to convergence and the conditional convergence hypothesis.

2.2.5 Conditional convergence hypothesis: Empirical evidence

It was stated above that empirical evidence suggests that not all countries converge unconditionally to equal incomes per person (see for e.g. Figure 6). When income per person in various countries is compared to the average income in the United States between 1970 and 2008, the following trends emerge. Firstly, a clear distinction between high growth and low growth countries can be made. Secondly, growth appears to be clustered between economies that are known to have made rapid technological advances in the period between 1970 and 2008. These countries include Japan, Singapore, South Korea and China. Evidence on the high technological nature of their exports will be discussed in Chapter 5. The preceding work has shown that savings and investment are the basic ingredients for growth in the Solow growth model, but for many countries it has not been enough.

Figure 6: Income per person as percentage of US income per person



Source: constructed from UNdata (National account of main aggregates, 2010)

To explain this exogenous factor of economic growth one can either expand the model or move one's attention to new growth theories. Expanding the model leads to the *conditional convergence hypothesis*. *Convergence* implies that all countries per capita income will in time tend towards each other. Convergence means that countries with lower per capita income will grow more rapidly than countries with high per capita income, because their capital supply is smaller and there can thus be higher income from investment. Under unconditional convergence free mobility of capital will then be attracted to the profitable opportunities for investment in capital-scarce countries (Kleynhans & Naudé, 1999:87).

Conditional convergence hypothesis is when income per person will eventually be equal in countries with similar economic fundamentals. Colander and Gamber (2002:158) give three reasons for non convergence; these are unequal quality of labour, institutional differences and increasing returns. According to Adams and Pigliaru (1999:102) there are two forms of convergence, namely beta convergence and sigma convergence. Beta convergence implies that countries with lower income per person grow faster than countries with higher income per person. This is due to the income differential between low and high income countries that allow low income countries to achieve higher levels of growth. Sigma convergence on the other hand, implies that the dispersion in income per person declines over time. As these low

income countries converge to higher growth levels, income per person experiences diminishing growth. In a study done by Adams and Pigliaru (1999:104) evidence revealed that countries converge at a speed of two per cent per year, after controlling for different steady states. The variance of income per person was also shown to converge to a steady state across countries. This corresponds with work done by Sala-I-Martin (1995) where conditional convergence was found between twenty OECD countries.

Adams and Pigliaru (1999:105) also made the following conclusions in terms of the relationship between beta and sigma convergence. The lesser the beta level (income per person differential), the smaller the dispersion or growth in income per person will be. Beta convergence in most cases will also lead to sigma convergence only if the initial dispersion (growth) is more than the steady state level. Sala-I-Martin (1995:21) explains that finding real world evidence of sigma or absolute beta convergence is not easy, and that setting proxies for different steady states is the only way of achieving this. Barro & Sala-I-Martin (1992:242) also found that countries converge at a rate of two per cent per year after holding certain variables constant. The following section discusses catching up and economic growth.

2.3 Catching up and economic growth

In a world where wealth and income are not equally distributed, some countries are making greater advances in growth than others (see Figure 6). Some are converging to a higher level of income per person, while others are not. Dowrick and Pitchford (2004:20) state that countries grow at different rates because of differences in their savings rate. Those countries that save more do so in order to achieve higher economic status. Competing for a higher status or position is a natural phenomenon and this competition takes place over the long-run. In the long-run however a hierarchy is established and this hierarchy determines the difference between rich and poor countries.

Dowrick and Pitchford (2004:41) conclude in their study that poor nations will catch up to rich nations if the elasticity of marginal utility is sufficient. Status seeking within individuals or individual countries will lead to more growth. When this growth is only

divided between the status seeking individuals, income inequality may lead to a reduction in welfare in the form of unequal income per person.

2.4 Empirical evidence and path dependence

According to Cypher and Dietz (2009:224), the 1950s and 1960s were periods of optimism in terms of global convergence. Economic models suggested that slower population growth and rapid investment in physical capital could in the long-run contribute to convergence. However, Barro and Sala-i-Martin (1992:242) found a divergence between countries where rich countries grew faster than poor countries.

Evidence in Table 1 suggests that the relative rapid growth of developing economies after the World War II period does correspond with the sense of optimism that existed. From the 1970s onwards only economies from the Pacific, East, and South Asian regions continued on the same growth path. Sub-Saharan regions performed the worst, with growth in income per capita being negative during the 1980s and zero during the 1990s.

Table 1: Income per capita growth and Gross National Income (GNI) 2001

Economy	1965-73 (%)	1973-80 (%)	1980-90 (%)	1990-2001 (%)	2001 GNI (US \$)
Low and middle	4.3	2.7	1.2	1.9	1160
Low income	2.5	2.6	2.0	1.4	430
Middle income	-	-	1.3	2.2	1850
Sub-Saharan	1.7	0.9	-1.3	0.0	470
East Asia & Pacific	5.0	4.8	5.9	6.3	900
South Asia	1.2	1.7	3.4	3.6	450
Latin America	4.6	2.2	-0.3	1.6	3560
Middle East & North Africa	6.0	1.7	-1.7	0.9	2000
High income	3.7	2.1	2.6	1.8	26710

Source: Cypher & Dietz, 2009:225.

Cypher and Dietz (2009:225) go on and explain how this evidence contradicts conventional thought on economic growth. Considering that capital is scarce in these regions, any movement of capital towards these economies would result in a higher expected rate of return to investors. This influx of international capital flows could in the long-run contribute to convergence within these economies.

Figures in Table 1 give the impression that there are significant differences in saving and investment rates between developing and developed countries. This is not the case, as seen in Table 2 some developing regions even showed higher savings and investment rates than developed or high income countries.

Table 2: Savings and investment by region as percentage of GDP

Economy	1965		1989		2000	
	S	I	S	I	S	I
Low and middle	20	20	27	26	26	23
Low income	18	19	26	28	20	20
Middle income	21	22	27	25	26	24
Sub Saharan	14	14	13	15	17	17
East Asia & pacific	23	22	35	34	35	30
South Asia	14	17	18	22	20	23
Latin America	21	20	24	20	19	20
High income	17	17	22	22	22	22

Source: Cypher & Dietz, 2009:225.

Apart from Sub-Saharan regions, most developing economies show similar savings and investment trends when compared to high income countries. The question now is why are there such large differences in income per capita if there is no significant difference in savings and investment?

Cypher and Dietz (2009:227) introduce the idea of path dependence. Path dependency implies that not all developing countries move towards convergence from the same level. Similar arguments are found in work done on convergence clubs or clusters. Countries have different growth characteristics and move towards higher income per person according to these characteristics. Some economies have been able to shift to higher levels of economic growth and income per person, while others failed to do so. Countries that are on higher growth paths show signs of convergence, and support the theory of conditional convergence.

Out of the theoretical and empirical shortcomings of the Solow neo-classical growth model, the endogenous and new growth theory was developed in the 1980s (Kleynhans & Naudé, 1999:99). Technology is still important in this model, but not central in explaining long-term economic growth (Cypher & Dietz, 2009:227). The new growth theory differs from the Solow model in that inputs are more defined,

technology differs between countries and that inputs have a varying influence on production (Kleynhans & Naudé, 1999:101). Although technology has a different significance in each model, it is still responsible for a certain proportion of economic growth. Kleynhans and Naudé (2003:117) conclude that education, training, research, development and experience are all characterised by externalities. Governments should support these activities to promote economic growth and development.

The above economic growth theories simply explain that technology can be used to explain differences between economies. Firm level analysis in Chapter 6 will examine if technology might also be used in explaining the output differential between firms.

2.5 Summary

Chapter 2 set out to briefly give an overview of the Solow neo-classical growth theory. This was done to emphasise the role human capital and technology play in the development of an economy. The conclusions drawn from this chapter are that not all developing economies consist of the right economic fundamentals to achieve rapid economic growth. The main purpose of Chapter 2 was to show that countries are on different growth paths, and that some emerging economies do show signs of convergence towards higher income per person, as seen in Table 1. Technological progress, savings and investment were shown to be the three main components of economic growth. However, empirical evidence suggests that savings and investment rates between developing and high income countries do not differ substantially. This leaves one to believe that technological innovation might explain the gap between high and low income countries. The neo-classical growth model discussed in this chapter referred to technological innovation as an exogenous factor of production. Technology might be an exogenous factor, but one should keep in mind that technology cannot function on its own. Technological innovation depends on individuals and individual groups endogenous to the model. This highlights the importance of quality human capital and adequate training and education. For this reason, the study will now turn its focus to the individuals and manufacturing firms within the South African economy. Chapters 3 and 4 will explore human capital

constraints in South Africa as described in the introduction. The theme of technological significance will again emerge in Chapters 5 and 6.

CHAPTER 3

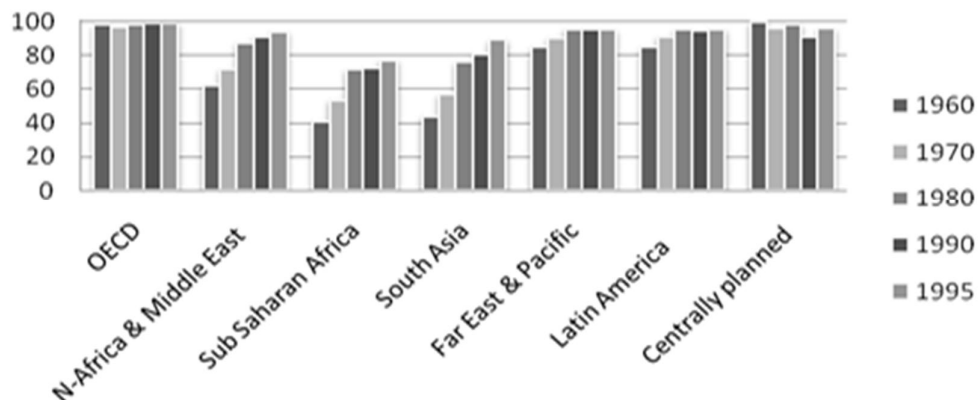
EDUCATIONAL ATTAINMENT AS HUMAN CAPITAL

The previous chapter explained the significant role technological innovation has on economic growth within the neo-classical growth model. Chapter 3 will explore the relationship between educational attainment, human capital formation and economic growth. After exploring the general significance of education, part two of this chapter will investigate the performance of the South African education system. The reason for this is to determine if an inadequately educated workforce could be one of the main human capital constraints as described in Chapter 1.

3.1 The significance of education

According to Checchi (2006:2), income inequality tends to be lower in countries where the average level of education is relatively high and more accessible. The reason for this is that increased schooling provides more labour market participation and this decreases the long-term inequality. Higher education is also associated with higher expected income. This leaves one to believe that individuals with higher average levels of education should have higher average levels of income (Romer, 1990:73). The next section will focus on primary, secondary and tertiary school enrolment rates in various countries between 1960 and 1995.

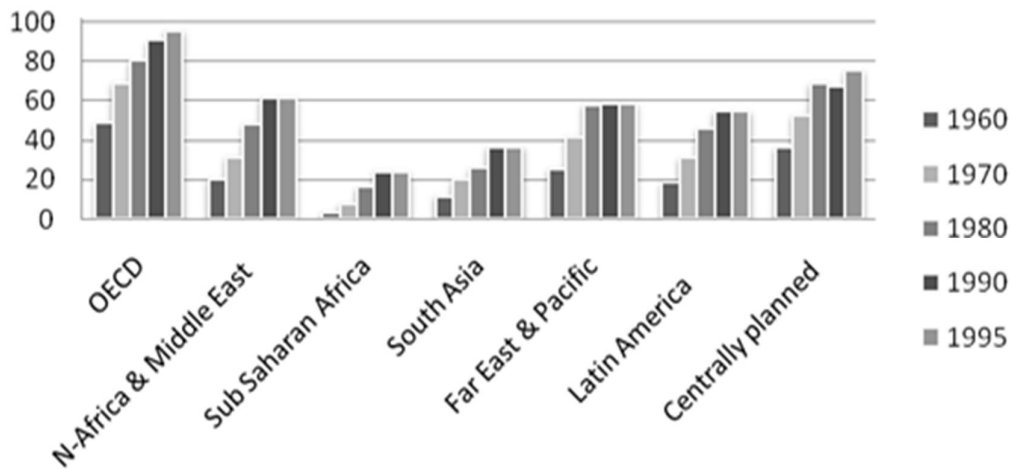
Figure 7: Primary school enrolment rates



Source: Checchi, 2006:2.

As seen in Figure 7, primary school enrolment rates have increased dramatically in developing countries since the 1960s. Enrolment rates in more developed countries show a lesser increase in primary enrolment; this is due to higher levels of initial enrolment. This indicates the efficiency in distributing educational services in developed countries and the quality of their education systems. For OECD (Organisation for Economic Co-operation and Development) countries, primary enrolment rates are the highest and most consistent. Sub-Saharan African countries have the lowest primary school enrolment figures.

Figure 8: Secondary school enrolment rates

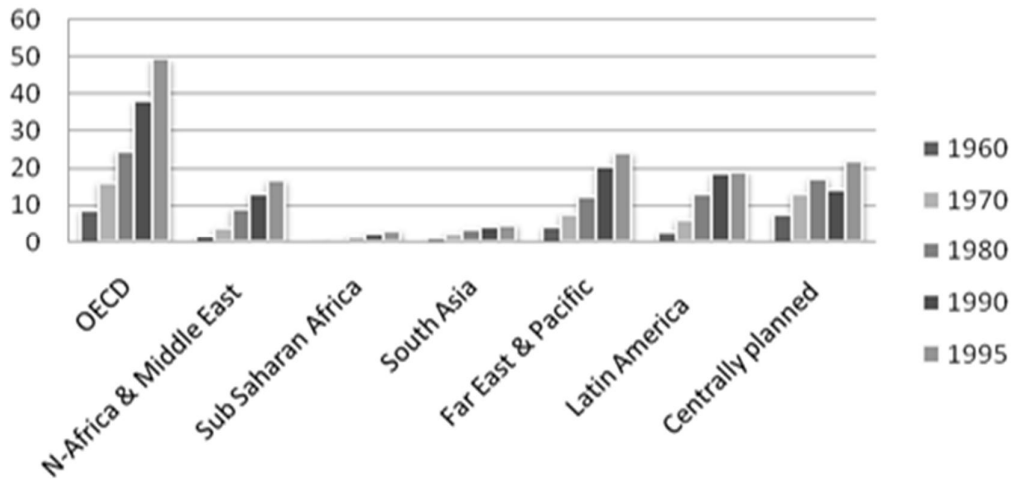


Source: Checchi, 2006:3.

Figure 8 shows that secondary school enrolment rates in more developed countries are much higher than in developing countries. Although evidence of increasing enrolment rates in developing countries is present, the total difference between developed and developing country secondary school enrolment rates is large.

Figure 9 points out that tertiary enrolment rates signify the biggest difference between education in developed and developing countries. Just as with primary and secondary school enrolment rates, OECD countries have the highest rates and Sub-Saharan African countries the lowest. Fedderke (2001:3) states that evidence suggest that educational improvements between 1970 and 1997 had a positive influence on factor productivity growth in South Africa.

Figure 9: Tertiary school enrolment rates



Source: Checchi, 2006:3.

The next section will explain the demand for education, as well as education's role in economic growth. After this, the performance of the South African education system will be explored. The emphasis will now be placed on quality education, and not quantity education as in the previous section. The reason for this is that quality education contributes more towards technological innovation and improved human capital than quantity education (De La Fuente & Doménech, 2001:325).

3.1.1 The demand for education

Education serves as a screening process in the workplace (Maziya, 2001:8). Individuals applying for a certain vacancy or position have different levels of knowledge and potential. One would presume that a person with a superior educational background has more knowledge, and would be able to complete the task at hand with greater ease. From a model introduced by Checchi (2006:23) to verify the determinants of educational choices as investment in human capital, the following conclusion was made. The demand for education is more intense the lower the starting level of human capital is. However, this incentive declines with the accumulation of human capital, because of decreasing marginal productivity in the formation of new capital. This then highlights the importance of education at lower levels, especially the primary and secondary level (Fedderke, 2002:27).

3.2 Education's role in economic growth

Griliches (1997:331) states that growth accountants like Fabricant and Solow observed the following in terms of economic growth during the middle part of the twentieth century. Economic growth is not only explained by conventional labour and capital measures. These accountants speculated that the changing quality of the labour force might be a crucial component in explaining the residual. This residual referred to the idea that investment in human capital explains the difference in wage and income distribution.

To explain how investment in education forms part of human capital, Schultz (1960:571) proposed the following: "Treat education as an investment in man and the consequences as a form of capital, namely human capital. Further work on this residual (according to Griliches, 1999:332) suggests that educational improvements in the United States labour force in the late nineteen eighties and early nineties, accounted for a 0.5 per cent aggregate output growth per year. These educational improvements also represented a third of the total factor productivity (TFP) residual.

3.2.1 The influence of education on human capital

As South Africa pursues outward orientated policies, the importance of developing and delivering value-added goods and services becomes more significant. The ability to create these goods and services determines the ability to generate future wealth. Wealth can be created by combining both human and physical capital in a productive manner. Barro (2001:14) explains that education can influence human capital in two ways. The first is in a quantitative approach (number of years of schooling), and the second a qualitative approach (competitiveness of schooling).

Higher levels of human capital tend to lead to higher economic growth. This is because of a higher ratio between human and physical capital. This high ratio influences growth via two channels. Higher levels of human capital assist in the absorption of more advanced technologies in the first channel. The second channel relates to slower adjustments of human capital relative to physical capital (Barro, 2001:17). While secondary and higher education enables the diffusion of higher

technologies, primary education serves as a prerequisite for secondary and higher education (Barro, 2001:18). This chapter argues that educational attainment is a determinant of technological innovation. Educational attainment influences technological progress, human capital and economic growth within an economy. Improved education has the potential to increase technological innovation, and technological progress causes economic growth as described in the Solow growth model.

3.2.2 Educational differences

The difference in educational attainment between countries as seen in Figures 7 to 9, explains the difference in human capital, technological progress and economic growth between various countries. If an improved level of educational attainment does not impact on economic growth or development, what happened to the educated labour and what is the utility of school expenditure?

Dessus (2001:2) explains that the difference in quality education is explained in the ability to produce one marginal unit of productive human capital. A productive unit of human capital contributes to an increase in GDP. The elasticity of GDP with respect to human capital also varies between countries, and this explains the weak contribution that human capital has on growth in some developing countries. The result is that the difference in educational infrastructure and quality explains the difference in the marginal productivity across countries.

The capacity of the education system to distribute quality educational services equally among the population, determines the contribution of human capital towards economic growth. The three main categories of educational differences are; educational infrastructure, initial human capital endowments and the ability to distribute education equally (Dessus, 2001:12). Fedderke (2002:29) explain that in order to improve the quality of tertiary education in South Arica, authorities should give attention to improving the quality of primary and secondary education. Human capital also carries significance jointly, and the ineffectiveness and inequality between black schools should also receive attention. This inequality discourages

individuals from obtaining an education. This also leads to only a few individuals gaining higher education, and contributes to income inequality.

3.2.3 The way forward for developing and developed countries

Focusing on primary education as the only determinant of human capital, technological innovation and economic growth is not enough. Comparable actions should assist education in improving human capital in an economy. These actions include improved institutions to motivate skilled individuals to engage in innovative activities. Along with this, encouraging the inflow of foreign technologies to maximise the social return to public investment in education is also needed (Dessus, 2001:16). One main problem area that has been identified is to find more accurate indicators for quality education as well as human capital and technological progress.

In the neo-classical growth theory, technological progress provided scope for further growth by creating new and improved products and methods of production (Colander & Gamber, 2002:142). The question now is what are the implications for developing and developed countries?

Developed countries boast quality educational institutions and highly educated labour forces as seen in Figures 7 to 9. However, rapid growth in educational attainment has slowed down in developing countries, and additional investment in human capital show signs of decreasing returns (Fedderke, 2005:2). The absorption of technology is also becoming saturated, and in this way constraining rapid economic growth.

In Fedderke (2002:27) it is shown that for some particularly poor developing countries, the low level of human capital leaves room for increasing returns on human capital expenditure. Increased mobility of financial capital helps the flow of capital to countries where there are prospects of increasing returns on investment (Lall, 2000:3). An inflow of advanced foreign technologies from developed countries can also be absorbed. However, labour forces in developing countries are inadequately educated when compared to developed countries, and human capital does not significantly contribute to growth.

3.3 Education in South Africa

In Chapter 1 the relative weakness of education in South Africa was briefly introduced. Recent Global Competitiveness Reports indicate that the South African work force is inadequately educated. The aim of this chapter is to determine if the South African education system produces a mass of inadequately equipped individuals or not. Reports show that South African learners do not have the ability to compete internationally in terms of reading, writing or computing. These inadequately educated individuals will make up the next generation of students in higher education institutions such as universities and colleges. In this section, investment, performance, curriculum and labour union problems surrounding education in South Africa will be examined.

3.3.1 Investment in education

As seen in Table 3 resource allocations towards education in South Africa are not lacking in terms of the amount of money spent on education. Since 1999, education annually received the biggest fraction of the national budget. The reason for the poor performance is not an inadequate resource allocation or shortage of funding.

Table 3: Investment on education in South Africa between 1999 and 2010

Year	As % of national budget
1999	18
2000	18
2001	19
2002	18
2003	20
2004	20
2005	18
2006	17
2007	18
2008	20
2009	18
2010	18

Source: National Treasury, 1998-2010.

According to Bloch (1999:82), the major problem is that the money allocated in the budget is not used to improve infrastructure in South Africa's schooling system. An example of this is the figures on backlogs in infrastructure spending as seen in Table

4. Comparing Tables 3 and 4 shows that South Africa's education system is not effective enough in distributing quality educational infrastructure and services.

Table 4 shows that resources are not equally distributed between schools, and that basic infrastructure is absent in a large percentage of schools. The lack of libraries, laboratories and computers also deprives learners from valuable resources that could assist them in the learning process.

Table 4: Infrastructure based figures

Infrastructure deficiency	% or number of schools
No electricity	17%
No library facilities	79%
No laboratory facilities	60%
No computers	68%
No constant water supply	31%
No sewerage disposal system	61%

Source: Bloch, 2009:82.

Next the performance of education in South Africa will be explored. This will be done to examine the effect that inadequate distribution of educational services has on the performance of learners in the country.

3.3.2 The performance of education in South Africa

Bloch (2009:59) highlights the following about the performance and trends in South African schools and universities. A small band of twenty per cent of schools produces the majority of university graduates in South Africa. Out of this twenty per cent, ten per cent comes from formerly white model C schools and the other ten per cent from well-established black schools. Only fifty per cent of kids in rural or township schools finish school. Grade 9 is seen as the major drop out point in these schools. When looking at the performance among university students, almost fifty per cent never finish their degrees. Forty-five per cent leave university without graduating and sixty-six per cent of university of technology students leave without finishing their studies. The next part will focus on the findings of various reports and studies surrounding the performance and competitiveness of South African education. These will include reports and studies conducted by the Department of Education (DoE), The International Mathematics and Science Study Report (TIMSS-

R), Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ), and the South African Institute for Race Relations (SAIRR).

3.3.2.1 The Department of Education (DoE)

Official tests conducted by the Department of Education in 2001 and 2007 revealed the following for grade 3 learners in South Africa.

Table 5: Systemic evaluations on grade 3 learners

	2001	2007
Study area	Average score	Average score
Numeracy	30%	35%
Literacy	30%	36%

Source: DoE, 2008:4.

These scores indicate a serious lack of understanding of mathematics and literacy among learners. Although the 2007 scores indicate an increase of five percent for numeracy and six per cent for literacy, these scores are still ominously low. The next report will examine the competitiveness of South African learners internationally.

3.3.2.2 The TIMSS-report

Table 6: TIMMS-R 1999 report

Country	Mathematics	Country	Science
1 st Singapore	604	1 st Chinese Taipei	569
2 nd Korea Rep	587	2 nd Singapore	568
3 rd Chinese Taipei	585	3 rd Hungary	552
United States	502	United States	515
Morocco	337	Morocco	323
South Africa	275	South Africa	242

Source: TIMMS-R, 1999.

The International Mathematics and Science Study (TIMSS) report has been conducted since 1999. The report collects data from various countries around the world including developed and developing countries. Tables constructed will include the average scores of the top three performing countries, the United States, South Africa and the average of the country ranked directly above South Africa. Due to a

lack of participation of South African learners since 1999, only data on grade 8 learners will be included.

South African learners occupied the bottom positions in both mathematics and science in the 1999 and 2003 report. The top three positions were dominated by learners from Asian countries in the 1999, 2003 and 2007 report. Table 7 shows that South African learners performed worse in the 2003 mathematics report, and only marginally better in the 2003 science report. The South African averages were also 44 per cent below the report average in 2003. Morocco moved up a few ranks in the 2003 report, replaced by Ghana as the country with the second worst performance.

Table 7: TIMMS-R 2003 report

Country	Mathematics	Country	Science
1 st Singapore	605	1 st Chinese Taipei	578
2 nd Korea Rep	589	2 nd Singapore	571
3 rd Hong Kong	586	3 rd Hungary	558
Report average	466	Report average	473
Ghana	276	Ghana	255
South Africa	264	South Africa	244

Source: TIMMS-R, 2003.

In Tables 6 and 7, the severe lack of understanding among South African learners in mathematics and science, compared to other countries was shown. An interesting finding is that Morocco was able to improve on their scores between 1999 and 2003, and in this way improved on their ranking. For South Africa this was not possible, and the country again held the last position on the report in 2003. A similar report in 2007 included annual data from all participating countries, but due to a lack of participation of South African authorities, no data is available for South African learners.

3.3.2.3 Other reports

In Barry and Taylor (2006:2) the SAQMEQ report published in 2005 indicates that grade 6 learners in South Africa performed worse than learners in African countries with fewer resources. South African learners scored on average lower than learners in poorer neighbouring countries, such as Mozambique, Botswana and Swaziland.

South Africa came ninth out of thirteen African countries partaking in the survey. The Institute for Race Relations states that from the one million learners who were in grade 10 in 2006, only fifty per cent wrote the OBE exam for grade twelve in 2008. Out of these, only thirty per cent passed at the end of 2008, and only eight per cent passed mathematics (Bloch, 2009:68).

3.3.3 Who should be blamed?

Although the Department of Education should take a great deal of responsibility for the dismal state of education in the country, the next section will focus on other relevant parties in the education system. These parties include the teachers, labour unions and the curriculum. First, the performance of the Department of Education will be discussed.

3.3.3.1 The Department of Education

From Tables 3 and 4 it can be seen that the Department is not distributing resources equally among schools in the country. The national treasury entrusts the Department of Education with funds allocated from the budget. It is the responsibility of the Department to distribute these funds to where it is most needed. According to Bloch (2009:101), South Africa requires an additional twenty thousand new teachers every year. Currently only six thousand are produced via the various universities and teacher-training institutions. Along with the shortage of teachers there were a number of retrenchments during 1996 and 1997. This was done to enforce the government's equal equity programme of the time.

Since 1994 one hundred and twenty teacher colleges have been closed. The idea behind this was to force students interested in becoming teachers to go to universities, where the quality of education is perceived to be higher. This effort should have supposedly increased the quality of future teachers, but it now restricts the poor from entering these universities due to the higher costs associated (Bloch, 2009:102).

3.3.3.2 The teachers

Bloch (2009:102) states that most teachers have a poor understanding of the subject contents, and this is particularly true in the case of subjects like mathematics and science. In some schools, only 15.18 hours of teaching a week occurs out of a possible forty-one hours a week. The rest of the time is spent on administration and sporting activities.

In a recent McKinsey Report on education according to the Democratic Alliance (DA, 2010:2), it was revealed that only 33% per cent of grade 4 to 7 teachers in four provinces were able to pass numeracy tests intended for students in grades four to seven. The sample was conducted out of one thousand teachers in four provinces. This might imply that the quality of some teachers is below par. Another contributing factor might also be the fact that the average teacher student ratio is one to thirty (Bloch, 2009:82).

3.3.3.3 The labour unions

In 2008, the South African Democratic Teachers Union (SADTU) sent a letter to all its members in Gauteng. This letter stated that they should not take part in any out-of-hour\$ programmes with the department, without authorisation from the union. The union threatened that any unauthorised participation would be met with disruptive and violent protests (Bloch, 2009: 106). In South Africa there are three main teacher unions: SADTU, National Professional Teachers Organisation of South Africa (NAPTOSA) and the Suid-Afrikaanse Onderwys Unie (SAO). All three signed an accord with the Department of Education to work together to improve the quality of education in South African schools. The independent Tokiso review found that forty-two per cent of all work days lost due to strike action between 1995 and 2009 were attributed to SADTU, the largest teacher union in the country (DA, 2010:1).

3.3.4 The curriculum

When the Ministry of Education announced the adoption of a new Outcome Based Education (OBE) curriculum in 1997, there were mixed reactions. Firstly, those

supporting OBE felt that the curriculum would meet the needs of all learners regardless of their background. Secondly, some had the opinion that it was merely an instrument to promote the political ideas of the government at the time. The third group warned that similar curricula had previously failed in other parts of the world (Meyer *et al.*, 2010: v). Since the implementation of the curriculum in 1998, there has been a debate surrounding the appropriateness of the curriculum in South Africa. This section will explain what an OBE curriculum consists of, and why it is not working within the South African context.

3.3.4.1 Outcome Based Education

The rationale and substructure of the OBE system are complex and extensive. This section will simply highlight the main structures in the OBE pyramid according to Meyer *et al.* (2010:5).

At the top of the pyramid is the paradigm. In simple terms the paradigm is only concerned about the fact that learning should take place. Next the purpose states that a specific learning environment should be created to achieve specific outcomes. Below the purpose, the argument is that by acknowledging different learner capabilities all learners can succeed. Next, the principles simply states that the outcomes are predetermined, and that the learners should be continually assessed according to these predetermined outcomes. Following this, the study will look at various criticisms against OBE.

3.3.4.2 Jansen's predictions

Jansen (1999:145) explains that since 1994 there have been three curriculum reform initiatives from the Department of Education. The first initiative aimed at eliminating the structures put in place during apartheid. The second and third initiatives were similar in nature and involved continual assessment and later on outcome based education. Jansen (1999:146) states that the implementation of OBE was politically motivated and that the authorities had no intention of improving the overall quality of education in South Africa. In Jansen (1999), ten explanations were given why OBE would fail in South Africa.

- 1) The language associated with OBE is too complex and confusing. There are more than fifty different concepts and labels.
- 2) Claims about the relationship between the curriculum and society are incorrect. Supporters wrongfully claim it could promote economic growth without any substantial evidence.
- 3) The assumptions of what goes on in schools as well as the amount of resources available to teachers are incorrect.
- 4) Predetermined outcomes are anti-democratic and destructive for creativity and innovation.
- 5) There is no real support system for teachers to experience ongoing learning.
- 6) It is too instrumental, and it avoids other central factors such as integrity, racism or even sexism.
- 7) Higher administrative burdens will be placed on teachers, and this will affect actual teaching hours.
- 8) The significance of the contents will be kept one dimensional as the learning environment becomes closed off to innovation.
- 9) For OBE to work, other parallel innovations will be needed. These include expert teachers, parental support and improved learning resources, such as textbooks and computers.
- 10) Radical revision of educational curricula does not always work.

Jansen made these explanations of why OBE would fail in South Africa in 1999; this was one year after the implementation of OBE. Next, more recent findings of problems associated with OBE will be discussed, and compared to the work done by Jansen.

3.3.4.3 Recent findings on education in South Africa

From evidence in part 3.3.2 it can be seen that there has been no substantial improvement in the performance of South African learners. The study will now look at the performance of the OBE systems and particularly outcome based assessment (OBA). OBA is seen as the vehicle of implementing OBE for teachers in South Africa.

In a study done by Matshidiso (2007) the following evidence on the effect OBA has on teachers in the North-West Province of South Africa emerged:

- Teachers supported the theoretical foundations of OBA, but can not implement it in practice.
- Teachers lacked knowledge of OBA due to inadequate training.
- Departmental support and guidance were missing.
- An administrative overload due to OBA.
- Insufficient resources and infrastructural problems.
- Insufficient parental support and involvement (Matshidiso, 2007: 111).

In a survey conducted by Reyneke (2008), similar aspects were found to trouble teachers in their efforts to provide quality education. These aspects included the following:

- Teachers did not feel competent to implement OBE and OBA due to a lack of training.
- No departmental investment to develop teachers professionally.
- Unclear learning outcomes and assessment criteria.
- A lack of learning resources.
- An administrative overload, and less time for actual teaching (Reyneke, 2008:159).

There are similarities between what Jansen predicted and what recent studies found. It seems as if access to learning resources, an administrative overload and non-existent teacher training are the biggest contributing factors. The final words of this section will consider comments made by William Spady, who is in some circles regarded as the father of OBE (Meyer *et al.*, 2010:4). In March 2008, Spady commented on the reasons why OBE did not work within the South African context. In Spady's opinion, policymakers in the Department of Education turned away from the fundamentals of OBE. Spady (2008:1) concludes that after ten years of OBE in South Africa, the curriculum should be discontinued, and that OBE in its true form never existed in South Africa (Spady 2008:1).

3.4 Summary

This chapter considered the importance of education on human capital. Chapter 3 showed how poor South African learners perform internationally, and what the possible reasons for this could be. Compared to countries in Africa with fewer resources, it becomes apparent that there are fundamental problems in South Africa's education system. The system is producing a mass of inadequately educated individuals, and this has the potential to severely impact on the quality of human capital in the economy. This is in line with what the Global Competitiveness Report found in terms of education in South Africa. According to Fedderke (2006:24), human capital accumulation shows signs of declining contribution to growth and that there is evidence of declining quality of education in South Africa. The relevant output generated by schools and universities come at a high price, and the only policy achievement is the expansion of access to education. Fedderke (2005:1) also explains that human capital both influences and determines institutions of society, and that these institutions determine the long-term productivity of all factors of production. Therefore, the current and possible future level of human capital in South Africa is not sufficient to stimulate high levels of technological progress, innovation or competitiveness. This lack of technological progress will ultimately impact negatively on future income per person levels in the country.

The following chapter will consider the second most influential human capital constraint in South Africa, as described in the introduction. Chapter 4 will explore labour market distortions in the South African economy. These distortions range from labour legislation to industry specific characteristics such as industry concentration and location. Chapter 4 will also explain the complexity of the South African labour market.

CHAPTER 4

LABOUR MARKET DISTORTIONS

Along with an inadequately educated labour force, restrictive labour regulations have also been cited as a major human capital constraint in South Africa (see chapter 1). Chapter 4 will focus on various distortions in the South African labour market. Four types of labour market distortions will be discussed. These include: labour laws and legislations, labour market characteristics, bargaining institutions and industry concentration. This chapter will explore various aspects of the South African labour market in order to determine if these distortions pose as a real human capital constraint, as described in the introduction.

4.1 The Labour law and legislation

According to Basson *et al.* (2009:3), the labour law is a system of rules regulating work or labour. These laws are legally binding and the court of law may be approached to relieve any breaching of these rules. The next section will explain the various parties involved in this system of rules.

4.1.1 Understanding the Labour laws

These laws not only affect all working individuals in an economy, but also certain groups in an economy. Two main relationships exist in this environment; the first one is the individual relationship between employer and employee. The second one refers to a wider relationship between employers, a group of employees, trade unions and employer organisations. The labour laws regulate the relationship between individual and collective parties in the labour market. The role of the state is also of importance, because the state employs a large number of workers and has rule-making power (Basson *et al.*, 2009:3). The labour laws are legislative in nature and the main focus is on job security and the establishment of minimum basic conditions for employees (Maziya, 2001:2). Benjamin (2008:5) states that the constitution allows all relevant parties to form trade unions or employee

organisations, participate in union activities and to partake in collective or individual bargaining processes.

4.1.2 Additional labour legislation

Basson *et al.* (2009:383) state that labour legislation in South Africa has three fundamental elements. The Labour Relations Act of 1995 (LRA), the Basic Conditions of Employment Act of 1997 (BCEA) and the Employment Equity Act of 1998 (EEA). Additional acts can be divided into three categories, as seen in Table 8. These acts all aim at improving the workplace environment for both the employee and employer. All parties also have legally binding responsibilities and duties to ensure a safe and secure workplace. Along with the various duties, there are also formal processes of enforcing and regulating these acts. These Acts can also be extended to other individuals who are unprotected at any specific moment (Benjamin, 2008:13).

Table 8: Additional labour legislation

Prevention of Workplace Injury	Social Security	Skills Development and Training
Occupational Health and Safety Act (OHSA)	Compensations for Occupational Injury and Disease Act (COIDA)	Skills Development Act (SDA)
Mine Health and Safety Act (MHSA)	Occupational Disease in Mines and Works Act (ODMWA)	Skills Development Levies Act (SDLA)
-	Unemployment Insurance Act (UIA)	
-	Pension, Medical Aid and Health	

Source: Basson *et al.*, 2009:383.

Chapter 4 will not go into further detail surrounding these acts, but the performance of the Skills Development Act in the form of SETA (Sector Education and Training Authority) will be evaluated later in the study. SETA support and effectiveness will receive attention in the firm level analysis of Chapter 6. Both SETA support and effectiveness will also be used in the regression analysis and Principal Component Analysis (PCA) of Chapter 7.

4.2 South African labour market characteristics

This section will explore the nature of the South African labour market. Labour force growth, unemployment and the informal-formal employment phenomenon will receive attention. The South African labour market differs to some extent from other developing economies (Nattrass, 2000b:73). The next section will explain these differences, and also how these differences influence the economy as human capital constraints.

4.2.1 Labour force growth and unemployment

The South African labour market is characterised by sharp segmentation, high levels of unemployment and relatively low non-agriculture informal employment. This is a phenomenon typical to poor African countries (Collier, 1997:35). The biggest dilemma is the distinctive differences between the formal and informal sector (Webster *et al.* 2008).

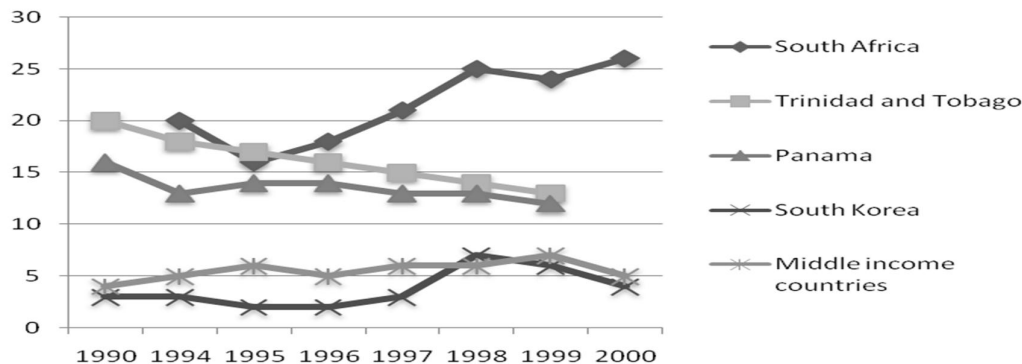
Figure 10 shows South Africa's high level of unemployment compared to other developing countries as well as middle income countries. From Figure 10, it can be seen that unemployment has gradually increased since 1990, and reached twenty-six per cent in 2000. The other countries in Figure 10 show smaller fluctuations in unemployment levels, and unemployment levels tend to decrease over time.

Jobless growth creates a problem in less developed countries, like South Africa, where employment opportunities do not increase when the economy grows, or at least not at the same rate (Todaro & Smith, 2003:332). Studies have indicated that the employment elasticity of economic growth, which is, the percentage increase in employment as a result of an one per cent increase in economic growth, is equal to 0.46 in South Africa (Kleynhans & Naudé, 2003:72). This means that an average annual real economic growth rate of at least six per cent is needed to keep abreast of the increases of the labour force of about 2.8 per cent annually. It is for this reason that the recent GEAR macro-economic strategy had set as an objective the achievement of an annual economic growth rate equal to six per cent. The employment elasticity of 0.46 above can even decrease, however, because of the

nature of unemployment itself. It is therefore necessary for policy-makers to make sure of the nature and causes of structural unemployment in South Africa and focus on the continual improvement of the country's human capital.

Fedderke (2006:1) gives evidence on the low labour absorbing growth path of the South African economy. This can be seen in the negative employment figures and real wage elasticity (Fedderke, 2006:16). International experience indicates that export orientation, flexible labour market characteristics and sufficient state support are the main determinants of employment creation (Nattrass, 2003:15). Unemployment in South Africa is also high due to increased participation rates (especially from black citizens), and a decreasing demand for resourced-based goods in international markets. Apart from high levels of unemployment, South Africa's labour market has other distinctive labour market characteristics (Wakeford, 1997:22). These include an uneven distribution in gender, age, skill and race.

Figure 10: Unemployment trends internationally

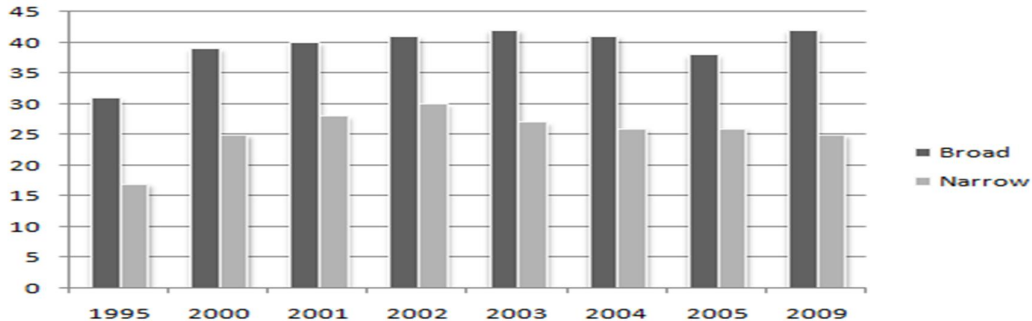


Source: Nattrass, 2003:5.

Measuring unemployment in South Africa is extremely difficult. Data on the size of the informal economy is not reliable, and available data suggests low levels of informal employment. In the literature, there are two distinctive measures of describing the level of South Africa's unemployment. These are the narrow and broad unemployment measures. Narrow unemployment refers to those individuals actively searching for formal work. While broad unemployment represents individuals that are available to work, but not actively searching for formal work.

Figure 11 shows the difference in narrow and broad unemployment in South Africa between 1995 and 2009. This shows that the unemployment rate in South Africa has increased from 17.6% to 24.4% for the narrow definition, and from 30.8% to 42.2% for the broad definition. This indicates that there is a large gap between narrow and broad unemployment in South Africa.

Figure 11: Broad and narrow unemployment in South Africa



Source: Constructed from Bohrat (2008:5) & UNdata (national accounts 2010)

When the labour force grows faster than formal sector employment, an economy is faced with either higher unemployment or higher informal sector employment. This is the case for South Africa. As the formal sector becomes saturated, workers have two options; either search for work in the informal sector, or stay unemployed. The next section will explore the formal and informal sectors.

4.2.2 The formal and informal sectors

Employees in the formal sector are seen as insiders, as they are inside the regulatory framework of the legislation and labour union activities. These unions through collective bargaining can protect workers against unfair dismissal, inadequate working conditions and real wage fluctuations. Kingdon and Knight (2007:819) found that the ratio of formal to informal sector monthly income was 3.4:1 in 2003. This indicates that collective bargaining serves as real wage resistance in the formal labour market. Workers in the formal sector also receive added benefits such as medical cover, pensions and annual leave.

The informal sector emanates from the fact that labour supply increases at a rate bigger than formal sector demand. Statistics South Africa (quoted by Kingdon & Knight, 2007:823) indicates that the informal labour market only absorbed 17% of the labour force in 1997, and 19% in 2002. International data indicates that South Africa is an outlier in terms of the size of the informal sector compared to formal sector employment and unemployment. Xaba, Horn and Motala (2002:25) found that government initiatives aimed at small businesses are only reaching the formal sector and not businesses in the informal sector. Due to the fact that most small businesses are labour intensive, the impact labour market regulations (like minimum wages) has on these businesses are severe.

High levels of unemployment and the saturated nature of the formal sector show that South Africa's formal labour market is struggling to absorb the excess labour supply (Nattrass, 2000b:74). Although the actual level of unemployment and the size of the informal sector may be debateable, high values for both indicate labour market failure.

Table 8 showed that there is legislation to improve the skills of South African labourers. The Skills Development Act and the Skills Development Levies Act have both been implemented via SETA (Sector Education and Training Authority). These initiatives have been implemented without success because the response of business to these initiatives has been weak. Kingdon and Knight (2007:838) also claim that skills levy revenue in South Africa, has largely been unclaimed by businesses. The performance of SETA will receive more attention in Chapter 6.

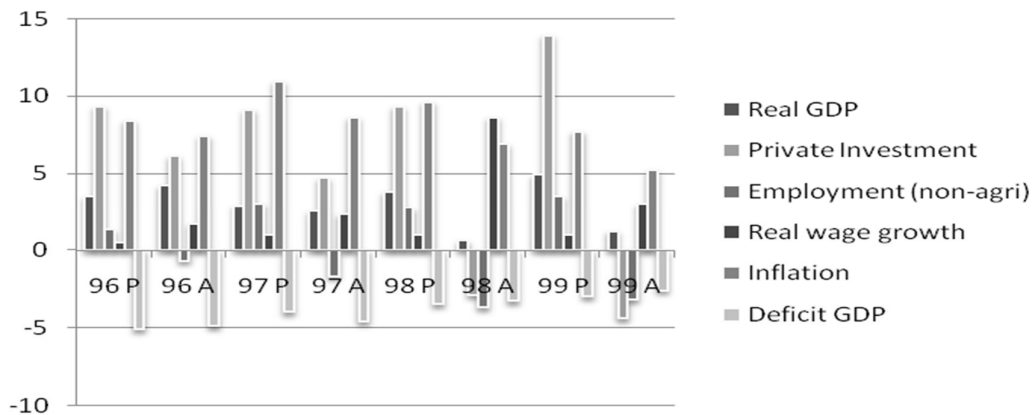
Up to now this chapter has provided an overview of the South African labour market, its development, legislation and its composition in terms of formal and informal employment. It was shown that there exists extreme rigidity in labour absorption, especially in the formal sector. It is also possible that overprotecting workers in the formal sector make it difficult for the formal sector to absorb workers from the informal sector. The next part of this chapter will focus on macro-economic implications, industry concentration and inappropriate bargaining institutions in the South African labour market.

4.3 The macro-economic front

Creating jobs is one of the main tasks of governments around the world. The government supported GEAR (Growth, Employment and Redistribution) strategy aimed to stimulate economic growth and to create employment opportunities for all South Africans.

Nattrass (2000a:1) states that economic growth that acquires more labour demanding production will be more beneficial to the South African economy, than capital intensive production. There are numerous factors like savings, interest rates, and expected profit, that drive investment, but economic policy plays a critical role in attracting investment. The most prominent growth initiative since 1994 was the GEAR strategy (1996) implemented by government to increase growth and employment in South Africa. As Figure 12 shows, success in various aspects of this strategy has been limited.

Figure 12: GEAR predictions (P) and actual performance (A)



Source: Nattrass, 2000:3.

The positive aspects of GEAR include a decrease in the fiscal deficit and greater price stability as seen in lower actual inflation values in Figure 12. On the contrary, lower fiscal deficits are also restrictive on the demand side of the economy. GEAR predictions and actual performance figures do not match, but one should also remember that the Asian crisis of the late 1990s had a severe effect on developing economies at the time. Evidence on the failure of the government backed GEAR strategy was also shown in the high unemployment figures in Figure 10.

OECD evidence indicates that countries that implement macro-economic stabilisation policies without addressing labour market rigidity, encountered employment difficulties (Natrass, 2000a:4). Other evidence indicates that trade with low wage developing countries leads to a decrease in the demand for less skilled labour in high and middle income countries. This is specifically evident in high performing Asian countries where wage flexibility decreases unemployment and increases productivity and employment.

In South Africa manufactured exports have increased, but these increases were mainly in the capital and skills intensive production sectors. Initiatives by the Department of Trade and Industry (DTI) to try and create jobs have proven to be costly. Natrass (2000a:10) indicates that spatial development initiatives have created 10 000 jobs at a cost of R17 billion, and that a further additional 400 initiatives created 68 000 jobs at a cost of R83 billion. This shows that job creation initiatives are capital intensive and that creating one additional job costs between 1.2 and 1.7 million Rand. Further evidence of this is the fact that the country's Industrial Development Zones (IDZs) only attracted capital intensive mega projects.

Moll (1996:326) states that large firms use more capital intensive techniques to increase labour productivity, and as a result wages are higher than in smaller firms. In South Africa, bargaining councils are dominated by larger firms, thus wage bargaining is perfect for capital intensive sectors but not labour intensive sectors. This harms the labour intensive smaller firms and contributes to a decrease in employment, and in this way collective bargaining impacts negatively on the smaller firms.

Another problematic aspect that hampers employment creation is the fact that unions reject wage flexibility. Unions argue that economic growth and not wage decreases will stimulate job creation. Unions also adjust wages according to inflation and not productivity, and in this way contribute to extreme employment rigidity in the South African labour market.

4.4 Inappropriate bargaining institutions

In South Africa, collective bargaining takes place via two systems namely statutory and non-statutory systems. Outside the statutory system bargaining also take place at a plant level (Godfrey, Theron and Visser, 2007:1).

4.4.1 The legislative framework

The Labour Relations Act (LRA) promotes voluntary entry to bargaining activities, but sometimes extends to all individuals in a specific sector. The constitution allows individuals to form and join trade unions, to take part in union activities and to strike (Benjamin 2008:3). On the other hand, statutory labour rights serve as a collection of rights for employees and employers (Benjamin 2008:4). This means that a bargaining party taking part in strike activities is merely exercising its statutory rights (Maziya, 2001:7).

Table 9: Collective bargaining framework

The Statutory system	The non Statutory system
Bargaining council number: 84 councils trends: -fewer councils representing more members -centralised negotiations enforce: CCMA (Commission for Conciliation, mediation and Arbitration)	Non statutory centralised bargaining trends: 3 industries only -mining: central bargaining forums -automobile: NBF (National Bargaining Forum) collective bargaining -fishing: annual forum and specific firm level negotiations
Statutory council number: 2 trends: -increased establishment, but none registered -only serve as dispute resolution agencies	Non statutory decentralised bargaining trends: retail sector -individuals firm level bargaining -sector specific agreements
Quasi-statutory centralised bargaining number: - trends: -only security and cleaning sectors -centralised negotiations -ministerial intervention on behalf of non members	

Source: Constructed from Godfrey *et al.*, 2007.

The New Labour Relations Act (NLRA) has introduced statutory councils to serve as a compromise between voluntarism and compulsion (Godfrey *et al.*, 2007:9). These councils can be established by either labour unions or employers' organisations, but have a limited bargaining agenda. To promote joint problem solving the LRA has introduced workplace forums where employers consult the forum with proposals. The main problem is that these bodies have limited decision making powers. Next, the collective bargaining framework will be summarised in Table 9.

To sum up the most prominent features of the collective bargaining framework, one can see that bargaining institutions are becoming fewer and represent more employees. Bargaining takes place at an industry level and bargaining at a plant or firm level only happens in some sectors. Small firms and firms in the informal sector are not represented in the negotiating process. The decentralisation of the bargaining process in some sectors hampers the effectiveness of trade unions. Godfrey *et al.* (2007:103) state that the most negative trend is the increase in industrial action, where intimidation and violence is on the rise. Statutory councils are ineffective and are being marginalised to dispute resolution entities. A further worrying aspect is that it seems as if bargaining institutions are not promoting training and development activities in any of the industries.

Labour regulations in South Africa are slowing down the rate of absorption of workers in the formal labour market, and increasing the cost of employing additional workers. In Chapter 6 the effect labour regulations have on firms in South Africa will receive more attention. A firm level analysis will use data on small, medium and large firms to estimate whether labour regulation pose as a human capital constraint or not. The next section of this chapter will explore the final labour market distortion as described in section 4.1. This section will explore the concentration of industries in South Africa, and the effect it has on the economy.

4.5 Industry concentration

Industry concentration refers to three aspects. Firstly, it refers to the concentrated nature of production in South Africa (resourced-based goods). Production is also concentrated within a small number of firms, and production is also location biased.

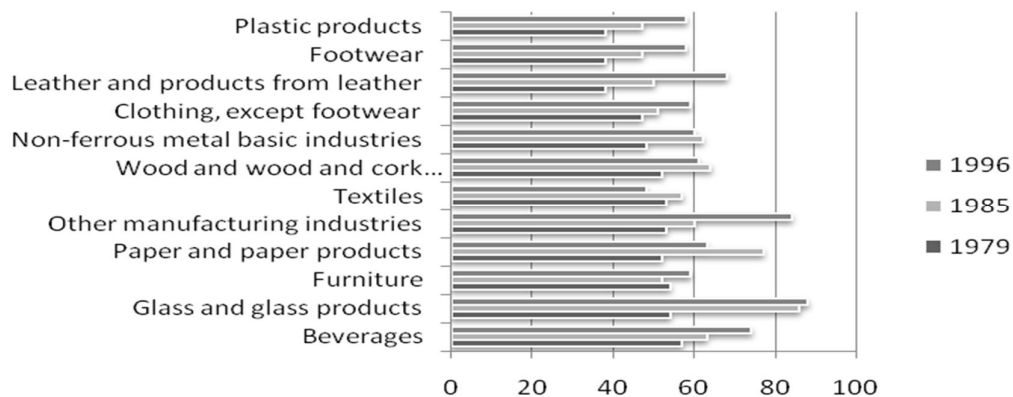
4.5.1 Industry concentrated goods and the number of firms

Fedderke and Szalontai (2005:1) state that increased industry concentration has the following impact on the South African economy:

- decreased output growth;
- increased cost of additional labour units and
- decreasing productivity of labour.

As seen in Figure 13, the top five per cent of firms produce a large fraction of total output in various industries. Evidence from Figure 13 suggests that five per cent of the biggest firms in certain sectors produce fifty per cent of the total industry output.

Figure 13: Industry output contribution of the top five per cent of firms



Source: Fedderke & Szalontai, 2005:9.

These figures show that industry concentration in South Africa in general is on the rise. Although somewhat unclear, evidence suggests that increased industry concentration does decrease employment, industry competition and total industry investment (Fedderke & Szalontai, 2005:30).

A number of indices exist to determine the level of industry concentration in an economy. The most widely used index is the Herfindahl index that measures the size of the firm relative to the specific industry, but due to lacking historical data it cannot be used for South Africa (Naudé, 2006:4). There are an additional two indices that can be used to determine the level of industry concentration; these are the Gini and

the Rosenbluth index. The Gini measures unequal distributions and the Rosenbluth takes into account the number of firms in an industry (Naudé, 2006:4).

Fedderke and Szalontai (2005:13) state that the Rosenbluth is known for its sensitivity as it includes small firms with little or no market share, and thus understates the level of concentration. In work done by Fedderke and Szalontai and Naudé, industry concentration was shown to be extremely high and on the increase. Increased industry concentration in the manufacturing sectors will also influence competition in these these sectors. Competition and industry concentration will also receive more attention in Chapters 6 and 7.

4.5.2 Industry location

Section 4.5 stated that industry concentration also refers to the concentration of industries in specific geographic areas. Naudé (2006:3) explains that different geographic areas are in constant competition to attract investment and production, and that the most attractive area will experience industry concentration. International studies have indicated several potential contributing factors towards industry concentration. These factors include transport cost, infrastructure, specialisation, ports, technological spill-overs, resource endowments and other location essentials (Naudé, 2006:2).

Naudé and Gries (2004:1) found that in South Africa eighty-five per cent of manufactured exports come from twenty-two out of the possible three-hundred-and-fifty-four magisterial districts. In a study done by Naudé (2006:14) it was found that only KwaZulu-Natal and Gauteng were export orientated, and that the ability to manufacture in only a few areas causes migration to areas where industries are more densely situated.

4.5.3 Industry concentration and its effect on employment

In the above section it was shown that South Africa's economy is densely concentrated in certain industries, firms and areas. To show the impact industry concentration has on employment, this section will look at the mining sector for

evidence. South Africa's mining sector experienced severe job losses during the 1990s. Along with job losses indicated in Table 10, real wage elasticity in the coal, gold, uranium, diamond and other mining activities were negative. Fedderke (2006:16) states that real labour costs are greater than improvements in labour productivity, and that this contributes to labour market rigidity. With an economy that is resource-based, job losses in sectors like mining can further increase the level of unemployment.

Table 10: Labour losses in the mining sector

Mining sector	Unskilled workers	Real wage elasticity
Coal mining		-0.44
1985	101 705	
1997	55 219	
Gold and uranium mining		-0.69
1985	526 839	
1997	241 352	
Diamond and other mining		-1.45
1990	199 572	
1997	136 543	

Source: Feddeke, 2006:16.

The highly concentrated nature of South African industries does have a negative impact on unemployment in the country. As firms find more advanced ways of production, the services of less skilled workers becomes excessive. These semi skilled workers then enter the labour market with industry specific skills. With the highly saturated nature of the formal labour market, these workers are forced to stay unemployed or to search for work in the informal sector. The final section will summarise the findings of Chapter 4.

4.6 Summary

Chapter 4 set out to examine different forms of labour market distortions in the South African economy. The impact that legislation, location and concentration have on various industries has been discussed. The evidence suggests that labour regulations can in some instances impact negatively on employment, especially in smaller firms. It has been shown that individuals in the informal sector and those working and providing work in smaller firms are being excluded from decision making activities. This is because bargaining is increasingly taking place at an industry level

and not at a plant level. Labour union numbers have decreased, but the number of employers they represent has increased. A further trend shows that councils are more occupied with bargaining higher wages and improved working conditions, than actively looking for ways to increase the productivity or skill level of their members. The concentrated nature of industries leads to migration of unskilled workers to areas that have a high concentration of industries. Job losses in specific sectors can have severe implications for employment, as seen in the mining sector during the 1990s.

To conclude: labour regulations in South Africa are restrictive and industries are concentrated in a small number of firms, locations and produce. Government initiatives to create employment opportunities have not been successful, and proved to be expensive. Labour regulations and their potential restrictive nature will again receive attention in Chapters 6 and 7. The next chapter will explore human capital development initiatives and will assess the complexity of South African exports.

CHAPTER 5

HUMAN CAPITAL DEVELOPMENT AND EXPORT COMPLEXITY

So far, this study has explored human capital constraints in the South African economy. Evidence suggests that the standard of education in the country is not up to standard and labour regulations were shown to be complex. This chapter will focus on human capital development and trends in the firm level environment in South Africa. This section will set off by looking at what government has done to promote business development, especially in terms of human capital development via training and support initiatives. This chapter will aim to determine if government programmes have been successful in developing human capital on a firm level. The second part of this chapter will focus on South Africa's export performance, in terms of the technological complexity of exported goods. Here the technological nature of goods exported will be assessed and compared to economies in Asia, and a resource-based group with similar characteristics as the South African economy.

5.1 Human capital development and national initiatives

Out of the GEAR strategy in the early 1990s, a parliamentary white paper on small businesses was established. In 1996, the National Small Business Development Act was established and up to 2005 it mainly had three roles: employment, redistribution and increased competitiveness. Rogerson (2004:766) describes these roles as conflicting, and that empirical evidence suggests that these policies have not been very successful. The following section will examine available empirical work to determine if these policy initiatives have been successful. Table 11 shows the three main support structures and their relevant initiatives. These programmes were established to help decentralise access to information, training, markets, finance, and technology.

The most well-know programmes are the Local Business Support Centres (LBSCs), Manufacturing Advice Centres (MACs) and the Retail Finance Intermediaries (RFIs). The biggest role the RFIs had was to help with tender advice and public

procurement contracts, while the other two provided general business support. In 2002 there were 40 RFI_z, and in 2003 there were 92 LBSC_z and 16 MAC_z (Rogerson, 2004:767).

Table 11: National policy initiatives to promote SMME development

DTI	Ntsika	Khula
Competitiveness fund	Local Business Support Centres (LBSC)	RFI (Retail Finance Intermediaries)
Sector partnership fund	Tender Advisory Centres (TAC)	
Economic empowerment scheme	Technopreneur programmes	
SMME development programmes	Training and Capacity building	
Emerging entrepreneur scheme	Manufacturing Advice Centres (MAC)	
Venture capital scheme		

Source: Chandra *et al.*, 2001:39.

The biggest problem in analysing the effectiveness of these programmes is the lack of quality data. Rogerson (2004:769) explains that Statistics South Africa estimated that there were 2.3 million SMME_z actively doing business in 2003, while Ntsika only estimated 1.2 million active SMME_z for the same period. With provincial discrepancies that exhibit similar trends, finding and analysing data tends to be difficult. However several studies have been done by using survey data on SMME_z across the country. The following part will focus on key findings in several of these survey analyses.

Recent efforts by government to promote small and medium-sized businesses mainly had three pillars: to promote entrepreneurship, to create a fertile environment and to increase competitiveness and capacity (Rogerson, 2008:61). The need for learning ledq competitiveness has become a global phenomenon and changing ideas and environments pose as the biggest challenge to SMME_z. Education, training and experience make out the most important aspects of competitiveness for all types and sizes of firms. Training seems to be informal and does not fit in with the NQF (National Qualifications Framework). The lack of formal evaluation on these programmes also generates questions about the quality of these training practices (Rogerson, 2008:72). The World Bank assessment of government SMME

programmes in 2006 indicates that it has not been successful. Findings in this report identify an absence of training and education as the main stumbling blocks. Other issues involved an unauthorised training supply, corporate orientated content that is unsuitable for SMMEs and a lack of appreciation for training among SMMEs (World Bank, 2006:4).

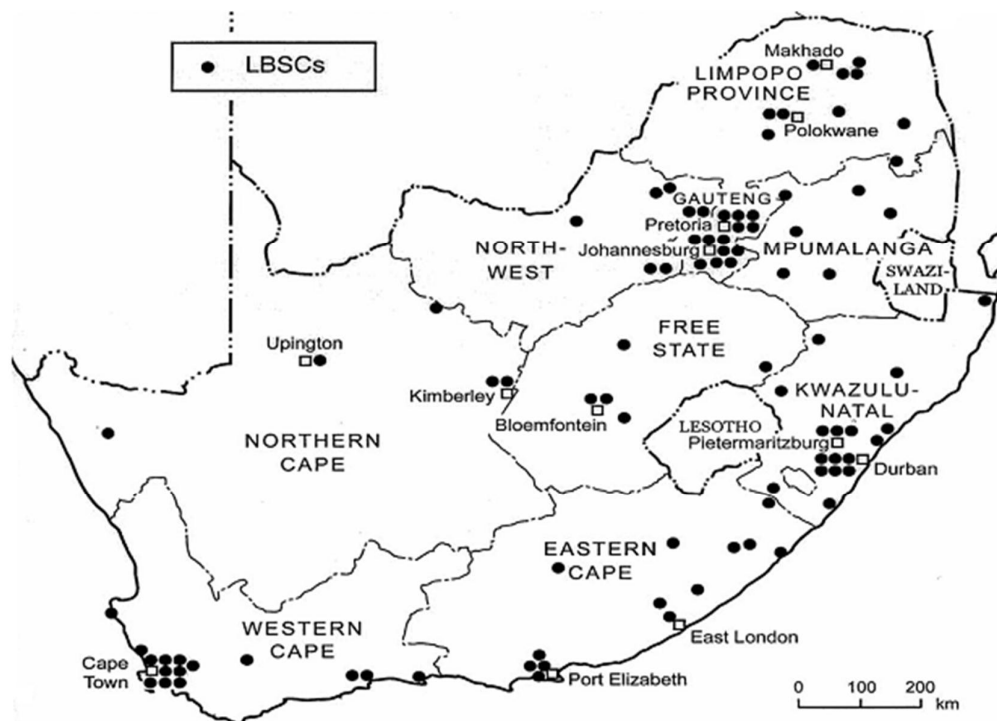
For SMMEs there seems to be a lack of understanding of labour laws. This is because labour legislation is perceived to be time consuming and expensive. Evidence also shows that South Africa's regulatory compliance cost is higher than in other developing countries.

Rogerson (2004:770) found that the share of SMME employment in South Africa is lower than in other developing countries. The main reasons behind this phenomenon are as follow.

- SMME programmes are not functionally integrated in the modern production process;
- SMME programmes are not dynamic enough to expand to more than one person firms, and
- Financial growth exceeds job growth by a large margin.

The greatest criticism on these initiatives is on the fact that these initiatives are unevenly spread across the country, as seen in Figure 14. Poor service providing and service providers varying in capacity as well as corruption are some of the other greatest concerns. Figure 14 shows the lack of business service centres in rural areas, and this explains why the redistribution pillar set out by the government was not met. Rogerson (2004:777) found that this type of uneven spread of centres also occurred for MAC and RFI programmes.

Figure 14: Local Business Support Centres (LBSC) distribution



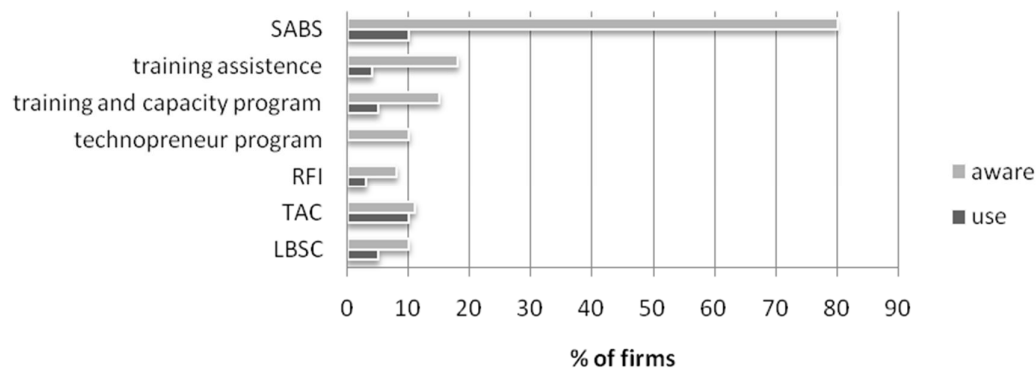
Source: Rogerson, 2004:775.

Survey work done by Chandra *et al.* (2001:iv) revealed that in 1999, 30% to 45% of SMMEs indicated a skills shortage. Only 24% to 30% of firms with more than five workers had formal skills training, and 10% of firms with fewer than five workers had formal skills training. The most worrying aspect is that the amount spent on crime prevention was bigger than the amount spent on training. SMMEs did not see labour regulations as a constraint, as they just used less permanent employees.

Export promotion programmes consisted out of three main categories. These were tax exemptions, export credit guarantees and forward foreign exchange cover. However, Chandra *et al.* (2001:v) found that monetary incentives were preferred above the other non-monetary incentives. The actual usage and awareness rates of government SMME programmes were also extremely low. As seen in Figure 15, usage and awareness figures for the RFI, TAC and LBSA initiatives were under twelve per cent. Training programmes have larger awareness figures, but the actual usage rate is under ten per cent. Chandra *et al.* (2001:41) found similar usage and awareness trends in DTI programmes. From data on DTI initiatives, loan

programmes had the highest usage and awareness rate of 17% and 36% respectively.

Figure 15: Awareness and use of government SMME programmes



Source: Chandra *et al.*, 2001:40.

To summarise: awareness and usage figures for human capital development programmes are low. Firms are most aware of the SABS (South African Bureau of Standards), and loan programmes are on average used the most. This corresponds well with earlier findings on export promotion programmes. For these programmes monetary incentives were preferred above other non- monetary incentives.

5.1.1 Training and apprenticeship trends

In the above section it was shown that government initiatives to promote human capital have not been successful. This section will explore trends in national training and apprenticeship levels. Table 12 shows that firms in the survey done by Chandra *et al.* (2001) preferred using non-governmental institutes as training providers. This evidence corresponds well with earlier evidence that found that training programmes among SMMEs are informal and not aligned with the NQF framework.

Bhorat and Lundall (2004:1039) also found evidence that in-house training schemes were preferred above outside training schemes. Sixteen per cent of firms in this survey did not invest in in-house training programmes, while the figure for outside training was twenty six.

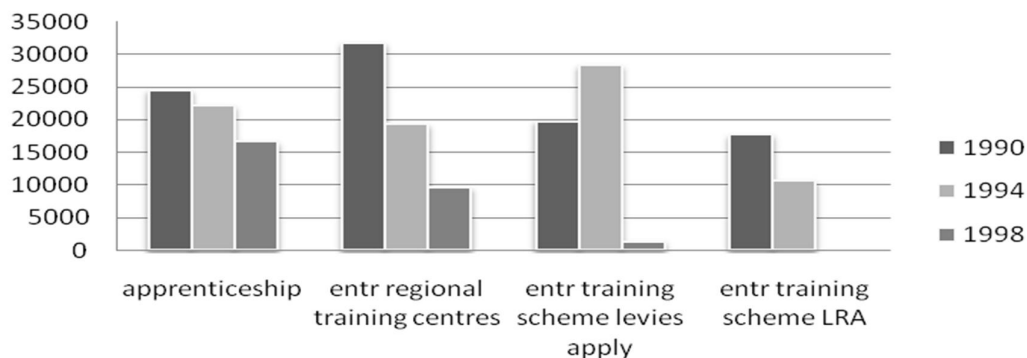
Table 12: Preferred training providers by SMME's in the survey

Type of training	Percentage %
In-house	71.5
Private training schools	30.1
Vocational / Technicons	29.6
Business partners	23.1
Industrial training boards	22.0
University	15.6
Government institutes	13.4
Community based training	2.7

Source: Chandra *et al.*, 2001:26.

Up to now, the study has shown that human capital development in South Africa tends to be either formal or informal. A large part of training programmes takes place outside the NQF framework, and evaluating these programmes is difficult due to a lack of data. The next part will look at trends in training programmes inside the NQF framework.

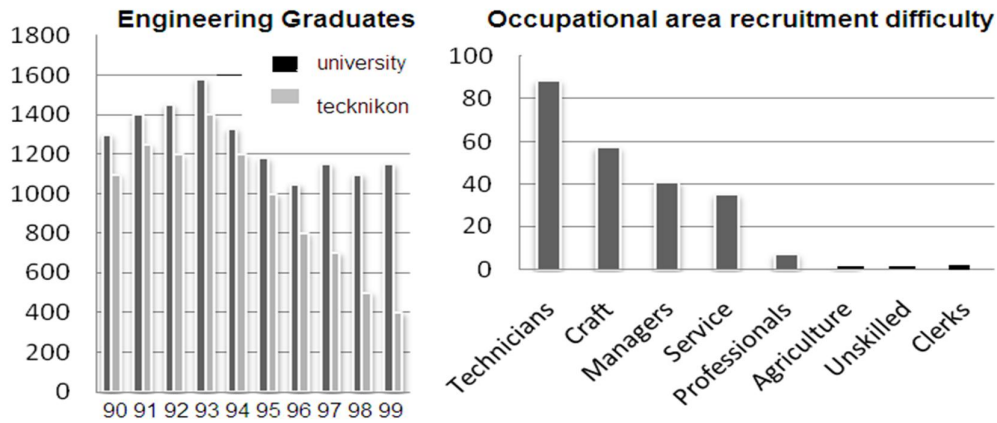
Figure 16: Enterprise training and apprenticeship



Source: Constructed from, Kraak, 2003:680.

Figure 16 shows the steep drop in learners in apprenticeships and enterprise training scheme across the country. The biggest drop in learner numbers is found in enterprise training schemes where levies apply. This might imply that a lack of financial support is the single biggest barrier to entering training schemes. There is no clear explanation for the drop in apprenticeship or enterprise training levels. Training schemes where levies apply did show the biggest drop, but for the other enterprise training schemes the drop in learner numbers cannot be blamed on a lack of funding. The reason for this is that education and training have received the largest fraction of the annual national budget since 1998.

Figure 17: Engineering graduates and recruitment difficulties



Source: Kraak, 2003:673 & 676.

Figure 17 shows a remarkable decrease in the number of engineering graduates at universities and technicons. Kraak (2003:678) explains that these numbers are extremely low when taken into account that between 1988 and 2000, the enrolment rate at technicons increased from 57 000 to 203 000 learners. At technicons, learners can enrol for a nation diploma as well as for B-Tech degrees. These courses help develop intermediary skills needed in several technical occupations. The second part of Figure 17 shows that the majority of the firms experienced difficulty in finding workers with technical and craftsmanship skills.

Section 5.1 showed that human capital development in South Africa has not been very successful. National initiatives are not effective and have low usage and awareness rates. Training and apprenticeship levels are also decreasing. The next section will focus on the complexity of South African exports. This will be done to determine the technological nature of South African exports.

Chapter 2 explained the importance of technological innovation and progress in the neo-classical growth model. Section 5.2 will explore international trends in terms of the technological complexity of manufactured goods. South Africa's export complexity will also be compared to other developing regions in Asia and a resource-based group of countries. In Chapter 7 the technological nature of manufactured goods in the World Bank enterprise survey will also receive attention.

5.2 Export complexity index

Up to now, this study has shown that there are human capital constraints in the South African economy. This section will examine the technological complexity of South African exports as well as other resource-based economies, and compare it with the complexity of Asian exports.

Edward and Alves (2006:473) found that South African manufacturing exports during the 1990s lag that of other resource-based economies. South African exports continue to comprise of resource-based goods, and these goods are experiencing a global decrease in demand. South African exporters were also shown to be price takers in international markets, and are supply driven. Work done in this chapter as well as Chapter 6 will illustrate the low technological nature of South African exports and manufactured goods.

Table 13: Technological classification index

Primary products	Fresh fruit, meat, rice, cocoa, tea, coffee, wood, coal, crude petroleum, gas, metals
Manufactured products	
Resource Base (RB)	
RB 1	Prepared meats/fruits, beverages, wood products, vegetable oils
RB 2	Ores & concentrates, petroleum/rubber products, cement, cut gems, glass
Low Technology (LT)	
LT 1	Textile fabrics, clothing, headgear, footwear, leather manufactures, travel goods
LT 2	Pottery, simple metal parts/structures, furniture, jewellery, toys, plastic products
Medium Technology (MT)	
MT 1	Passenger vehicles and parts, commercial vehicles, motorcycles and parts
MT 2	Synthetic fibres, chemicals and paints, fertilizers, plastics, iron, pipes/tubes
MT 3	Engines, motors, industrial machinery, pumps, switchgear, ships, watches
High Technology (HT)	
HT 1	Office/data processing/telecommunications equip, TVs, transistors, turbines, power generating equipment
HT 2	Pharmaceuticals, aerospace, optical/measuring instruments, cameras
HT (other)	Electricity, cinema film, printed matter, special transactions, gold, art, coins, pets

Source: Lall, 2000:7.

Edward and Alves (2006:473) determined that factors such as the real effective exchange rate, infrastructure cost and skilled labour are the major determinants of export supply among South African exporters.

Table 13 indicates the technological classification of manufactured goods according to Lall (2000:7). The classification classifies goods from unskilled labour intensive primary goods, to high-tech capital intensive goods that are produced by skilled workers. As the level of technology increases more skills are needed. Growth in high-tech sectors is also driven by greater productivity gains. Some other important aspects of high-tech goods include: higher demand for high-tech goods compared to resource-based goods, income elasticity, they create new demand and old products are more frequently substituted (Edward & Alves, 2006:475).

5.2.1 Global trends in manufactured goods

As Table 14 shows growth in high-tech products has increased substantially since 1985, and most of the growth has been centred in the developing world. High-tech goods share of global trade has risen from 12.4% in 1985 to 21.1% in 1998.

Table 14: Export growth rates (annual %)

	Growth between 1985 – 1998						
	All	Primary	All Mfg	RB	LT	MT	HT
World	8.6	3.4	9.7	7	9.7	9.3	13
Developed	8.4	4.4	8.8	7	8.5	8.5	11.3
Developing	8.7	1.3	12.5	6	11.7	14.3	21.4
Shares of products in world exports, 1985 & 1998							
1985	100	21.7	73.8	21.1	13.7	30.2	12.4
1998	100	11.5	84.2	14.5	15.8	32.8	21.1
Shares of developing countries in world exports, 1985 & 1998							
1985	24.3	52.1	16.4	26.3	26.7	8.3	10.7
1998	25	39.7	23.3	23.7	34.5	15.3	27

Source: Lall, 200:10.

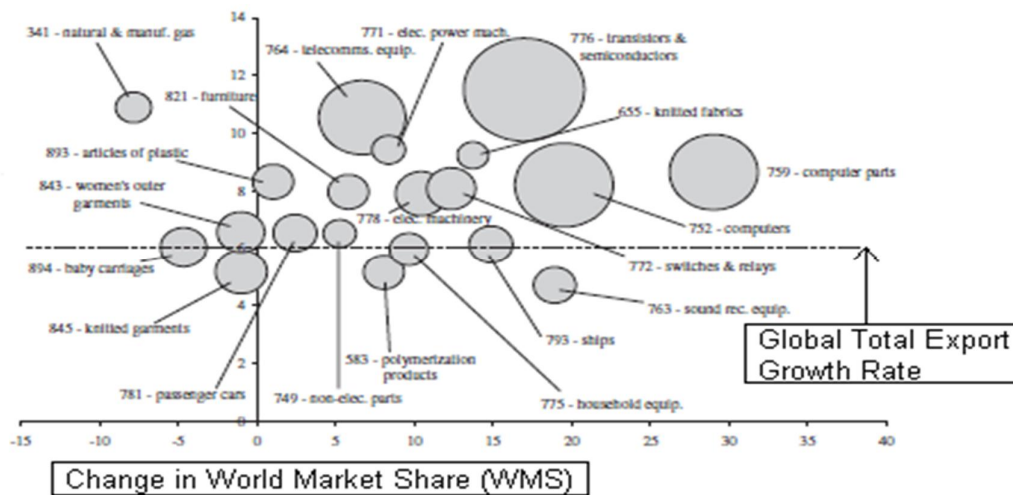
Findings in UNCTAD (2002) and UNIDO (2004) reveal similar trends on global manufacturing export growth and complexity. Table 14 also serves as evidence that technological innovation is associated with higher economic growth, as explained in the Solow growth model. In Chapter 2 it was also shown that Asian countries achieved the highest, and most constant economic growth since the 1960s.

Therefore it is not surprising that most of the growth in high-tech goods comes from Asian economies.

5.2.2 Comparing South Africa's export complexity

From the technological classification of exports in Lall (2000:7), Edward and Alves created the following three figures to indicate trends in manufacturing exports for South Africa, Asia and a resource-based group of countries. These countries (resource group) have similar economic characteristics to South Africa. These figures indicate the global total export growth rate line, as well as the change in world market share.

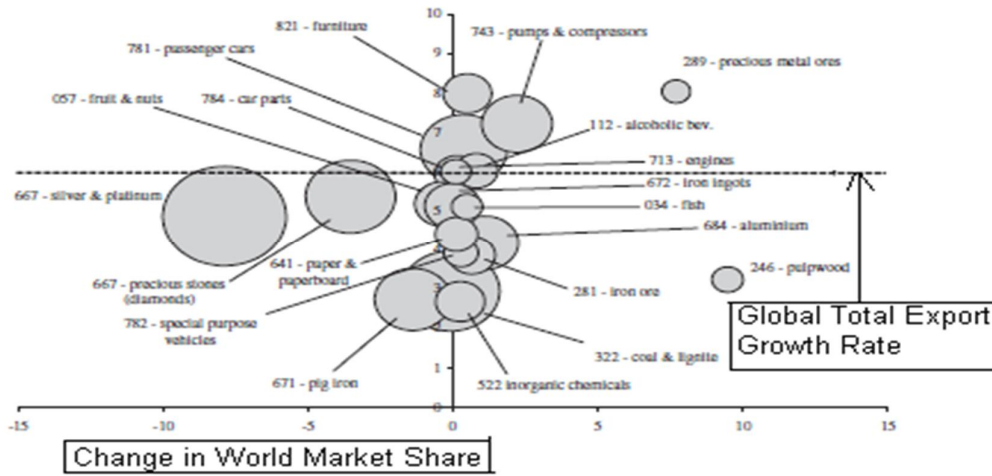
Figure 18: Asian export complexity



Source: Edward & Alves, 2006:480.

Figure 18 shows that Asian exports are experiencing increasing world market shares, and their products are also above the global total export growth rate line. The most important aspect of Asian exports is that most of the products are classified as medium to high-tech goods, according to the technological classification of Lall (2000:7). When compared to Figures 19 and 20, one can also see that the changes in world market share for Asian exports are noticeably greater than for South Africa and the resource-based group.

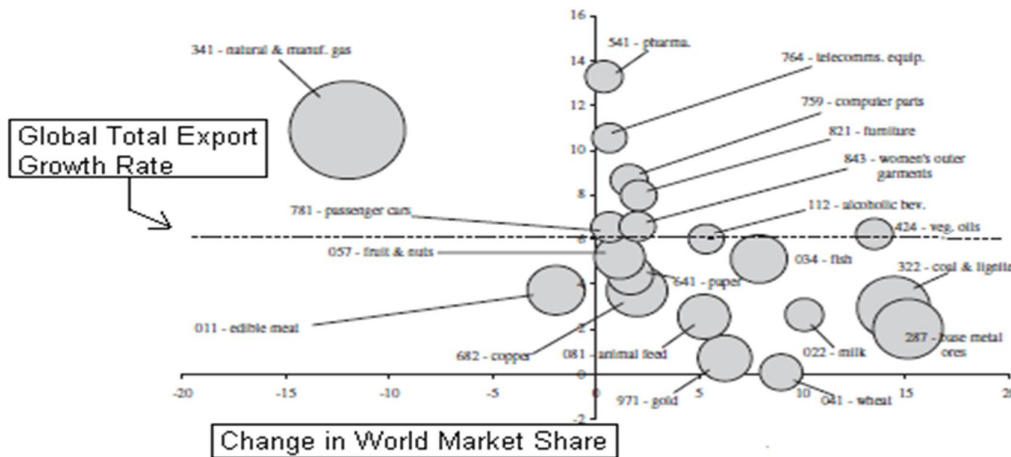
Figure 19: South African export complexity



Source: Edward & Alves, 2006:480.

When looking at South African exports three trends emerge. Firstly, most goods are below the global total export growth rate line. Secondly, the majority of these products are experiencing low world market shares and some are also experiencing decreasing world market shares. The third is the fact that most of these goods are classified as low to medium-tech goods according to the technological classification index. Evidence in Figure 19 also supports the idea that resource based goods are experiencing decreasing export growth as well as lower global demand.

Figure 20: Resource group's export complexity



Source: Edward & Alves, 2006:481.

To take into account the differences between Asian and the South African economy, a resource-based group of countries is also included. From Figure 20 it is clear that South African exports are lagging behind that of the resource-based group. This is in terms of world market share, global total export growth rates and the technological classification index. The export complexity for the resource-based group is similar to that of South Africa, but their world market share and global total export growth rates are higher. The evidence from figures 18, 19 and 20 compare relatively well with findings in other studies on South Africa's export complexity. Van Seventer & Gibson (2004) found an extremely low share of South African exports in the top 40 exported goods between 2000 and 2003. Earlier work by Tsikata (1999) also found that relative to middle income countries, South African exports continue to focus on stagnating world markets.

5.3 Summary

Chapter 5 set out to examine human capital development and to determine the complexity of South African exports. Section 5.1 showed that success in human capital development in South Africa has not been too impressive. Evidence on usage and awareness rates on various development and training initiatives suggest low levels of interaction between government and the private sector. Evidence on South Africa's export complexity suggests that South African exports are of low technological nature, when compared to Asian economies as well as other resource-based economies. The majority of growth in manufactured exports is taking place in developing countries, but Asia and specifically South East Asia are responsible for this.

Lall (2000:2) states that East Asia dominates developing world exports of manufactured high-tech goods, and that there seems to be a divergence among developing countries in terms of export complexity and performance. Production is also not only concentrated among Asian countries, but also among certain individual companies. Lall (2000:22) shows that the market share of the top ten companies in Asia is on the rise. Edward and Alves (2006:475) explain that export structures are path dependant and difficult to change, and that human capital plays an important role in this phenomenon. If the quality of human capital increases, so will

productivity, and this will facilitate diversification into more technologically advanced goods. According to Lall (2000:29), countries with more advanced learning systems are capable of improving their economic policies, accumulate skills and develop innovative institutions of society.

To conclude, high-tech manufactured exports are experiencing high levels of growth and demand in international markets. South African exporters should pursue production of these items to expand business and to achieve higher levels of profit. The neo-classical growth theory explains that economic growth depends on technological innovation and progress. The model does not explain the origin of technology, and assumes that it is distributed equally between countries. The divergence of growth between developing countries indicates that technological innovation is not equally distributed between countries. Evidence on this is the fact that most of the growth in manufactured goods since the 1980s has been in developing countries in Asia. Only a few countries have been able to increase the technological complexity of their exported goods and services. This study states that technological innovation depends on human capital improvements, and human capital improvements depend on quality education. Chapter 6 will explore survey data to determine the extent of the effect that human capital constraints have on firms in South Africa.

Human capital initiatives and training will also be analysed. Chapter 5 also gave evidence that human capital development in South Africa has not been effective. In the literature, most studies on human capital initiatives have been done using survey data. The reason for this is that data on this subject is not very reliable. Chapter 6 will therefore use the same method to determine the effectiveness of human capital initiatives in South Africa.

CHAPTER 6

FIRM LEVEL ANALYSIS

The first five chapters of this study explored human capital's role in economic growth, as well as several human capital constraints in the South African economy. Chapter 2 explained that a productive mix of capital, labour and technology are the main ingredients for increased economic growth or output. The introduction stated that labour regulations along with an inadequately educated workforce pose as the two greatest risks to South Africa's competitiveness. Chapter 3 found evidence that the South African education system produces a large quantity of inadequately educated individuals. Labour market distortions were discussed in Chapter 4. These distortions included the legislative environment, inappropriate bargaining, excessive rigidity and industry concentration. The technological complexity of South African manufactured exports was shown to be mediocre in Chapter 5. Chapter 5 also showed that success in human capital development in South Africa has been limited. Chapter 6 will consist of a firm level analysis of South African manufacturers, and a regression analysis on the determinants of increased output per worker will follow in Chapter 7.

6.1 Method of analysis

This analysis is based on data gathered by the World Bank (2008) enterprise survey on productivity and investment climate in South Africa. Various aspects were analysed and comparisons for 2003 and 2006 are available for certain variables. The survey targeted establishments located in the cities of Johannesburg, Cape Town, Port Elizabeth and Durban in the following industries (according to ISIC revision 3.1): all manufacturing, construction, retail, hospitality, transport, storage, communication and computer related activities. After careful consideration, four industries were eliminated for the purpose of this study. The analysis will focus on manufacturing establishments and therefore wholesale, retail, hotel and IT establishments have been eliminated from the dataset. For the purpose of this study a sample of 745

establishments will be used to analyse constraints and trends among South African manufacturers.

6.2 Descriptive statistics

This part of the study will explore the data and provide information on trends and other occurrences in the manufacturing sector. Due to large differences between small, medium and large firms, the data will be analysed according to the size of these firms. Initially the study will look at aspects that include demographic and industry specifics, and will progressively go into more specific aspects such as labour, finance and cost structures. After splitting the data according to industry and size, twenty-five missing values emerged. The sample now consists out of 720 firms, with 248 of them small, 287 medium and 185 large firms. SPSS will be used to process the data.

6.2.1 Demographic information

The first part of this section will explore the survey demographics. These include region, size, experience and the type of industry. This section aims to highlight general characteristics for firms in the survey.

Region

As indicated in Chapter 5, industry concentration with respect to region or location is a well-known characteristic of the South African manufacturing sector. Firm level analysis in this study found similar evidence as seen in Table 15.

Table15: Average location of industries

Region	Small (%)	Medium (%)	Large (%)	Total (%)
Johannesburg	64.9	60.3	62.7	63.8
Cape Town	17.7	16	16.2	16.1
Port Elizabeth	7.7	5.9	9.2	13
Durban	9.7	17.8	11.9	7.1
Total (n)	248	287	185	100

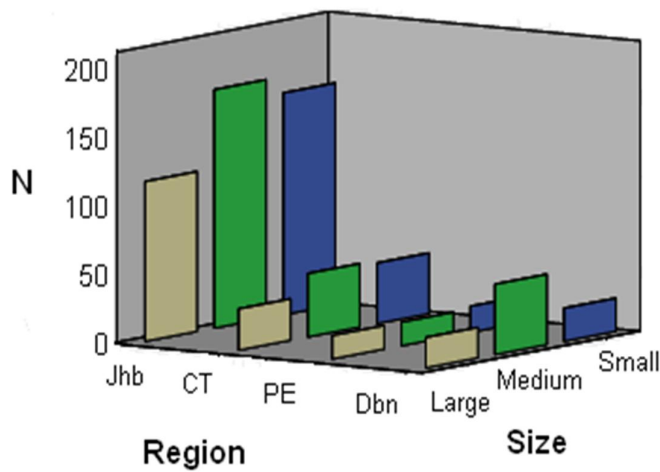
As mentioned in the method of analysis, only four regions were used in compiling the data set. These regions are Johannesburg, Cape Town, Port Elizabeth and Durban. The evidence suggests that industries are heavily concentrated in Johannesburg, as 63.8 per cent of the sample population were situated in Johannesburg followed by Cape Town (16.1%), Durban (13%) and Port Elizabeth (7.1%).

Size

The requirement for establishments to be included in the survey was a minimum of five full-time paid employees. To further distinguish between small, medium and large companies, scales were introduced. Small size companies ranged between 5-19 employees, medium size between 20-99 employees and large size companies with 100 or more employees. Figure 21 shows the distribution of companies according to their size and region. Small establishments made out 33.3% of the sample population, while medium and large size establishments made out 38.5% and 24.8% respectively. Only 3.4% of the respondents failed to indicate the size of their establishment. These establishments or missing values were left out of the rest of the analysis.

The majority of establishments in the small, medium and large categories are concentrated in the city of Johannesburg.

Figure 21: Size of establishments



An interesting aspect of the size variable is that 47.6% of the large firms indicated that they were part of larger establishments or groups. For small and medium establishments, this figure was 20.2% and 24% respectively. This might have a positive impact on these establishments due to the fact that business can be outsourced within the group of companies.

Market experience

When analysing the experience of these establishments, two variables are taken in to account. Firstly, the average year in which operations began, and then the average amount of experience managers have.

Table 16: Average experience (Year/s)

	Small	Medium	Large
Managers experience (years)	11.57	16.37	18.70
Starting date of operations	1997	1987	1975

Table 16 indicates that larger firms have on average been doing business for a longer period of time than small and medium sized establishments. Managers working for larger establishments also have on average more years of experience than managers working for small and medium sized establishments. Small firms are relatively new entrants to the market, while large and medium sized firms enjoy greater market experience. This also explains why managers working for larger establishments have on average more experience than managers working for small establishments.

• *Industry*

The industry analysis will be done by comparing the technological classification index of Chapter 5 with the actual data in the survey. This is done to determine the level of technological complexity of the products produced by establishments in the survey. Table 17 indicates two trends, firstly a high concentration of activity in the RB1, LT1 and MT2 sectors. Secondly, low levels of representation of activity in the high-tech sectors. This evidence corresponds well with evidence from Edward and

Alves (2006:480), which found South African exported goods to be of low to medium technological complexity.

Table 17: Sample technological classification

Manufactured products	Percentage of establishments' output (%)		
	Small	Medium	Large
Resource Base (RB)			
RB 1	24.1	20.8	20.7
RB 2	5.4	8.4	6.9
Low Technology (LT)			
LT 1	28.2	19.4	15.2
LT 2	-	0.5	0.8
Medium Technology (MT)			
MT 1	0.7	0.5	-
MT 2	34.7	39.9	40.3
MT 3	4.3	7.1	8.4
High Technology (HT)			
HT 1	2.5	3.3	7.6
HT 2	-	-	-
HT (other)	-	-	-

The largest industries were found in the food, chemical, clothing and fabricated metals sectors. Evidence suggests that small and medium sized establishments do have the means to produce low and medium tech goods, but that larger establishments are better equipped to produce goods of higher technological nature.

6.2.2 Industry information

This section will explore industrial tendencies and compare differences between small, medium and large establishments. Aspects such as sales markets, competition, outsourcing and capacity utilisation will receive attention.

- **Sales market**

This section will determine where the majority of these establishments sell their products, and how much is exported. The evidence reveals that on average 93.6% of the establishments sales are national, 4.4% of their products are sold as exports and 1.9% is sold as indirect exports. Evidence from Table 18 reveals that larger firms do export relatively more than small and medium sized establishments. For indirect exports it seems as if medium sized establishments produce the highest fraction of

products that serve as indirect exports. These intermediary goods are sold to local firms that process them further, and then export them to various locations around the world.

Table 18: Average sales market

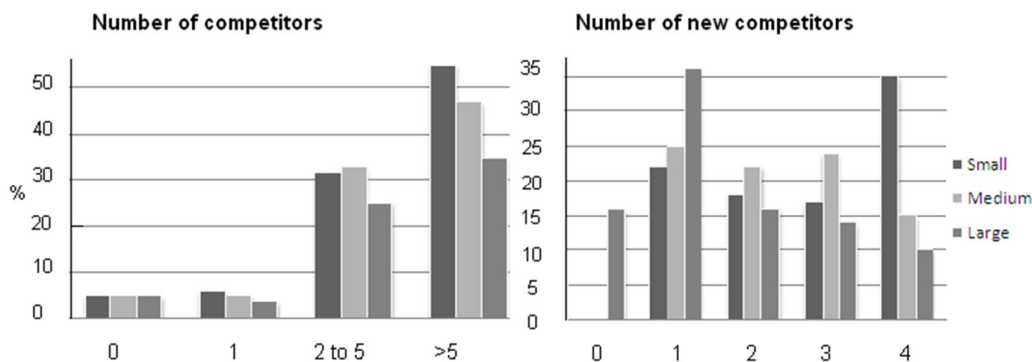
Region	Small (%)	Medium (%)	Large (%)
National sales	97.3	93.8	87.7
Direct exports	1.2	3.9	10.2
Indirect exports	1.5	2.3	2.1

It has become evident that larger establishments marginally produce more high-tech goods and export a larger percentage of their manufactured goods. The next part will focus on competitiveness aspects which include capacity, the number of competitors and outsourcing.

Competition

This part will consider the number of competitors and the number of new competitors that have entered the market. Figure 22 indicates that larger establishments do on average have fewer competitors than small and medium sized establishments.

Figure 22: Average number of current and new competitors



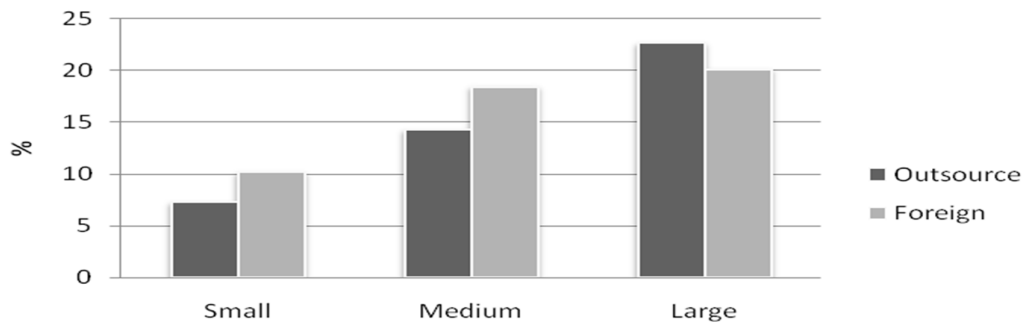
Competition seems to be the highest between small firms, with 55% of the respondents indicating that they compete against five or more small firms in the same market. The same trends are evident when asked about new competitors. For small firms 33% of the respondents indicated that four new competitors entered the market, for medium and large firms this figure was 15% and 10% respectively.

When asked whether firms compete with establishments in the informal sector, 56% of small establishments indicated that they do. For medium and large establishments this figure is 39% and 17% respectively. Nearly 50% of large establishments indicated that only one new entrant had entered the market. This might be due to the fact that entry is not easy and is more costly in the large firm segment of the market.

• **Outsourcing**

Outsourcing refers to a part of the production process being sub-contracted out to other firms. From Figure 23, one can see that larger firms on average sub-contract a larger percentage of production than small and medium sized firms. The fact that close to 50% of large establishments form part of larger groups or companies, might explain this phenomenon.

Figure 23: Average outsourcing and foreign inputs used



Larger firms also use more material inputs that are of foreign origin. When asked why firms outsource production, the majority of the establishments failed to answer. The small percentage that did answer indicated that they wanted to focus on core production processes. No questions were asked on why foreign inputs were used, but licensing and technological aspects might explain this phenomenon.

Capacity utilisation

Table 19 indicates that large firms are on average closer to full capacity utilisation than small and medium sized firms. These larger establishments also work on average longer hours per week.

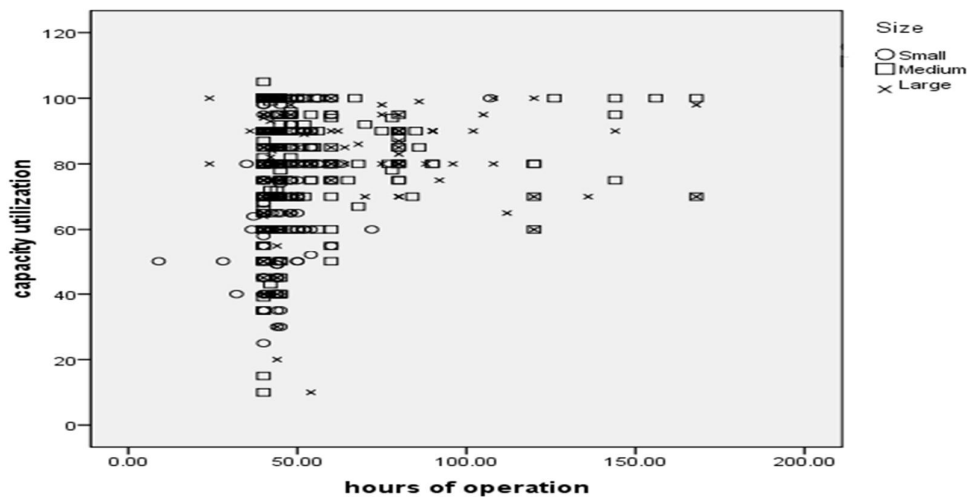
Table 19: Average capacity utilisation and working hours

	Small (%)	Medium (%)	Large (%)
Capacity utilisation	76.6	78.8	80.9
Working hours / week	44.8	52.1	54.9

The scatter plot in Figure 24 shows no real indication of a positive relationship between the number of hours worked and capacity utilisation. When the same plot is estimated for small, medium and large establishments the same result emerges. On average, establishments are not utilising their full production capacity and increasing the amount of hours worked will not increase the capacity any further.

This might imply that there are demand side constraints for most manufacturers in the survey. Section 6.2.4 will explore the possible reasons behind this occurrence.

Figure 24: Scatter plot of capacity utilisation and hours worked



The next part of the section will look at obstacles faced by small, medium and large establishments in the survey. These obstacles will resemble human capital constraints as described in Chapter 1.

6.2.3 Human capital constraints and training

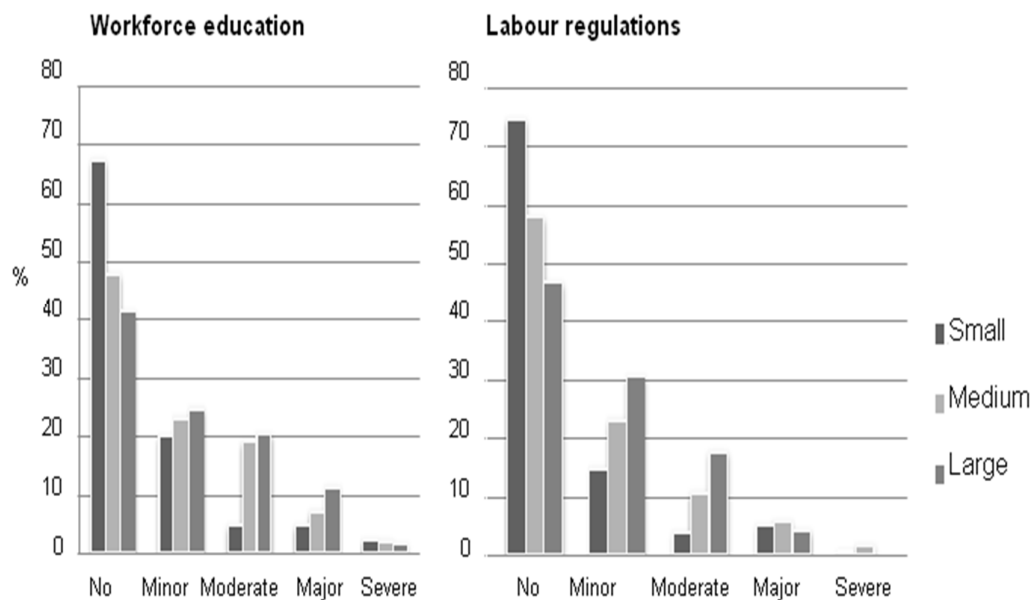
This section will explore various workforce characteristics and identify key human capital constraints facing the firms in the survey. Education, training and compensation will also receive attention along with the performance of SETA in small, medium and large establishments.

● **Obstacles**

In Chapter 1, two aspects of human capital were introduced as the main source of human capital constraints in South Africa. The global competitiveness reports indicated that an inadequately educated workforce along with labour regulations is the two major constraints facing the South African economy.

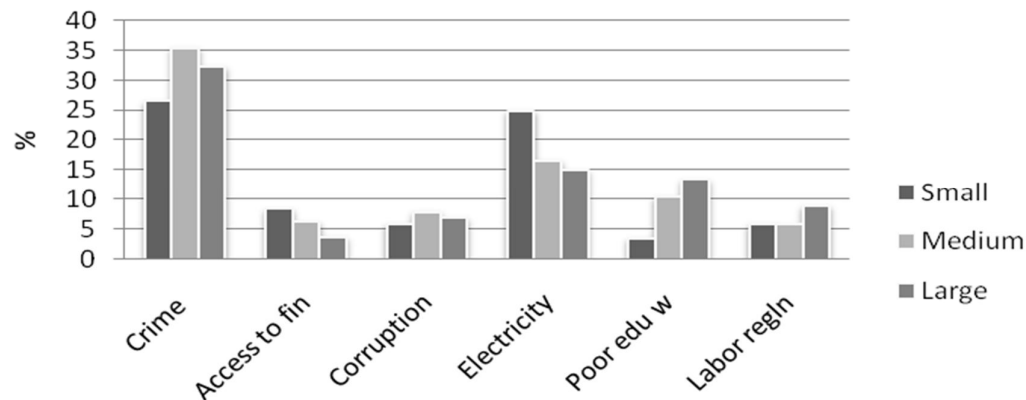
From evidence in Chapter 3, it was seen that there are problems in South Africa's education system. Chapter 4 explained that South Africa's legislative environment surrounding labour is vast and complex. Next, the impact will be assessed on a firm level.

Figure 25: Labour regulations and workforce education as obstacles



The survey asked the firms about the obstacles that they face in doing business. Figure 25 shows that firms in the survey did not experience immense problems with labour regulations and labour force education. The majority of small, medium and large firms indicated that these two aspects serve as either no or as minor constraints. It does however seem that finding adequately educated labour is on average a bigger obstacle than dealing with labour regulations. Next, the top six obstacles will be identified and discussed.

Figure 26: The top six obstacles



Although the global competitiveness index indicated that labour regulations and inadequately educated workers are the biggest obstacles facing South Africa, this survey found slightly different evidence. Evidence from Figure 26 indicates that crime and electricity are the biggest threats to firms in the survey. Followed by crime and electricity are inadequately educated workers and labour regulations. Again, one can see that larger firms find labour regulations and inadequately educated workers bigger obstacles than small and medium sized firms do.

Workforce

This section will look at the average number of employees for small, medium and large firms as well as other relevant workforce characteristics and growth. In this section it now becomes clear why splitting the data into size categories is important.

Table 20: Average workforce characteristics

Economy	Small	Medium	Large
Starting workforce	5	17	139
2003 workforce	4	34	357
2006 workforce	10	44	388
Workforce growth 2003-2006 (%)	150	29.4	8.6
Production workers 06	8	33	270
Non-production workers 06	2	11	93
Ratio of non-production: production workers	1 : 4	1 : 3	1 : 2.9
Seasonal workers	1	6	66

As seen in Table 20, there is a distinct grouping of statistics for small, medium and large firms. On average small firms employed four workers in 2003 while medium and large firms employed thirty-four and one-hundred and-thirty-nine respectively. When comparing the average starting workforce and the 2003 workforce, small firms show a slight decrease of one worker.

Evidence suggests that between 2003 and 2006, small firms achieved the highest workforce growth rate. Another interesting aspect is that small firms have the highest ratio of non-production to production workers in the survey.

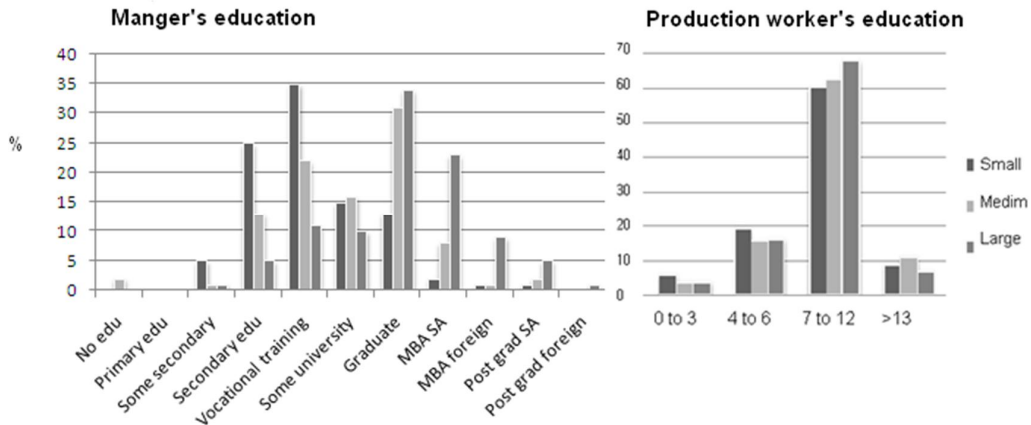
Education and compensation

In the section about obstacles, it can be seen that finding adequately educated workers is a real problem for some firms, especially large firms. Figure 27 indicates that education among production workers is evenly matched between small, medium and large firms. Most production workers have between seven and twelve years of education. When the educational level of managers is analysed, it becomes evident that managers working in larger firms are on average higher educated than those working for small and medium sized firms.

In small firms the average educational level of managers is between secondary school and vocational training. For medium sized firms the average educational level of managers is found between vocational training and university graduates. In large firms, the average level of education for managers is found between university graduates, MBA and post graduate studies.

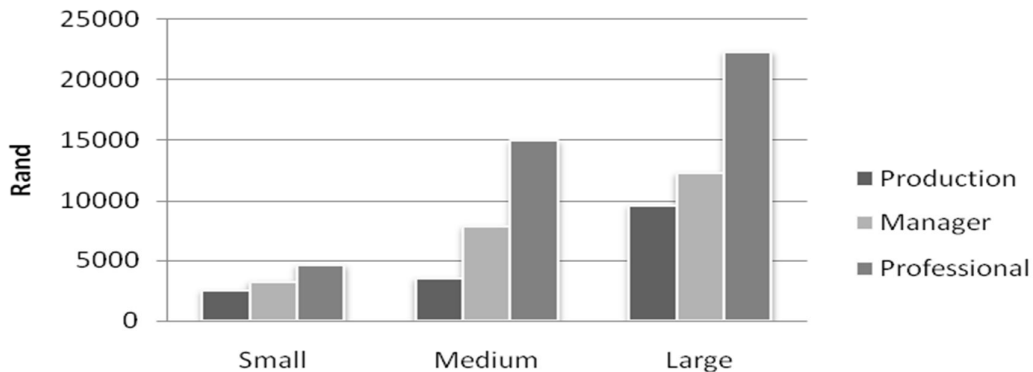
So far it has become apparent that managers working for large firms have the highest average number of years of experience and education. The relationship between education and output per worker will receive attention in Chapter 7. Next, the relationship between the level of education and compensation will be explored. Both these variables (education and compensation) will also be used as explanatory variables in the regression analysis of Chapter 7. Chapter 7 will also contain a Principal Component Analysis (PCA).

Figure 27: Average education of managers and production workers



It is not surprising that when it comes to compensation, managers in large firms receive on average much more than managers in small and medium firms. This is evident from Figure 28, where managerial workers receive more than production workers and professional workers receive more than managerial workers. This phenomenon is observable in small, medium and large firms.

Figure 28: Average level of compensation



Note: Rand is the South African currency

Figure 27 and 28 show that education and compensation are highly correlated. Chapter 7 will determine the effect that education and compensation have on output per worker. A higher level of education is therefore associated with a higher level of compensation. The evidence is not surprising, but the large difference in compensation between small, medium and large firms does show signs of income disparity.

Table 21 shows that medium and large firms use more skilled production workers for every unskilled production worker in their respective production processes. This can be seen in the higher ratio of unskilled to skilled production workers. Although these ratios are relatively the same, multiplying by 10 on both sides shows that the difference between small and medium firms is substantial. After this exercise, small firms will use four skilled workers for every ten unskilled production workers, while medium firms will use close to eight.

Table 21: Skilled and unskilled workers

	Small	Medium	Large
Skilled production workers	5.69	19.06	164.81
Unskilled production workers	2.53	14.65	106.07
Ratio of unskilled : skilled production workers	1 : 0.44	1 : 0.77	1 : 0.64

Training and SETA support

Godfrey *et al.* (2007:33) explain that none of the bargaining councils received invitations from SETA, and that no enquiries have been submitted to NEDLAC (National Education Development and Labour Council). This accompanied with evidence from Chapter 5 then shows that the SETAs are ineffective vehicles for promoting workplace education and training.

In Table 22, one can see that a very low percentage of small firms have training programmes. These small firms also spend on average the smallest amount of money on these programmes and experience very little support from SETA.

Table 22: Average training and SETA support

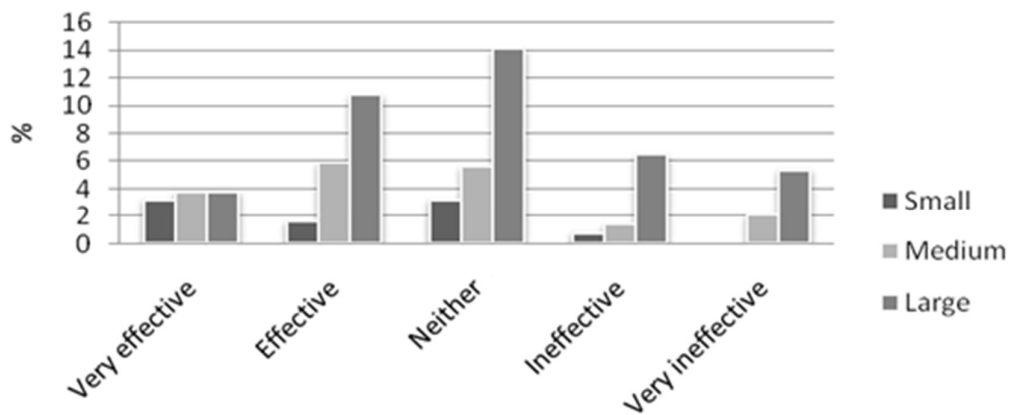
	Small (%)	Medium (%)	Large (%)
Training programme/s	27.4	47.4	70.8
Cost of training programme As 1 to 2 % of sales	19.4	35.2	50.2
SETA support	4.8	11.8	26.5

Table 22 suggests that a greater percentage of large and medium firms have training programmes and experience more support from SETA. The majority of firms indicated that they spend between one and two per cent of their total sales on

training. Evidence from Table 22 suggests that SETA support is inadequate, and that expenditure on training is on average extremely low.

This can also be seen in Figure 29 where the effectiveness of SETA is determined. There seems to be mixed reactions to SETA's effectiveness, and on average it seems as if SETA support is neither effective nor ineffective. However, large firms experience more support from SETA, but close to 12% of the respondents reported that SETA was in fact ineffective or very ineffective. The average percentage of firms that view SETA support as effective is more than the percentage that view SETA support as ineffective. The circumstances are similar for medium and small firms in the survey.

Figure 29: SETA effectiveness



Section 6.2.3 showed that an inadequately educated workforce and labour regulations are not the most severe obstacles for firms in the survey. The levels of education between managers do tend to vary, and human capital initiatives are not effective. Almost 70 per cent of large firms have some training programme in place, but SETA support for all firms in the survey tends to be very low.

The next section will focus on the financial and macro-economic instability aspects of firms in the survey. This section will explore constraints from a sales, expenditure and economic policy point of view.

6.2.4 Finances

The final part in this section will explore sales and cost structures in small, medium and large firms in the survey. Certain cost structures will also receive attention, and macro-economic instability aspects will determine economic policy constraints.

Sales and cost structures

To conclude the descriptive statistics section of the survey analyses, sales and cost figures will be analysed. When comparing sales figures from 2003 to 2006, it is clear that large firms achieved the most sales growth, followed by small and medium firms. Large firms have bigger margins for profit as they spend on average smaller fractions of their sales on goods and labour than small and medium sized firms do.

Table 23: Average sales and cost structure of firms (Rand)

	Small	Medium	Large
Sales 2006	3 105 995	21 890 686	305 000 000
Sales 2003	2 468 087	18 428 580	231 000 000
Sales growth %	25.8	18.8	32
Cost of goods	1 260 533	9 942 104	121 000 000
As % of total sales 06	40.6	45.4	39.7
Cost of labour	646 939 20.8	4 124 370	57 777 379
As % of total sales 06		18.8	18.9
Sales per worker 06	310 599	497 515	786 082

Sales per worker are also the highest in large firms, followed by medium and small firms. The average sales per worker figure for large firms is also more than twice the amount it is for small firms, and almost sixty percent more than for medium firms in the survey.

When analysing the expenditure of firms on other production aspects it becomes clear that small firms spend on average a bigger fraction of total sales on electricity than medium and large firms do. This is the same for all the other aspects in Table 24. The only exception is transportation costs. Here it seems as if medium and large firms also have more expenses. Compared to other expenditure aspects, transport costs also pose as a notable cost constraint.

Table 24: Average expenditure on basic goods (Rand)

Expenditure	Small	Medium	Large
Electricity	60 205	302 891	3 458 316
As % of total sales 06	1.9	1.3	1.1
Fuel	48 959	287 255	2 382 049
As % of total sales 06	1.6	1.3	0.8
Water	15 894	64 878	318 820
As % of total sales 06	0.5	0.3	0.1
Transportation	63 895	422 376	6 090 923
As % of total sales 06	2.1	1.9	2.0
Communication	31 698	176 858	1 360 328
As % of total sales 06	1.0	0.8	0.4

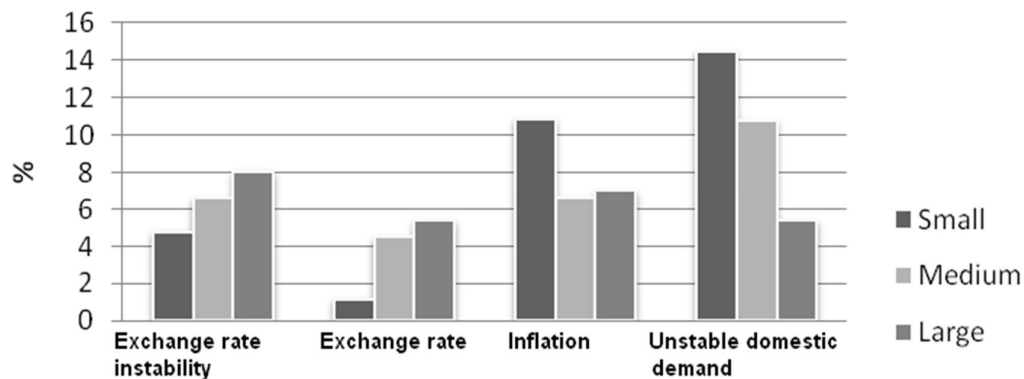
- ***Macro-economic instability aspects***

The final part of this section involves macro-economic instability aspects. From Figure 30, it becomes apparent that unstable domestic demand poses as the greatest threat to small firms, followed by inflation and exchange rate instability. For medium sized firms, unstable domestic demand poses as the greatest threat, followed by exchange rate instability and inflation. For large firms, exchange rate instability, followed by inflation and the actual exchange rate pose as the biggest threats.

These figures are not surprising, because large firms were shown to export a greater percentage of their products compared to small and medium sized firms. Small and medium sized firms also sell the majority of their goods in the domestic market.

Therefore the exchange rate and fluctuations in the exchange rate do not have any substantial influence on their businesses. Figure 24 showed that there is no real relationship between capacity utilisation and hours worked. It was mentioned in section 6.2.2 that there might be demand side constraints, and evidence from Figure 30 suggests something similar.

Figure 30: Macro-economic instability aspects



Various aspects of manufacturing firms in South Africa were explored in this chapter. The final section will summarise the relevant findings and explain how the findings in Chapter 6 will aid in the regression analysis of Chapter 7.

6.3 Summary

To briefly conclude the findings of the survey analysis, evidence from Chapter 6 found the following. Manufacturing firms are concentrated in Johannesburg and on average the majority of goods produced are of low to medium technological nature. The majority of these firms produce for the national market, with only a small fraction of large firms exporting their products. Large firms indicate that exchange rate instability and the actual exchange rate are concerns, while small and medium firms find unstable domestic demand as the greatest economic instability factor. Capacity utilisation is higher for larger firms due to the fact that they do not only focus on the national market. Instability in domestic demand also explains why there is no real positive correlation between hours worked and capacity utilisation. Human capital constraints in the form of labour legislation and inadequately educated individuals do pose as constraints for businesses. Large establishments find inadequately educated workers a bigger problem than labour legislation, but larger firms also have on average higher educated managers. Other obstacles in doing business include crime, electricity and transportation costs. Large firms have on average less competition and outsource a larger part of production to other firms. On average, large firms also form part of bigger establishments and have more experience in the market.

Formal training programmes are also more commonly found in large firms, and most firms spend between one and two percent of their total sales on training. SETAs are not supporting small and medium sized firms, and in large firms where SETA support is higher evidence suggests that the support is ineffective. Average work force growth between 2003 and 2006 has been the highest between small firms, but average sales growth for the same period favours large firms. On the expenditure side, transportation costs seem to be remarkably high for small, medium and large firms, followed by electricity costs.

Evidence from the firm level analysis corresponds well with the literature described in Chapters 3, 4 and 5. The next part of this study will comprise of a regression analysis. This will be done to try and explain what causes changes in output per worker. Findings from Chapter 6 on human capital aspects will be used in the regression analysis. This will be done to estimate the effect that human capital constraints as described in this study, has on output in manufacturing firms in the survey.

CHAPTER 7

REGRESSION ANALYSIS

7.1 Introduction

The preceding chapters have explored human capital constraints in South Africa. From Chapters 2 to 5 various aspects of human capital were covered. These included constraints, trends and human capital development initiatives. Chapter 6 illustrated that human capital constraints have a varying influence on small, medium and large firms in South Africa. Chapter 7 will determine the influence that these human capital constraints have on establishments that took part in the World Bank enterprise survey. This will be done by means of an OLS (Ordinary Least Square) regression analysis. By examining the nature of the relationship between output per worker and the various human capital constraints, the following will be achieved: estimating a multiple regression model, determining the numerical extent of these constraints and distinguishing between significant and less significant human capital constraints in the South African manufacturing sector.

7.2 Overview of empirical literature

In the literature, one finds a variety of approaches that explain human capital and its role in economic growth. Two main features that surface in the majority of the studies surrounding human capital include quality education and labour market distortions. In studies that focus on education, one can identify four aspects that influence human capital. These include quantity, quality, inequality and institutional differences. Work done by Barro (2001), Checchi (2006) and Dessus (2001) explains each one of these aspects.

The other feature, namely labour market distortions can also be divided into four aspects that influence human capital. Labour market rigidity, inappropriate bargaining, industry concentration and the mispricing of labour make out four key aspects that explain the role that labour market distortions have on human capital.

Fedderke (2005), Griliches (1997), Kingdon (2007) and Moll (1996) to name a few have all described these aspects intensively.

This chapter aims to determine the influence that the above mentioned constraints have on manufacturing firms in South Africa. The following sections will establish the influence these human capital constraints have on productivity and output in manufacturing firms.

7.3 Estimating the determinants of output per worker

The dependant variable (Y) in this regression will be output per worker (total sales/total workforce). The independent or explanatory variables (X_{ϕ}) will coincide with the work done in Chapters 2 to 6. Variables that represent educational attainment and labour market distortions will be created and used in the regression analysis. Some of the explanatory variables can also further be divided into categories, and dummy coding will be used to distinguish between them. The next part of this section will explain these explanatory variables and their relevant codes.

The multiple regression model generally has the following form:

$$Y_i = \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \dots + \beta_k X_{ki} + \epsilon_i \quad (7-1)$$

Equation (7-1) specifies Y_i as the dependent variable, in this case output per worker. The X_{ϕ} on the other side of the equation represent the various explanatory variables. One should note that the variable X_{1i} is only a vector that allows the equation to have a constant term (Asteriou & Hall 2007: 56). Although data in Chapter 6 was divided into the actual size of the firms, this chapter will look at the manufacturing industry as a whole.

X_2 = Educational level of managers

This variable distinguishes between the levels of education for managers in the survey. Dummies are introduced to code this variable for eleven different levels of education. The lowest dummy represents a manager with no formal education, and

the highest dummy represents a manager with a post graduate qualification obtained in a foreign country. The reference group is D1, D2 and D3. This is done to determine if managers with more than primary education achieve higher output per worker levels than those with no education or primary education.

Dummy variables:

D1: no education, D2: primary education, D3: secondary education not completed, D4: secondary education completed, D5: training completed, D6: some university, D7: university graduate, D8: MBA (South Africa), D9: MBA (foreign origin), D10: post graduate (South Africa), D11: post graduate (foreign origin).

$$Y_i = \beta_1 + \beta_2 X_i + \beta_4 D_{4i} + \beta_5 D_{5i} + \beta_6 D_{6i} + \beta_7 D_{7i} + \beta_8 D_{8i} + \beta_9 D_{9i} + \beta_{10} D_{10i} + \beta_{11} D_{11i} + \epsilon_i \quad (7-2)$$

Equation (7-2) shows what the regression equation would look like if only the educational level of managers is used to explain the dependant variable (Y_i).

X3 = Educational level of production workers

The second variable measures the amount of education for production workers in the survey. Only three dummies exist, and range from zero to more than thirteen years of education. Setting D1 (0 to 3 years of education) as the reference group enables one to determine if production workers with more than three years of education achieve higher levels of output per worker.

Dummy variables:

D1: 0 to 3 years, D2: 4 to 6 years, D3: 7 to 12 years, D4: more than 13 years.

$$Y_i = \beta_1 + \beta_2 X_i + \beta_2 D_{2i} + \beta_3 D_{3i} + \beta_4 D_{4i} + \epsilon_i \quad (7-3)$$

X4 = Labour regulations as an obstacle

Due to the fact that labour regulations are difficult to quantify, five dummies have been introduced. With D1 (no obstacle) as the reference group it is now possible to determine if labour regulations have an influence on output per worker. D2 indicates that labour regulations are seen as a minor obstacle, while D5 represents labour regulations that serve as a severe obstacle.

Dummy variables:

D1: no obstacle, D2: minor obstacle, D3: moderate obstacle, D4: major obstacle, D5: severe obstacle.

$$Y_i = \beta_1 + \beta_2 X + a_2 D_{2i} + a_3 D_{3i} + a_4 D_{4i} + a_5 D_{5i} + \epsilon_i \quad (7-4)$$

X5 = Training programme existence

The fifth variable aims to determine if firms with official training programmes have higher output levels than firms with no official training programmes. For this variable D1 (no official training programme) is the reference group.

Dummy variables:

D1: no official training programme/s, D2: official training programme/s.

$$Y_i = \beta_1 + \beta_2 X + a_2 D_{2i} + \epsilon_i \quad (7-5)$$

X6 = SETA support

Variable six is similar to the previous variable. This variable aims to determine if firms with Sector Education and Training Authority (SETA) support have greater output levels than firms without SETA support. Firms with no SETA support (D1) make out the reference group.

Dummy variables:

D1: no SETA support, D2: SETA support.

$$Y_i = \beta_1 + \beta_2 X + a_2 D_{2i} + \epsilon_i \quad (7-6)$$

X7 = SETA effectiveness

After determining if the existence of SETA support has an influence on the level of output per worker, the effectiveness of SETA will be analysed. Having D5 (very ineffective SETA support) as the reference group, enables one to determine if effective SETA support leads to greater output per worker levels than ineffective SETA support.

Dummy variables:

D1: very effective, D2: effective, D3: neither effective nor ineffective, D4: ineffective, D5: very ineffective.

$$Y_i = \beta_1 + \beta_2 X + \alpha_1 D_{1i} + \alpha_2 D_{2i} + \alpha_3 D_{3i} + \alpha_4 D_{4i} + \epsilon_i \quad (7-7)$$

X8 = Compensation of production workers

This variable has no dummies. The variable will be transformed into a Log transformed variable. This measure reduces any positive skewness in the data. This will enable one to determine if higher compensation for production workers leads to higher output per worker levels.

No dummy variables:

$$Y_i = \beta_1 + \beta_2 X + \epsilon_i \quad (7-8)$$

X9 = Compensation of managerial workers

This variable also has no dummies, and will be transformed into a Log transformed variable. Again this measure reduces any positive skewness in the data. Similar to the previous variable this variable will enable one to determine if an increase in compensation for managerial workers is associated with an increase in output per worker levels.

No dummy variables:

$$Y_i = \beta_1 + \beta_2 X_i + \epsilon_i \quad (7-9)$$

X10 = Competition

In Chapter 4, industry concentration was described as a labour market distortion. By setting D1 (0 competitors) as the reference group, one can determine if greater competition serves as a catalyst for greater output per worker levels in the manufacturing sector.

Dummy variables:

D1: 0 competitors, D2: 1 competitor, D3: 2 to 5 competitors, D4: more than 5 competitors.

$$Y_i = \beta_1 + \beta_2 X_i + \alpha_2 D_{2i} + \alpha_3 D_{3i} + \alpha_4 D_{4i} + \epsilon_i \quad (7-10)$$

X11 = Location

Another labour market distortion described in Chapter 4 was industry location. This variable will determine if output per worker is location biased or not. For this variable D4 (City of Durban) is set as the reference group. This will enable one to determine if production in other areas is associated with higher output per worker levels or not. This variable will also indicate the area that produces the highest output per worker.

Dummy variables:

D1: Johannesburg, D2: Cape Town, D3: Port Elizabeth, D4: Durban.

$$Y_i = \beta_1 + \beta_2 X_i + \alpha_1 D_{1i} + \alpha_2 D_{2i} + \alpha_3 D_{3i} + \epsilon_i \quad (7-11)$$

This section explained the explanatory variables and their appropriate dummy codes. The next section will explain the process followed for the regression analysis.

7.4 Regression model

This section will explain the regression equation, as well as the model summary and regression results. The section will be divided into two parts. Firstly, the estimation of the regression equation will be discussed, followed by the actual regression results. A Principal Component Analysis (PCA) will follow in section 7.5.

7.4.1 Estimation of the multiple regression equations

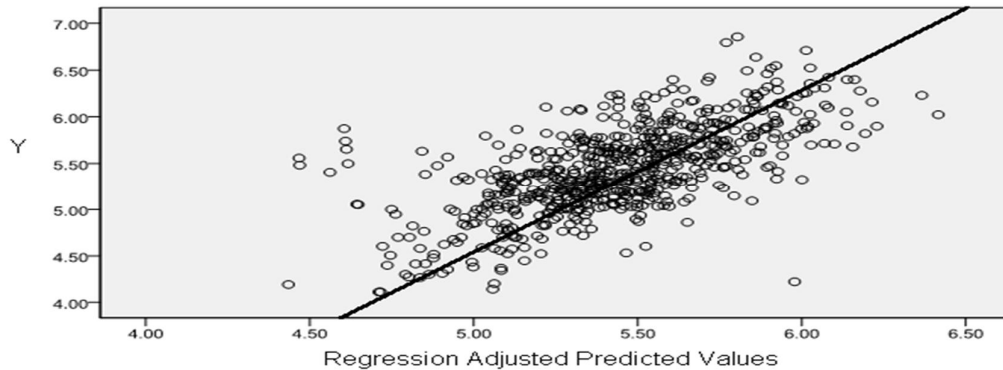
The previous section identified ten variables that represent the subject matter of Chapters 2 to 6. By adding all these explanatory variables to equation (7-1), one obtains equation (7-12). This represents a regression with a linear functional form. None of the variables have been transformed and the explanatory variables have been entered without their relevant dummy codes.

$$Y_i = \beta_0 + \beta_1 X_{2i} + \beta_2 X_{3i} + \beta_3 X_{4i} + \beta_4 X_{5i} + \beta_5 X_{6i} + \beta_6 X_{7i} + \beta_7 X_{8i} + \beta_8 X_{9i} + \beta_9 X_{10i} + \beta_{10} X_{11i} + \epsilon_i \quad (7-12)$$

Equation (7-12) indicates that output per worker is explained by ten explanatory variables and an error term. The previous section described the supplementary dummy codes for eight of the explanatory variables. The new regression equation is represented by equation (7-13). This equation has a linear functional form with various dummies added to the equation. Note that the explanatory variables are the same as explained in section 7.3. The dummy (D_{4i}) therefore has a different meaning for each explanatory variable.

$$Y_i = \beta_0 + \beta_1 X_{2i} + \alpha_1 D_{4i} + \alpha_2 D_{5i} + \alpha_3 D_{6i} + \alpha_4 D_{7i} + \alpha_5 D_{8i} + \alpha_6 D_{9i} + \alpha_7 D_{10i} + \alpha_8 D_{11i} + \beta_2 X_{3i} + \alpha_9 D_{2i} + \alpha_{10} D_{3i} + \alpha_{11} D_{4i} + \beta_3 X_{4i} + \alpha_{12} D_{2i} + \alpha_{13} D_{3i} + \alpha_{14} D_{4i} + \alpha_{15} D_{5i} + \beta_4 X_{5i} + \alpha_{16} D_{2i} + \beta_5 X_{6i} + \alpha_{17} D_{2i} + \beta_6 X_{7i} + \alpha_{18} D_{1i} + \alpha_{19} D_{2i} + \alpha_{20} D_{3i} + \alpha_{21} D_{4i} + \beta_7 X_{8i} + \beta_8 X_{9i} + \beta_9 X_{10i} + \alpha_{22} D_{2i} + \alpha_{23} D_{3i} + \alpha_{24} D_{4i} + \beta_{10} X_{11i} + \alpha_{25} D_{1i} + \alpha_{26} D_{2i} + \alpha_{27} D_{3i} + \epsilon_i \quad (7-13)$$

Figure 31: Scatter plot of dependant variable and predicted value



The above mentioned method yielded the following results as seen in Table 25. The ANOVA (Analysis of Variance) section of the model summary indicates that there is a less than 0.1 per cent chance that the large F-ratio happened by chance alone (Field 2005:190). This is because $p < 0.001$.

The second part of Table 25 includes the model summary. The R^2 value of 0.480 indicates that 48 per cent of the variability of output per worker is explained by the explanatory variables in this model. The adjusted R^2 takes into account the influence of adding more explanatory variables. This value of 0.456 is close to the model's R^2 , and indicates that this model is a good generalisation of the dependant variable. Field (2005:189) suggests that a Durbin Watson value (in this case 1.685) close to two satisfies the Classical Linear Regression Model (CLRM) assumption of independent errors. The R value of 0.693 indicates that the multiple correlations between the predictors (explanatory variables) and the outcome (dependant variable) are relatively high.

Table 25: Model summary

Model		ANOVA			
	Sum of squares	Df	Mean squares	F	Sig
Regression	70.407	29	2.428	20.084	.000
Residual	76.399	632	.121		
Total	146.806	661			
Model Summary					
R	R^2	Adjusted R^2	Std. Error of Estimates	Durbin Watson	
.693	.480	.456	.34769	1.685	

Analysing the regression coefficients forms the final part of the regression results. Table 26 indicates the influence every explanatory variable has on the dependant variable Y_i (output per worker). In the previous section it was said that dummy variables were included in the regression. The next section will explain the implications of each variable and its related dummy codes.

Table 26: Regression coefficients

	B	Std error	β	VIF
Constant	1.904	.214		
Managers education				
- secondary education	-.073	.077	-.055	3.976
- training	-.022	.073	-.020	5.409
- some university	.066	.077	.049	3.954
- graduate	.136	.074	.126	5.667
- MBA (South Africa)	.191*	.082	.125*	3.489
- MBA (foreign)	.097	.102	.038	1.907
- post graduate (South Africa)	.157	.110	.054	1.762
- post graduate (foreign)	.341	.215	.049	1.139
Labour regulations				
- minimal obstacle	-.025	.035	-.022	1.190
- moderate obstacle	-.059	.048	-.039	1.178
- major obstacle	.039	.064	.018	1.078
- severe obstacle	.052	.136	.011	1.065
Production workers education				
- 4 to 6 years	-.006	.070	-.005	3.196
- 7 to 12 years	.044	.064	.044	4.878
- >13 years	-.057	.075	-.036	2.745
Training				
- yes	-.013	.034	-.014	1.588
SETA support				
- yes	.116	.087	.082	4.610
SETA effectiveness				
- very effective	-.273*	.116*	-.106*	2.486
- effective	.044	.106	.021	3.141
- neither effective nor ineffective	.074	.061	.041	1.411
- ineffective	-.063	.100	-.021	1.370
Compensation				
- production workers	.635*	.056*	.438 *	1.800
- managerial workers	.254*	.055*	.180 *	1.823
Location				
- CT	.117*	.053*	.093*	2.147
- JHB	.216*	.044*	.222*	2.432
- PE	.112	.063	.064	1.624
Competition				
- 1	.178*	.070*	.090 *	1.510
- 2 to 5	.085	.048	.085	2.838
- >5	.115*	.046*	.122 *	2.948

Note: $R^2 = .48$ (*) indicates $p < .005$

Table 26 is a summary of the regression coefficients. The b-values (B) will be used to explain the results obtained from this regression. Variables with an asterisk (*) next to it, indicate that the specific variable is significant at a five per cent level (or $p < 0.005$). Significance indicates that the variable contributes to the model in a significant way. This shows that the b-value is significantly different from zero, and not equal to zero as described in the null hypothesis. The Variance Inflation Factor scores (VIF) in the last column indicate whether an explanatory variable has a strong linear relationship with other explanatory variables. This measure is used to detect multicollinearity in the model. This model does not suffer from multicollinearity, as the VIF scores are all less than ten (Field, 2005:175).

Next, the coefficients of the explanatory variables will be explained. The b-values (B) explain each variable's individual contribution to the dependant variable (output per worker). This explains how a one unit change in the explanatory variable affects the dependant variable, while all other explanatory variables are held constant. The beta values (β) are similar to the b-values. These values indicate the number of standard deviations that the outcome (output per worker) will change as a result of a one standard deviation change in the explanatory variable.

X2: Educational level of managers

For this variable dummies were included. The reason for this is to clearly distinguish between the levels of education. The b-values show that compared to managers with no or primary education, secondary education and training are negatively related to the dependant variable. (Reference group: primary / no education)

Higher education seems to be positively related to the dependant variable, but only the MBA (Masters of Business Administration in South Africa) dummy is significant. This shows that increased output per worker is positively correlated with higher levels of education such as tertiary education and MBA qualifications.

X3: Educational level of production workers

This variable shows a similar trend as the previous variable. Production workers with between four and six years of education show a negative relationship with the

dependant variable. A production worker with between seven and twelve years of education, has a positive influence on the dependant variable, but is not significant at a five per cent level. Production workers with more than thirteen years of education also have a negative relationship with the dependant variable. Chapter 6 showed that on average, production workers in small, medium and large firms have between seven and twelve years of education. This might explain why relative to the reference group of zero to three years of education, production workers with between seven and twelve years of education have a positive relationship with output per worker. None of the dummies are statistically significant.

X4: Labour regulation as an obstacle

In Chapter 6 it was shown that on average labour regulations do not pose as a major obstacle. The coefficients suggest that when labour regulations pose as a minimal or moderate obstacle, the dependant variable decreases (Reference group: no obstacle). Large firms were also shown to experience more difficulty with labour regulations than small and medium firms. The positive relationship between labour regulations as a major and severe obstacle and the dependant variable might be explained by the fact that large firms are better equipped to deal with labour regulations. However, none of these variables were significant at the five per cent level, and these assumptions are made without absolute certainty.

X5 & X6: Training programme existence and SETA support

The existence of training programmes has a negative relationship with the dependant variable, while SETA support has a positive relationship. These variables are both statistically insignificant. It is therefore unclear whether the presence of training programmes or SETA support influences the dependant variable. (Reference group: no training program / no SETA support)

X7: SETA effectiveness

SETA support was on average indicated as being neither effective nor ineffective in Chapter 6. The coefficients show that SETA effectiveness varies a lot. SETA support

that is neither effective nor ineffective contributes to the biggest increase in the dependant variable. An interesting point is that SETA support that is very effective has a negative relationship with the dependant variable, and is statistically significant. SETA support that is ineffective has a negative relationship with output per worker, but this coefficient is not statistically significant. (Reference group: SETA very ineffective)

X8 & X9: Compensation of production and managerial workers

Both these variables have a positive relationship with the dependant variable, and are statistically significant. A one unit increase in the compensation of production workers yields a greater increase in output per worker than that of managerial workers. This suggests that increasing the level of compensation for production workers will yield higher output per worker levels than for managerial workers. Chapter 6 also showed that the compensation differential between production workers and managerial workers is remarkably high.

X10: Competition

The coefficients for this variable suggest two scenarios. Firstly, firms that have a single competitor have the highest positive relationship with the dependant variable. This may represent firms that are monopolistic, as the reference group refers to firms with no competitors. Secondly, where there are more than five competitors in the same market, a positive relationship exists with the dependant variable. This relationship is also statistically significant, but smaller than the first scenario. Where competition takes place between two to five firms, the coefficient is positive, but not statistically significant.

X11: Location

This variable show that compared to Durban, firms in Johannesburg and Cape Town have a greater relationship with the dependant variable. Both these dummies are also statistically significant. For Port Elizabeth the relationship is also positive, but the coefficient is not statistically significant. Manufacturing output in this survey is

also location biased. Manufacturing firms in Johannesburg achieve much greater levels of output than those in the other three cities.

7.5 Principal Component Analysis (PCA)

Factor analysis is used to measure aspects that cannot directly be measured. This analysis determines if different variables are driven by the same underlying variable (latent variable). This section will use the same variables used in the previous section, and aims to identify groups or clusters of variables. These groups of variables (also called factors) will also be used in a regression analysis. The dependant variable (output per worker) in this regression analysis will be exactly the same as in section 7.4.

Field (2007:640) explains that variables that measure the same underlying dimension or different aspects of the same dimension should not be entered into the analysis simultaneously. Instead only one variable should be entered into the analysis. Therefore the following two variables have been omitted from the analysis: production workers' level of education and production workers' compensation. These variables measure the same underlying trend as the variables that measure managers' level of education and compensation.

After running the analysis in SPSS, the KMO and Bartlett's test produced a score of 0.677. Field (2007:648) suggests a minimum score of five, and that a score close to seven is a good score for this test. This test is also significant at the five per cent level ($p < .005$), and tells us that there is some relationship between the variables. After factor extraction, the rotation sums of squared loadings indicate that three factors are present. These three factors also cumulatively explain 60.7% of the total variance. Factor 1 explains 29.6% of the total variance, while factors 2 and 3 explain 18.5% and 12.6% of the total variance respectively.

After selecting an Orthogonal rotation (varimax), the rotated component matrix was estimated (Table 27). This matrix shows the factor loadings for each variable onto each factor. There are two things to consider about this matrix. Firstly, factor loadings less than 0.4 are not displayed. This is the reason why there is no factor

loading for the variable labelled labour regulations. Secondly, the variables are listed according to the size of their factor loading.

Table 27: Rotated component matrix

	Factors		
	1	2	3
- training supported by SETA	.930		
- formal training	-.861		
- SETA effectiveness	.833		
- managers education		.732	
- managers compensation		.664	
- number of competitors		-.592	
- labour regulations			
- region			.964

Note: KMO and Bartlett's test = 0.677

The next step is to identify common themes for all three factors. The variables that load on to factor 1 all seem to relate to training and SETA involvement. Variables that load on to factor 2 relate to the level of managers education and compensation as well as the number of competitors. Only one variable loads onto factor 3, which involves region. Now the nature of the underlying themes for each factor will be labelled. Factor 1 can be labelled as 'training' factor 2 as 'management competitiveness' and the third factor as region.

Now that the explanatory variables have been reduced to three factors that measure three different underlying dimensions, a regression analysis will be estimated. Again, the method of ordinary least squares (OLS) estimates a line that best fits the data. This line goes through as many of the data points, and has the smallest possible residual values.

Table 28: Regression analysis with factor scores

	B	Std error	β	VIF
Constant	5.425	.016		
- factor score 1 'training'	.106*	.016	.221*	1.000
- factor score 2 'management competitiveness'	.190*	.016	.397*	1.000
- factor score 3 'region'	-.077*	.016	-.160*	1.000

Note: R² = .23 (*) indicates p<.005

Low variance inflation factor (VIF) scores and a Durban-Watson score of 1.6 indicate that the model satisfies the Classical Linear Regression Model (CLRM) criteria. Both factors 1 and 2 have a positive relationship with the dependant variable that is statistically significant. Factor 3 has a negative relationship with the dependant variable, and is also statistically significant. A one unit change in management's competitiveness (factor 2) will lead to the greatest increase in the dependant variable (output per worker).

The regression model in this section has an R^2 of 0.23. Only 23 per cent of the variability of output per worker is explained by the explanatory variables in this model. This model is inferior to the model in section 7.4 which had an R^2 of 0.48, and explained 48 per cent of the variability of output per worker. The principal component analysis showed that output per worker can be explained by three underlying factors. These are training, management's competitiveness and region. Next the findings of Chapter 7 will be summarised in section 7.6.

7.6 Summary

Chapter 7 contained a regression analysis to estimate the determinants of increased output per worker. The results indicate a positive relationship between educational attainment and the dependant variable. The influence that labour regulations have on firms in the survey is unclear as all the dummy variables were statistically insignificant. The presence of training programmes and SETA support also has no real significant influence on output per worker. The level of compensation managers and production workers receive is also positively related to the dependant variable. A one unit increase in production workers' compensation leads to higher output per worker levels. Production and output per worker are location biased, and Johannesburg is the area with the highest output per worker followed by Cape Town. In sectors where only one or two firms dominate the market, output per worker has the highest relationship with the dependant variable. Sectors that have more than five competitors have the second largest relationship with the dependant variable.

Chapter 8 will summarise all seven chapters and conclude the findings of this study. Comparisons between the literature and the results of the empirical work will also be

discussed. This will be done to determine the influence that human capital constraints have on firms in South Africa, and on the South African economy as a whole.

CHAPTER 8

CONCLUSION

This study explored potential human capital constraints in the South African economy. An inadequately educated workforce along with labour regulation made out the core of these constraints. To attain this objective, four secondary objectives were introduced in the introduction. These were as follow: determining the importance of education in human capital formation; identifying current labour market distortions in the South African economy; reviewing human capital development initiatives as well as the complexity of South African exports and determining the extent of human capital constraints among manufacturing firms in South Africa.

Human capital constraints are aspects of human capital that limit the productivity and effectiveness of the workforce. Chapter 1 pointed to an inadequately educated workforce along with restrictive labour regulations as the two major human capital constraints facing the South African economy. Chapter 2 explained the importance of technological innovation in the neo-classical growth theory. Evidence from Chapters 5 and 6 indicate that South African manufactured goods are of low to medium technological nature, and that these products are experiencing decreasing growth in international markets.

Chapter 3 explained education's significance in human capital formation. The consequences of investing in education were explained to be a form of capital, namely human capital. The changing quality of the labour force was also shown to be a crucial component in explaining the difference in wage, income and output between countries. Chapter 3 argued that the quality of human capital depends on quality education as well as quality institutions of society. The South African education system was shown to be ineffective in distributing quality educational services. Learner scores in South Africa are also relatively low compared to other developing and African countries. Empirical evidence in Chapter 7 indicated that there exists a positive relationship between educational attainment and the dependant variable (output per worker). Managers and production workers with

higher levels of education achieved higher levels of output per worker. The study also found that the existence of training programmes and Sector Education and Training Authority (SETA) support had no significant influence on output levels among firms in the survey. SETA support was also shown to have neither an effective nor ineffective influence on firms in the survey. Small and medium sized firms also experienced very little SETA support compared to large firms.

Labour regulations were shown to be complex in Chapter 4. Bargaining institutions are centralised in the mining and manufacturing sectors, while decentralised in the retail and other sectors. It might also be possible that labour legislation contributes to employment rigidity. The reason for this is that formal sector employment is over protected. However, this study found no significant evidence that suggests that restrictive labour regulations have an influence on the level of output among manufacturing firms in the survey. Other labour market distortions also exist in the South African economy. These include high levels of unemployment, an oversupply of semi skilled workers and a concentration of industries and firms that are location biased. Firms situated in the city of Johannesburg were shown to have the highest output per worker figures.

For South Africa to achieve higher levels of growth and output, a new approach to human capital development is needed. The current global market is one that is learning led and the demand for newer, more advanced products and services is immense. Recent initiatives to develop human capital in South Africa have proven to be unsuccessful. Apprenticeship and training levels are decreasing, and the awareness and usage rates of government backed development initiatives are low. Government initiatives as well as labour unions are more focussed on redistribution and improved working conditions than on increased competitiveness and productivity. Results from a Principal Component Analysis (PCA) revealed that the explanatory variables used in the regression analysis measured three underlying dimensions. These are training, management, competitiveness and region. The first two latent variables (underlying dimensions) explained the majority of the total variance. The importance of quality human capital measures such as the level of education, compensation and training therefore highlights the importance of quality education and training in the manufacturing sector.

Scope for further research on human capital and its influence on productivity will depend greatly on the availability of improved measures to define the quality aspect of human capital. Countries, firms and even individuals possess over differ levels of financial and human capital, and it's the mixture of these two forms of capital that bring forth productivity. Policy recommendations include:

Public debate on the relevance of outcome based education in the South African context.

Additional measures to create a more flexible bargaining process in sectors that are sensitive to changes in labour legislation. This includes more decentralised bargaining in the manufacturing and mining sectors.

Implementing structures to evaluate and regulate human capital development initiatives that incorporate training, education, export promotion and business development.

A final aspect that needs attention is the unavailability of reliable data on human capital development, and the absence of measures to assess developments in human capital formation and quality education.

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