UNIVERSITY OF CAPE TOWN

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AN EVALUATION OF SKILLS DEVELOPMENT IN A SAMPLE OF METAL AND ENGINEERING FIRMS IN GAUTENG

By Marisa Ferreira Ribeiro (RBRMAR016)

Supervised by Professor Johann Maree

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DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this thesis from the work, or works, of other people has been attributed, and has been cited and referenced.

Signature

Date

ABSTRACT

The metal and engineering industry is one of the most significant contributors to South Africa's manufacturing employment and economic performance. In recent times though debate regarding the industry has centered on reported critical skills shortages, alluding to decreased employment and performance. Studies confirmed that skills shortages at artisan, technical, engineering and management levels existed with artisans representing the most critical skills shortage in the industry.

This study evaluates the nature and extent of skills development taking place in a sample of metal and engineering firms located in the industry's most significant province, Gauteng. Research was conducted through interviews with skills development representatives from a non-randomly selected sample of firms belonging to three categories in the metals beneficiation value chain, namely: raw material processing firms; intermediate product producing firms and finished product producing firms.

The principal data collection method used in this study was semi-structured in-depth interviews with a combination of open and closed ended questions. Additional sources of information included video material, websites and varying types of booklets supplied by the participating respondents. Both qualitative and quantitative data were analyzed through personal reflection on initial ideas, reconciliation of emerging ideas, and the documentation of findings in an interview notebook. Lastly, emerging themes were cross-referenced to existing views in the reviewed literary texts.

The results indicated that the sample was dominated by a preference for the following skills development initiatives, in-house initiatives such as on-the-job training (coaching and mentoring) and apprenticeships. Participation in and commitment to skills development was inconsistent throughout the sample, highlighting concentration at raw material processing and finished product producing firms, which are typically larger and well capitalized. Firms trained most aggressively at the critically required artisan level, indicating encouraging alignment of training to the most critical skills requirements.

Overall, the growing demand exceeded the limited supply of skills, confirming suspected skills shortages. A state of equilibrium needs to be established between the demand and supply of skills within the metal and engineering industry. The solution to this lies in increasing skills development and training outputs. The most obvious way to begin increasing these outputs would be for the intermediate product producing firms within the sample to improve their skills development performance as these firms trained the least and were the only firms not collaborating on skills development.

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I dedicate this thesis to my parents and to the love of my life, to honour their love, patience and support during these years.

ACRONYMS AND ABBREVIATIONS

AATP	Accelerated Artisan Training Programme
ABET	Adult Basic Education and Training
AIDC	Automotive Industry Development Centre
Asgisa	Accelerated and Shared Growth Initiative for South Africa
ATRAMI	Artisan Training and Recognition Agreement for the Metal Industry
BBBEE	broad-based black economic empowerment
BEE	black economic empowerment
BEng	Bachelor of Engineering
BTech	Bachelor of Technology
CAGR	compound annual growth rate
CEO	Chief Executive Officer
CHIETA	Chemical Industries Education and Training Authority
CNC	computerized numerical control
COTT	Central Organization for Technical Training
CSI	Corporate Social Investment
DoE	Department of Education
DoL	Department of Labour
DoM	Department of Manpower
DTI	Department of Trade and Industry
EAC	Economic Advisory Council
ECSA	Engineering Council of South Africa
EMIS	Education Management Information System
ETQA	Education and Training Quality Assurance
FET	Further Education and Training
FRIDGE	Funds for Research into Industrial Development Growth and Equity
GDP	Gross Domestic Product
GDS	Growth Development Summit
GET	General Education and Training
GMET	Generic, Manufacturing, Engineering and Technology
HE	higher education
HET	Higher Education and Training
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
HRD	Human Resources Development

HSRC	Human Sciences Research Council
IISI	International Iron and Steel Institute
IT	Information Technology
ITB	Industrial Training Board
Jipsa	Joint Initiative on Priority Skills Acquisition
KMP	Knowledge Management Programme
MAP	Management Advancement Programme
MBA	Master of Business Administration
MEIBC	Metals and Engineering Industries Bargaining Council
MERSETA	Manufacturing, Engineering and Related Services Sector Education and Training Authority
MLA	Monitoring Learner Assessment
MOU	memorandum of understanding
MTA	Manpower Training Act
NAB	National Apprenticeship Board
NACI	National Advisory Council on Innovation
NATED	National Technical Education
NBI	National Business Initiative
NC(V)	National Certificate (Vocational)
NDip	National Diploma
NQF	National Qualifications Framework
NSB	National Standards Body
NSDS	National Skills Development Strategy
NSF	National Skills Fund
NTB	National Training Board
NTC	National Technical Certificate
OBE	outcomes-based education
POEA	Philippine Overseas Employment Administration
SA	South Africa
SAISI	South African Iron and Steel Institute
SAP	System Application Programme
SAQA	South African Qualification Authority
SARS	South African Revenue Service
SDA	Skills Development Act
SDF	Skills Development Facilitator
SDLA	Skills Development Levies Act

SDP	Structured Development Programme
SEDA	Small Enterprise Development Agency
SEIFSA	Steel and Engineering Industries Federation of South Africa
SETA	Sector Education and Training Authority
SGB	Standards Generating Body
SMME	Small, Medium and Micro Enterprise
SSP	Sector Skills Plan
Stats SA	Statistics South Africa
TIMSS-R	Third International Maths and Science Study Repeat
TNA	Training Needs Analysis
TSBP	Technical Skills Business Partnership
TVET	technical vocational education and training
UCT	University of Cape Town
USA	United States of America
VSP	Voluntary Severance Package
WIL	Work Integrated Learning
WSP	Workplace Skills Plan

CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

The metal and engineering industry forms part of South Africa's (SA) manufacturing sector which is the second largest sector in the economy and as a result contributes significantly towards the country's Gross Domestic Product (GDP) (DTI, 2006, cited in Lundall *et al*., 2008: 4). Furthermore, the industry is significant to the country's economy due to its potential for employment creation, despite employment in the sector having decreased over the last decade (FRIDGE, 2003a: 13). The government also aspires for the industry to contribute meaningfully to the (DTI, 2005: 8):

- Improvement of global competitiveness.
- Enhancement of exports.
- Attraction of local and foreign investments.
- Encouragement of broad-based black economic empowerment (BBBEE).

Being mineral rich and having been a major exporter of basic metals for more than a century, SA has failed to beneficiate substantially, largely due two reasons. The first of these is import-parity pricing and the second is skills shortages which form the focal point for this research (Lundall *et al*., 2008: 19-20).

Statements by senior government leaders and policy makers indicate that they regard the development, recruitment and retention of skilled people as the most important factor in achieving a higher rate of economic growth (Johnston & Bernstein, 2007: 11). As a result, in recent times skills development in SA has received increased focus from the government spurred on by amongst other things, the severe skills shortages of artisans, technicians and engineers (MERSETA, 2005: 41-42; DTI, 2005: 53). Government's major initiatives geared towards skills development include the Accelerated and Shared Growth Initiative for South Africa (Asgisa) and the Joint Initiative on Priority Skills Acquisition (Jipsa) which are also supported by private skills development initiatives. Government alone is spending R430 billion on infrastructure in a bid to realize the targets of Asgisa which are to halve unemployment and poverty by 2014 (Le Roux, 2007: 1). With increased activity in the skills development and training environment, the need for research of an evaluative nature across all levels is apparent.

Having sustained declines of up to approximately 11 000 apprentices over a two decade period (DTI, 2005: 53), coupled with declines in other technical occupations, the country allegedly now finds itself with an

estimated shortage of 68 000 artisans, technicians and engineers (Ray, 2008: 12). The severity of the situation has resulted in large SA corporations importing skills from abroad (Macrae, cited in Spadavecchia, 2006: 1). According to Johnston (2007: 5) SA skills shortages were not only persisting but intensifying by 2006.

This study aims to evaluate skills development in a sample of metal and engineering firms in Gauteng. This problem statement can be broken down into five inter-related research questions, namely:

- Is there a shortage of skills in the sampled metal and engineering firms?
- What are the skills shortages in the sampled metal and engineering firms?
- Why are these required skills in the sampled metal and engineering firms not being supplied?
- What skills development strategies are the sampled metal and engineering firms currently employing in order to address skills shortages?
- How do existing skills shortages impact on the economic growth of the sampled metal and engineering firms?

As home to the majority of metal and engineering firms, Gauteng was selected as the study area for this research which focuses on three stages of the metals beneficiation value chain, namely (MERSETA, 2005: 20):

- Raw material processing firms.
- Intermediate product producing firms.
- Finished product producing firms.

A non-random sample of ten metal and engineering firms was selected, initially relying on convenience and then snowball sampling techniques. Furthermore, the following stakeholders were also consulted:

- A large parastatal involved in projects linked to the metal and engineering industry.
- Industry bodies (MERSETA and SEIFSA).
- Training providers.
- A labour supply company.

Both qualitative and quantitative methods of research were employed in the collection, analysis and reporting of information.

The purpose of this research is to contribute to academic research within this field of study and specific topic. In order to evaluate skills development in the sample, a view of skills development will be provided for individual firms, firms within the same stages of beneficiation and lastly, for firms across differing stages of beneficiation. Aligned to the contributions discussed above, this research will be of importance to academics as well as firms and stakeholders included in the sample which could make use of the research findings in order to enhance their approaches to skills development and training.

This thesis commences with a review of secondary research findings in Chapter 2 in order to develop a contextual background. Chapter 3 discusses the research problem, rationale and conceptual framework while Chapter 4 provides the research design and methods employed as a means of demonstrating the validity of the findings. Chapter 5 provides the research findings and discussion. Finally, Chapter 6 draws together the conclusion of the research project.

CHAPTER 2
LITERATURE REVIEW

The literature review is divided into three main sections, namely: the metal and engineering industry in SA; the demand and supply of skills in the industry and lastly, a conclusion providing a summary of the main findings.

2.1 THE METAL AND ENGINEERING INDUSTRY IN SOUTH AFRICA

This section provides a profile of the industry and a discussion of metals beneficiation and the value chain.

2.1.1 Profile of the industry

The manufacturing sector in SA is large[1] and diverse and forms a key driver in achieving national macroeconomic objectives, such as improved export trade performance. Metal and engineering is a very significant sub-sector in the manufacturing sector as a whole and contributes approximately 5.3% to the country's GDP (MERSETA, 2005: 4; 19).

For the purpose of this study the metal and engineering industry includes the sectors represented within the Metals and Engineering Industries Bargaining Council (MEIBC), namely (FRIDGE, 2003a: 18):

- Basic metals.
- Light and heavy engineering.
- Machinery and equipment.
- Electronics and electrical engineering[2].

Total employment in the metal and engineering industries grew by 1.9% compound annual growth rate (CAGR) between 1999 and 2002. However, during this period, permanent employment declined annually by 5.6%, offset by increases in 'atypical' or 'non-standard' employment (casual, temporary and sub-contracted labour) which grew considerably between 1999 and 2002. The primary driver of employment growth in the sectors represented within the MEIBC has been atypical employment (FRIDGE, 2003a: 20).

[1] The manufacturing sector is the second largest sector in the economy (DTI, 2006, cited in Lundall *et al*., 2008: 4).

[2] The Funds for Research into Industrial Development Growth and Equity (FRIDGE) (2003a: 18) study represents a broader section of the metal and engineering industry than is included in this study because it is inclusive of the automotive components and plastic converters sectors.

SAs basic metals sector produces ferrous and non-ferrous metals especially iron, steel and aluminium which are vital raw material inputs to downstream industries (FRIDGE, 2003a: 69). It is important to differentiate between 'upstream' and 'downstream' industries. Generally, upstream industries are "large-scale and capital-intensive operations involved in the primary activity of extracting, processing and refining a mineral deposit" and the "workshops, foundries, manufacturing plants and enterprises that undertake the further transformation of basic metal products are referred to as downstream industries" (DTI, 2005: 12). The upstream basic metals industries (inclusive of a diminutive number of producers with monopoly powers to set prices (DTI, 2005: 18)) have performed very well as a result of demand for resources from China. However, there is some belief that there may be a gradual decline in the demand from China as it is boosting its own capacity as a producer of basic metals. Chinese basic metal exports are likely to be cheaper because of their lower labour costs, posing a potential threat to the domestic sector (MERSETA, 2005: 39).

The light and heavy engineering industries (incorporating metal products and fabrication) have been experiencing a decline in GDP growth over the past twenty years, with the value added to products dropping, profitability decreasing, retrenchment of workers increasing coupled with poor export performance (FRIDGE, 2003a: 185).

The machinery and equipment sector plays an extremely important role in nearly all primary and manufacturing sectors in providing and servicing capital equipment. The sectors' value chain (in which firm level production is organized) is complex, given that it sources inputs from the upstream metal producers as well as the electronic and electrical sector and produces outputs for downstream producers as well as for its own sector. "Globally, the sector is becoming increasingly linked with the electronics sector and is placing increasing emphasis on innovation and globalisation of production" (FRIDGE, 2003a: 257). The basic metals, light and heavy engineering, machinery and equipment sectors fit into the second, third and fourth stages of the metals beneficiation process respectively, which are discussed in more detail under the metals beneficiation and the value chain section below.

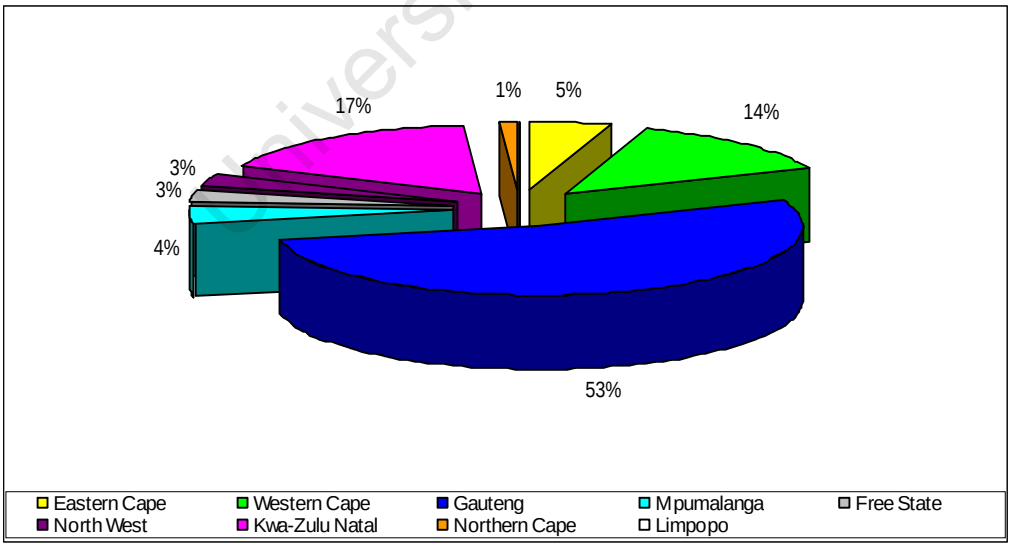
There are a number of historical forces that drove and shaped the metal and engineering industry. The first impetus came from the mining industry. "Initially the large mining companies were the nodes around which a network of suppliers of infrastructure and services came to be established" (Feinstein, 2005; Rosenthal, 1981, cited in Lundall *et al*., 2008: 4). Another catalytic force identified that impacted on the structure, growth and development of the industry was state policy to develop the automobile manufacturing industry. Furthermore, the involvement of the state in the SA economy has had a strong influence on metal and engineering firms. In the 1920s, state-owned enterprises such as Eskom and Iscor were established to

stimulate the metal and engineering industry and to provide a ready supply of cheap energy and material inputs (i.e. ingots and ancillary products derived from pig and scrap iron) to firms within the industry. The final major impetus that led to the development of the metal and engineering industry was the impact of expenditure on the military commencing in the 1940s which enabled specialized and sub-contracted firms to emerge (Lundall *et al*., 2008: 5-6).

The current catalytic forces that drive the metal and engineering industry include: the strong export orientated motor industry; the state's infrastructural expansion (particularly in the provision of electricity, construction in preparation for the 2010 Soccer World Cup as well as the upgrading of public transport) and the expansion of the Angolan oil fields (Maree, Lundall & Godfrey *et al.,* 2009: 88).

Gauteng Province (strategically selected as the area of study) accounts for over half (53%) of the geographic distribution of the country's metal and engineering industry. Figure 1 demonstrates the geographic distribution of the metal and engineering industry as per Manufacturing, Engineering and Related Services Sector Education and Training Authority (MERSETA) data (MERSETA, 2005: 20). Primary steel production mainly takes place in Mpumalanga because of the raw material availability in the province and to a lesser extent it also takes place in Gauteng. Most value-added production takes place in Gauteng due to extensive metals fabrication (MERSETA, 2006, cited in Lundall *et al*., 2008: 12).

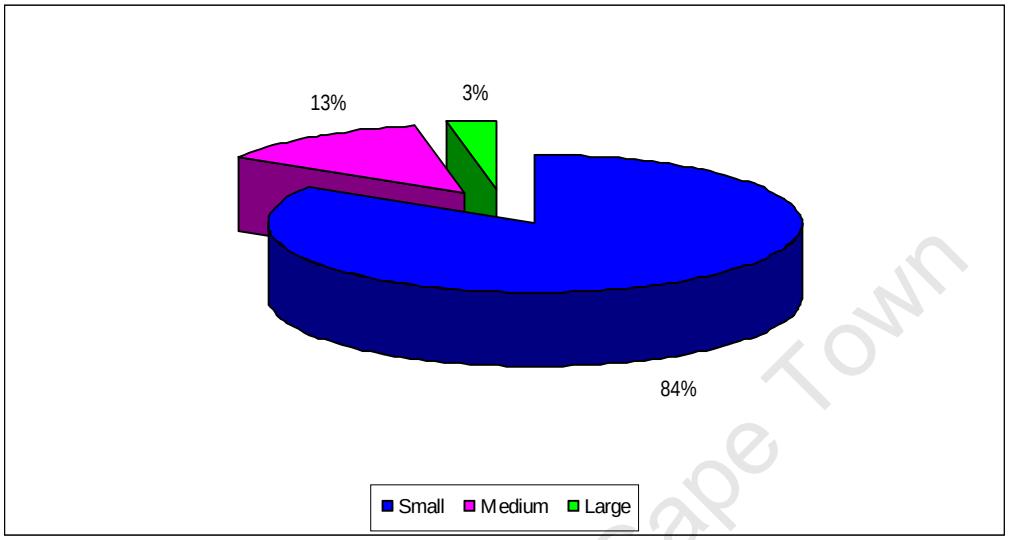
Figure 1: Geographic distribution of the metal and engineering industry



Source: MERSETA 2005: 20

It is evident that the metal and engineering industry is generally made up of small[3] firms (84%). Figure 2 demonstrates the distribution of employers by size and category as per MERSETA data (MERSETA, 2005: 20).

Figure 2: Distribution of employers by size and category in the metal and engineering industry



Source: MERSETA 2005: 20

Having briefly demarcated the metal and engineering industry and considered its significance to the SA economy; the historical and contemporary driving forces; the industry's geographic distribution and distribution of employers by size and category, it is necessary to understand the stages of production in the beneficiation of metals.

2.1.2 Metals beneficiation and the value chain

"SA has a unique comparative advantage in mineral and metal resources" (DTI, 2005: 13). The country has a considerable portion of the world's known reserves of platinum-group metals and manganese (over 80%); chrome (over 70%); vanadium and gold (around 40%). Additionally, it is rich (holding considerable reserves) in titanium and zirconium and produces considerable iron ore and nickel (DTI, 2005: 13-14). According to Lundall *et al*. (2008: 3), combined with the abundant supply of coal and cheap electricity, SA thus has a substantial advantage in metals beneficiation.

[3] The National Small Business Act of 1996, as revised by the National Small Business Amendment Bill of 2003, defines manufacturing enterprises as follows: Micro (5 or less employees); very small (6-20 employees); small (21-50 employees); medium (51-200 employees) and large (200 or more employees) (The SA Small Business Sector, 2004-2005: 30).

Value-added processing, or beneficiation, involves the conversion of the raw material (using local capital and labour) to a higher value-added finished product (DTI, 2005: 14). There are generally four stages involved in metals beneficiation:

- Stage 1: The primary stage of mining and producing an ore or concentrate (DTI, 2005: 15).

- Stage 2: Converts the ore or concentrate into an intermediate product such as a metal or alloy. "The production of intermediate products usually takes place in capital-intensive, energy-intensive smelters and refineries" (DTI, 2005: 15). Lundall *et al*. (2008: 7) refers to this stage as the 'milling' stage, and in SA milling firms are primarily involved in the production and conversion of pig iron into a range of wrought iron and steel materials. These materials are produced to be available in different forms, e.g. ingots, plate, sheet and coil[4] (Lundall *et al*., 2008: 7).

- Stage 3: Transforms an intermediate good into a refined, semi-fabricated product suitable for use by both small and sophisticated industries. Employment levels are greater and the degree of beneficiation increases substantially due to the inclusion of other resources and inputs such as skills and technology. This stage of transformation takes place in "blast furnaces and foundries[5] using heat-treating and/or cold finishing processes" (DTI, 2005: 15). According to Lundall *et al*. (2008: 7), this stage is referred to as 'engineering or machine shops' that are responsible for the "manufacture of products, parts, components, tools, forgings and moulds as well as the fabrication of products and structures" (Lundall *et al*., 2008: 7).

- Stage 4: The converted metal is further transformed into finished products of a large variety. The range of employment opportunities is significantly greater at this stage of production and firms include small, medium and large manufacturers (DTI, 2005: 15). Lundall *et al*. (2008: 7) refers to this stage as 'machine builders', which generally tend to source parts and components from engineering or machine shops and control systems from electronic and electrical firms.

[4] ArcelorMittal SA (formerly Mittal SA and before that Iscor) dominates the primary steel industry, with only Highveld Steel competing with it in the flat steel products market (one of the forms in which carbon steel is produced and consists mainly of coils and plates). Highveld Steel, Scaw Metals, Cape Gate and Cisco compete with it in the long products market (another form in which carbon steel is produced and consists of wire rods and bars) (DTI, 2005: 23-24).

[5] The foundry industry which involves casting production is crucial and provides critical inputs to most of the manufacturing sectors, with mining, automotive and general engineering being the largest industries it supplies. There has been significant restructuring and consolidation in the SA foundry industry over the past 10 to 15 years. The number of foundries decreased from 450 in the early to mid-1980s to just over 200 in 2003 (DTI, 2005: 35).

This study focuses on stages 2, 3 and 4, generally referred to as 'raw material processing firms', 'intermediate product producing firms' and 'finished product producing firms' respectively. Some characteristics of these three stages are discussed below.

2.1.2.1 Characteristics of the different stages of metals beneficiation

This section discusses the structure, skills and training in the three different stages of the value-adding or metals beneficiation process. This is followed by a discussion of the benefits of metals beneficiation, the levels of beneficiation that have been achieved thus far and the reasons for the levels of beneficiation achieved.

According to research conducted concerning the *Industrial Structure and Skills in the Metals Beneficiation Sector of South Africa* by Lundall *et al*. (2008: 61-62)[6] in which the sample base was small i.e. eleven metal and engineering firms at different stages, metal processing or milling firms were generally large firms with a staff compliment exceeding 200 employees, and the engineering or machine shops, which are mostly involved in intermediate production activities, tend to occupy the medium and small employee class size. There was a variation in the distribution of machine builders in terms of size. The latter two stages were generally smaller than the iron and steel mills because their competitive advantage derives from specialization rather than economies of scale. Although firm size differentiated and distinguished the milling firms from engineering or machine shops and machine builders, all three different stages of beneficiation shared overlapping skills requirements (Lundall *et al*., 2008: 8; 62).

Furthermore, research conducted by Lundall *et al*. (2008: 64), showed that key stakeholders at iron and steel milling firms suggest that the low number of registered learners in higher education (HE) engineering programmes is a weakness in the system. The main problem is one of an under-supply of skilled labour at particular levels, which arises principally because of competition between several HE and professional programmes for a small pool of matriculants with a prerequisite in mathematics and science (Maree *et al.,* 2009: 105). Milling firms were faced with the challenge of recruiting sufficient numbers of school leavers with mathematics and science as school subjects. To address this problem, a number of these firms used their social responsibility interventions to support the teaching of these competencies in disadvantaged schools within their geographical proximity (Lundall *et al*., 2008: 66-67).

Lundall *et al*. (2008: 62; 67) found that milling firms (characterized by operating their own in-house training facility with dedicated instructors in various trade specializations) had, in addition, raised the entrance

[6] Note that the *Metals Beneficiation* study by Maree *et al.* (2009) is a shorter version of Lundall's *et al.* (2008) study.

requirements for firm-based artisan training programmes due to the schooling system no longer guaranteeing the quality of school leaving certificates. Apart from the training programmes for artisans and the practical experiential training for technicians and engineers, milling firms had instituted operator training and other skills programmes for employees within occupational levels lower than the artisan level (Lundall *et al*., 2008: 69). Some programmes formed part of MERSETAs workplace skills development programmes; some were self-funded; others were part of learnership programmes that firms were supporting for their internal workforce and others were provided by initiatives that Further Education and Training (FET) institutions had put into place in collaboration with a Sector Education and Training Authority (SETA). "These new initiatives appear to incorporate a qualifications progression through which the recipients of the training can eventually qualify as artisans" (Maree *et al.,* 2009: 105).

Skilled labour produced by the training programmes of the milling firms were poached by smaller downstream firms mainly because of their size and system constraints. Comparatively, the large milling firms contributed a much larger proportion to the overall training of metal and engineering artisans. An informant at a steel mill had claimed that the high demand for skills in the economy (examined in greater depth below) contributed to the firm recording a staff turnover ranging from 10-14% per annum, mostly blamed on poaching by competitors (Lundall *et al*., 2008: 82).

The engineering or machine shops that Lundall *et al*. (2008: 70) interviewed undertook a range of general and specialized engineering work, which usually involved machining; welding and fabrication; maintenance and repair; and work related to the creation of tools and dies, and to more specialized casting and forging. In most cases work was customized for the specific needs of clients (generally for larger firms) and the type of work demanded is continuously changing (Lundall *et al*., 2008: 70).

Several utilized machinery in the engineering or machine shops operated through computerized numerical control (CNC) technology. As a result of computerization of key processes, skills are crucial for the growth and expansion of general engineering and machine shops. FET institutions have lagged behind "incorporating the knowledge applications of the technological advances that have occurred" (Lundall *et al*., 2008: 71).

The engineering or machine shops operated some form of in-house training. For those that had an apprenticeship training programme in place, there was a modest number of apprentices undergoing training in technical trades (such as tool and die makers and fitters and turners) that were deemed necessary for the firm's transmission of specialized skills. Other firms had a learnership programme in place with the aim of

supplying/supplementing the internal labour supply (Maree *et al.,* 2009: 106). To qualify as a potential candidate to enter a trade in these firms, at least a matriculation certificate would normally be required. Welders were an exception as apprentices/learners with a Grade 10 or higher could still be trained (Lundall *et al*., 2008: 72).

Machine builders in the manufacturing sector use the final output derived from iron and steel mills to produce a wide range of products, according to Lundall's *et al*. (2008: 75) study. With regard to skills availability, problems in the schooling system have had a detrimental negative impact on this. Employers at machine building firms felt that the basic learning background on which to build engineering and scientific skills was often absent in new employees (Lundall *et al*., 2008: 76).

In the spectrum of machine builders investigated during Lundall's *et al*. (2008: 78) fieldwork, skills development and upgrading was not a big concern at a small extrusion machine building firm as opposed to the large machine building firms who took internal skills upgrading initiatives very seriously. For example, an industrial boiler building firm had a training facility at its plant for training apprentices, technicians and engineers. The firm had been encouraged to expand its labour force (by finding new artisans as well as increasing the number of apprentices to be trained) due to the "envisaged construction of new power stations, upgrading existing ones, and other infrastructural investments" (Lundall *et al*., 2008: 76). Despite numerous criticisms about the bureaucratic administration of the SETA system, a large firm indicated that the legislation regarding skills development forced many firms that had never done training before to become actively engaged with skills development. Many of these firms had become "more strategic in diverting skills development resources into areas of training that the firm is generally better at doing" (Lundall *et al*., 2008: 78).

Drawing from the highly informative *Metals Sector Development Strategy* study of the Department of Trade and Industry (DTI) (2005: 15), employment opportunities tend to vary from low at the refinery/milling stage, to very high at the mass semi-manufacturing and final production stages. The DTI (2005: 16) study illustrates by example of the carbon steel pipeline (Table 1) that stages 2 and 3 are highly capital intensive, with investments of R1.5 to R8.5 million required per job while employment per 1000 ton of steel produced is extremely low with only 1 to 7 workers employed. By contrast, stage 4, invests R0.1 to R0.6 million per job while employment per 1000 ton of steel ranges from 75 to 150, signifying that it is much more labour intensive. The downstream metals industries are not only labour intensive but also employ a large proportion of unskilled and semi-skilled labour, which accounted for 63% of total employment in metal products in 2004. Therefore, these industries have the potential to create jobs which is important given the large amount of

low-skilled labour in SA. Furthermore, it should be noted that the selling price per ton of steel considerably increases as metals are beneficiated through to stage 4 (Table 1) (DTI, 2005: 16; 52).

Table 1: Benefits of beneficiation: selling price, employment and investment in different stages of carbon steel

Nature of product	Selling price per ton of steel ($)	Employment per 1000 ton of steel	Investment (R million per job)	Stage
Iron ore	30	0.12	n.a.	1
Iron	120	0.6	R2 m	2
Hot rolled steel	300	1.1	R6 m	3
Cold rolled steel	500	1.6	R8.5 m	3
Pipe and tube	650	7	R1.5 m	3
Structural steel	1000	75	R0.1 m	4
White goods	5000	100	R0.4 m	4
Mining equipment	13000	150	R0.6 m	4

Source: DTI 2005: 16

Although SA is remarkably well-endowed with metals, only a very small proportion of most metals are beneficiated through to the final production stage, where the largest employment creation occurs (DTI, 2005: 16). According to Maree *et al.* (2009: 107), "most of the metals are still exported after the milling stage when relatively little value has been added to the product". Table 2 quantitatively demonstrates the overall underdevelopment of the downstream metal products industries. For example, 100% of aluminium in SA is processed (stage 2), but only 11% is beneficiated into a final product (stage 4) (DTI, 2005: 16). Developing the downstream higher value-added industries should therefore become a main concern, placing great emphasis on the skills required to grow and develop these industries (Lundall *et al*., 2008: 9).

Table 2: Stages of beneficiation and levels achieved

Commodity	Stage 1 Ores / Concentrates (%)	Stage 2 Processed / Refined Ore (%)	Stage 3 Primary Manufacture (%)	Stage 4 Finished Manufacture (%)
Gold	100	100	5	2
PGM (Platinum-group Metals)	100	100	n.a.	6
Iron ore to steel	100	30	30	15
Chrome to stainless steel	100	85	9	3
Aluminium	0	100	30	11
Zinc	100	100	90	60
Manganese	100	50	25	22
Titanium	100	15	4	Small
Copper	100	100	65	50

Source: DTI 2005: 16

The reasons for the low levels of beneficiation include "weak linkages and import-parity pricing by upstream metals producers at stages 2 and 3, and other factors impacting on the competitiveness of downstream firms at stage 4 which relate to skills, investment, production capabilities and demand" (DTI, 2005: 16). Maree *et al.* (2009: 107) identified the pricing policy of the upstream monopolistic mills as the main reason for the low levels of beneficiation. Their practices of import-parity pricing[7] have served to impede the growth of more labour-intensive downstream producers (Maree *et al.,* 2009: 107). The FRIDGE (2003b: 3) study consistently raised import-parity pricing as an impediment to growth and employment creation by the downstream sectors. Table 3 demonstrates the competitive disadvantage in terms of the pricing of basic metals faced by local buyers.

Table 3: Mark-ups of basic metal prices, 2003/04

	Carbon steel	Stainless steel	Aluminium
SA net export price	100	100	100
EU price	122	120-139	107
East Asian price	101	113	104
SA buyer price	146	130	105-109

Source: DTI 2005: 51

There is a further question that also needs to be addressed and that is whether a shortage of skills has contributed in any way to the extremely low levels of beneficiation. The following section of this chapter explores the demand and supply of skilled labour in the metal and engineering industry.

2.2 DEMAND AND SUPPLY OF SKILLS IN THE METAL AND ENGINEERING INDUSTRY

The contemporary SA labour market situation reflects that there is a severe mismatch in the demand for and supply of skills. There is a massive surplus of unskilled and semi-skilled labour, while there is a shortage of required skilled labour (Maree, 2006: 4). The latter can be clearly seen in particular sectors and professions.

Research conducted by the MERSETA (2005) in alliance with the DTI revealed that in the metal and engineering industry there are severe skills shortages at artisan, technical and engineering levels, which is a major limiting factor concerning industry growth (MERSETA, 2005: 21; 41-42; DTI, 2005: 53). A local financial publication, *Finweek*, estimated in February 2008 that the country was currently short of 68 000 artisans, technicians and engineers (Ray, 2008: 12). One of the biggest constraints faced by the industry

[7] Local firms are being charged higher prices for basic metals than firms in other countries, despite SA having amongst the lowest production costs in the world for basic metals (DTI, 2005, cited in Maree *et al*., 2009: 91). The SA competition authorities imposed a fine of R691.8 million on the dominant supplier of steel ArcelorMittal SA for charging excessive prices (Creamer Media, 2008a: 1).

(and the manufacturing industry as a whole) is a general shortage of artisans. In the face of this challenge, "a number of firms have developed their own in-house training programmes, but a major problem with these independent initiatives is that they are neither formally recognised nor accredited by the SETA concerned" (DTI, 2005: 39; 53). Figures emerging from the DTI (2005: 53) research demonstrate that in 1982, 13 000 artisan apprentices were registered, but this figure had significantly declined in 2003, to only 2 000.

Historically, the role of the state-owned enterprises (such as Eskom, Iscor and Spoornet) and other large private sector conglomerates in the production of intermediate skilled labour had been considerable. It was these institutions that produced large numbers of artisans, both for their own needs and also for those small firms reliant on poaching of skilled workers to meet their technical skill needs (Kraak, 2008: 485). Since these enterprises scaled back their training programmes, the skills shortages have accelerated (DTI, 2005: 54). Downturns in economic cycles and the privatisation and commercialization of state-owned enterprises in the late 1980s contributed to reductions in training which negatively affected the supply of artisans (Johnston, 2007: 46).

Validating that there is a shortage of skills requires an examination of both the demand for and supply of skills. Additionally, it requires a study examining the perceptions and experiences of key stakeholders in metal and engineering firms regarding the availability and suitability of skilled labour which has been done in Chapter 5 (Maree *et al.,* 2009: 92).

2.2.1 The demand for skills

This section examines the demand for skills within the metal and engineering industry. This will be accomplished in two ways, firstly by outlining the profile of skills in demand according to MERSETA and secondly by investigating employment trends within the industry for different occupational levels.

2.2.1.1 Profile of skills in demand

The metal and engineering industry requires technical and engineering skills, which are highly sought after given the small pool of candidates. A detailed description of the skills needs of the industry is provided in Table 4 below (MERSETA, 2005: 42).

Table 4: Skills requirements of the metal and engineering industry

Engineering	Technicians	Trade	Management
Design & development ▪ Design & development engineers ▪ Electrical engineering designers ▪ Mechanical designers (CAD)	Drafting & design ▪ Draftsman	Repair & maintenance ▪ Electricians ▪ Coded & pipe welders ▪ Mechanics ▪ Millwrights ▪ Roll turners ▪ Instrument mechanics	Senior executive-strategic ▪ Production manager ▪ Black managers ▪ Business unit managers
Materials ▪ Chemical engineers ▪ Metallurgical engineers ▪ Black material engineers	Electronic repair & maintenance ▪ Millwright	Manufacturing ▪ Pipe welders ▪ Fitters & turners ▪ Power transformer specialist ▪ Ceramists ▪ Chrome platters DTI (2005: 53) ▪ Boilermakers ▪ Patternmakers ▪ CNC operators	Middle management ▪ Operations managers ▪ IT managers ▪ Production managers ▪ Project managers
Process ▪ Product engineers	Instrumentation & control systems ▪ Instrument mechanics		
Specialised ▪ Power transformer specialist ▪ Black engineers	Other ▪ Contract technicians		
Traditional ▪ Mechanical engineers ▪ Civil engineers ▪ Electrical engineers ▪ Contract engineers			

Source: MERSETA 2005: 42

2.2.1.2 Employment trends for different occupational levels

Employment trends are usually a good indication of the demand for labour or certain types of skills. It is important to note that this data is an indirect way of analyzing demand (Du Toit & Roodt, 2008: 454). Maree *et al.* (2009: 93) investigated the employment trends within the metal and engineering industry for different occupational levels, which provided an indication of the rate at which the demand for each occupation had been increasing.

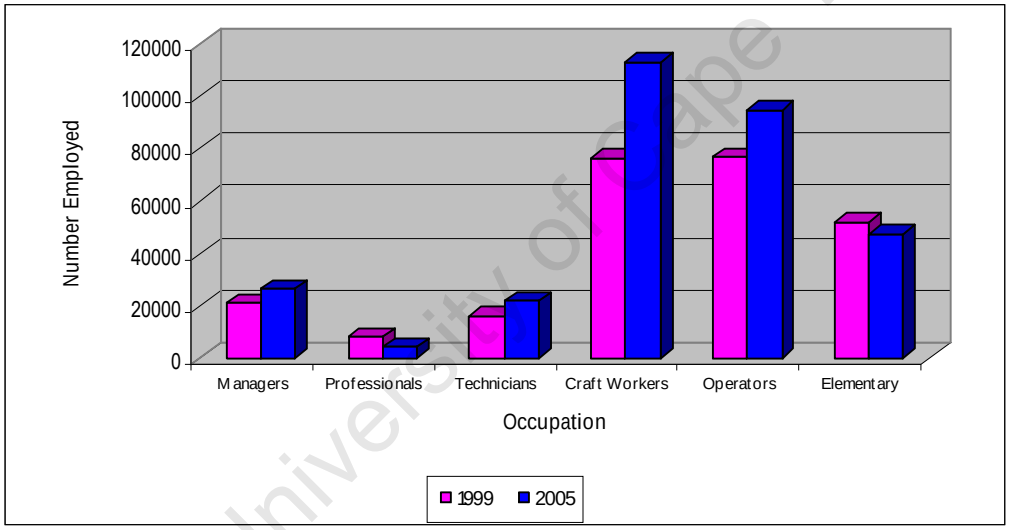
Using data in Maree *et al.* (2009: 94-95) which was derived from household surveys conducted by Statistics South Africa (Stats SA) (see Figure 3 and Table 5)[8], it was reported that the demand for the skills of technicians, craft workers and operators had increased by 35%; 48% and 24% respectively over the period 1999-2005. Furthermore, it was surprising that the number of professional engineers employed decreased

[8] The statistical data should be treated with caution due to small sample sizes contributing to the unreliability of the data (Maree *et al.,* 2009: 94).

by almost half over the period (49%). This is confirmed by Du Toit & Roodt (2008: 461), as the employment of engineers decreased at a rate of 2.7% per annum between 2000 and 2004. Portions of this loss may be due to the shift of engineers into management[9] (that increased by 24% over the period) (Maree *et al.,* 2009: 95).

Maree *et al.* (2009: 94) emphasized that the survey data figures for professional engineers should be viewed with great caution[10]. Steyn and Daniels (2003, cited in Maree *et al.,* 2009: 95) found that engineering employment hovered around 70 000 between the period 1990 and 2001. Additionally, the number of engineers of all classes registered with the Engineering Council of South Africa (ECSA) had been relatively stable at just under 26 000 over much of this period, which slightly increased to 27 000 in 2005 and 2006[11] (Maree *et al.,* 2009: 95).

Figure 3: Employment by occupation in metal and engineering, 1999 and 2005



Source: Derived from Table 5

Table 5: Employment by occupation in metal and engineering, 1999 and 2005

	Managers	Professionals	Technicians	Craft workers	Operators	Elementary
1999	21093	8090	16170	76298	76886	52062
2005	26143	4166	21856	113067	94962	47202
Percentage Change	24	-49	35	48	24	-9

Source: Stats SA 1999, 2005, cited in Maree et al. 2009: 95

[9] Most engineers work is in the financial and business sectors where they do not apply technical skills (Du Toit & Roodt, 2008: 472).

[10] See Maree *et al.* (2009: 94-95) for further information on the limitations of the survey data.

[11] It should be noted that most engineers in employment are not registered with ECSA (Du Toit & Roodt, 2008: 453).

Overall, employment by occupation confirms MERSETAs (2005: 42) finding that the metal and engineering industry critically requires skilled artisans, technicians and engineers.

2.2.2 The supply of skills

This section commences with a brief historical overview of apprenticeship training in SA. Then it outlines the new skills dispensation system that emerged in the country from the post-apartheid government. The major laws, institutions and processes that the new dispensation has brought into existence are mentioned and some strengths and weaknesses of the system are considered. This section also examines education supply data primarily pertaining to metal and engineering programmes offered within public FET colleges and HE institutions.

2.2.2.1 A brief history of apprenticeship training in South Africa

The apprenticeship system emerged largely in response to the mid-nineteenth century mining revolution and the subsequent development of railway systems, which brought about a need for a supply of skilled labour (HSRC, 1985: 14). The apprenticeship system was considered the main route through which to acquire vocational and technical training (Lundall, 1995: 4).

The first attempt to regulate apprenticeship training in SA was contained in the Apprenticeship Act of 1922 which limited Black, Indian and Coloured access to apprenticeships[12]. Consequently, apprenticeship training favoured Whites and was therefore "racially biased" (Maree, 2006: 18). In 1944, the Apprenticeship Act was amended[13], and one of the major introductions of the new Act was the establishment of a National Apprenticeship Board (NAB), whose functions included the co-ordination and facilitation of training (HSRC, 1985: 16).

The Central Organization for Technical Training (COTT) was established in 1940, and was a key new institution involved in the war-time growth of Black skills with training centres attached to technical colleges. In 1945, COTT centres were taken over by the Union Education Department and focused on "training mostly White ex-volunteers, often in the same trades[14] as previous Black trainees" (Badroodien, 2004: 37).

[12] This Act whilst not actively excluding Blacks from apprenticeship training nevertheless had that effect, due to the high educational qualification expected of potential apprentices and the requirement to have attended trade school. This effectively hampered the opportunities for non-Whites in general (Lewis: 1984: 24).

[13] This Act was amended again and was replaced by the Apprenticeship Act of 1963 (HSRC, 1985: 17).

[14] Fitters, machine tool operators, welders, sheet metal workers etc. (Badroodien, 2004: 37).

In 1960, the Economic Advisory Council (EAC) was instituted due to there being a general concern with regard to "economic development, industrialization and an adequate supply of trained manpower" (HSRC, 1989: 24). The fast growth of the economy during this period and sustained growth during the 1970s, called upon many Black workers who required training into industrial labour (Maree, 2006: 18). According to Maree (2006: 18), there was virtually no provision for training Black workers, but in 1974, tax concessions applied to training schemes for Black individuals. One of the strategies by employers was to train Blacks under the Black-In-Service Training Act of 1976[15] and thereby bypassing the training of White apprentices and undermining the apprenticeship system. Blacks received training at levels below that of artisans, primarily at the semi-skilled level (HSRC, 1989: 24).

Further reforms were introduced to the apprenticeship system in 1981 with the passing of the Manpower Training Act (MTA). This Act removed 'job reservation' in most artisan trades and got rid of former discriminatory Acts (HSRC, 1985: 18-19). According to Lundall (1995: 5), "this Act did not cater exclusively for apprentice training but covered the promotion and training of employees in *all* sectors of the economy". Furthermore, in terms of the Act, the National Training Board (NTB) was established. It was a tripartite body that consisted of 21 members with equal representation from state departments, employers and employees (HSRC, 1985: 31). The conditions specified in the Act relating to the training of apprentices included:

- In order to be selected as an apprentice, one had to be no younger than 16 years, with a minimum education qualification of Grade 9 with a credit in mathematics[16] (HSRC, 1985: 32).
- The average period of training was to be 4 years (with block-releases lasting for up to 15 weeks, to attend trimester N-courses in trade theory subjects at an FET college (Lundall *et al.,* 2008: 36)) while the minimum would be 3 years. This training period included 80 to 93 weeks of practical training required before the completion of a trade test (HSRC, 1985: 33).

Apprentices continue to be governed by the 1981 MTA even after the promulgation of the Skills Development Act (SDA) of 1998 and the establishment of SETAs in 2001 (discussed in more detail under the new skills dispensation section below). While the MTA has been repealed, fragments associated with apprenticeship training still remain (Kraak, 2008: 487). Consequently, there are two main routes by which workers can qualify as artisans:

[15] The Black Building Workers Act of 1951 was another important piece of legislation which regulated apprenticeship training (HSRC, 1989: 21).

[16] In contemporary times, admission into apprenticeship programmes requires that students achieve the National Technical Certificate (NTC) 2 level, but in the newer technology programmes this minimum statutory requirement can be raised to NTC 3 (equivalent to Grade 12) (Lundall *et al.,* 2007: 37).

- *"Section 13* (S13) of Chapter 2 of the MTA refers to those (young) persons who have been formally indentured as apprentices, who meet the age criteria, who serve the full time period and who pass the trade test as prescribed by the Act" (Kraak, 2008: 487).
- *"Section 28* (S28)[17] of Chapter 2 of the MTA refers to (adult) persons not indentured under S13 but who satisfy the Registrar of Training that they have gained sufficient work experience over an adequate period of time, and can therefore undergo the trade test, after which (if they pass) they become qualified artisans[18]" (Kraak, 2008: 487).

The apprenticeship system in SA operated effectively and remained strong until the mid-1980s; the graduation of artisans peaked at 13 500 in 1985. However, by this time there were already severe problems, triggering a dramatic decline in indenturing in key economic sectors. This decline has continued into the present period (Table 6) (Kraak, 2008: 486-487).

Table 6: Total number of apprentices qualifying as artisans, 1970-2004

Year	No. of artisans graduated	Year	No. of artisans graduated	Year	No. of artisans graduated
1970	5 500	1982	11 000	1994	7 000
1971	6 050	1983	12 000	1995	5 000
1972	7 000	1984	12 000	1996	3 000
1973	7 000	1985	13 500	1997	4 874
1974	8 000	1986	13 100	1998	4 933
1975	8 050	1987	13 000	1999	5 145
1976	8 050	1988	11 000	2000	5 600
1977	8 500	1989	8 000	2001	3 191
1978	9 500	1990	7 500	2002	2 916
1979	9 600	1991	7 200	2003	2 779
1980	10 000	1992	8 000	2004	2 548
1981	10 500	1993	9 550		

Source: Lishman, cited in Kraak 2008: 487

The metal sector was one of the sectors with the most dramatic quantitative reductions with regard to the number of newly indentured apprentices (those enrolling for their first year of training). Numbers declined from 3 911 in 1991 to 320 in 1999[19] (Moleke, 2006, cited in Kraak, 2008: 487-488).

[17] It is important to recognize that the system for granting artisan status under S28 for the metal industry is known as Artisan Training and Recognition Agreement for the Metal Industry (ATRAMI) (Maree *et al.* 2009: 97).

[18] A total of 12 577 MERSETA apprentices enrolled in terms of both of these routes (S13 and S28) between the 1 April 2001 and 31 March 2005, the period during which the new National Skills Development Strategy (NSDS) was implemented (DoL, 2006, cited in Kraak, 2008: 489).

[19] For an analysis of *The Erosion of Apprenticeship Training in South Africa's Metal and Engineering Industry*, see Lundall (1997).

The findings of the 1979 Riekert and 1982 Wiehahn Commissions of Inquiry, and the 1984 HSRC/NTB *Investigation into the Training of Artisans* led to significant changes in the artisan training system. The latter report recommended a system of "modular performance-based institutional training coupled with controlled on-the-job training and experience" (HSRC, 1984, cited in Kraak, 2004a: 54). The state accepted and incorporated this into the Manpower Training Amendment Act of 1990. The amended Act abolished the time-based training system known as 'effluxion-of-time[20]' to attain artisan status and introduced a 'competency-based modular training' system which required demonstrated competence at each stage of a training module (Kraak, 2004a: 55).

Importantly, the amended Act of 1990 devolved control over apprenticeship training from the Department of Manpower (DoM) to Industrial Training Boards (ITBs). "ITBs were established in all industries, and were granted full control over administration and certification of all training undertaken in that industry" (Kraak, 2004a: 55). It was argued that this devolution of authority to ITBs would leave such boards free to "meet the training needs of its industry in the best way it sees fit, without state intervention" (HSRC, 1989, cited in Kraak, 2004a: 55) signifying the decentralized role the state was adopting with regard to apprentice training.

Research work done by Bennell (1992: 1) evaluated the performance of ITBs. It was found that employers and employer organizations were 'overwhelmingly positive' about the amended MTA (Bennell, 1992: 2). The main reason for this, according to Bennell (1992: 2-3), was because "industry for the first time ever has been given the freedom to provide its own high quality, structured training that caters for its own specific training requirements", giving an industry a sense of 'ownership' over its own training activities.

However, the ITB system was also faced with constraints, challenges and weaknesses. To give an example, the composition of the ITBs should have been 'representative' of their industries but in practice, employer representatives dominated the boards (Bennell, 1992: 13-14). Despite the limitations, Bennell (1992: 19) was very optimistic with regard to ITBs and concluded that they should be retained and strengthened. It was proposed that "every industry should be legally obliged to have its own ITB" and that "there should be equal employer-employee representation on all ITBs" (Bennell, 1992: 19). However, the post-apartheid government completely discarded the ITBs and almost all the other existing institutions and practices engaged with skills development and introduced completely new education and training policies (Maree, 2006: 19; 21).

[20] Apprentices could acquire their trade certificate after serving out their contract period (the 'effluxion-of-time-method) or through the passing of a trade test. Trade test pass rates (particularly for apprentices in the metal industry) were remarkably low, with roughly more than half failing (Lundall, 1995: 25).

2.2.2.2 The new skills dispensation in South Africa

The new democratic government introduced an entirely new skills dispensation in SA, sought to meet the major challenges facing the labour market such as discrimination; segmentation of the labour market; separation of education and training; high unemployment, as well as the impact of global forces on the economy (DoL, 2001a: 9-10).

2.2.2.2.1 South African Qualifications Authority (SAQA) Act of 1995 and the National Qualifications Framework (NQF)

The starting point of the education and training model, was to base learning on 'competencies' (connecting education and training to allow workers to enjoy upward mobility without having to re-enter the school system[21]). The challenge remained, namely where to fit school into the model. This is where the concept 'critical cross-field outcomes' was introduced, laying the basis for 'outcomes-based education (OBE)[22]' in which competencies would play a vital role in assessing performance (Jansen, 2001: 14-15).

The SAQA Act of 1995 was created to co-ordinate education and training into a single system and to establish institutions to ensure that training qualifications are of a high standard (through the NQF) (Jansen, 2001: 16). The Act established an institution called the South African Qualification Authority that rules over the NQF and is tasked with the registration of qualifications on the NQF and ensuring that the education and training delivered to learners actually helps them to reach these qualifications and standards (DoL, 2001a: 18).

In terms of the Act, two other institutions are involved in determining and setting of quality standards. They are the Standards Generating Bodies (SGBs) and National Standards Bodies (NSBs). The former generates standards and qualifications and then recommends them to the NSB that evaluates standards and qualifications from the sector for which the qualifications are developed (SAQA, 2007: 1). NSBs are

[21] Briefly, with regard to SAs school education system, policies adopted such as 'rightsizing' in order to equalize learner-teacher ratios have had devastating implications. Many teachers instead of relocating to schools where they were needed preferred to accept Voluntary Severance Packages (VSPs). In addition, several of the best teachers and principles had left the system. This has had significant effects with regard to mathematics and science teaching, which are priority areas (Fiske & Ladd, 2004: 105; 110).

[22] Fiske & Ladd (2004: 157) describe OBE as follows, "OBE is an instructional method in which curriculum planners define the general knowledge, skills, and values that learners should acquire. Teachers then work backward to design teaching strategies for reaching these outcomes tailored to the situation and needs of their particular learners". Some practical problems with OBE had to do with its "design, notably its complexity and overestimation of the capacity of teachers to develop their own curriculum materials" (Fiske & Ladd, 2004: 171). This is further confirmed in Jansen (1999: 147) in that the "language of innovation associated with OBE is too complex and confusing" for instance to understand 'outcomes' requires understanding of "competencies, unit standards, learning programmes . . ."

established for each different area of learning[23]. Another important task of SAQA is to accredit institutions as Education and Training Quality Assurance (ETQA) bodies, which in turn have the responsibility of ensuring that the training provided is according to NQF standards and qualifications (DoL, 2001b: 7).

"The NQF is the set of principles and guidelines by which records of learner achievement are registered to enable national recognition of acquired skills and knowledge, thereby ensuring an integrated system that encourages life-long learning" (SAQA, 2007: 1).

The NQF consists of 8 levels[24] against which learning outcomes are registered and quality assured. The levels measure the difficulty of the learning for different qualifications, rather than how long the person has studied. The qualifications within the framework is made of standards, each of which carries a number of smaller parts called credits and each credit is equal to an average of about 10 hours of learning. NQF level 1 consists of 120 credits, approximately 1200 learning hours and each NQF level requires an additional 120 credits (DoL, 2001a: 18-19). The 8 NQF levels are divided in three bands. NQF level 1, the first band (known as General Education and Training (GET) band) is reached by compulsory schooling up to Grade 9, and can also be reached through Adult Basic Education and Training (ABET) for adults who did not get the chance to complete their schooling. NQF levels 2, 3 and 4 making up the second band (known as Further Education and Training (FET) band), covers secondary level schooling and technical certificates up to the equivalent of Grade 12. NQF levels 5, 6, 7 and 8, making up the third band (known as Higher Education and Training (HET) band), consists of higher level diplomas and degrees acquired at universities, the former technikons and colleges[25] (DoL, 2001a: 20).

The National Skills Development Strategy (NSDS) is integrated with the provisions and institutions established under the SAQA Act (Maree, 2006: 20-21). The next section provides a brief discussion and evaluation of the new training regime, the NSDS.

2.2.2.2.2 The National Skills Development Strategy (NSDS)

The major union federations participated in the formation of the NSDS which took place in 2001 (Macun, 2000: 42). The new strategy was set out into two acts, namely the SDA of 1998 and the Skills Development Levies Act (SDLA) of 1999. The main function of the strategy is to set 'Success Indicators' for each of its objectives over a specified period (DoL, 2001a: 41).

[23] There are 12 NSBs in total that are made up of "government, organized business, organized labour, education and training providers, community and learner organizations and other groups" (DoL, 2001a: 21).

[24] During the course of 2009, two additional NQF levels (levels 9 and 10) were added in the Higher Education and Training (HET) band.

[25] Refer to Appendix 1, to view the NQF classifications of education and training levels.

The passing of the SDA in 1998 led to the establishment of 25 SETAs[26] (DoL, 2001a: 28). They are tripartite bodies established by the Minister of Labour and consist of representatives from organized labour; organized employers (including small businesses) and relevant government departments[27] (DoL, 2004a: 7-8). The main responsibility of these core new institutions are, firstly, to develop Sector Skills Plans (SSPs), which are expected to help ensure that SETAs know their sectors and understand its dynamics, and therefore know what the employment and skills needs are[28] (DoL, 2001a: 29). Secondly, they play an important role in implementing SSPs by establishing learnerships; approving Workplace Skills Plans (WSPs) and allocating grants to employers, education and training providers and workers[29] (DoL, 2004a: 7). The Act requires that SETAs apply to SAQA for accreditation as ETQA bodies[30] (Barry & Norton, 2000: 7-8).

WSPs (similar to SSPs, but for one workplace instead of a whole sector) play a vital role in skills development as they identify "what skills are needed, who needs them, how they will get the skills and how much it will cost" (DoL, 2001a: 30). The skills training specified in a WSP can constitute a justifiable skills shortage perceived by the firm and therefore does not have to be part of a formal qualification under the NQF or accumulate credits towards such a qualification[31] (Maree, 2006: 22).

The SDA defines two types of learnerships:

- "Section 18.1: Learnerships entailing employed workers" (Kraak, 2008: 496).
- "Section 18.2: Learnerships entailing unemployed learners" (Kraak, 2008: 496).

The resolutions passed at the Growth Development Summit (GDS) of 2003 had the effect of privileging the training of 18.2 (unemployed learners) over 18.1 (employed workers) who also need significant skills upgrading. Out of a target of 8 831, a total of 9 671 unemployed youth registered for 18.2 learnerships by June 2004, per MERSETA (DoL, 2004, cited in Kraak, 2008: 497-498). Research unearths that "in the four years to March 2009, MERSETAs learnership programme saw a success rate of more than 200% in the numbers of successfully completed learnerships" (MERSETA, 2009: 8). Out of a target of 5 125, over 11 300

[26] SETA 17: MERSETA (DoL, 2001a: 28).

[27] Section 11 of the SDA (DoL, 2004a: 7-8).

[28] According to MERSETA (2005: 5), it is imperative that its SSP (2005-2010) contributes to the overall supply of skills within the manufacturing sectors.

[29] Section 10(1) (a) & (b) of the SDA (DoL, 2004a: 7).

[30] It is important to accentuate that major changes are on the horizon in terms of skills development policy. Both the SDA and the SAQA Act are in the process of amendment (Isaacs, 2008). For further information on the Skills Development Amendment Bill, view the website: http://www.info.gov.za/view/DownloadFileAction?id=90883

[31] Section 20(1) (b) of the SDA refers to this as a 'skills programme' (DoL, 2004a: 11).

learnerships were successfully completed. Similarly, almost 10 500 apprenticeships were completed, a number surpassing the target emphatically (MERSETA, 2009: 8).

Learnerships are "central to the ambitious thrust of the new skills development model" (Kraak, 2004b:122). In contrast to the restricted apprenticeships, it should be emphasized that learnerships are open to everybody in the economy requiring training. Another major strength of the new system is that learnerships provide more than just technical skills. It provides a wide range of skills required in SA from basic literacy to highly specialized professional qualifications (DoL, 2001a: 26). The main differences between learnerships and apprenticeships are that learnerships are demand-led i.e. learning programmes are closely aligned to employers' actual skills needs (Kraak, 2008: 496); they appeal to a wide range of learners including the employed and unemployed; they are more diverse than apprenticeships and they have differing curriculum content to apprenticeships aiming to integrate theoretical education and skills training (DoL, 1999b, cited in Kraak, 2004b: 122).

SETAs do not provide industrial training themselves but channel funds to training providers and enterprises undertaking their own training. The SDA works closely with the SDLA which obliges employers with a wage bill greater than R500 000 per annum[32] to pay levies (1% of their payroll to South African Revenue Services (SARS))[33] which is intended to fund the skills development of employees and people that are unemployed. There are advantages to the payroll levy, in that employers who voluntarily participate in the skills development process, can claim back up to 70% of the levy in the form of mandatory grants (50% covers those employers who submit a WSP, appoint a skills development facilitator and submit annual training reports) and discretionary grants (20% covers those employers who offer learnerships, skills programmes or who have programmes addressing SETA Sector Skills Priorities or scarce skills[34]) (Cloete, 2005: 13).

It is important to note, that the second NSDS for the period 2005 to 2010 focuses on identifying and addressing skills that are in short supply. SETAs are instructed to use their discretionary funds to identify critical skills in their sectors, and then the skills development bodies must address the scarcities in line with projected demand (DoL, 2005, cited in Maree *et al.,* 2009: 86).

[32] The levy-grant system was revised in 2005, the threshold for levy-paying firms increased from R250 000 to R500 000 (Cloete, 2005: 13).

[33] To expand on the route the money follows: SARS then transfers 20% to the National Skills Fund (NSF) (which is further distributed to Provincial Offices and Labour Centres for social development projects and training unemployed people) and divides 80% between the SETAs (of this the SETA gets to keep 10% to cover administration costs of running the SETA operations) (Cloete, 2005: 13).

[34] Firms will have to apply with the latter (Cloete, 2005: 13).

Tax concessions have been added in April 2002 by the Minister of Finance, which consist of a R25 000 tax deduction when a learnership agreement is signed and an additional R25 000 when it is successfully completed (Kraak, 2004b: 126). All of this can be seen as an incentive encouraging employers to embrace skills development in the workplace (DoL, 2001a: 36).

(a) Weaknesses of the new strategy

According to Kraak (2004c: 235), a problem and weakness facing the NSDS (and in turn SETAs), is that many employers view the new levy-grant system as an additional tax burden which negatively impacts on cost and profit margins. This can be especially seen in MERSETA as only 12% of potential grant claims had been processed in April 2004 (Kraak, 2004c: 235).

MERSETA has been determined as the largest SETA in terms of levies collected, having received in the region of R457.7 million from 24 946 levy paying companies in 2005 (Grawitzky, 2007: 18). However, SETAs have been unable to spend their money on training, as of the R3.1 billion received from the levies, only R1.6, or 52%, had been paid out in grants, pointing to one of the most serious problems in the NSDS that is the "voluntary requirement for enterprises to enter into training and the non-provision of training by SETAs themselves" (Maree, 2006: 27). Several SETA officials maintain that the regulations and procedures for claiming the levy are too bureaucratic (Kraak, 2004c: 236).

A further problem is that MERSETA is not seen as effective by the management of firms (DTI, 2005: 41), especially amongst the smaller firms that have claimed to experience administrative difficulties with MERSETA (FRIDGE, 2003a: 103). "There has thus been a gap between the ending of apprenticeship programmes of many firms and the establishment of new learnerships" (DTI, 2005:41). According to Maree *et al.* (2009: 107), MERSETA is not the primary source of the skills crises in the metal and engineering industry. The problem is deeply rooted in three fundamental areas: "first, in the the low quality of public education and training, particularly at the general education or schooling level[35]; second, in the outdated equipment and curriculum of FET institutions, which results in inferior-quality education (Fisher *et al.,* 2003, cited in Maree *et al.,* 2009: 107); and third, in an enterprise training orientation that is unable to align enterprise training with the demands of a new millennium" (Maree *et al.,* 2009: 107).

[35] The quality of school education in SA is very poor as can be seen when our country took part in two international comparative studies between 1998 and 2002. The Grade 8 maths and science study i.e. Third International Maths and Science Study Repeat (TIMSS-R), was conducted in 38 countries worldwide, while the Monitoring Learner Assessment (MLA) was a Grade 4 study of literacy, numeracy and life skills in 12 African countries. SA learners performed well below the levels of their counterparts in both studies (Taylor, Muller & Vinjevold, 2003: 41-42).

Most learnerships designed by SETAs are registered but not active and there are more learnerships at the lower levels of the NQF than at the higher levels (DoL, 2005a: 21; 26). Using data from the learnerships established under MERSETA, it was found that a large number of more than 11 000 learnerships initiated since 2001 were at NQF level 1. Furthermore, the majority of revenue for training had been spent on the development of 'soft skills[36]', with a minimal amount being directed at higher level artisan training. It is a concern that the type of training and skills provided is at levels which are too low to meet with industry demands. In addition, developing, registering and implementing a learnership is extremely time consuming and resource intensive, such a long process does not necessarily make learnerships responsive to the scarce skills needs (Grawitzky, 2006: 20; 30).

Other areas of concern pertain to poor linkages between firms, colleges and SETAs (Kraak, 2008: 500). SETAs are meant to play a large role in creating links between industry and the FET colleges so as to facilitate quality provision needed by the industry concerned. Grawitzky (2006: 6) has in a number of ways shown how SETAs have failed to find the balance between the upskilling and training that has occurred and actual skills needs. Some of the factors listed by Grawitzky (2006: 6) include: the SETAs' failure to align the SSPs to their sector needs; the inability of boards to agree on priority skills development areas and the drive by SETAs to meet numerical NSDS targets[37] instead of focusing on quality and impact[38].

In addition to the weaknesses of the state-driven industrial training system, the general reaction of the metal and engineering industry to skills development and contribution towards increasing and improving the supply of skills has not been adequate. A major reason is the fact that the majority of the industry is made up of Small, Medium and Micro Enterprises (SMMEs), therefore there is not enough capital for training (production focused) (MERSETA, 2005: 41). According to Kraak (2008: 481), when employers do train, they tend to train in narrow firm-specific skills and those employers who do not train, poach.

Industrial training is only one of the ways in which the state and private sector seek to supply skills required by the economy. Further education and training and higher education are two more ways. The next two sections discuss these two ways of providing skills.

[36] Soft skills have become a priority in the metal and engineering industry (MERSETA, 2005: 21).

[37] For an assessment on the performance of the NSDS 2001 to 2005 against selected indicators, see McGrath & Paterson (2008).

[38] For a more extensive discussion on the role of the SETAs in contributing towards skills development, see Grawitzky (2006).

2.2.2.3 Public Further Education and Training (FET) colleges

The release of the policy document, *A New Institutional Landscape for the Public Further Education and Training Colleges,* in August 2001 was the most important point in the transformation of the FET sector in post-apartheid SA (Akoojee, McGrath & Visser, 2008: 256). The public college sector comprises of multi-campus institutions, acknowledged as FET institutions in terms of the FET Act of 1998. These institutions were merged into 50 colleges nationally in 2002[39] (Fisher, Jaff, Powell & Hall, 2003: 332).

As already stated, SA is experiencing a critical shortage of technically skilled labour at the intermediate level (Kraak, 2008: 479). It is important to emphasize that in contemporary times the restructured FET sector is expected to play a significant role in meeting the intermediate to high-level skills needs of the country, and this is one of the major reasons why the sector has become important again (Fisher *et al.*, 2003: 327-328). This is reinforced by the Minister of Education, Naledi Pandor, who affirms that FET colleges are central to the delivery of priority skills needed in SA (Attwell, 2007: 1). Does the FET sector deliver this expectation in reality? This question is answered below.

2.2.2.3.1 Enrolments, pass rates and dropout rates at FET colleges

Before embarking on the analysis of college enrolments, pass and dropout rates, it is important to understand that engineering courses offered at FET colleges range from N1 to N6 of the National Technical Certificate (NTC), with N3 being equivalent to Grade 12, and N4 to N6 representing post-Grade 12 education (Lundall *et al*., 2008: 38).

Over the period 1996-2005 there were increases in enrolments and pass rates (learners who wrote the examination), for engineering based courses, across specific levels in the range N1-N6. Table 7 shows that the pass rate increases were from 40% to 49% for N1; from 55% to 76% for N3 and from 57% to 60% for N4 all over the period 1996-2005 (Lundall *et al*., 2008: 39).

The pass rate decreased at N2, N5 and N6 with N2 experiencing the lowest pass rate decrease and N5 and N6 experiencing higher pass rate decreases. The pass rate decreases were from 56% to 54% for N2; 51% to 44% for N5; from 49% to 43% for N6 over the same period, as shown in Table 7. The dropout rate (learners who failed to qualify for the writing of the examination) decreased for all six levels from 1996-2005 (Lundall *et al*., 2008: 39).

[39] These technical colleges were merged with colleges of education and training centres (Fisher *et al.*, 2003: 332).

Table 7: National success outputs in FET N level theoretical engineering courses, 1996-2005

Theoretical courses		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	% Growth: '96-'05
Level 1	P/W%	40.54	45.49	42.45	39.88	44.36	51.87	52.93	48.99	50.95	49.99	23.3
Level 2	P/W%	56.9	55.89	55.07	54.68	54.67	58.68	56.64	59.22	54.47	54.61	-4.0
Level 3	P/W%	55.37	61.86	68.43	69.53	61.6	56.57	56.35	71.1	77	76.95	39.0
Level 4	P/W%	57.49	44.61	49.71	56.12	60.11	58.2	60.63	63.84	56.64	60.04	4.4
Level 5	P/W%	51.54	47.73	43.72	52.27	50.71	53.3	44.94	45.6	43.7	44.08	-14.5
Level 6	P/W%	49.37	47.84	51.74	57.83	63.65	53.54	54.94	53.2	45.46	43.46	-12.0

Source: Lundall et al. 2008: 39, calculated from HSRC data obtained from EMIS

Key: W=Wrote; P=Passed.

The positive performance in engineering based courses in FET colleges over the period of investigation is a clear indication that FET colleges are able to increase their efficiency which is crucial to supplying the much needed intermediate skills.

When analyzing enrolments at a deeper level, it is clear that enrolment numbers from N1 to N2 and from N3 to N4 are consistent. However, it is worrying that learners do not progress from N2 to N3 as only 18.7% do. This raises concerns regarding learner retention and the fact that the lower level of the metal and engineering labour force mostly consists of individuals with only an N2 certificate. A similar trend was observed for N5 to N6 enrolments which decreased by more than half between 1996 and 2005 (Lundall *et al*., 2008: 40).

The trends discussed above highlight the inconsistency of enrolments from one level to another which suggests that groups of learners that enter the system at the same time and level, disintegrate over time and are not subjected to a common technical education endowment. This is due to different groups of learners making use of the FET college system due to differing circumstances and goals, these groups include: learners who either do not hold a matriculation certificate or just scraped through; learners who only have the FET system as an entrance point to study further, a minority of these learners enroll at the N1 and N2 levels and do not participate beyond this point once the theoretical requirements to be admitted to artisan status have been fulfilled and lastly, learners who enter the FET system as dropouts from the HE system (Lundall *et al*., 2008: 42). This diversity of learners entering the system at differing levels poses challenges for the education and training of intermediate level individuals. Until the FET system accomplishes consistency in enrolments from one level to the next it will be perceived as a "stopgap measure that will have low credibility" (Maree *et al.,* 2009: 99).

There is still a "skewed distribution of learners in SA across publicly funded universities, technikons and technical colleges" (Akoojee, 2003: 399), in that the latter has the lowest enrolment rate[40]. This goes against international trends where technikon i.e. university of technology and college enrolments are higher than that of university enrolments (Akoojee, 2003: 399). Lastly, a significant positive change within the public sphere from 1990-2000 was greater equity of race and gender college enrolments[41] (Fisher *et al.*, 2003: 331; 334).

2.2.2.3.2 Curriculum changes at FET colleges

Previously, technical colleges only offered a set of programmes known as the National Technical Education (NATED) programmes which spanned from N1 to N6. In recent years, these programmes have been predominantly criticized for the following:

- The programmes were generally outdated, some of which had not been revised since the 1980s thus lagging behind changes in industry and the labour market (Pretorius, 2007: 1).
- The programmes were more theoretically orientated and the alignment between theory and practice was a shortcoming (Lundall *et al*., 2008: 87).
- The programmes insufficiently articulated with HE technical programmes because of the standard at which they existed (Lolwana, 2007: 2).

With regard to the last bullet point above, in 2001 the national government instructed that the sector should focus only on the provision of N1 to N3, rather than on the post-N3 levels. This posed problems for universities of technology that had the ability to build stronger articulation pathways between the FET colleges and HE. The weakening in articulation has limited the ability of both colleges and universities of technology to co-operatively produce larger numbers of highly skilled technicians at the top end of the intermediate-skill band (Kraak, 2008: 492).

These criticisms have fuelled a radical shift away from the NATED programmes to those more responsive to the needs of industry. The Department of Education (DoE) decided as from January 2007 that the trimester NATED courses (N1 to N3) previously offered by FET colleges would be phased out and would be replaced with new one-year National Certificate (Vocational) (NC(V)) courses offered at NQF levels 2, 3 and 4 over three years (Johnston, 2007: 47). The new vocational study opportunity which incorporates both theory and

[40] Enrolment rate in 1999: Universities (245 000); Technikons (141 000) and Colleges (138 712) (Akoojee, 2003: 399).

[41] With regard to race, college enrolments changed from 68% White and 18% Black to 12% White and 75% Black over the period (Fisher *et al.*, 2003: 331).

practice is intended "to directly respond to the priority skills demand of the modern economy" (Public FET, 2007: 1).

However, as in the case of the NATED programmes, there are critical concerns about the new FET curriculum that is being implemented by the DoE. As stated by van Rooyen (2006: 1), "the demise of the very neglected and outdated N courses is perhaps a good thing, however, our apprentices will need some kind of theory training and the new vocational curriculum seems to leave a vacuum regarding this need". This vacuum is further highlighted by Lundall *et al.* (2008: 86) in that the new curriculum does not adequately cater for the technical trades that the old NATED curriculum embodies. An additional concern is that the new system is costly for employers in that apprentices in employment now have to be away from work at FET institutions for a longer period (one year), which negatively impacts production (Lundall *et al.* 2008: 87). A Steel and Engineering Industries Federation of South Africa (SEIFSA) internal document (March 2007) raises another concern: "It seems problematic that at a time when shortages of skilled artisans present a key constraint to growth, the DoE is introducing new and unpiloted one year vocational programmes at colleges without proper transitional arrangements for companies indenturing apprentices …" (Johnston, 2007: 47).

2.2.2.3.3 Linkages and the supply of college graduates to the labour market

Internationally it is widely accepted that public vocational education and training system linkages to business are key to supplying the necessary skills for labour markets. In SA these linkages have been extended to include other stakeholders such as SETAs (Akoojee *et al.*, 2008: 271). However, the most severe constraint on further college development in SA has been the poor placement rates of its graduates in meaningful employment. Job placement rates for FET college graduates are about 34% of annual college-leaving cohorts (Cosser *et al.,* 2003, cited in Kraak, 2008: 486). Access to employment after training has weakened because of a lack of linkages between firms, colleges and SETAs (Kraak, 2008: 500). According to Kraak (2008: 495), additional reasons for the break up between college output and employment prospects include the following: stagnant mining and manufacturing economies; employer claims of poor quality and outdated training from FET colleges; continued racialization of labour markets and lastly, employers choosing to employ less skilled workers for lower remuneration in an effort to cut costs.

According to Joy Papier (College Council Chairperson)[42], in light of the above findings, "There is a renewed energy in FET colleges". National treasury is "recapitalizing colleges to the tune of 1.5billion and a flurry of planning is under way" (Papier, 2006: 5). This new investment has prioritized staff and curriculum development as well as infrastructural renewal. The idea is that with an improved image in the labour

[42] Papier held a workshop at the University of Cape Town (UCT) attended on the 25th of September 2007.

market, the employment prospects of college graduates will improve (Kraak, 2008: 500). How this investment will impact on FET colleges' performance in developing skills matching the needs of the labour market, still has to be seen (DoE, 2005: 4).

2.2.2.4 Higher education (HE) institutions

In order to study engineering at university, an A, B or C symbol in higher grade mathematics is required, and to do the same at a university of technology a minimum of a C symbol in standard grade mathematics is required. These criteria present a challenge, as the engineering field has to compete with other professions to attract potential learners from the limited mathematics and science pool at Grade 12 level (Du Toit & Roodt, 2008: 461).

Problems hampering the supply of suitable entrants to tertiary institutions include the poor quality of mathematics and science education at school level, and the general low quality of the school system. Solutions to these problems should be amongst SAs highest national priorities as an increased supply of suitably skilled entrants to tertiary institutions is central to improving the supply of future engineering capacity (Du Toit & Roodt, 2008: 472).

Most graduates are sourced from institutions with established engineering faculties such as the Universities of the Witwatersrand, Pretoria, Cape Town, Stellenbosch, as well as Mintek (DTI, 2005: 53). A number of large organizations in the metal and engineering industry are very active in sponsoring engineering studies at HET level (MERSETA, 2005: 41).

2.2.2.4.1 Enrolments and graduations in engineering at universities and universities of technology

This section investigates enrolment and graduation trends in engineering at universities and universities of technology, in order to determine the adequacy of skills being supplied by HE institutions (Du Toit & Roodt, 2008: 461). The National Diploma (NDip), Bachelor of Technology (BTech) Degree and the Bachelor of Engineering (BEng) Degree are HE qualifications that account for more than 80% of technicians and engineers in the metal (Maree *et al.,* 2009: 99). The trends in enrolments and graduations for these HE qualifications are shown below in Figure 4.

(a) Enrolment and graduation trends at universities

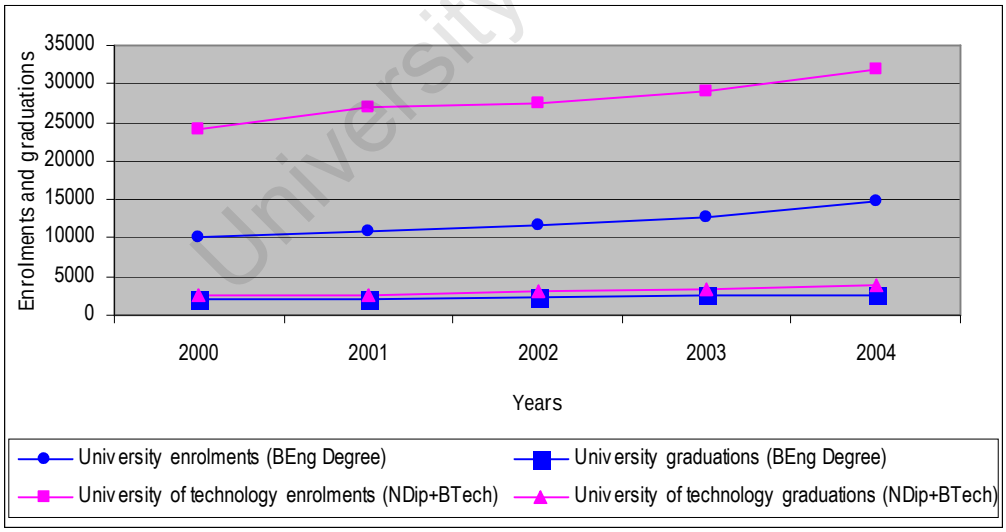
Although the rate of employment for engineers (excluding technologists and technicians) decreased at a rate of 2.7% per annum between 2000 and 2004, efforts to attract more students into the engineering discipline have achieved some success, as both enrolments and graduations at universities are on the increase.

Enrolments for BEng Degrees increased at a rate of 9.4% per annum over the period 2000-2004. Regarding graduations, the growth rate for 2000-2004 was a positive but low 4% per annum. What is worrying though is that a decrease in graduations was experienced over the longer period 1991-2000 (Du Toit & Roodt, 2008: 461-462). The BEng Degree only accounted for a mere 20% of all HE engineering enrolments in 2005 (Maree *et al.,* 2009: 99).

(b) Enrolment and graduation trends at universities of technology

In the short term enrolments at universities of technology (for both NDip and BTech) have increased by 7.4% per annum over the period 2000-2004. Furthermore, a positive growth of 20% per annum was also experienced over the longer period 1995-2004. These findings raise concern, in that the rate of growth in enrolments is poorer over the short-term period which also happens to be the most recent period. Graduations at universities of technology grew at 18.1% per annum from 2000-2004. "This is very encouraging, in light of the need to address the problem of underemployment of engineers who are currently doing work that can be done by technologists and technicians" (Du Toit & Roodt, 2008: 466). It is important to note that the NDip qualification accounted for no less than 62% of all HE engineering enrolments in 2005, making it the most common type of HE qualification in engineering obtained in SA, while the BTech accounted for 11% during the same year (Maree *et al.,* 2009: 99).

Figure 4: Higher education enrolments and graduations, 2000-2004



Source: DoE 2000-2004, cited in Du Toit & Roodt 2008: 462; 467

Overall, MERSETA (2005: 53) confirms the above findings, by stating that the pattern of enrolments and graduations shows a steady increase at both universities and universities of technology over the period

2001-2003. According to Maree *et al.* (2009: 102), the most concerning finding is the fact that the graduation to enrolment ratio has declined for all three qualifications over the period 1996-2005, which has surely exacerbated the skills shortage as the output rate for engineers, technologists and technicians decreased over this long period. A central factor contributing to the poor graduation to enrolment ratio is tertiary institutions struggling to retain quality teaching and research staff due to competition from the private sector for these skills resources (Du Toit & Roodt, 2008: 463).

The education system is slowly producing more graduates but these graduates lack crucial work experience and mentoring which highlights experiential training as a serious problem. In order to overcome this challenge many graduates leave after graduation to gain experience abroad. Attracting experienced engineers back to SA and retaining qualified engineers in the country is an additional challenge due to a world-wide shortage of engineers. It is important though to note that many large firms in the country still provide graduates with the opportunity to get the required experiential training (Du Toit & Roodt, 2008: 462; 473).

2.2.2.4.2 Employment equity trends regarding HE qualifications

With regard to employment equity, qualified and experienced Black candidates and women (technical, engineering and management) are very scarce as available skills are hard to attract and retain (MERSETA, 2005: 43). Over the period 1996-2005, only a 10-15% increase in HE female graduates was achieved (Maree *et al.,* 2009: 102).

According to Maree *et al.* (2009: 102), the most remarkable finding concerning HE qualifications within the engineering sector is the rapid growth in the number of African graduates. In 2005, Africans constituted the majority of recipients of the NDip (70%); BTech Degrees (53%) and Post Certificates or Diplomas (56%). However, Africans are less dominant in graduating with BEng Degrees having improved from constituting 9% of graduates in 1996 to 25% in 2005 (Maree *et al.,* 2009: 102-103). Although the majority of postgraduates are still White, growth in the number of previously disadvantages groups can contribute to accelerating the BBBEE to support shared growth (Du Toit & Roodt, 2008: 473).

2.2.2.4.3 Postgraduates and specialization in HE

For the period 2000-2004, postgraduates experienced more growth than undergraduates at universities. Postgraduates are crucial for building up the necessary higher-level knowledge base that is required for innovation that "opens up opportunities for leveraging higher levels of economic growth" (Du Toit & Roodt, 2008: 471). Although there was an increase in graduations at the more specialized postgraduate level, there

is a shortage in specialization in specific disciplines that are essential for innovation and stimulation of economic growth (Du Toit & Roodt, 2008: 463). The three most critical disciplines in terms of specialization are electrical, chemical and mechanical engineering (MERSETA, 2005: 53-54).

2.3 CONCLUSION

2.3.1 Profile of the industry and the metals beneficiation value chain

SAs metal and engineering industry which contributes approximately 5.3% towards GDP is dominated by SMMEs and forms part of the manufacturing sector. The industry was initially established through mining and continued through the automobile industry, state-owned enterprises i.e. Eskom and Iscor and lastly, military spending in the 1940s. Currently, the industry is sustained by strong exporting in the automobile industry and state infrastructure expansion. Most of the industry is located in Gauteng which also happens to be the area where the most value-added production occurs.

The stages of metals beneficiation considered in this study include raw material processing firms; intermediate product producing firms and finished product producing firms. In order to gain more insight into these stages, their characteristics are briefly considered. Despite differing in size (number of employees) and having differing areas of focus, all three stages have overlapping skills requirements.

Employment opportunities vary amongst the stages, being low in the raw material processing firms and high in intermediate and final product producing firms. The raw material processing and intermediate product producing firms are capital intensive while the downstream producers employ most of the unskilled and semi-skilled labour. The biggest concerns with the industry are the low levels of beneficiation which result in limited job creation as well as the need for the development of the downstream producers.

2.3.2 Preferred skills development initiatives

Shifting focus towards skills development initiatives employed in the stages listed above, raw material processing firms prioritize acquisition of good quality mathematics and science candidates which is why they invest heavily in social responsibility interventions. Furthermore, the following skills development initiatives are preferred by firms belonging to this stage:

- Artisan training programmes.
- Practical experiential training for technicians and engineers.
- Operator training/skills programmes.

It is important to note that this stage which suffers from poaching was the major trainer in the past and continues to be in the present time, despite decreased training volumes.

Intermediate product producing firms have their work and skills aligned to constantly changing jobs. Firms in this stage prefer the following skills development initiatives: in-house training programmes in the form of apprenticeships and learnerships. Lastly, there is a sentiment from these firms that FET colleges are not responsive to technological developments within the industry. Finished product producers have identified that new employees lack the basic background (skills and training) required, to work in this stage. Firms in this stage took skills development seriously and align skills development and training to areas of strength.

2.3.3 The new skills dispensation

It is important to note that skills development in SA is co-ordinated under a fairly new dispensation. The new skills dispensation differs drastically from the old with the introduction and implementation of new legislation, institutions and processes. The NSDS has given rise to two acts, the SDA and SDLA. The SDA then in turn gave rise to SETAs and learnerships while the SDLA gave rise to the levy-grant system. Weaknesses of this new dispensation include:

- The use of the levy-grant system.
- Limitations of the SETAs to spend funds on skills development in their own capacity.
- Poor administration in SETAs.
- Poor linkages between business, SETAs and education and training establishments.

2.3.4 Demand and supply of skills

The literature initially paints a picture of severe skills shortages in the industry in section 2.2 (demand and supply of skills in the metal and engineering industry). As support for this statement, critical skills shortages are referred to and massive decreases in registered apprentices from 1982-2003 are also highlighted. Under section 2.2.1 (the demand for skills), a vast and comprehensive table of the types of skills required in the metal and engineering industry was presented. This dire outlook persists with trends indicating increasing demand for technical skills, decreasing engineer registration and employment figures.

Section 2.2.2 (the supply of skills) begins optimistically with the graduation figures for artisans peaking in 1985 but when looking at these graduation figures over a longer period (1970-present) it is apparent that massive decreases have been experienced, with the most dramatic decreases taking place during the period 1985-2003.

With regard to FET colleges, increases were experienced in technical qualification enrolments and graduations for the period 1996-2005. What is worrying though, is the fact that FETs had the least enrolments of all three HE institutions, which goes against international trends. Additional concern is raised by the fact that job placements for FET graduates are meagre, indicating that the skills produced are struggling to reach the labour market.

Universities and universities of technology both achieved marginal increases in graduations in recent times but graduation/enrolment ratios for both continue to decrease. On an encouraging note, specialization at both these types of institutions is on the increase as postgraduate growth rates surpassed undergraduate growth rates. Lastly, supply is being further eroded by outflows of skills to international markets.

The demand discussion is dominated by increases in demand in terms of quantity and specialization while the supply over a long period (1970-present) is very poor. It is important to note that in the short-term HE has experienced marginal growth in numbers and specialization but still has concerning issues to resolve which are compounded by the outflow of skills from the country. Overall, the large demand out-ways the marginal supply, therefore according to reviewed literature the metal and engineering industry is definitely experiencing skills shortages.

Having discussed the contextual basis of the research, a discussion of the research problem, rationale and conceptual framework follows. Thereafter, the research design and methodology used in this study are discussed.

CHAPTER 3
RESEARCH PROBLEM, RATIONALE, CONCEPTUAL FRAMEWORK

This chapter commences with the research problem that is presented along with its inter-related research questions, followed by a rationale for the study undertaken. The chapter concludes with the conceptual framework which discusses the related concepts 'skill' and 'skills development' in order to clarify how both are understood and employed in this study.

3.1 RESEARCH PROBLEM

This section introduces the research problem statement along with its inter-related research questions.

Problem statement: An evaluation of skills development in a sample of metal and engineering firms in Gauteng.

The research problem can be broken down into five inter-related research questions, namely:

1. Is there a shortage of skills in the sampled metal and engineering firms?
2. What are the skills shortages in the sampled metal and engineering firms?
3. Why are these required skills in the sampled metal and engineering firms not being supplied?
4. What skills development strategies are the sampled metal and engineering firms currently employing in order to address skills shortages?
5. How do existing skills shortages impact on the economic growth of the sampled metal and engineering firms?

3.2 RATIONALE

This section begins with a setting of the context in which this study was based, followed by reasons and justification as to why such a study was undertaken. The topic of skills development is then discussed in order to highlight its significance in SA. Finally, this section concludes by stating the academic and practical contributions this study will make.

3.2.1 Context of the study

The study was set within the SA manufacturing sector, more specifically the metal and engineering industry in Gauteng. The diverse manufacturing sector in SA is the second largest sector in the economy and forms a key driver in achieving national macroeconomic objectives, such as improved export trade performance. The metal and engineering industry which this study focuses on contributes approximately 5.3% to the country's GDP and has been called upon along with the construction sector to play a crucial role in the preparation of infrastructure for the 2010 Soccer World Cup. Gauteng Province was strategically selected as the area of

study as the province accounts for over half (53%) of the geographic distribution of the country's metal and engineering industry (MERSETA, 2005: 4; 19-20).

3.2.2 Rationale for the study undertaken

In terms of a broader need for a study of this type, it is important to briefly consider skills development in the context of SA. Since the launch of the second NSDS (2005-2010) by Minister of Labour, Membathisi Mdladlana on 4 March 2005 at the National Skills Conference, skills development has received increased attention and focus (DoL, 2005b: 1). The much publicized 'skills shortage' debate (see Chapter 2), reveals that in the metal and engineering industry, highly-skilled engineers and skilled or semi-skilled technicians and artisans are required (MERSETA, 2005: 41-42).

Research has also shown that despite radical changes to the primary and secondary education systems, and the introduction of a new skills development dispensation (both of which should be providing the foundation for addressing the skills backlog), it is still unclear whether these measures introduced are actually decreasing skills shortages (Maree *et al.,* 2009: 86). Furthermore, the DTI (2005: 53-54) maintains that although many firms have embarked on internal artisan training programmes, such initiatives are insufficient to meet the future skills needs of the industry.

Most experts agree that SA is a country that is facing a critical shortage of skills and at the same time is also a country that is putting huge amounts of resources and strategies into alleviating this shortage. Therefore, it is important to undertake studies of this type as they evaluate skills development holistically in order to determine whether the interventions being made in the sampled firms are having the desired or suitable impacts i.e. addressing the ongoing skills shortage.

In further justifying the need for such a study, it is important to note that Asgisa holds skills shortages accountable for hampered economic growth (Maree *et al.,* 2009: 86). This clearly indicates a need for constant and reliable research into skills development in order to aid efforts in combating skills shortages which would eventually stimulate economic growth and global competitiveness.

3.2.3 Significance of the research topic

It is also important to look at the severity of the skills shortages in SA and how they progressed in time in order to clarify the context in which the study is set. Statistics show that in 1982, 13 000 artisan apprentices were registered, but this figure had significantly declined in 2003, to only 2 000, a completely inadequate number (DTI, 2005: 53). A further indication of the severity of the skills shortage is an increase in large SA

conglomerates importing foreign skilled labour e.g. petrochemicals giant Sasol has had to import foreign skilled labour on various large-scale projects (Macrae, cited in Spadavecchia, 2006: 2).

Highlighted by former State President, Thabo Mbeki as a key development area, addressing the skills shortage will have a direct affect on the growth and future competitiveness of the entire country. Without the necessary technical skills SA will be unable to maintain or extend the infrastructure and economic strength required for it to compete meaningfully on a global stage (ArcelorMittal, 2007: 44).

In order for SA to become a successful developing economy, it is crucial that the country's human resources be developed in a manner which will yield the necessary magnitude and diversity of skills. This is reinforced further, according to Castells (2001: 2) who believes that labour is the source of productivity and competitiveness in the 'new economy'. Therefore, developing labourers' skills, through education and training is crucial.

3.2.4 Contribution of the study undertaken

In terms of contributing to knowledge, this study will increase the amount and type of academic information available on the research topic and will improve academic understanding of skills development based on a sample of metal and engineering firms in Gauteng Province. Furthermore, the completed research will be submitted to Firm A as agreed and also circulated to all other participating firms in order to draw out any key learnings which may improve skills development.

3.3 CONCEPTUAL FRAMEWORK

Before commencing with an evaluation of skills development in a sample of metal and engineering firms in Gauteng, it is essential to define the concept 'skill'. Theoretical material for this framework was drawn primarily from the research work of Maree (2006: 4-6) and Littler (1982: 7-11). There are four main ways in which the concept 'skill' has been approached, and these different approaches will be discussed briefly below. The approach adopted in this study will then be indicated.

3.3.1 Conceptualizing skill

3.3.1.1 Skill as competency

This is a contemporary conception of skill that has been embraced by the post-apartheid SA government's Departments' of Education and Labour. The DoL defines skills "as the necessary competencies that can be expertly applied in a particular context for a defined purpose" (DoL, 2002, cited in Maree, 2006: 5).

Three competencies are outlined below that indicate different types and levels of skill (DoL, 2002, cited in Maree, 2006: 5):

- Practical competency: The ability to perform tasks.
- Foundational competency: The ability to understand what one is doing and why.
- Reflexive competency: The ability to connect our performance to others, so as to learn and adapt.

Despite of the distinction made between the first two types of competencies, the approach assumes that "the ability to perform a task embodies the theoretical knowledge required to do the task" (Maree, 2006: 6).

Having discussed the skill as competency approach that presently holds currency in SA, Littler's (1982: 7-11) three 'widespread' conceptions of skill are considered next.

3.3.1.2 Skill as job knowledge and learning time

The first conception of skill provided by Littler (1982: 7) can be defined in terms of "job-learning time or the type of knowledge-base of the occupation". According to Maree (2006: 4), job-learning time relates to the job-specific training a worker receives, whereas the knowledge-base of the occupation relates to the educational level of the worker. Littler (1982: 7) considers this conception of skill as objective because skill is regarded "as an objective characteristic of work routines and job knowledge" (Littler, 1982: 7).

3.3.1.3 Skill as discretionary content or job autonomy

Skill as discretionary content or job autonomy is the second widespread conception of skill, and is based on management trusting workers to make the right decisions and the ability of the workers to control the productive processes without any management interference (Littler, 1982: 8). However, this is not an objective measure of skill because "workers with job autonomy may not be skilled and, conversely, skilled labour may not have job autonomy" (Maree, 2006: 5).

3.3.1.4 Skill as social status

The third widespread conception of skill, namely skill as social status, is the theoretical possibility "for skill to be socially constructed through the artificial delimitation of certain work as skilled" (Littler, 1982: 9). It can be seen that this approach to skill is not objective, in that it depends on "custom and tradition plus collective organisation" (Littler, 1982: 9). This approach was largely adopted by White artisans and craft unions previously in SA, as they continued to demarcate non-skilled job tasks as skilled work so as to protect their

member's privileged status (Webster, 1985: 33). This socially constructed conceptualization of skill is a "serious aberration of what the concept skill normally means", according to Maree (2006: 5).

3.3.2 Conceptualization of skill employed in this study

The above discussion has signified that there are various understandings and uses of the concept 'skill' in academically accepted literature.

The approach adopted in this study is a combination of the contemporary conception of skill, namely 'skill as competency' as well as Littler's (1982: 7) first conception of skill, namely 'skill as job knowledge and learning time'. These objective approaches were used as they incorporate knowledge, workplace training and learning as essential components of skill. Furthermore, these approaches are particularly useful in that the level of skill is determined according to two fundamental factors, namely: education and training.

'Skills development' is therefore understood as the education (theoretically oriented) and training (practically oriented) that the employer provides to his employees. Education and training in this regard can be provided internally by the metal and engineering firms or institutions and/or training providers. When provided complimentarily and then applied, the two should equip an individual with the ability to execute specific tasks, indicating competence.

CHAPTER 4
RESEARCH DESIGN AND METHODOLOGY

This chapter includes a detailed description of the research design and methodology used. A rationale for the chosen design and methods is included throughout this chapter, as well as the associated challenges and limitations. Finally, the chapter ends off by considering the validity and reliability of the research design and methodology employed.

4.1 RESEARCH DESIGN

Seeing as the aim of this research was to evaluate skills development in metal and engineering firms in Gauteng, survey research was used coupled with a research design which made use of qualitative evaluation approaches. These qualitative research methods are used to describe and evaluate the performance of programmes, in this case skills development programmes and initiatives in the sampled firms (Mouton, 2001: 161). However, this study is not exclusively qualitative.

This exploratory research study used both qualitative and quantitative research methods to evaluate skills development in a sample of metal and engineering firms in Gauteng. This measurement of the success achieved by skills development interventions in metal and engineering firms defines this as an empirical study (Mouton, 2001: 51-52).

Empirical studies tend to rely on secondary data such as literary texts as it is important to review existing material when approaching a research question (Mouton, 2001: 57). Secondary data was included in this study in the form of a literature review. The literature review was used to guide the research process and to provide a basis of comparison and enrichment for the research findings. Secondary data is more often than not used as a platform to begin research and has the added advantage of low costs and superior availability (Kotler & Keller, 2006: 104). Secondary data is readily accessible in the form of electronic media, legislation, books, journals etc. and enables access to a wide array of views and opinions on various phenomena.

Primary data was also gathered in the form of semi-structured in-depth interviews, conducted with various stakeholders in the Gauteng metal and engineering industry. These stakeholders included ten metal and engineering firms; one large parastatal involved in projects linked to the metal and engineering industry; two industry bodies, namely MERSETA and SEIFSA; three training providers and one labour supply company, adding to a total of seventeen stakeholders interviewed. Table 8 provides a breakdown of the sample.

Table 8: Breakdown of surveyed stakeholders by number of industry organizations

	Metal and engineering firms	Large parastatals	Industry bodies	Training providers	Labour supply companies	TOTAL
No. of industry organizations	10	1	2	3	1	17

Information to address the research problem was obtained through the utilization of evaluative, causal and descriptive questions. The results of the research study provide evaluative, causal and descriptive evidence to address the research questions. Supplementary reasoning for the selection of qualitative approaches is the fact that this style of research attempts to address research problems by obtaining a more subjective insider-perspective (Mouton, 2001: 194).

The collaborative and participatory nature of qualitative evaluation approaches eliminated respondent research suspicion and distrust while improving trust and credibility. This was evident in the nature of the highly confidential information supplied, as well as the researcher's subjective analysis of the respondent's body language, which became more trusting and accommodating as the interviews progressed. Establishing rapport and trust with the candidates is an added strength of evaluative qualitative research (Mouton, 2001: 162).

Primary data was collected in the form of an interview schedule[43], as the majority of the information required to address the research questions was only available from operational firms and industry organizations. Primary data also provided a clearer and more accurate indication of what is currently happening in the sampled firms and industry organizations with respect to skills development, adding credibility in terms of how relevant and up-to-date the research is (Kotler & Keller, 2006: 104).

The researcher decided to personally go and conduct interviews at the firms using the interview schedule compiled. The advantage of this type of fieldwork was that the researcher was able to use probing techniques on respondents in order to make sure that the correct and adequate information was supplied. This also allowed the researcher to make sure that the interview schedules were completed in full and that all interviews were completed and in the possession of the researcher by the time the interview was deemed complete. The only disadvantage concerning this type of data collection was that it was resource intensive in terms of the amount of time the researcher spent conducting field research and it was also costly for the researcher to travel to all the respondents at their respective firms.

[43] Refer to Appendix 2 to view the interview schedule.

An alternative data collection strategy could have been telephone surveys which may have been perceived by the respondents as unreasonable, due to the excessive time duration of the interview (Kotler & Keller, 2006: 111). The interview schedules could have also been mailed or e-mailed to respondents but then there would have been no guarantee that the quality of information received would be of the quality required or that all interview schedules would be completed and returned on time (Kotler & Keller, 2006: 111).

4.2 RESEARCH METHODOLOGY

4.2.1 Sampling unit, size, area and procedure

4.2.1.1 Sampling unit

The sampling unit particular to this study was metal and engineering firms. The sample included a spread of small, medium and large firms that operate in differing stages of the value-adding or metals beneficiation process i.e. raw material processing firms (milling firms), intermediate product producing firms (engineering and machine shops), and finished product producing firms (machine builders). This conceptual breakdown is discussed in Chapter 2. The ten firms at which interviews were conducted are shown in Table 9.

Table 9: Sub-sectoral distribution of firms by number of employees

	Raw material processing firms	Intermediate product producing firms	Finished product producing firms	TOTAL
1-5 Employees				0
6-20 Employees				0
21-50 Employees		Firm D, E	Firm G	3
51-200 Employees		Firm F		1
200 Employees+	Firm A, B, C		Firm H, I, J	6
TOTAL	3	3	4	10

Note: For confidentiality purposes the names of the firms are not disclosed.

Additional sampling units included: one large parastatal involved in projects linked to the metal and engineering industry; MERSETA; SEIFSA; two training centres; one training and development institution and one labour supply company, adding to a total of seventeen stakeholders interviewed. Importantly, MERSETA and SEIFSA were included as both these organizations play a crucial role in the metal and engineering industry in both a regional and national context. MERSETA aims to promote and facilitate skills development across the SA economy, while SEIFSA is an employer federation that represents and promotes the interests of their members in the metal and engineering industry.

4.2.1.2 Sample size and area

A non-representative sample size of ten metal and engineering firms was decided upon as sampling the entire population would have been virtually impossible due to time and financial constraints, so a smaller sample was chosen as these smaller samples have the ability to provide credible results (Kotler & Keller, 2006: 110). Gauteng Province was selected as the study area due to the province accounting for over half (53%) of the geographic distribution of the country's metal and engineering industry (MERSETA, 2005: 10-20).

4.2.1.3 Sampling procedure

Non-probability sampling (population selected in a non-random manner) was preferred over probability sampling due to the latter being resource intensive in terms of time and cost. Furthermore, the researcher had already been assured participation and access to various firms which probability sampling would have excluded (Kotler & Keller, 2006: 110).

The firms in the sample were primarily selected from individual contacts in the industry (convenience sampling (including the most convenient firms in the sample)) and then extended through the use of snowball sampling (additional respondents selected based on referrals from initial respondents) as the researcher selected the most convenient and accessible metal and engineering firms in Gauteng. The disadvantage of not using probability sampling is the fact that the findings cannot be extrapolated to the entire population and are therefore only representative for the sampled firms.

The decision to use this sampling method was influenced by practical considerations such as the availability of time as the researcher and host university were not based in Gauteng as well as the high financial costs associated with sampling from a complete population (Mouton, 2001: 100). An additional disadvantage associated with the sampling method adopted was its inability to allow sampling error to be measured (Kotler & Keller, 2006: 110).

4.2.2 Data collection methods and fieldwork practice

This study made use of observation and personal face-to-face interviewing, primarily supported by telephonic and e-mail communication for follow-ups or for the clarification of information received. Additional sources of information included video material, websites and varying types of booklets supplied by participating respondents.

The principal data collection method used in this study was semi-structured in-depth interviews with various key stakeholders, using an interview schedule which sought to address the key inter-related research questions. An interview schedule was employed as it is the most widespread instrument used in the collection of primary data and was considered the most appropriate method of data collection for this research study. The interview schedule was designed with both closed and open questions in order to make sure that the necessary information was obtained from each respondent. The inclusion of both closed and open ended questions allowed for promptness and detail respectively, depending on the type of information required (Kotler & Keller, 2006:107).

The interview schedule used was piloted with Firm D in an effort to uncover any irregularities/problems before conducting interviews on other firms included in the sample. An additional reason for conducting the pilot was to test the questionnaire in terms of the respondents' overall understanding of the questions. During the design of the schedule the order or sequence of questions was reviewed repeatedly as the incorrect order/sequence may have negatively affected response accuracy and response rates (Mouton, 2001: 103).

Interviews ranged from 45 minutes to an hour and a half in length. The number of interviews per person depended on the quality of information obtained, for Firms A, D, G, I and J more than one interview was conducted. All the interviews were audio-taped with the respondents' permission and these recordings were then transcribed and the resulting texts analyzed. In addition to the use of tape recordings, extensive notes were taken during the interviews.

The relevant research candidates from the metal and engineering firms (those responsible for dealing with skills development i.e. the human resources development managers or directors etc.) were personally and telephonically consulted in order to gain access and to schedule appointments for the interviews. Acceptance of proposed interviews by the firms approached was good with a low refusal rate of 17% or 2/12 firms and the reason for refusal was increased workloads at month end.

An additional valuable source of information was found in interviewing key role-players such as the apprentices, learners and individuals being trained themselves as well as trainers/service providers. Observation was a further useful data collection technique that was used as a period of time was spent at various training locations in an effort to gain first hand experience in the field (e.g. observing the operations of the firm in terms of its core production processes and its principal products and learning more about the

different trades such as boilermaking and welding etc.). Throughout the entire fieldwork observation period, comprehensive field notes were taken.

Data was collected and reported in both textual and numeric formats, the inclusion of both formats is beneficial as it creates a balance between data which is more difficult to capture and less structured (textual), and data which is easier to capture but more structured (numeric) (Mouton, 2001: 108).

On an ethical note, participating firms were assured of absolute confidentiality as their names would not be disclosed, and they would not be identifiable during the discussion of the interviews. A confidentiality agreement[44] was entered into with all the participating firms and some of the industry organizations in order to provide consistency regarding the conditions under which the information was supplied. Firm A only granted access and co-operation on the condition that a confidentiality agreement of their choice be entered into and that they receive a rough draft of the report before final submission which they would then inspect for accuracy and no breaches of confidentiality.

Finally, a crucial part of the data collection included collecting presentations at the SEIFSA Skills Development Conference held on 9 May 2008 in Johannesburg. This conference was attended by stakeholders in government, business and civil society. In addition, obtaining a copy of a presentation at the Automotive Industry Development Centre (AIDC) on 9 June 2008 was also an essential method of collecting data.

4.2.3 Data analysis

The analysis process included personal reflection on initial ideas, reconciliation of emerging ideas, and the documentation of findings in an interview notebook. The analysis of the research findings strictly followed the structure of the interview schedule.

According to Miles & Huberman (1994) the first step of qualitative data analysis is to familiarize oneself with the data obtained. All seventeen interviews were transcribed, in order to gain familiarity with the collected data, and this formed the beginning of the analysis process which was a process of reading and re-reading the data. The data collected was made up of qualitative data that was represented in text and quantitative data represented in tables and graphs.

[44] Refer to Appendix 3 to view the confidentiality agreement.

The interview schedule was designed to manage and organize data into central themes, sub-themes and topics under the sub-themes. Accordingly, qualitative data was analyzed in Chapter 5 in a manner which identified emerging patterns from the central themes, sub-themes and lastly, the topics under the sub-themes. An example of a central theme would be "5.1 Information on interviewees and metal and engineering firms", that of a sub-theme would be "5.1.1 Profile of respondents" and lastly, "5.1.1.1 Respondents by occupational category" would be an indication of a topic under a sub-theme. The analysis progressed by formulating explanations for the patterns observed in the data, furthermore these explanations were then related to existing views to determine whether the new ones supported or differed from existing ones (Mouton, 2001: 108-109).

The quantitative analysis began with the selection of questions to be presented in tables and graphs, and then each response for the same question was recorded. Furthermore, additional tables and graphs that show relationships which emerged from the data were also employed as a quantitative analysis tool.

During the fieldwork component of this study, many of the firms provided additional information in the form of websites, pamphlets and videos. This information was then organized into the central themes, sub-themes and topics under the sub-themes of the study through a process called thematic content analysis.

In commencement of the final data analysis stage, both qualitative and quantitative themes which emerged from the primary data were cross-referenced to existing views in the reviewed literary texts. This was done to determine whether the new information uncovered, supported or contradicted academically accepted theories.

4.3 CHALLENGES AND LIMITATIONS OF THE RESEARCH DESIGN AND METHODOLOGY

Numerous challenges and limitations of the research design and methodology were experienced throughout the research process. These are listed and briefly discussed below. The discussion highlights challenges and limitations of the research design, sample size, sample area and concludes with those associated with the sampling procedure:

- The design of the interview schedule provided considerable challenge in deciding which to compromise: the need to include all the questions necessary or keeping the interview schedule short. This was a challenging task as schedules that are too long can have a negative impact on the quality of the responses (Mouton, 2001: 104). A decision was taken to retrieve all the necessary information at the cost of having a lengthy interview schedule.

- According to George (2004: 108) the larger the sample the lower the sampling error but large samples cost more money, therefore a sample size of ten metal and engineering firms was selected and it should be emphasized that the small sample size was not statistically representative.
- The study area selected for this study presented a limitation in that Gauteng was only one of the nine provinces that are found in the country that have active metal and engineering firms. In reality though, the resources associated with a nationwide study were not available therefore a study of such extended geographic magnitude was not feasible.
- The limitations of the convenience and snowball sampling methods selected include a high bias, because purposeful non-randomness involves deliberately excluding or over representing certain subsets of the population. The degree to which the sample is representative of the population is not known and the results obtained cannot be extrapolated to the entire population.
- Lastly, snowball sampling is likely to be biased in that the sample units depend on each other (referral will be similar to the person who referred them) (George, 2004: 106-110).

4.4 CONSIDERATIONS OF VALIDITY AND RELIABILITY

Various strategies were used to enhance the validity and reliability of the data collected and reported in this study, the most crucial of these include the following: prolonged engagement with research respondents; triangulation; peer debriefing; respondent checking and lastly, maintaining a journal.

Engagement with respondents was prolonged in that it initially began with an interview and was continued through various means of communication such as e-mail and telephone as the research progressed. Triangulation was employed in this research as multiple methods of collecting data were used, these include collecting data through literature, interviews, observation, media resources and conference presentations. Throughout the research process experts in the field of study were consulted in order to provide guidance and feedback regarding the development of the research analysis. Respondent checking took place in order to verify the correct interpretation of the information supplied. Lastly, in an effort to self-reflect a journal was kept during the research process, this aided in tracking the researcher's own ideas and biases as well as separating these from those of the respondents.

The reliability of the data collected and reported in this study is high, as a sound research design and methodology has been followed throughout the research process. The approach employed was the best possible in order to obtain the necessary information to adequately address the key research questions.

The next chapter will provide the research findings and discussion.

CHAPTER 5
RESEARCH FINDINGS AND DISCUSSION

This chapter provides an analysis of the main findings from the interviews conducted with various stakeholders in the Gauteng metal and engineering industry, with a primary focus on the ten sampled metal and engineering firms.

The chapter below explores, among other things, whether the skills shortage confirmed in the literature review is also evident in the sampled firms; the principal reasons for the scarcity of skills; the constraints that skills shortages imposed on firms; skills training orientation across the spectrum of firms and their interaction with the skills development system and MERSETA; and inter-firm, industrial, regional and international collaboration around skills development activities.

The findings have been divided into the following two main themes, firstly, information on interviewees and metal and engineering firms and secondly, metal and engineering firms' skills requirements, constraints and development. This analysis follows the format of the detailed interviewing schedule. The findings will be discussed in relation to existing literature and specific reports presented at the SEIFSA Skills Development Conference and at the Automotive Industry Development Centre (AIDC).

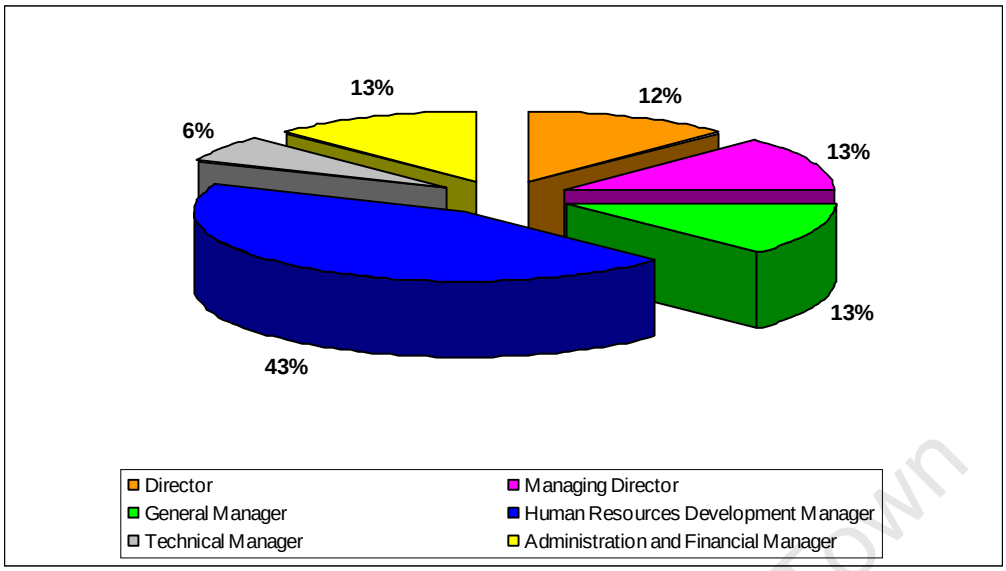
5.1 INFORMATION ON INTERVIEWEES AND METAL AND ENGINEERING FIRMS

5.1.1 Profile of respondents

5.1.1.1 Respondents by occupational category

This section focuses on the profile of respondents in metal and engineering firms, which include directors, managing directors and managers available at the time of the interview. At times there were more than one respondent present per interview and more than one interview conducted for the same firm, resulting in a total of 16 respondents. Figure 5 presents that 12% of respondents were directors; 13% were managing directors and general managers; 43% were human resources development managers; 6% in a technical management function and lastly, 13% were administration and financial managers. This distribution shows that most respondents occupy very senior positions within these firms, and are thus able to reflect reliably upon issues under investigation. Furthermore, it shows that almost half of the respondents were human resources development managers, which shows that the correct individuals dealing with the issue under investigation were consulted.

Figure 5: Respondents' occupational category



5.1.1.2 Years of experience in current establishment and industry

In this section the focus is on the length of establishment and industry experience according to the profile of respondents by occupational category. Table 10 suggests that respondents were generally well experienced at both establishment and industry level.

Table 10: Years of experience in current establishment and industry

	1-3 Years	4-6 Years	7-9 Years	10 Years+	TOTAL
Establishment experience					
Director	1	0	0	2	3
Managing Director	0	0	1	0	1
General Manager	0	2	0	0	2
Financial Manager	1	0	0	0	1
Human Resources Development Manager	0	5	1	4	10
TOTAL	2	7	2	6	17
Industry experience					
Director	0	1	0	2	3
Managing Director	0	0	0	1	1
General Manager	0	0	2	0	2
Financial Manager	1	0	0	0	1
Human Resources Development Manager	1	1	1	7	10
TOTAL	2	2	3	10	17

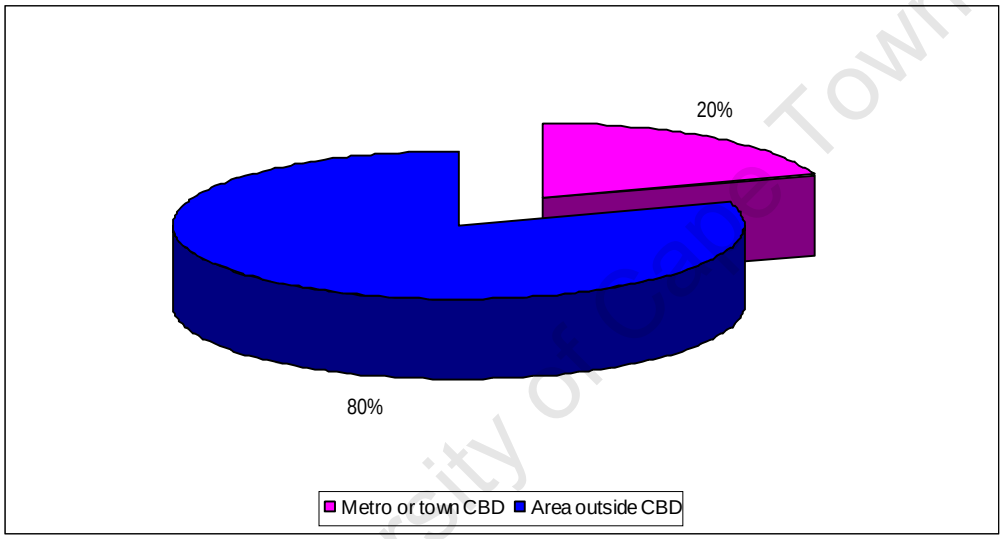
5.1.2 Profile of firms

This section provides an overview of the general characteristics of participating firms.

5.1.2.1 Provincial distribution

The firms in the sample were concentrated in Gauteng. Figure 6 shows that 20% of firms were located in Johannesburg's CBD, while an additional 80% were located in the Vaal Triangle[45]. Gauteng Province was strategically selected as the area of study, as the province accounts for over half (53%) of the geographic distribution of the country's metal and engineering industry (MERSETA, 2005: 20).

Figure 6: Location of firms



Although large firms are dispersed throughout the economy, the primary reason why firms decided to locate in Gauteng had to do with the province being the financial hub of SA, offering a host of benefits to firms requiring a commercial base. Supplementary reasons for investing in Gauteng were due to the concentration of the industry in the province and the extensive value-added metals production taking place in the province which was available in close proximity, minimizing transportation costs. The majority of firms would remain located in this part of the country with the exception of Firm G which was able to conceive relocating to Witbank where business would improve as its core business was doing work for the power stations that are situated in this specific area. In terms of potential supply and recruitment of employees, the majority of firms reported that their location in Gauteng had been advantageous to a certain extent as the province was

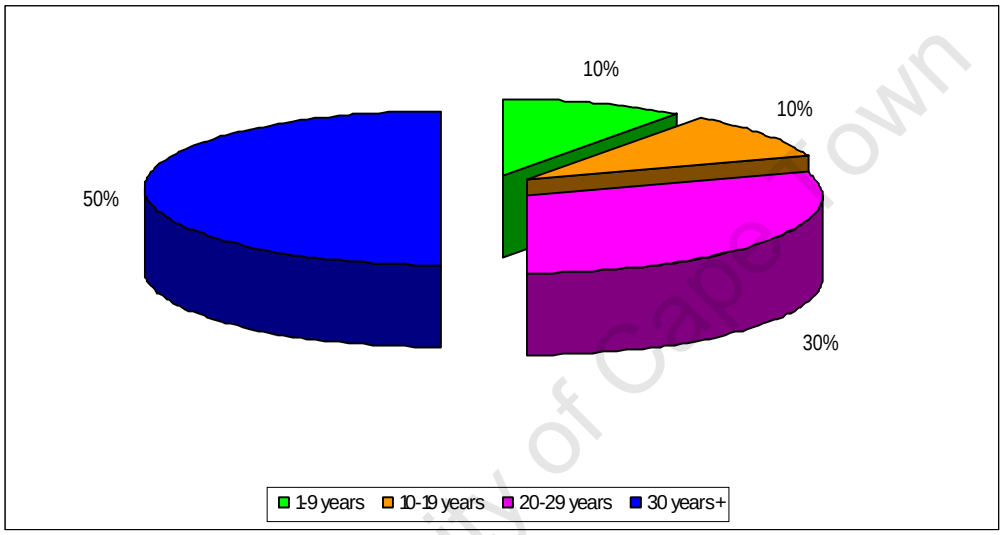
[45] Southern Gauteng region which includes the steel producing towns of Vereeniging and Vanderbijlpark and all their surrounding areas.

where a large proportion of individuals' sought employment, however, finding and retaining qualified and experienced employees is a challenge.

5.1.2.2 Number of years in operation

Figure 7 shows that of the ten sampled firms, one firm had been in operation between 1-9 years; one between 10-19 years; three between 20-29 years and the last five for over 30 years. The sampled firms were generally well established with 90% operating for ten years or more.

Figure 7: Number of years in operation by firms



5.1.2.3 Distribution by firm size category

According to the study conducted by MERSETA (2005: 20), the metal and engineering industry is generally made up of small firms (84%). Now follows a contrasting picture, Table 11 shows that of the ten sampled firms, six firms (60%) were in the category exceeding 200 employees, followed by three firms (30%) in the category 21-50 employees and one firm (10%) in the category 51-200 employees. Therefore, in accordance with the National Small Business Act of 1996, which was further revised by the National Small Business Amendment Bill of 2003, the majority of firms in the sample were large firms followed by small firms and lastly, medium sized firms (The SA Small Business Sector, 2004-2005: 30). Table 11 also shows that raw material processing firms represented large firms in the sample with a staff complement in excess of 200 employees. Intermediate product producing firms tend to occupy the small and medium employee class size. Finished product producing firms tend to range from small to large sized firms. The study conducted by Lundall *et al*. (2008: 61-62) also showed that milling or raw material processing firms were generally large firms, engineering or machine shops, which are mostly involved in intermediate production activities, were

small and medium sized firms and there was also a variation in the distribution of machine building or finished product producing firms in terms of size.

Table 11: Sub-sectoral distribution of firms by number of employees

	Raw material processing firms	Intermediate product producing firms	Finished product producing firms	Total number of firms	Percentage (%)
1-5 Employees				0	0
6-20 Employees				0	0
21-50 Employees		Firm D, E	Firm G	3	30
51-200 Employees		Firm F		1	10
200 Employees+	Firm A, B, C		Firm H, I, J	6	60
TOTAL	3	3	4	10	100

Furthermore in terms of size, the highly capital intensive raw material processing firms had not grown their staff compliment over the last twelve months, while intermediate and finished product producing firms i.e. downstream producers, reported that they had created employment opportunities over this period, particularly employing a large number of temporary artisan labourers to work on big contracts. Significantly, the employment growth is associated with an accelerated demand for the skills of artisans. The demand for the skills of craft workers i.e. artisans had increased by 48% over the period 1999-2005 in the metal and engineering industry (Maree *et al.,* 2009: 94-95). Furthermore, the growing trend of employing temporary labourers confirms the FRIDGE (2003a: 20) study in that atypical employment has been increasing in the industry.

When respondents were asked whether their staff compliment would grow over the next three years, a similar response was provided. Raw material processing firms would increase their staff compliment marginally due to expected high rates of growth, however their strategic approach would be to reduce their labour force as a result of being driven by cost reduction. The majority of downstream producers reported that they would continue to create employment opportunities in the future, with the exception of Firm H that is currently labour-intensive, but plans to adopt the upstream producers' strategy by downsizing staff because of labour cost implications. Therefore, the research findings indicate that downstream producers have a greater potential for employment creation. In comparison, the DTI (2005: 15) study also identified that employment opportunities tend to be low at the raw material processing i.e. refinery stage, but can become very high at the mass semi-manufacturing and final production stages.

5.1.2.4 Employment of different occupational classifications

It is evident from the results that all the firms interviewed employed artisans. The majority of firms reported that roughly over 40% of employees were classified in this occupational category. Shop-floor operators and machine operators were also key occupational groups. To a lesser extent, most firms also employed engineers, technologists, technicians, among other reported workforce profiles.

Briefly, 40% of the firms interviewed confirmed having qualified engineers in management positions but there was immense variation as Firm A had 70% of its management consisting of qualified engineers while Firms B, D and G had between 2-6%. All of these managers were in production departments where they could still make use of their technical skills due to their close proximity to production processes. It is important to note that as these managers move further away from these production areas and higher up into senior management, they make use of their technical skills less. The knowledge of technical processes is what makes these engineers suitable candidates for management positions.

Furthermore, with regard to the employment of engineers, the study conducted by Maree *et al.* (2009: 94-95) publicized low employment/demand level survey data figures for this occupational category in recent years. It should be borne in mind that Maree's *et al.* (2009: 94) figures should be viewed with great caution, as they are not the same as engineering employment levels in other studies. However, the information generated from the firms indicated low figures of engineers employed, validating the weak demand for engineers in the metal and engineering industry.

Employment trends are usually a good indication of the demand for labour or specific types of skills (Du Toit & Roodt, 2008: 454), therefore the major types of skills required by the firms are artisanal and operational skills. This confirms the observation in Chapter 2 of this thesis that craft workers and operators are in high demand within the metal and engineering industry Maree *et al.* (2009: 94-95).

5.1.2.5 The firm's structure and core operations

Respondents were asked to outline the structure of the firm by providing information on the holding company, subsidiaries and branches, etc. and to also provide a brief description of the firm's core operations i.e. its core production process(es) and principal products. Respondents were then asked if the types of products that are produced would undergo changes within the next three years. In this analysis, the sample is broken down by the sub-sectoral distribution of the firms and each sub-sector will end off with a brief summary of the main findings.

5.1.2.5.1 Raw material processing firms

Firm A is part of the largest steel manufacturer in the world with plants and offices in 60 countries. The SA subsidiary (which was previously owned by the state but is now privately-owned) is the dominant producer of steel on the African continent, producing 7.1 million tonnes of liquid steel per annum. The firm's SA steel operations comprises of four major facilities (Vanderbijlpark Works, Saldanha Works, New Castle Works and Vereeniging Works), which produce both flat and long steel products. According to the DTI (2005: 23) study, flat-rolled products are one of the forms in which carbon steel is produced and mainly consists of coils and plates, while long products are another form in which carbon steel is produced and mainly consists of wire rods and bars. The Vanderbijlpark mill, where this research was conducted, produces 81% of SAs flat steel requirements, which includes a range of high-grade products, namely: hot rolled steel sheet, plate and strip; cold rolled steel sheet; hot dip galvanized steel sheet; electrolytic steel plate and other products. The types of products produced would remain the same over the following three years, with the only anticipated change being the production of higher quality value-added products, as the firm had a strong belief in total customer satisfaction. Additionally, Firm A operates a metallurgical by-products processing division, called Coke and Chemicals which has plants in Vanderbijlpark and Pretoria[46]. The firm also has a Science Centre and a training centre division in Vanderbijlpark.

Firm B is a SA firm and owns a large privately-owned steel mill in Vanderbijlpark. The firm has processing subsidiaries in Israel. In recent years, the firm formed a joint venture company (which produces and supplies various stranded wire products) in order to promote black economic empowerment (BEE). According to the DTI (2005: 24) study, Firm B competes with Firm A in the long products market. The firm consists of three major divisions: the steel division; the wire mill division and the specialized wire division. The steel division's main product range includes: reinforcing bars; light section profiles and wire rods. The wire mill division processes wire rod into uncoated and galvanized wire, and produces wire products which include: welded and diamond mesh; barbed wire; field fence and other products. The specialized wire division manufactures medium and high carbon wire for sophisticated applications, as well as a specific range of steel wire ropes. According to the respondent, the types of products that are produced would remain the same over the following three years.

Firm C is part of an international Group, wholly-owned by Anglo American plc, manufacturing a diverse range of steel products. Its principal operations are located in SA, South America, Canada and Australia, with smaller operations in Namibia, Zimbabwe and Zambia. The firm's SA operations comprises of numerous branches such as the Germiston, Benoni and Vereeniging branch. The Germiston branch

[46] The division is no longer required for the steel making process.

(primary work site and head office), where research was conducted, has a training centre division. The main product lines manufactured currently and in the future include: rolled steel; steel and alloy iron castings; chain; steel wire rope; strand and wire products. Firm C also competes with Firms A and B in the long products market (DTI, 2005: 24). With regard to casting production, the respondent said:

"Our foundry is one of the largest foundries in the southern hemisphere, and it is a leading supplier of automotive components" (Interview, 2008d).

This confirms the DTI (2005: 35) study that the foundry industry provides critical inputs to most of the manufacturing sectors, with automotive being one of the largest industries it supplies. Furthermore, the DTI (2005: 35) study mentioned that the number of foundries decreased from 450 in the early to mid-1980's to just over 200 in 2003, therefore Firm C is one of the large Groups that dominate this diminished foundry industry.

From the interviews that were conducted, the majority of raw material processing firms were foreign-owned. These firms are primarily involved in the production of steel materials, which are produced in different forms, e.g. hot rolled steel plate, cold rolled steel sheet, wire rod and reinforcing bar. Firm A is the dominant steel producer on the African continent, with Firm B and C competing with it in the long products market. All raw material processing firms reported that the types of products that are produced would remain the same over the following three years, Firm A's only anticipated change would be the production of higher quality value-added products.

5.1.2.5.2 Intermediate product producing firms

Firm D is an independent firm based in Vanderbijlpark. Due to the rapid growth of the firm in recent years, Firm D has acquired a dedicated fabrication department, strategically located in close proximity of its primary premises. The firm's primary activities include precision machining and fabrication. In particular, the fabrication department has serviced Sasol Chemical Industries' Chlorine Department for the reconditioning and refurbishment of cathode cans and related equipment, used in the production of chlorine. The principal product produced (cathode cans) would not change within the next three years, however other products would undergo changes as the type of work demanded is continuously changing and the firm being customer-focused, is dedicated to providing distinctive, quality work to meet customer's needs.

In recent years, Firm E has been involved in promoting BEE through their share in the development of a BEE company. Based in Vanderbijlpark, together the firms specialize in: precision machining and fabrication; repairs and general engineering services. The types of products produced would undergo changes within

the next three years, as the respondent explained that there was not much profit in manufacturing, particularly in turning, attributable to the high cost of labour and materials. Consequently, the firm would need to service the engineering industry through an innovative, value-added product or service that contributes towards profitability.

Firm F is an independent firm based in Vanderbijlpark. Over the following three years, the firm would continue to specialize in the design, manufacture and installation of: furnaces; water cooled systems and panels; fume take-off ducting; heat exchangers; pressure vessels; structures and machining. The firm is not only involved in fabrication, but also has an expert team overseeing site erections. Over the years the firm gained a tremendous amount of experience in erecting various items including: ducting; structures; pumps; hydraulic and water piping etc.

In summary, intermediate product producing firms are made up of independent SA firms that have become entrenched in specific niche areas. Collectively these firms specialize in design, precision machining and fabrication, repairs and general engineering services which is similar to the undertaking of work found at the engineering or machine shops by Lundall *et al*. (2008: 70). Generally, the types of products produced would undergo changes over the following three years for two main reasons: the type of work demanded by customers is continuously changing (as also seen in Lundall's *et al*. (2008: 70) study) and due to returning poor profits from existing products.

5.1.2.5.3 Finished product producing firms

Firm G is part of an international Group, the world's leading manufacturer of cleaning systems for all types of heat exchangers. The international Group comprises of manufacturing facilities in the United States of America (USA) and Scotland. The USA Group has subsidiary companies in Thailand, Brazil, Australia, Canada and a joint venture company in China. The Scotland Group has subsidiary companies in Sweden, Finland, Germany and SA. The firm's SA operation, based in Vanderbijlpark, boasts principle products consisting of a unique range of sootblowers which ensures complete boiler cleaning coverage. Firm G is a specialist firm providing services to meet specific requirements including replacement parts, maintenance, installation and commissioning. The firm's mission is to ensure its long term viability by supplying new quality engineered products and services that are logical extensions of existing marketing, engineered or manufacturing disciplines.

Firm H is an independent firm and has two factories based in Vanderbijlpark. The firm recently opened the second factory in order to expand its ability to supply existing products. The firm manufactures a complete

range of roof sheets, slit strip and cold formed sections i.e. cold formed lipped channel and lipped angle. Firm H believes that internal development should match market demand and therefore the types of products that are produced would remain very similar within the next three years as the market is growing strongly in the products manufactured. The respondent explained:

"We keep on looking at adding more products that are closely related to what we already do . . . such as bullnosing and curving of roof sheets, all types of flashings and other roofing accessories. Strategically we must stick to what we're good in" (Interview, 2008l).

Firm I is part of a SA Group that is multi-faceted, servicing a diverse customer base. The firm consists of three divisions: the rail division (based in Boksburg, Springs and Rosslyn); the heavy engineering division (based in Vereeniging, Vanderbijlpark and Newcastle) and the marine division (based in East London and Cape Town). The Vereeniging Works, where research was conducted, has a training centre division. The heavy engineering firm is involved in the machining and fabrication of capital equipment. Typical products produced by the firm are: mills; kilns; converters; draglines and many more products. The training manager said:

"We are competing internationally in the heavy manufacturing sector for the manufacture of these types of equipment" (Interview, 2008n).

The challenge currently facing the firm is to increase its versatility through the development of new products.

Firm J's SA operation is a subsidiary of a global conglomerate, one of the world's leading and largest, publicly owned engineering, procurement, construction and maintenance services companies. The international company maintains a network of 50 offices in more than 25 countries across 6 continents. The SA head office is based in Sunninghill, Johannesburg and manages operations in Durban and Secunda. Within the next three years, the firm's SA operation would continue to offer total engineering capabilities, from front-end design studies to procurement, construction and maintenance[47]. The firm has a training centre division in Secunda, which provides unemployed and previously disadvantaged individuals with an opportunity to acquire marketable trade skills.

The interviews indicate that finished product producing firms in SA are either locally or foreign owned. Similar to the study by Lundall *et al*. (2008: 75), these firms produce a wide range of products and also offer

[47] Firm J offers services as oppose to products to its customers, and falls under this sub-sector as it has built some of SAs most complex capital projects linked to the metal and engineering industry.

engineering services. It is important to note, that the value chain of this sub-sector is more complex as similarly stated in the FRIDGE (2003a: 257) study , given that it sources inputs from steel mills as well as intermediate product producing firms and produces outputs for downstream producers as well as for its own sub-sector. The majority of firms within this sub-sector reported that the types of products produced would undergo changes within the next three years, mainly to ensure long term viability and increased versatility. However, these products would be closely related to those currently produced.

5.1.2.6 Export trade performance

Over the past two decades, light and heavy engineering industries (incorporating metal products and fabrication) have been experiencing a decline in economic growth, with poor export performance being a contributing factor (FRIDGE, 2003a: 185). Of the ten firms in this survey it was found that the majority (60%) of firms either did not export their production output or exported less than 5%, mainly to African countries. In contrast, the remaining 40% of firms were characterized by high growth rates as a result of a high export orientation with roughly over half of outputs and services designated for exports. Raw material processing and finished product producing firms mainly feed into international export markets.

Although SA is richly endowed with metals, only a very small proportion of most metals are beneficiated through to the final product stage, where the largest value is earned and employment creation occurs especially with respect to employment at lower skills levels (DTI, 2005: 16; 52). According to Maree *et al.* (2009: 107), "most metals are still exported after the milling stage when relatively little value has been added to the product". Significantly, Firm A's high levels of long steel product exports, were due to the limited demand of the SA market. The weak domestic demand is attributable to the challenges faced by the producers of beneficiated products, predominantly being the pricing policies of the upstream monopolistic mills which impede growth (Maree *et al.,* 2009: 107).

Furthermore, respondents were asked if the proportion of the firm's output directed to exports would undergo changes within the next three years. The majority (70%) of firms anticipated changes in the proportion of exports. To encapsulate the general feeling, in the future these firms would set new standards of efficiency and competitiveness by focusing on entering new markets internationally and growing export markets exponentially in order to generate foreign earnings, whilst continuing to participate in local markets. Those that would not undergo changes (30%) provided varying reasons. Firm A would maintain a strong footing internationally if the limited domestic demand for long steel products continued. By way of contrast another two respondents did not have the capacity to embrace globalization.

5.2 METAL & ENGINEERING FIRMS' SKILLS REQUIREMENTS, CONSTRAINTS AND DEVELOPMENT

5.2.1 Skills in short supply, reasons and impact

5.2.1.1 Skills in short supply and the time frame of the problem

Research has shown that there are severe skills shortages at artisan, technical and engineering levels, which is a major limiting factor concerning growth in the metal and engineering industry (MERSETA, 2005: 21; 41-42; DTI, 2005: 53). Verifying the findings of the macro data, all key stakeholders interviewed reported that their firms were currently experiencing shortages of skilled labour. A shortage of skilled/certified trades was a key human resource issue faced by all ten sampled firms. Similarly, according to the DTI (2005: 53) study, one of the biggest constraints faced by the industry (and the manufacturing industry as a whole) is a general shortage of artisans. The information generated from the interviews indicated that the most critical artisanal skills in short supply included:

- Fitters and Turners.
- Boilermakers.
- Electricians.
- Millwrights.
- Welders.
- CNC operators.

Furthermore, 60% of respondents (mainly raw material processing and finished product producing firms) reported experiencing a shortage of engineering and technical skills. Generally, the fields of engineering and technical skills in short supply were:

- Electrical.
- Mechanical.
- Metallurgical.
- Draftsmen.
- Instrument mechanics.

With regard to employment equity, qualified and experienced Black candidates and women (technical, engineering and management) are very scarce (MERSETA, 2005: 43). Correspondingly, the research findings obtained from informants demonstrated the scarcity of:

- Female engineers.
- Black material and specialized engineers.
- Senior executive-strategic black managers.

Senior executive-strategic and middle level production managers were also highly sought after.

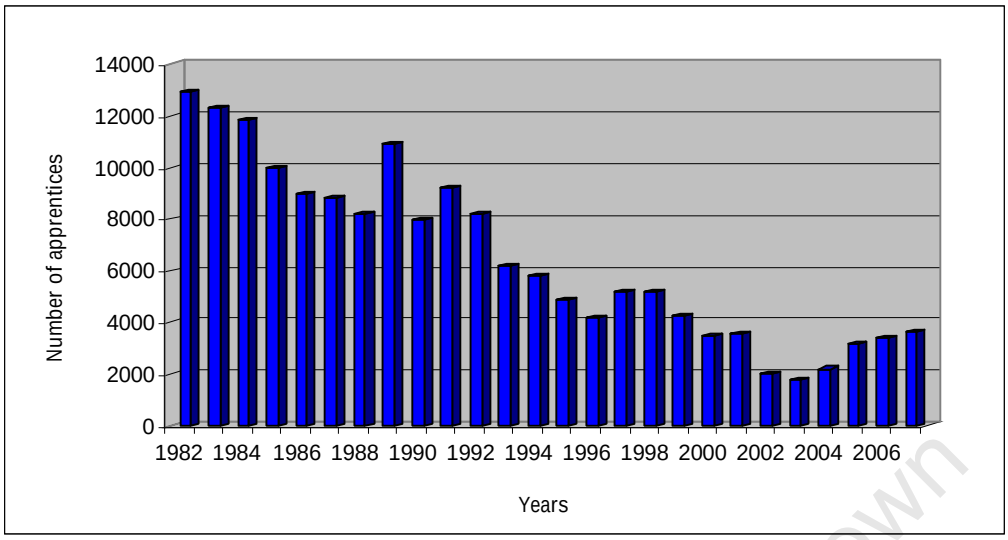
Overall, there was hardly any deviation in the acknowledged scarce skills by the firms, when compared to MERSETAs (2005: 42) detailed description of the skills required in the metal and engineering industry. The only different acknowledged skill in short supply by two finished product producing firms (Firms I and J) was:

- Riggers.

According to the perceptions and experiences of nearly all key stakeholders interviewed, the shortages in skills have existed for approximately five years, which means that the problem seems to have been persistent in the medium term. Firms A, E, G and I have been struggling to fill artisanal positions, especially in the past two years.

An interview was carried out with the skills development manager at SEIFSA. Briefly, SEIFSA is a national employer federation for the metal and engineering industry, and an umbrella body for a number of independent employer associations representing specific sectors within the industry. SEIFSAs skills development manager revealed that the number of apprentice intake in the metals industry declined dramatically from 12 893 in 1982, to only 1 800 in 2003, a completely inadequate number (Figure 8). The declining apprentice intake trend is compatible with the declining trend in apprentices registered (DTI, 2005: 53) as discussed in Chapter 2. This informant stated that emphasis would be placed on any initiatives that support the training of MERSETAs identified critical skills in the metals industry, an industry which is in dire need of capacity boosting.

Figure 8: Metals industry apprentice intake, 1982-2007



Source: SEIFSA 2008

Furthermore, the informant highlighted that there had been a marginal turnaround and improvement in the number of apprentice intake which began to manifest itself from 2004 into the present period. Similarly, drawing on the information obtained from the firm interviews, a growth in the number of apprentice intake in recent years was evident. For instance, Firm I's apprentice growth in numbers substantiates this proclamation. This is demonstrated quantitatively in Table 12. The table clearly reflects that the overall number of apprentice intake had increased from 10 to 47 over the period 2005 to 2008.

Table 12: Number of apprentice intake by artisanal occupations, 2005-2008

	2005 Apprentice Intake	2006 Apprentice Intake	2007 Apprentice Intake	2008 Apprentice Intake
Welders	5	8	11	4
Boilermakers	2	5	8	5
Fitter and Turners	2	5	9	13
Electrician	1	1	1	5
Riggers	0	2	1	1
Fast-Track Boilermakers	0	0	9	15
Fast-Track Welders	0	0	0	4
TOTAL	10	21	39	47

However, this optimistic growth trajectory will need to increase significantly and maintain growth for a number of years before there is a discernible positive impact concerning skills shortages within the metal and engineering industry. Firm J's current involvement in a large-scale, cross-business unit project aims to

increase the number of apprentices to be trained and has committed to training approximately 548 artisans over the period 2008 to 2010. If this is achieved it will help in starting to alleviate the shortage of artisans.

Overall, the severe skills shortage problem experienced by the industry, triggered by the dramatic quantitative reduction in the number of apprentice intake, is not a new phenomenon and emerged many years ago. However, in recent times the problem has been exacerbated and the lowest apprentice intake levels recorded, which helps explain the time frame of the shortages in skills reported by key stakeholders in the sampled firms.

5.2.1.2 Perceptions of principal reasons for the scarcity of skills

Through the interviews and discussions with key informants whose insights were captured during the research process, one could identify several reasons why the required skills are not being supplied. The discussion below presents some interesting and important information regarding the key factors that have pushed the skills shortages to crisis point.

5.2.1.2.1 Dramatic decline in artisan training by parastatals and large private conglomerates

The data on the dramatic decline in the number of apprentice intake as discussed above by SEIFSAs skills development manager, is generally one of the principal reasons for the scarcity of artisanal skills identified in various firms.

Various firms interviewed reported that in the past, state-owned enterprises such as Eskom, Iscor, Sasol and other large private sector conglomerates produced large numbers of artisans, not only for their own needs but also to meet the technical skill needs of the market. The study conducted by Kraak (2008: 485), confirms that this had indeed been the case historically. Additionally, key informants interviewed reported that many of these crucial producers of intermediate skilled labour had either closed down their training centre facilities or profoundly downsized training.

According to Firm J, there are at least 18 existing training centres in SA which are located in Gauteng; Secunda; Sasolburg; Kwazulu-Natal; the Eastern and Western Cape. In spite of the skills shortage, it appears that these training centres are underused. A respondent from the firm who is involved in the development of skills suggested that these underused training facilities that have the potential to be rejuvenated should be used (by businesses in partnership with government) for skills training programmes which might help turn the tide in terms of artisan and technician shortages in SA.

A recession experienced by the industry during the mid-to late 1970s was a prime reason provided by Firm C, as to why it had become more difficult for many of the state-owned enterprises and large private firms to sustain the same levels of training. Literature supports the respondent's statement as economic cycles have decreased training in the past (Johnston, 2007: 46). Similarly, Firm D's director believes that many parastatals have, over the years, put a halt on apprenticeship training programmes as a result of financial constraints. Furthermore, the director of the cathode can manufacturing firm said:

"It is a well-known fact that most training facilities at corporate companies have closed down due to a reduction of apprenticeship subsidies from the government" (Interview, 2008e).

According to the DTI (2005: 54), since these firms have scaled back their training programmes the skills shortages have accelerated. A point raised by Firm H was that in contemporary times, these institutions do not produce artisans in surplus but only for their own needs, different to their previous strategic approach to training.

To confirm the assessment of these key informants, the two large raw material processing firms (Firm A and C) and a finished product producing firm (Firm J), concurred that previously they made immense contributions to training, whereas today they provide a much smaller contribution to training. An interview with a large parastatal involved in projects linked to the metal and engineering industry, also revealed reductions in its training output. The most visible example was the significant training reduction experienced by Firm A, the dominant producer of steel. At the time of the interview, over 400 apprentices were undergoing training. However, this large employer used to train approximately 2 000 apprentices on an annual basis, much more than the current levels of output. It should be emphasized that even though Firms A, C, J and the large parastatal have undergone a significant training reduction, they still make a considerable contribution to the training of metal and engineering artisans, overall.

Furthermore, it was stated by the majority of these participating firms in artisan training initiatives that they still supply excess labour to a wider network of firms in the economy, consequently contradicting the assessment made by Firm H. To provide an example, an informant at a steel mill claimed that 50% of technical trained labour is utilized for their own needs and the remaining amount is especially available for those small firms reliant on poaching of skilled workers. Although a reasonable proportion of artisans are produced for the market, this will only have a limited impact on the availability of skilled artisan labour as plenty more is required to solve the skills shortage problem.

5.2.1.2.2 Social stigma attached to artisanal occupations

Gauging from the interviews, the majority of firms commented that societal perceptions (particularly the perceptions of today's youth) regarding artisanal occupations have had a negative effect on the number of individuals entering trades. To sum up the general feeling one respondent said:

"Artisans are perceived as grease monkeys by society and consequently the profession is not a sought after career path" (Interview, 2008o).

Now follows a contrasting picture that contradicts the viewpoint of SEIFSAs skills development manager, as SEIFSA is reported to be experiencing an increase in the number of young individuals interested in technical occupations (Bezuidenhout, 2007: 1).

However, if the myth that the youth of today are not interested in developing their technical skills primarily due to the social stigma attached to trades is true, then it is crucial to remove the stigma. Within Firm I, there is a focus on giving apprentices substantial recognition for the work they do in an effort to promote the trade and motivate the employee. An apprentice scoring highest in their specific trade following the individual assessment is selected as 'the apprentice of the month' by a panel of foremen and training officers. Furthermore, apprentices who keep on achieving exceptional standards of work are awarded with 'the apprentice of the year award'.

One of the finished product producing firms (Firm F) emphasized that boilermakers, electricians, welders etc. are all legitimate occupations. The firm added that, in contemporary times artisans can earn a substantial salary along with additional benefits due to their scarceness. According to SEIFSAs skills development manager, the problem is that not enough is being done at government and SETA levels to attract the youth to technical skill occupations (Bezuidenhout, 2007: 1).

Historically, artisanship was considered as a valued skill in the workplace as observed in Chapter 2, but the above findings demonstrate that presently artisans appear to be less valued, especially by the youth, regardless of their high demand in the metal and engineering industry. In order to encourage the youth of today to become artisans and raise the image of artisans, the occupation will have to be marketed more effectively in secondary schools. Reversing social perceptions of artisanal occupations is indispensable to increasing the number of artisans in the country and reducing the skills shortages.

5.2.1.2.3 Career guidance in secondary schooling

The subject choices students make during their initial years of secondary education have major implications for their further education and employment options. A common response by metal and engineering firms interviewed was:

"Grade 11 and 12 students did not have the correct career guidance as to take the minimum requirement subjects, specifically mathematics and science that would enable them to gain access into technical and scientific fields of study" (Interview, 2008c).

Firm A claims that learners are not prepared to follow careers which require further studies in mathematics and science. Career guidance and support for students regarding correct subject choice and career path decisions is therefore crucial. According to some interview respondents, a matter of great concern is that those who provide career guidance often lack specialist knowledge.

Firm C's training manager accentuated that career guidance services offered in secondary schools have tenuous links with the world of work as guidance staff do not know much about what is on offer and involved in different types of jobs in the labour market. Furthermore, this informant claimed that little provision is made for exploratory company visits, which is an integral part of career guidance as it helps students develop insights into the world of work and their own occupational orientations.

Two intermediate product producing firms (Firms D and E) assumed that students not intending to enter tertiary education but vocational education pathways receive significantly less or no career assistance. This takes diminutive account of the high employment probability that can flow from vocational education and training.

Given the importance of addressing the above problems, a radically new approach to effective career guidance, known as Career Planet, has recently[48] been initiated. Career Planet is an initiative designed to bring together industry, government and academia to drive skills development and promote career diversity and access to career opportunities while highlighting and addressing the scarce and critical skills shortages in SA[49] (Chisholm, 2008).

[48] On the 16th of June 2008 – Youth Day.

[49] For more information, view the website: http://www.careerplanet.co.za

5.2.1.2.4 The educational system in South Africa

This section commences by analyzing the data concerning the quality of public school education, which is then followed by an evaluation of FET colleges and HE institutions.

(a) The quality of public school education

Before embarking on this section that provides an analysis of the quality of public school education, it is essential to provide a brief background of the school educational system. These findings are derived from a study conducted by Firm A. The functional & generic training manager from the dominant steel producing firm revealed that in 2004 there were 1.06 million students in Grade 10. This number dramatically declined in 2006 to 528 525 students in Grade 12 (50% had dropped out). An alarming finding, is that 351 726 passed matric and only 25 217 of these students passed mathematics on higher grade (2.3% of 2004 Grade 10 students). These mere 25 217 formed the core of any future supply.

Based on the views of most firms that were studied, the metal and engineering skills shortage problem is deeply rooted in the poor quality of public school education. Research has revealed that this is a fundamental area contributing to the problem. Generally, firms perceive the schooling system to no longer be delivering the correct calibre of students with competence in mathematics and science. Furthermore, interviews and the literature review suggest that the general low quality of the school system and particularly the poor quality of mathematics and science education should be one of SAs national priorities as an increased supply of suitably skilled entrants to tertiary institutions is central to improving the future supply of engineering capacity (Du Toit & Roodt, 2008: 472).

There are a number of reasons why mathematics and science education is considered to be in crisis. Perhaps the most important of these is the perception that many educators do not have the adequate skills to teach learners, predominantly in schools from previously disadvantaged areas. A finding of great concern would be that:

"Only 14.7% of educators teaching mathematics and science in rural schools have the minimum prescribed qualification to do so" (Interview, 2008b).

Some interviewees stated that inequality within the school educational system is an issue. The majority of schools in poorer communities do not have the necessary facilities and resources such as laboratories and computer centres to perform well in subjects such as mathematics and science.

Without a solid educational foundation and the appropriate competence in mathematics and science at the matriculation level, gaining direct access to technical and scientific fields of study at higher institutions of learning is not possible. Furthermore, without these competencies potential candidates cannot gain admission to artisan training programmes in various firms and subsequently artisan status is unattainable. The admission requirements for these programmes are discussed in more detail below.

To qualify as a potential candidate for an artisan training programme in Firm I, the minimum statutory requirement of NTC 2 i.e. N2 (equivalent to Grade 11) with applicable technical subjects is a prerequisite. The three raw material processing firms and a finished product producing firm (Firm J), all indicated that a minimum education qualification of a matriculation certificate or an equivalent of NTC 3 with mathematics and science as subject credits, coupled with additional applicable trade theory subjects would normally be required. It should be noted that certain artisan programmes at Firm B have a lower entrance thresholds. The evidence clearly shows that the traditional entry level of a Grade 9 school leaving certificate is an outdated criteria. Moreover, four technical training firms raised their entrance levels higher than the basic minimum statutory requirement.

The majority of these large employers' main route to becoming a qualified artisan is through an Accelerated Artisan Training Programme (AATP) (discussed in more detail under the skills development section below). Because the programme accelerates the pace of theoretical learning and competence, the selection criteria of candidate apprentices have been raised. However, it was found that the primary reason for raising the entrance requirements for firm-based artisan training programmes was due to the declining quality standards within the public school education system. This assessment is confirmed by the milling firms i.e. raw material processing firms in Lundall's *et al*. (2008: 67) study. Furthermore, through the interviews conducted it was discovered that not only raw material processing firms but also two finished product producing firms (Firms I and J) had higher entrance thresholds compared with the minimum educational qualification required of previous apprentices.

These criteria present a challenge, especially in terms of recruiting sufficient numbers of school leaving students from the already limited mathematics and science pool. Lundall's *et al*. (2008: 67) study also found that milling firms were faced with this challenge. To encapsulate the general feeling, one respondent said:

"It is becoming difficult to get people with the minimum qualifications to go on the programme" (Interview, 2008o).

Firm J added that, even when qualifying potential candidates are obtained, there are quality issues that are identified when testing mathematical literacy levels. The poor quality of mathematics, science and communication among potential candidates is hampering the development of technical skills at the firm. According to Firm C's training manager, the firm manufacturing a diverse range of steel products, has a rigid assessment system for those entering training programmes in an attempt to source the best potential to be trained. Firm C's experience is similar to that of Firm J. Despite the fact that most of the applicants hold a matriculation certificate, only a very small proportion actually pass the arithmetical requirement test. Generally, these large firms who are actively training artisans have made substantial improvements with regard to testing, assessment and selection of candidates, signifying that they are taking account of declining school standards. These firms bear a higher burden of costs associated with complex recruitment processes for those entering training programmes.

According to Firm A, poor mathematics and science performance at secondary school level poses challenges through the unsuitability of learners in all training pipelines and the lack of availability of employment equity candidates.

Some comparative examples of educational systems in other countries were discussed. For example, a participant mentioned that Japan had an incredibly strong general education system which was a good foundation for long-term training on-the-job. Empirical data provided by Taylor *et al.* (2003: 41-42), shows that the quality of school education in SA is very poor in comparison to other countries as can be seen when SA learners performed well below the levels of their counterparts in international comparative studies, as discussed in Chapter 2.

Having discussed the poor quality of public school education, FET colleges and HE institutions which play a crucial role in providing the skills are considered next.

(b) The quality of public FET colleges

It was evident that Firms D and J which are involved in areas of higher beneficiation were satisfied with the quality and relevance of FET colleges. This sentiment was not shared by the raw material processing firm (Firm C) and finished product producing firm (Firm I), both of which experienced difficulties with the quality standards of FET colleges. In the same way, Kraak's (2008: 495) research found employer claims of poor quality from FET colleges. To give an example, the human resources manager from the heavy engineering firm (Firm I), complained that once apprentices have completed the theoretical instruction at a FET college,

they tend to struggle with applying their theoretical knowledge in the workplace. The respondent provided an example of a practical skills training shortcoming:

"My apprentice is not able to successfully get the centre of a cylinder" (Interview, 2008m).

An interview with the director from a training and development institution i.e. training provider in the Vaal region explained that government is in the process of empowering the newly formed FET colleges (which have been reduced from 150 to 50) to address the skills shortages. The respondent alluded to the enormous investments being injected into these institutions by government, but claimed that the effectiveness of public FET colleges' performance in developing technical skills matching the needs of industry can only be described as 'disastrous'. On the other hand, the DoE states that the impact of these subsidies on the performance of FET colleges remains to be seen (DoE, 2005: 4). Furthermore, the respondent commented that the poor quality of educators and outmoded curriculum are key constraints on the delivery of effective classroom instruction. Research has also indicated that the previous FET curriculum was among the sources of the skills crises in the metal and engineering industry due to the curriculum being outdated (Fisher *et al.,* 2003, cited in Maree *et al.,* 2009: 107). This outdated curriculum was a common theme in literature reviewed. A former FET college graduate that was present during the interview at the training and development institution, experienced problems of poor quality in education and training, alleging that learners go through an entire theoretical course without the necessary educational material, exams and at times educator course attendance. Another major issue highlighted by the college graduate that resonates with the FET college sector is the fact that the majority of graduates struggle to gain access to employment (Cosser *et al.,* 2003, cited in Kraak, 2008: 486).

A continuous topic of discussion with various stakeholders in the Gauteng metal and engineering industry is the transition from one educational and industrial training system to another. Concerns were raised about the new NC(V) set to replace the NATED courses (N1-N3). A third of respondents interviewed were of the opinion that the curriculum changes at the FET level would not provide apprentices with the necessary theoretical training in order to become artisans. Similarly, existing literature has revealed shortcomings in terms of the technical theory training provided by the new NC(V) curriculum at FET institutions. Surprisingly, the increased time period and associated cost implications for obtaining the qualification as well as the perceived lack of appropriate transitional arrangements for companies indenturing apprentices were not raised as contentious issues by the respondents. This could be due to the curriculum's recent implementation and concerns could be identified as time progresses.

(c) HE institutions

Responses analyzed have revealed that the supply problems regarding enrolments and graduations for engineering studies at HE institutions begin at the secondary school level, with a limited pool of good quality mathematics and science students, as already discussed above. This poor foundation to begin HE studies is worsened as, an informant at a very large steel mill in Vanderbijlpark (Firm A) indicated that, there is a marked decline in the interest of young individuals in engineering studies and a decline in the percentage of science degrees awarded. Empirical data shows that over the period 2000-2004, HE enrolment and graduation rates increased. It is possible that these increases in HE enrolments and graduations are not occurring at sufficient rates to adequately address continuing skills shortages.

The response rate of firms regarding HE institutions' contribution to the necessary skills not being supplied was low. This was largely due to a lack of probing questions used during the interviews.

5.2.1.2.5 Outflow of South African skilled labour to other countries

Global labour market opportunities are impacting on the availability of skilled labour in the country, as from the interviews it appears that SA is losing skills at an alarming rate especially to countries like Angola, Nigeria, parts of the United Arab Emirates such as Dubai, Australia etc., where much higher competitive salaries are earned. Many firms identified Australia as being the main beneficiary of SA artisan skills. Maree's *et al.,* (2009: 107) study substantiates that an outflow of skilled labour (particularly artisans) to most of the countries identified has been the scenario, attributable to intermediate skilled incumbents chasing more money.

Since the problem is deeply embedded in capital, one respondent provided a reactive measure that might address and eliminate the problem:

"South African artisan rates are not high enough! In attracting and retaining skills, attractive artisan remuneration packages are essential" (Interview, 2008o).

Furthermore, raw material processing firms reported that numerous graduate engineers leave the country to gain experience abroad (information regarding whether they return again was not provided). These firms also recognized that a lack of engineering capacity internationally is an external factor affecting the retention of SA engineering skills. Secondary analytical literature confirms this assessment and in addition conveyed that enticing experienced engineers back to SA is a further challenge due to the world-wide shortage of engineers (Du Toit & Roodt, 2008: 473).

5.2.1.2.6 HIV/AIDS

The firms at which interviews were conducted had mixed opinions on whether HIV/AIDS is a contributing factor towards the scarcity of skills.

It is evident from the firm-based results that some firms noticed modest increases in vacancy rates for low skilled and semi-skilled workers/positions (specifically shop-floor and machine operators) which is primarily attributable to the HIV/AIDS pandemic. However, the problem is not only experienced by low and semi-skilled workers. One of the finished product producing firms (Firm J) stressed that repair and maintenance artisans working on plant shutdowns are also suffering and dying at the age of 25 from this chronic illness. Firm J added that, HIV/AIDS is a serious concern, particularly as it is alleged to reduce the number of young individuals entering the industry. This is clearly indicative of the potential threat posed to the relatively small pool of skilled artisan labour in the metal and engineering industry.

On the contrary, the majority of firms were of the opinion that the skills distribution of HIV infections is directed towards lower skill levels and consequently metal and engineering is not a high-risk industry due to the skills intensity and distribution being focused/concentrated at intermediate and high skill levels. Hence according to the firms interviewed, HIV/AIDS is not likely to exacerbate the insufficiency of skills.

5.2.1.2.7 Age distribution of the artisan workforce

The process of data collection through firm interviews revealed that 70% of firms were experiencing an ageing artisan workforce. Firm A's functional & generic training manager illustrated starkly that the firm had numerous crucial technically skilled artisans aged 55 and above, that would be exiting the labour force over the next five years. The respondent at the large steel mill explained:

"This vital skills category is ageing and urgent attention is required in this area. Forward succession planning is essential and we should not merely be training for current needs, but also to replace the ageing skilled workforce. If we don't we will face a serious problem in the future!" (Interview, 2008b).

Overall, a key driver of scarce artisan skills is the lack of individuals with the skills that are needed to fill occurring occupational vacancies due to retirement.

5.2.1.2.8 Shortage of technical instructors, mentors and assessors

A shortage of qualified workplace technical instructors is evident and negatively impacts on the ability of training institutions to maintain and increase their existing training capacity. A similar problem exists around the shortage of workplace mentors and assessors.

During the course of this study, one of the key reasons for the current shortfall of instructors that emerged was the absence of a high level of willingness amongst senior artisans to become instructors. Hence there is a need to consider some form of built-in incentives for these specialists and subject experts to build the necessary skills capacity. To deal with the current backlog, the large raw material processing firm (Firm A) is currently exploring various ways in which to incentivize and encourage senior artisans to assist with the transfer of knowledge and skills to experiential learners by considering training as a career option, not necessarily on a permanent but rather on a rotational basis. In turn this would mean that there would be replacement skilled artisans to fill retirement occupational vacancies.

5.2.1.3 The impact of skill shortages and exogenous factors on the growth potential of firms

Due to past and ongoing skills shortages, 40% of the firms have suffered project losses which directly limit expansion. This impact is supported on a wider scale by Pauw, Oosthuizen & van der Westhuizen (2006: 11) who found that firms, policymakers and government all agree that skills shortages are probably the most important obstacle to accelerated growth in SA. According to Firms C and D, in present times, these skills shortages have also resulted in high staff turnovers regarding artisans as their numbers are limited and competition for their skills is very high. According to Firm E, skills shortages also have the ability to compromise the quality of product being produced by the firm which will inevitably affect growth potential negatively. A third of the firms mentioned that increased costs incurred by employers in the drive to source the highly sought after and limited skills from both local and international labour markets, further limit the availability of funds to facilitate expansion. According to 40% of the firms, continuing skills shortages in the future are sure to further limit expansion due to the lack of numbers and skills required for growth to take place.

With regard to exogenous factors impacting on the growth potential of firms, over 80% of the firms listed the recent SA electricity shortages as the main factor (not related to their own skills shortages) which negatively impacted on their growth potential. This contrasts with Lundall's *et al*. (2008: 3) view of SA having an abundant supply of coal and cheap electricity which does not highlight recent inconsistencies in the supply of electricity.

Another exogenous factor impacting on the growth of firms was import-parity pricing regarding the sale of selected metal products in SA. Half of the respondents believed the current import-parity conditions did not favour the expansion of their firms. Firm A explained that import-parity pricing is the price which an importer would have to pay to obtain a specific commodity from abroad and includes the best obtainable international price plus the cost of transport (and associated import costs) to the country of destination. Firms argued that

buying metals in SA at international prices in dollars and the enormous increases in metal prices adversely affect expansion. Regarding the latter, a respondent reported:

"Metal prices have quadrupled over a six month period" (Interview, 2008d).

Import-parity pricing has been repeatedly mentioned as an impediment to growth and employment creation within downstream players in the metal and engineering industry (FRIDGE, 2003b: 3). Minor factors impacting the growth potential of firms include fuel price increases and BEE compliance according to 20% of respondents in both cases.

5.2.2 Methods of obtaining skilled labour

Firms interviewed make use of a combination of methods to obtain skilled labour. The most common method of obtaining technical skills according to 90% of respondents is in-house training which differs amongst firms in terms of content, design and time frames. This is not surprising as corporates in engineering have a key interest in the use of in-house training (Astro Tech, 2007: 1). This method is followed by the use of bursaries (70%); institutions of the education system (60%) and the skills development system and the relevant SETA(s) (60%). Less favoured methods of obtaining skilled labour included: labour broking; advertising; word of mouth; the use of foreign labour and poaching. In the skills development section below, most of the methods of obtaining skilled labour is discussed in more detail.

Methods of obtaining skilled labour would not change for 60% of firms in the future while 20% of firms not making use of the skills development system and the relevant SETA intended to do so in the future. Firms C and F also aimed to begin making use of universities and bursaries respectively.

5.2.3 Skills development sector case studies

This section provides insight into skills development processes at the ten sampled metal and engineering firms. In this analysis, the firms are placed within their sub-sectors, namely raw materials, intermediate products and final products (as in Table 9 shown in Chapter 4). Interesting details arose at the firms which contribute a great deal to skills development (Firms A, B, C, I and J) and these firms are discussed individually. The data on the remaining 50% of firms (Firms D, E, F, G, and H) regarding their involvement in enterprise level training and their orientation towards becoming actively engaged with skills development is discussed simultaneously under the relevant sub-sectors. Linkages in skills development have been made amongst firms in the same stage of the value-adding or beneficiation process as well as amongst firms in differing stages of beneficiation. This section ends off with a brief summary of the main findings.

5.2.3.1 Case studies of raw material processing firms' skills training orientation

An overview of the three large raw material processing firms skills training orientation is provided, starting off with an individual detailed discussion on Firm A, followed by Firm C and then Firm B.

5.2.3.1.1 Firm A investing heavily in skills development, education and training

The Vanderbijlpark steel mill, where research was conducted, recognizes how heavily its growth, ongoing sustainability and success depend on being able to attract, retain and develop talented people who can offer the skills critical to its operation.

The national and industry-wide skills shortage and in particular, the issue of poor performance in mathematics and science at the secondary school education level and the unpopularity of careers which require further studies in these technical subjects at the tertiary level, directly affect the performance and sustainability of the firm. This is due to the firm's core business profoundly relying on being able to access skilled people in the scientific, engineering and technological fields as well as artisans.

Apart from the successful application for a corporate permit to procure scarce technical skills from abroad in order to secure contracts and a recruitment drive which has involved approaching former employees for re-employment, the dominant producer of steel addresses the challenges outlined above through the vehicle of its Corporate Social Investment (CSI) programme and a number of other key training interventions that secure a continuous supply of critical skills in both the immediate and long-term future. These interventions include training through bursaries; apprenticeships; learnerships; skills programmes; conversion training initiatives; graduate development initiatives; leadership development programmes and external training programmes (discussed below).

As a Group, the SA subsidiary plays a leading role in Jipsa[50] and, similar to the large parastatal interviewed, has been recognized as a corporate leader in skills development and training. According to the firms' functional & generic training manager, an integral part of the firm's financial budget is the skills development budget. The total budget for training expenditure per annum amounts to approximately R60 million.

[50] Jipsa is a multi-stakeholder working group aimed at fast-tracking the provision of priority skills required to support Asgisa. Jipsa is not a delivery institution but a catalyst designed to make delivery institutions work more efficiently (Johnston, 2007: 14; 55).

(a) Skills development processes

(i) CSI programme

The firm justified making a corporate social investment in education (with specific emphasis on mathematics and science development) because it believed that improving the performance of these subject areas at schools in the communities[51] around the firm's locality would not only provide a vital and sustainable resource for the firm, but would also contribute towards alleviating the national skills crisis. Needless to say a skilled population will contribute to the economic success of the country. Lundall *et al*. (2008: 66) also identified that a number of milling firms used their social responsibility interventions to support the teaching of these competencies in disadvantaged schools within their geographical proximity.

- Science Centre

Firm A has over the past three years invested R22 million in establishing a Science Centre[52] which represents a close partnership with the DoE. The centre provides facilities for both learners and educators in the Vaal region to take mathematics, science and technology to new and desired levels in secondary education. Fundamentally, the centre provides secondary school learners from previously disadvantaged schools with DoE curriculum-linked mathematics and science instruction. The centres 'edutainers[53]' that have been contracted by the firm are of a high standard. To date, over 2 000 learners from 43 previously disadvantaged secondary schools have benefited from the centre's mathematics and science classes. There has been a tremendous improvement in the learners overall performance and enhanced interest in the sciences. The functional & generic training manager explained that every year will see a new batch of learners benefiting from the centres offerings. The return on investment is that the best candidates will be awarded with bursaries and recruited. Furthermore, the firm is aware that educator upskilling is essential in order to achieve true sustainability and far-reaching impact. As a result, the centre provides mathematics and science educators with training to improve their subject knowledge and teaching ability. To date, close to 100 educators have benefited from such training.

- Building of primary schools

Briefly, with regard to building a strong primary educational foundation in poorer communities, Firm A, in partnership with the DoE, is to build ten new public schools throughout the country over the next seven years, one new primary school is scheduled for completion by the end of 2009. The total value of this

[51] It is important to note that the firm recognizes that government alone cannot tackle the enormous backlog pertaining to the existing discrepancy between schools in poorer areas and those in more affluent suburbs.

[52] The Science Centre opened in July 2006 in the Sebokeng township, Vanderbijlpark.

[53] Terminology used by the firm which means staff that entertain while teaching.

education initiative is estimated at R250 million and the primary schools will be built using steel supplied by the firm.

Firm A now has a fully integrated education and skills development strategy in place, upon which future investments can be structured and learners at all levels can be positively impacted. The strategy initially begins with primary schooling, then at the secondary school level through the Science Centre, followed by bursary schemes for tertiary qualifications at universities and FET colleges. Finally, the firm offers all their employees continuous opportunities to upgrade their skills. The bursary schemes and upskilling of employees is discussed in more detail below.

(ii) Bursary schemes

The bursary schemes offered aim to supply the firm with high quality engineering graduates, artisans and other technical skills as well as allowing the firm to contribute towards the national skills building initiative.

- Engineering bursary scheme

Bursaries are granted for a four year BEng degree at a nominated SA university. Bursaries in the following engineering disciplines are awarded: mechanical; electrical; chemical; metallurgical; and industrial. Briefly providing an outline of the scheme, students are contracted on a year for year basis and contracts are renewable yearly, based on satisfactory academic performance. The firm's functional & generic training manager stated that the average cost annually per learner for this university bursary scheme amounts to approximately R62 000[54]. This sponsorship includes sponsored items such as tuition fees; residence fees; a cash allowance for miscellaneous expenses and a computer allowance which is provided in the second academic year of study. Those who receive bursary funding are obliged to work for the firm for the same number of years for which the bursary was obtained. The firm's bursary holders are enrolled at the following universities: University of Pretoria; Witwatersrand University; North-West University; University of Natal; University of Cape Town and University of Stellenbosch.

- Learner technician bursary scheme

Bursaries are granted for the formalised university of technology accredited 'Work Integrated Learning (WIL)' part (P1 and P2[55]) of the NDip to qualifying candidates who have successfully completed the theoretical part (S4) of the NDip. Bursaries in the following engineering disciplines are awarded: mechanical; electrical (heavy current); chemical; metallurgical; instrumentation and control and industrial. Students are contracted

[54] It is important to note that costs for all bursary schemes were based on 2008 data and are subject to annual increases.

[55] P1 is the first part of learner technician's practical training and P2 is the second part.

on a one year basis. The average annual cost per learner, amounts to approximately R29 000. This sponsorship includes institutional training costs; personal protective equipment; insurance etc. The WIL training programme has elements of coaching support and mentoring for learner technicians.

- Apprenticeship bursary scheme

Bursaries are also granted to complete an apprenticeship and are offered over a period of 80 weeks. Bursaries in the following trades are awarded: fitter and turner; fitter; turner; boilermaker; electrician; millwright; welder; instrument mechanician and refractory bricklayer. The average total cost (without claimable grants) annually per learner amounts to approximately R90 000. This includes the institutional and practical training costs.

- Production learnership bursary scheme

The objective of this bursary scheme is to upgrade or provide production workers with skills and knowledge in the production field based on recognized formal national qualifications in order to enhance the quality of the product, improve productivity of the plant and create flexibility amongst the workforce. Students are contracted with the MERSETA learnership agreement (academic and practical per NQF level). The average annual cost per internal and external learner amounts to approximately R12 000 and R31 000 respectively, inclusive of fundamental training costs for the internal learner and fundamental training costs; personal protective equipment; insurance etc. for the external learner.

It was reported that during 2008, a total of 143 bursars were studying engineering science through the engineering bursary scheme. The firm also funded 71 learner technicians; over 400 apprentices and 178 production learners, adding up to a training expenditure of over R54 million. An employment equity ratio favouring designated groups of 90:10 is aimed for (subject to availability). More than 75% of sponsored learners enter formal employment with the firm on successful completion of their studies.

(iii) Apprenticeships

The firm's administration support services manager within training, explained that the capacity of the firm's in-house technical training centre had increased by an additional 100 learners, bringing the total number of learners in the training pipeline to over 400. Earlier analysis had highlighted that this large employer used to train approximately 2 000 apprentices on an annual basis, much more than the current levels of output.

Although an intake of over 400 apprentices might sound like a high enough number, there are several factors which must be taken into consideration that might affect this total number negatively. According to

the functional & generic training manager, the losses of these numbers can be attributed to external factors, including: legislation; high industrial growth; special national projects; external companies targeting the firm's employees (especially trained artisans); job hopping due to attractive remuneration packages and career paths and, national and international skills shortages. Internal factors such as remuneration limitations affect the retention of skills. Therefore, it is clear that expanded training is essential to develop the pool of skills needed[56]. This in turn would be an invaluable investment into the future and wellbeing of the firm.

The training centre is accredited by the MERSETA to undertake apprenticeship training and aims to address not only the firm's own immediate need for artisans, but also the national skills development goals of Jipsa. The centre's focus lies in the training of: fitters and turners; fitters; turners; boilermakers; electricians; millwrights; welders; instrument mechanicians and refractory bricklayers. The training duration for the work-based routes to learning and gaining a trade qualification ranges from an 80 week accelerated apprenticeship programme to a 4 year traditional apprenticeship. 80% of apprenticeship training is done over the shorter period. The training centre is also undertaking Section 28 governed training for employees with vast experience who do not have formal certification.

As a visitor to the centre, a buzzing environment with learners engaged in the theoretical and practical aspects of their training was observed. The training centre is also MERSETA-accredited as a trade test centre for the certification of artisans. The steel mill in Vanderbijlpark, boasted a pass rate of 65% for artisan trade tests.

(iv) Learnerships

Firm A has been intensively involved in the establishment of learnerships within the Iron and Steel Manufacturing subfield in co-operation with the MERSETA. The development of skills within the firm is fully aligned with the national skills development standards in SA and as a result, full accreditation has been received which enables the firm to train and assess 18.1 (employed workers) and 18.2 (unemployed learners) in production learnerships. The fundamental (academic) programme content is presented by an external training provider. It is a unit standard based training programme for NQF levels 2 to 4 where-after each level, learners will have a national qualification. All assessments and moderations are undertaken by the firm's NQF assessors/moderators. The firm envisaged increasing the number of learnerships through the use of this programme.

[56] Technical training at Vanderbijlpark is limited to 680.

(v) Skills programmes

Employees within occupational ranks lower than the artisan level i.e. operators are provided with better career path prospects than previously. The firm's functional & generic training manager explained that high flyers are selected and put through a 'basic engineering skills programme' at NQF level 2 and external learners are recruited to fill the positions of the operators receiving training. The administration support services manager uses a different designation referred to as the 'operator maintainer programme' to describe this training and added that during plant shutdowns the firm has repair and maintenance artisans, however it needs people to do first line maintenance. Therefore, the programme is employed to upgrade operators not to be fully-fledged artisans but with the minimum requirements in order to perform some support actions within maintenance. According to Lundall's *et al*. (2008: 69) research findings, iron and steel milling firms had also instituted operator training and other skills programmes.

(vi) Conversion training initiatives

Existing employees are given the opportunity to further their skills through the following programmes facilitating the conversion of:

- Artisan to technician.
- Artisan to artisan[57].

The programme facilitating the conversion of an artisanship to an NDip in Engineering maps a six-year career path and an on-site training delivery by the Vaal University of Technology. At the time of the interview, there were 60 enrolments for artisans wishing to convert to technicians. The artisan to artisan conversion programme allows employees with dual trades to be remunerated accordingly.

(vii) Graduate development initiatives

Training through graduate development initiatives is also a key component of the firm's efforts to secure a continuous supply of critical skills.

- Candidate engineer programme

Besides the practical experiential training for learner technicians, the aim of this programme is to provide well trained engineers with experience (for professional registration) by effectively training qualified engineering bursars through a Structured Development Programme (SDP) to ensure that they are able to apply theoretical knowledge practically in the workplace. Candidate engineers are exposed to the SDP over

[57] Conversion from one trade to another.

24 months and the SDP consists of projects for each incumbent. Candidate engineers are mentored by qualified and experienced engineers and the formal structured Mentor Committee guide their development. Six monthly evaluations by the Mentor Committee are held per candidate engineer to ensure adherence to the programme. Salary adjustments are made according to a structured salary scale depending on satisfactory evaluation reports. It was reported that during 2006, the total number of candidate engineers for the following disciplines mechanical; electrical; metallurgical and chemical amounted to 36[58].

- Graduates-in-training for staff divisions

The aim of this internship programme is to create a pipeline of suitably trained graduates for the following staff divisions: sales & marketing; finance; procurement & logistics; internal assurance; human resources and information management. High talent graduates-in-training employed are also exposed to a SDP with functional mentors over 18 to 24 months and are given a thorough understanding of the firm's overall business processes by being exposed to different business departments. There are evaluations per semester against programme outcomes. Subsequent to this rotation through functional areas, each intern is recruited into their originally intended department. Information regarding the amount of graduates-in-training recruited during 2006 was not provided.

(viii) Leadership development programmes

The position requirement of incumbents in management, specialist, supervisory and clerical positions requires special skills. The gaps are assessed and individuals are developed to close these gaps. Within the firm's business departments a number of employees (unspecified) had embarked on leadership development education through various university programmes i.e. the Master of Business Administration (MBA) programme, the Management Advancement Programme (MAP) and various functional degrees, all funded by the firm. Approval of all applications took business requirements, the firm's talent management and succession planning programme into account. The application process is aimed at senior, middle and first line management levels. The firm's administration support services manager explained that the firm is committed to harnessing its full spectrum of skills. Therefore, all other bargaining unit employees have individual career development plans which guide competency declarations and enhance future career prospects (discussed below).

(ix) External training programmes

The firm aims to provide the necessary skills to its employees by utilizing external training providers in order to satisfy the needs of the various functional departments. A Training Needs Analysis (TNA) determines the

[58] The numbers include 1st and 2nd year candidate engineers.

required courses and is performed quarterly per functional division, excluding management development. Approval of external training is based on: inclusions in the quarterly TNA and motivation in the case of non inclusion in the TNA. The firm makes use of the System Application Programme (SAP) in which the position requirement profile, based on competency and linked to reward, is loaded against the position of every incumbent in the firm. The gap between the profile and the incumbent's current competence determines who needs to do which training. Employee performance is reviewed biannually and this advises annual remuneration adjustments.

Firm A's skills development philosophy is to continuously upskill employees in order to increasingly contribute towards business performance improvement and operational excellence.

5.2.3.1.2 Firm C's investment in people

The Germiston operation, where research was conducted, provides a skills development platform for the enhancement of productivity and revenue growth. Firm C which competes with Firm A in the long steel products market (DTI, 2005: 24), also sets out to attract, retain and develop the best employees.

The training manager interviewed underscored that the firm relies upon a strong contingent of skilled artisans and technically qualified employees and it seeks to source these skills locally, rather than from abroad. In fact, international skills have never been imported. The firm follows a policy of developing skills and capabilities from within and at all levels. Internal promotions along production career paths have resulted in many employees rising from the shop-floor to supervisory levels.

Firm C has made a commitment that its CSI programme should significantly contribute to the provision of livelihoods for the communities located near the operation. Employment prospects are highly sought after, especially because the firm offers bursaries; apprenticeships and learnerships leading to the certification of qualifications in terms of the SDA; practical training for learner technicians and managerial training (discussed below). As demonstrated through the research findings, both Firm A and C invest in corporate social initiatives and have similar key training interventions.

(a) Skills development processes

Training, education and development of Firm C are underpinned by the principles of the current skills development legislation in SA. Management interacts with trade unions active in the operation in order to consult on skills development plans and training activities for the year. Skills development is aligned to the firm's strategic business objectives which include product quality and productivity improvement.

(i) CSI programme

The training manager accentuated that there is a need to improve the current unacceptably low level of technical skills in local communities as the majority are forced to seek entry level unskilled work at a time when organizations require skilled labour. In light of this, significant sums of money are spent on a number of CSI initiatives and community development projects. These initiatives and projects focus on skills training and education aimed at enhancing the employment prospects of beneficiaries. This is discussed in more detail below.

- Community Training School

Firm C had initiated a similar venture to Firm A's Science Centre. During 2004, the firm based in Germiston established a Community Training School at its operation that offers courses in welding and computing skills. The community 'welding training school' offers young, unemployed members of the community an opportunity to obtain a basic qualification in welding. The welding course is registered with the MERSETA as a skills training course, and ensures that trainees reach specific levels of competency in welding. The course content has standards of learning which are recognized nationally and against which the trainee must be assessed for competency before certification commences. The welding school has the capacity to enroll up to 20 trainees at a time and does not charge any fees. The skills course takes place over a three month period, enabling the school to train up to 80 people per annum.

The training manager explained that disadvantaged students in communities in and around the firm's operation often have no access to a computer at home and there are few schools in the communities that offer any computer training. As a result, the 'computer skills training school' was established. Training is provided in the general suite of software packages used in commerce and industry. Trainees in the computer skills school undergo individual assessments before skills certificates are awarded. This course has recently been accredited by the training authorities of the Information Technology (IT) sector. The school can accommodate 16 trainees at a time. Training is conducted over a three month period which enables 64 trainees to qualify each year. The trainees will be equipped with a skill which will open up many employment opportunities, especially in an increasingly technologically geared world.

- Read Education Trust

Furthermore, in conjunction with education authorities, the firm provided funds to the Read Education Trust to facilitate a literacy programme at two schools in a large residential area adjoining the main works. Similar to Firm A's Science Centre upskilling mathematics and science educators, the primary focus of the literacy programme is to provide teaching staff with training in the principles of school management and teaching

methods, and to upgrade and enrich materials used in teaching English language skills. The training manager explained that there is a high correlation between English language skills and mathematical ability. Therefore, in supporting the Read Education Trust, indirectly the firm is also impacting positively on a learner's ability to succeed in technical fields such as engineering.

(ii) Bursary schemes

Two types of bursary schemes are offered for children of employees.

- School bursary scheme: children of employees

Various benefits are offered to employees, including a school bursary scheme in which children of employees with over five years of service qualify for a bursary. The bursary scheme assists one child per family in secondary school and covers part of the cost of school fees, books and school uniforms.

- Tertiary bursary scheme: children of employees

Bursaries are also offered to children of employees to further their tertiary education. These bursaries are aligned to the disciplines that can be used in the metal and engineering industries such as engineering.

(iii) Apprenticeships

Drawing on firm information obtained from the internet, it was found that while the metal and engineering industry of the SA economy has experienced a reduction of apprentices in training, the firm has maintained training efforts and has consistently increased the apprentice intake over the past few years. This represents a positive training outcome because it does not suggest reductions in training output. However, the training manager stated that the firm has experienced a significant apprentice training reduction from over 300 apprentices a number of years ago to nearly 80 apprentices today, an issue common to Firm A.

In spite of this pessimistic trend, the firm has a long-standing commitment to training skilled artisans for its operation, offering apprenticeships in a number of trades. Skills taught include production artisan skills of moulding and pattern-making, as well as maintenance disciplines of fitting, turning, electrical and millwright trades. To train an apprentice to qualify as an artisan takes up to four years of institutional (theoretical) training and practical on-the-job training. According to the interviewee, the accelerated apprenticeship route to becoming a qualified artisan did not suit the firm's business needs even though it was said to be an effective initiative. The ATRAMI route (designed as a form of recognition of prior learning that would convey experienced skilled operators into the artisan ranks) has recently been actively pursued. Annually, the firm trains 10 trainees through the use of this scheme. The firm envisaged increasing this number in the future.

In comparison to the largest Vanderbijlpark steel mill, Firm C's training centre is also MERSETA-accredited to undertake apprenticeship training and trade tests. The principal difference is that Firm C is only accredited as a trade test centre for the certification of pattern-making artisans. With the exception of pattern-making trainees, all other trainees undergo a national trade test at an external accredited trade test centre. Successful apprentices can go on to enjoy long and fruitful careers with the firm, but in spite of this skill retention is a concern.

According to the training manager, labour turnover due to resignations had increased from 5-6% in 2007 to 18-19% in 2008, mainly due to the high demand for skills in the economy. This assessment is confirmed by a milling firm in Lundall's *et al*. (2008: 82) study that also recorded a high labour turnover percentage per annum, mostly blamed on poaching by competitors. In order to retain skilled qualified artisans, Firm C offers competitive remuneration packages, which include subsidized membership of a medical aid scheme and membership of a retirement fund.

(iv) Learnerships

In addition to apprenticeship training, the firm has embarked on implementing learnerships which provide employees with structured learning and experience that will culminate in a qualification recognized by the NQF. On a NQF levels 2 to 4 learnership, training is done on core, elective and fundamental unit standards and a portfolio of evidence must be handed in for moderation after each level before the learner will be awarded a qualification. The firm had registered learnerships with the MERSETA in arc-furnace steel making skills as well as in chain making. Briefly, with regard to chain making, it is a specialized process and requires an extensive training programme for initiates over a period of 6 to 12 months. It was reported that trainees in these learnership areas were at various stages in training.

Trainees on both the apprenticeship and learnership training scheme were progressing well according to the training manager at the firms apprentice training centre.

(v) Practical training for learner technicians

Practical training for learner technicians in mechanical; electrical; chemical and metallurgical engineering is offered to young university of technology graduates who wish to build a career with the firm. The above evidence from Firm A indicated that bursaries are granted for learner technicians' practical training. However, it is unclear whether learner technicians receive bursary funding from Firm C.

(vi) Upskilling of managerial employees

Firm C has an internal talent management system, whereby employees (within the management structure of the firm) are assessed and high performers identified to take part in the larger Group Achiever Programme for further training and development. Medium to lower performers are trained and developed through incentive programmes. Managerial training is done through an external training provider. Furthermore, in compliance with Employment Equity legislation, the firm submits an annual report on the progress made in increasing the number of previously disadvantaged employees, particularly within supervisory and managerial levels. The firm reported to be making strides in this very important aspect through recruitment, internal training and development initiatives.

5.2.3.1.3 Workplace skills training at Firm B

The human resources manager at the second largest privately-owned steel mill in Vanderbijlpark stated that skills development was not a big concern as it is not the firm's core business. However, at the other two large raw material processing firms, skills upgrading initiatives were taken very seriously. Moreover, the data on Firm A discussed above indicated that the firm had developed a sophisticated system that aligns the skills requirements of the firm with the skills possessed by employees. At Firm B, there was no formal needs analysis process.

(a) Skills development processes

(i) Bursary schemes

Firm B offers two types of bursary schemes, an engineering bursary scheme and a bursary scheme for employees' children. The human resources manager provided valuable insight into the former scheme which is briefly discussed below. It can be seen that all three raw material processing firms interviewed offer bursaries, with a common engineering bursary endowment.

The engineering bursary scheme provides educational assistance to prospective candidates for engineering degrees at approved universities in SA for mechanical, electrical, metallurgical and industrial engineering. The firm had changed its policy for awarding engineering bursaries because of quality problems regarding students leaving the school system. The firm discontinued bursaries for first year engineering degree students. The firm's bursary allocation to university engineering students now commences only after students have successfully completed their first year of study (with at least an aggregate C symbol) and are entering the second year of an engineering degree. Relating to Firm A, this scheme also favours previously disadvantaged students and at the sole discretion of the firm, bursars who obtain their qualifications can be

recruited to work for the firm for the period that the bursar was sponsored. Should bursars choose not to meet this obligation, the bursar will be required to reimburse the firm for all monies spent on the tertiary studies, plus interest.

(ii) Apprenticeships and short courses

The human resources manager reported that the firm had a total number of 24 apprentices in training and was planning to increase this number to 30 apprentices in the future. With regard to forward planning, the firm also envisaged embarking on 18.2 production NQF levels 2 to 4 learnerships.

Apprenticeship training at the firm takes up to four years, inclusive of institutional training and practical on-the-job training. Interestingly, Firm A plays a crucial role in fulfilling Firm B's training needs by providing the institutional training component and trade testing. The research findings show that a traditional apprenticeship is a common route that is followed to become an artisan among all three firms in the raw material processing sub-sector. According to the manager, the firm is reluctant to adopt the short 80 week accelerated apprenticeship route (AATP). The above analysis on Firm C also showed that the accelerated route was seen as insufficient to meet the firms' demands. Furthermore, the same sentiment was echoed by a training provider interviewed.

The firm did not offer learnership training due to learnerships being extremely time consuming in terms of registration. Grawitzky (2006: 30) confirms this assessment and in addition conveyed that developing and implementing a learnership is also very time consuming.

Not all training is qualification driven and registered. The firm also holds regular short-course training.

(iii) Practical training for learner technicians

At the time of the interview, the firm had taken in 6 learner technicians from a university of technology in the region to undergo practical experiential training. This type of training is evident across all three raw material processing firms interviewed, irrespective of whether the firms fund this training or not.

(iv) Leadership development programme

Similar to Firm A, within Firm B's business departments, employees are able to embark on a leadership development MBA programme, funded by the firm.

5.2.3.2 Case studies of intermediate product producing firms' skills training orientation

Maree's *et al.* (2009: 106) study illustrated that the engineering or machine shops interviewed operated some form of in-house training. This finding is compared and contrasted with the skills training orientation of the three intermediate product producing firms researched for this study. They are discussed simultaneously below.

Firms D, E and F all considered experiential training i.e. practical on-the-job training to be of the utmost importance when recruiting individuals for technical occupations, as it provides an opportunity for candidates to become familiar with firms' core business and job requirements. Surprisingly though, out of the three firms in this beneficiation stage, only Firm D provided apprentices with the opportunity to acquire experiential training.

Once again the cathode cans manufacturing firm (Firm D) continued to demonstrate the most commitment to skills development and training amongst these firms. The firm has entered into an agreement with a training provider to sponsor the training of specific apprentices, these trainees then gain experiential training while providing services to the firm (host employer). The firm has the alternative of supporting these trainees through loans for the entire duration of their apprenticeship training, after which, the trainees can be employed by the firm and embark on repaying their loans. The remaining two firms displayed questionable commitment to skills development and training, with Firm E offering coaching and mentoring while Firm F's training was being impeded while waiting for training accreditation from MERSETA.

In terms of determining employees who required training as well as the type of training required, Firms E and F relied on informal methods such as observation while Firm D's accredited training provider performed this assessment. Firm D also had an open door policy regarding skills development and training where employees are able to approach management and request training in areas of development or interest.

All three firms relied heavily on their own in-house training initiatives and only Firm D combined these initiatives with the use of the skills development system and the relevant SETA. This was unlikely to change in the near future for Firms D and E while Firm F intended to begin making use of the skills development system and the relevant SETA. With regard to the types of training offered, Firm D offered boilermaking and welding apprenticeships/learnerships (NQF level 4) as well as less significant/inconsequential skills training such as CNC machine, crane, fork-lift operator training; fire-fighting; first aid and lastly, health and safety training. Firm D's training outlined above is largely facilitated by training providers and the skills development system and relevant SETA. The remaining two firms made use of basic, coaching type, on-the-job training

where an individual without specific educational and/or training requirements is trained under the supervision of experienced individuals. Similarly, a survey of metal and engineering firms in the East Rand region of Gauteng Province found most of the training to be generic or basic on-the-job type training (Moleke, 2005: 11). Only Firm D made use of training providers for core training requirements (three training providers) while all three firms made use of training providers for non-core training requirements such as health and safety training. All training providers used by the three firms were recognized and accredited.

Firm D disclosed that it also recruited or poached artisans from the larger firms that undertake artisan training attributable to its size and system constraints. However, Firms E and F were reluctant to provide information concerning poaching.

All three intermediate product producing firms considered the development of employees' skills to improve firm growth and competitive ability through improved quality of product and this could be indicated in profits as well as customer satisfaction.

5.2.3.3 Case studies of finished product producing firms' skills training orientation

An overview of the four finished product producing firms' skills training orientation is provided, starting off with a simultaneous discussion on Firms G and H, followed by individual detailed discussions on Firms I and J.

Both Firms G and H agreed that practical experiential training was a prerequisite preferred over theoretical knowledge when recruiting individuals for technical occupations. However, it is important to note that the manufacturer of boiler cleaning systems (Firm G) was also prepared to recruit promising individuals and then provide them with this type of training, informally. Both firms did not offer any formal experiential training for trainees.

Firm G reported its commitment to skills development to be serious as the firm was prepared to finance further training and development for employees. Firm H reported that more focus was gradually being applied to skills development and training as the associated budgets were increasing. Like the three intermediate product producing firms discussed above, Firm G identified employees requiring further training and the subsequent types of training required through observation by workshop managers/supervisors or the employees themselves approaching management.

Both firms relied exclusively on in-house training but Firm G had similar intentions as Firm F of making use of the skills development system and the relevant SETA in the near future. However, the firm did complain that it had made desperate attempts to locate training providers using this avenue, to no avail. Besides admitting to poaching skilled labour as a solution to skills needs, Firm G also makes use of its factory managers/supervisors to provide in-house training in the form of limited theory and more on-the-job practical training for machine and overhead crane operators. Firm H provided similar training on an ad hoc basis depending on the firms' changing skills requirements. Functional literacy and numeracy at Firm H is addressed via ABET programmes at levels 1 to 4, and during the year under review a number of learners successfully completed various levels. These learners now have access to improved career prospects in the firm. The firm makes use of accredited training providers in order to facilitate ABET training.

Only Firm G considered the development of employees' skills to improve firm growth and competitive ability through improved quality of product. Both firms did not experience substantial challenges in keeping their training abreast of technological developments as their business was very basic and did not undergo regular technological developments.

5.2.3.3.1 Fast-track training initiative by Firm I heavy engineering

In light of the continuing shortage of competent artisans in SA, Firm I has set out a plan of action to overcome this problem by fast-tracking skills development programmes to support its needs of accommodating the high workload demands being experienced.

A similar response to many other firms was uncovered in the heavy engineering firm. The human resources manager explained that by developing the skills of employees, there would be significant improvements in the growth and competitive ability of the firm. For example, the firm would be able to ensure the execution of orders that are on hand and those anticipated.

Previously, the firm imported skills from China. According to one of the training providers in education and training interviewed, cheap labour was one of the key drivers in the use of foreign Chinese labour. However, this proved to be a short-term solution for the firm which did not achieve the intended benefits and is one of the reasons why the firm developed the fast-track training programme for the welding and boilermaking disciplines. Another reason is that a definite need exists to significantly decrease the training period required in order to place selected trainees into productive employment.

The firm's technical training manager provided very important data on the fast-track training programme. This programme is an internal training programme aimed specifically at providing individuals with skills that satisfy the internal needs of the firm. The programme focuses on precise work needs, processes and methodologies, making it very specific. At the time of the interview, the firm had an intake of 28 fast-track candidates. The nine boilermakers that entered the fast-track training programme during the piloted initiation period in September 2007 (see Table 12 on page 63) were scheduled to complete their training in August 2008. Minimum requirements are set in terms of practical and physical ability and potential candidates for the programme from within the firm were assessed against these. The total course duration for this initiative is 50 weeks as opposed to the AATP initiative that runs for just over 80 weeks. According to the DTI (2005: 39), "a major problem with these independent initiatives is that they are neither formally recognised nor accredited by the SETA concerned". Although the programme is still in its infancy, it is anticipated that it will eventually be accredited by the MERSETA. This accreditation would enable the firm to source funding and have quality assurance. Through an analysis of the training offerings, the interview data showed that the firm was also training a number of apprentices via the four year traditional apprenticeship route accredited by the MERSETA.

The MERSETA requirements have been adapted to the actual work procedure requirements at the firm's training facility. Essentially, the firm has removed non-core function modules that are unnecessary for their working environment. Furthermore, the technical training manager explained that the very large equipment utilized is not in any training programme and that practical experiential training is much more extensive than the criteria stipulated in the module books.

The firm is planning to spend a significant amount of capital in order to upgrade a number of older machines to be fully computer numerically controlled and to purchase new equipment. Computerization of processes means that employee levels of skill will have to increase, thus training is required. During the course of the factory tour, a stark differentiation between light and heavy engineering was identified. Very large equipment is utilized by this heavy engineering firm in comparison to the other lighter engineering firms interviewed, for example its equipment includes large vertical and horizontal boring mills and extra heavy lathes etc. These production technologies have shaped the labour force skills that are necessary to operate such heavy engineering equipment. The technical training manager claimed that their artisans are in especially high demand due to the firm's own in-house training programmes being more extensive than the MERSETA requirements. The firm's strategy in retaining skills is to provide artisans with competitive salaries, an approach also adopted by Firm C.

In addition to providing an analysis and discussion of the fast-track training programme, after each section of work or module, assessments are carried out to identify areas where upgrading skills and intervention is required. This ensures competency before progressing to the next module. Competency assessment is similar to the conventional artisan training assessment system, as prescribed by the training board. However, on account of the nature of the products produced, the firm's boilermakers specialize in heavy fabrication (particularly cylindrical construction as well as the associated structural elements) so they are following a more specific/tailored training programme.

It is important to emphasize that the fast-track training programme is formalized, ensuring that specific skills are transferred and quality standards maintained. The programme trainers guide the trainees through the theory aspect of boilermaking and welding. Practical training forms an integral part of the process at the firm. Once the theory part of the programme has been completed, the trainees then work closely with mentors and undergo practical training (with preliminary practical training conducted within the training environment). Only once trainees are assessed and deemed competent, are they sent into the production environment for a period of time, where they partake only on a 'look and learn' basis. Once this prescribed part of training has been successfully completed, trainees can begin operating in a production environment after which they are assessed once again. This shows that standards are/can be maintained without all the formal qualifications of the NSDS/SDA.

An additional training initiative embarked on was to offer unskilled shop-floor workers the opportunity to enter a welder training programme. Through the selection process, twenty applicants were recruited for flux core welding training at the time of the interview. Of these trainees, fifteen proved to be competent in flux core welding and gouging, in all positions including horizontal and vertical. Five of these trainees were trained further in submerged arc welding.

The information generated from the interview has indicated another area of skills in short supply which is within the vertical and horizontal boring operations. Another specifically designed fast-track training programme has been developed to cater for the firms future needs in this area. One of the firm's top business priorities is investing in their most important asset, their human resources. Through the multi-skilling of all its employees and earnest commitment to on-going training programmes, Firm I invests in all its staff members from the lowest rank through to top management. The firm has an active mentoring programme aimed at ensuring real skills transfer and capacity building.

5.2.3.3.2 Firm J's training centre addressing the shortage of artisan skills

Firm J identified the need to train and provide a steady supply of skilled individuals into the market in the 1980s. During this period, Firm J's training centre was established to address both the national skills shortage and more specifically to serve the skilled manpower needs of the firm itself.

Approximately 25 000 workers have been trained in the centre during the past 25 years, previously through ATRAMI, short-courses and skills programmes. This has provided the unskilled, unemployed and previously disadvantaged with an opportunity to acquire marketable trade skills, thus fulfilling a social responsibility to the community. The firm was one of the first to break down the apartheid structure by de-racializing artisan labour at a time when 'job reservation' was in place as discussed in Chapter 2 (Creamer Media, 2008b: 1).

A respondent from the firm who is involved in the development of skills stated that currently in SA a lot of training is going on, although not nearly enough to meet the skills shortages both regionally and nationally. Furthermore, the respondent explained that over the years the skills shortages have changed from semi-skilled workers to qualified artisans. The firm has addressed this change by regularly upgrading and expanding their accreditation portfolio, and now has accreditation from Chemical Industries Education and Training Authority (CHIETA) and MERSETA.

The firm has derived a number of benefits from training, such as the entrepreneurial benefits to the individual, company and country as well as the cost savings which the company will make by not importing foreign labour. The firms' business development manager explained that:

"In the past few years, due to the shortage of skills and maybe lack of training, we have seen some of the capital projects importing foreign labour at HIGH costs . . . so in improving and training your labour force, you ensure that we have that competency in the country, we have a broader skills pool that we can draw from to undertake projects and thereby ensuring that we do not loose valuable forex as a country" (Interview, 2008o).

The training centre provides training for the DoL; the private sector and private individuals and is in touch with constant changing needs of industry, and adapts and trains people to meet those needs. When there are specific training needs in the industry, the firm is approached. A specific subject matter expert from the training centre is then assigned to conduct a proper needs analysis which will then advise course development, presentation and facilitation. The firm then performs follow-up evaluations and feedback to ensure that the original need has been addressed.

Skills development is taken very seriously. Annually, the firm invests up to R5 million in training. In comparison to Firm A, the training budget per annum is much less, however it is still a significant amount for training expenditure. According to the firm's general manager:

"Training is not seen as a profit opportunity, it is seen as an investment in people and the country as a whole and we will carry on doing this and addressing the skills gap in the country and industry" (Interview, 2008p).

(a) Skills development processes

A large part of training is in support of the firm's own projects on various sites. For a specific major project in 2004, the firm began preparation work two years before the starting date of the project and this involved conducting craft competency assessments; large-scale modifications to the facility and hiring additional trainers and training them up, in order to accommodate the larger numbers coming through the facility.

Training is provided by competent instructors using modern training techniques in order to respond to scientifically determined industrial needs. It was emphasized that:

"The team is passionate about the training and development of people. We are proud of the fact that the facility is staffed by highly qualified professionals who are constantly updating their knowledge and keeping abreast of new trends in industry" (Interview, 2008o).

When asked how the firm ensures that its training provision corresponds to changes in prevailing production technologies, it was understood that artisan training falls in line with national standards. The Standards Generating Bodies (SGBs) in conjunction with the firms subject matter experts in the field, look at existing standards and re-evaluate according to the latest standards (which would include for example machinery commonly used in industry and the latest welding technology etc.), which is then passed through the Generic, Manufacturing, Engineering and Technology (GMET) SGB before submission for final registration through SAQA.

A wide variety of training programmes are on offer and at different levels of competency. On completion of each training programme, individuals are issued with a certificate and competence report clearly stating the task he/she is capable of performing. The training centre's focus lies in the training of: boilermakers; electricians; welders; mechanical fitters and riggers (discussed below). Artisans are trained at the Secunda facility at NQF Levels 2 to 4 and this training comprises both an institutional as well as an in-service component i.e. theoretical and practical on-the job training, through the CHIETA and MERSETA. Other

courses that are also run at the facility are: fire-fighting; first aid; hydro-testing; safety training and supervisory training.

This training focus changes annually based on the demands of industry and the firm adjusts to these. Training at the centre is divided into the following categories: basic skills training; private training; artisan training; multi-skills training; trade test preparation; skills assessment and skills audits.

Simulations of work sites give the trainees a feel of what a real site situation is like and this provides the trainee with the opportunity to build confidence and skills ready for any eventuality and any conditions on-site. The firm prepares all trainees in their different trades for the workplace. Safety is an integral part of that training as the firm's objective is to achieve a zero-accident environment and to promote safe work behaviour.

(i) Learnerships and skills programmes

- Boilermaking department

In the boilermaking department, learner boilermakers are trained in the practical aspect of the trade, in accordance with industry requirements. On each NQF level, assessments are carried out to ensure competency before progressing to the next level. Similar to Firm C, a portfolio is compiled which contains evidence of competence in each unit standard for each level. On a learnership, the NQF levels (2 to 4) comprise of an institutional as well as an in-service component and the total number of weeks for all levels amount to approximately 88 weeks[59]. The in-service training levels are signed off in a log book at the host employer and are assessed once the candidate returns to the training institution. The learner qualification is sent off to the relevant SETA for national certification. From 1994-2007, 145 boilermakers received training at the firm's training centre, 120 of which were skills programmes through government sponsored grants.

- Electrical department

The electrical department trains the country's future electricians in three phases: high voltage generation; transmission, distribution and the safe usage of electricity. The firm's method of training involves the use of clusters of unit standards which are registered through SAQA as a national qualification. In order to attain NQF level 2, a candidate needs to complete both an institutional and an in-service training programme of 15 unit standards. NQF level 3 consists of 13 unit standards and NQF level 4 consists of a further 4 unit standards. Only upon the successful completion of NQF levels 2 to 4 can the candidate be classified as a

[59] Generally, the institutional training duration (inclusive of the assessment period) takes longer than the in-service training duration.

qualified artisan. Upon completion the candidate would have completed approximately 109 weeks of training. The ideal ratio for these courses is between 12 and 16 learners per trainer, with a strong emphasis on safety. At the firms training centre from 1994-2007, over 235 learners received electrical training.

- Welding department

The welding department, where practical training and assessment takes place, makes use of the latest equipment to train learners in the theoretical concepts and practical techniques in various processes such as shielded metal arc welding and gas tungsten arc welding, as well as in the more specialized processes such as air-arc gouging. On a learnership, the firm starts training at NQF level 2 and moves up to NQF level 4, which is the most advanced. All levels take approximately 105 weeks to complete. From 2004-2006, over 1600 welders were tested, trained and brushed-up for the major 2004 project mentioned above. Briefly, the brush-up initiative involved taking welders that are not quite there yet in terms of quality standards and coaching them in order to bring them up to the desired level, which could take between 3 weeks and 3 months. Surprisingly, for every 10 welders tested only 2 passed despite this trade not being complicated. Given that the welding trade test pass rates were remarkably low, one can assume that there is even lower pass rates in boilermaking, electrical, mechanical fitting and rigging. The investigation at Firm J uncovered a similar strategic approach as Firm A, in order to address this challenge. Firm J is currently looking at its corporate social investment budget to spend money on mathematics and science development at secondary schools.

- Mechanical fitting department

The mechanical fitting department trains SAs future fitters to work according to specification. With the use of engineering drawings, trainees are able to inspect, physically repair and finally, replace mechanical parts such as pumps, valves and gear boxes in any hazardous environments. The training of the mechanical fitters is divided into four parts: practical training done at an accredited training facility; in-service practical training done on-site with a host employer under the supervision of a qualified mechanical fitter; theoretical training at the training centre and lastly, theoretical training at a technical college. Once all the prescribed parts have been successfully completed, would the candidate have completed approximately 113 weeks of training. During petro-chemical plant shutdowns the firm also assesses all the mechanical fitting candidates who are employed to work on the plant. More than 800 mechanical fitters have been assessed, excluding the assessment of approximately 50 mechanical foremen and 20 mechanical supervisors every year. From 1994-2007, the firm trained 267 mechanical fitters in basic, intermediate and advanced levels.

- Rigging department

The practical aspect of rigging is done in the rigging department. The total training duration for NQF levels 2 to 4 (including both institutional and in-service duration) is approximately 111 weeks. The firm can accommodate 12 learners at a time.

(ii) Apprenticeships

Important details have been shared on the most recent training being undertaken at the firm. In addition to the above mentioned NQF levels 2 to 4 learnerships through CHIETA (which are still in process) and skills programmes, two groups of 60 learners were receiving training, under the MERSETA-funded Accelerated Artisan Training Programme (AATP) for the first time. This data gives a depiction of similar skills development characteristics as the other firms interviewed who contribute a great deal to skills development. The firm's business development manager explained that the AATP group size included 15 learners for each of the trades of boilermaking; welding; mechanical fitting and rigging.

This route to becoming a qualified artisan is the preferred route at the moment due to the shorter training period which addresses the current need. In fact, the above analysis shows that the majority of apprenticeship training is done over the shorter period by the raw material processing firm (Firm A) and the finished product producing firm (Firm J) embarked on a similar internal training venture that significantly decreases the training period.

Firm J's business development manager added that the total course duration for the AATP initiative is just over 80 weeks. The intensive AATP learning cycle comprises of 24 weeks institutional training and 54 weeks of practical experience on-site (in-service). Akin to Firm I's 'look and learn' basis, by attentive observation and practice in a safe environment, Firm J's apprentices acquire their practical training done on-site. According to the manager, apprentices cannot add value to the production activities because they are not yet qualified as artisans and of concern is that they are taking from work hours. The manager emphasized that one of the biggest challenges is getting people to commit to hosting students on-site.

Those who have been in the trade for the required period of time are assisted in order to obtain qualifications through Indlela (the old Olifantsfontein artisan assessment centre). The training centre tests trainees to ascertain their competence and the period of preparation time needed (trade test preparation usually takes 6 weeks at the training centre). The centre then prepares them for the final trade test by re-testing them in order to make sure they are ready. Finally, the training centre makes the necessary bookings for the final

test at Indlela. The centre's next objective is to accredit the centre as a regional trade test centre, similar to Firm A's MERSETA-accredited trade test centre for the certification of artisans.

Analogous to Firms A and C, Firm J's training centre is also undertaking what they refer to as 'skills gap training (Section 28)' funded by the Services SETA to obtain recognition of prior experience for craftspeople who do not have formal certification. A further similarity to Firm A is with regard to training targets and measurements. Every business unit has a skills matrix for each employee. A skills matrix is a table matching personnel, with desired skills to provide views of the need for additional training and development. It allows the firm to continuously identify skills gaps in resources that will need to be closed through training and development.

This global conglomerate is continuously subjected to poaching of skilled labour by the smaller downstream as well as larger upstream firms that invest less in training. These firms that adopt a 'poaching' approach offer more lucrative salaries as an enticement to qualified artisans that have got the necessary work experience. Furthermore, from the interview it appears that a percentage of trainees get poached before actually completing their skills training. The main category of trainees being lost before successful completion of the trade was NQF level 2 welders. The problem is that the firm looses a great deal of money, not forgetting the costs associated with hiring trainers and training them up. A further problem is obtaining funds from government for training another group of trainees, as the mechanism to obtaining funds is very difficult.

In future, the training centre is going to be integral to the firm's execution of projects; providing brush-up/refresher training to labourers that aren't quite there yet in terms of quality standards; providing supervisory training and safety initiatives; training of labour from unskilled labour to craftsmen and finally, the firm is going to assist the construction division with assessment and grading of labour.

(b) Project execution within the current labour constraints

The business development manager has recently undertaken an assignment to identify projected trainer and artisan requirements for a major expansion project. The respondent explained that the aim is to determine the total need of trainers and artisans in each trade (boilermaking; electrical; welding; mechanical fitting; pipe fitting and rigging) for this large-scale project.

The respondent has ascertained that a peak total (maximum labour required) of approximately 190 trainers are projected for this project and approximately 5 700 is the projected peak total artisan requirement.

However, the firm's present trainer compliment adds up to a total of only 10 trainers and the existing numbers of artisans are extremely far lower than the projected requirements. This indicates the 'gaps' in resources that will need to be trained and that apart from artisans, a shortage of trainers also exists.

These exceptional demand peaks will also need to be staffed with local labourers that need brush-up training for the project and imported foreign skilled craft labourers and trainers that can provide assistance in the training programmes. The insufficient local resources to deliver on investment requirements, has necessitated Firms A, I and J seeking international resources to compensate for the shortage.

Firm J's general manager had gone to the Philippines to observe their assessment and training facilities and assess various agencies that source Filipino workers. The manager met the head of the Philippine Overseas Employment Administration (POEA) which focuses on monitoring the employment of unskilled/skilled Filipino workers out of the country. It was stated by this informant that the export of skills is seen as the export of a product; by exporting globally competent human resources hard foreign currency is earned for their country and an opportunity for employment is created resulting in a strengthened economy and eventually poverty eradication. When looking abroad to countries that SA has a common denominator with, Philippines was identified as the most suitable country from which to import skills, owing largely to their English language competence. Hence, the integration with the workforce and also the transfer of skills is made easier because there is not a language barrier. Briefly, the general manager explained that the Philippine training system is much more deregulated in comparison to SA. There are no unit standards, however technical vocational education and training (TVET) graduates do undergo the process of assessment and certification to ensure that quality assured individuals are produced that will meet the demands of both the local and overseas labour market.

A forecast of approximately 1 500 foreign workers are going to be imported for the major expansion project (as was already required for the project in 2004), not only from the Philippines but also from Nigeria where the firm had previously trained welders in the Delta. According to the Labour Minister, Membathisi Mdladlana, SAs should invest heavily in the training of their own people in critical skills for the country's growing economy. The Minister highlighted that too much reliance on foreign skills poses a danger for the country's economy (DoL, 2007: 1). According to MERSETAs Chief Executive Officer (CEO), Dr Raymond Patel:

"There is clearly a need to bring in skills, just as we lose them. But let's be wary about who, how many and what we bring and assess carefully its long-term impact on our development" (Patel, 2008a).

The business development manager asserted that it is not believed that importing human resources is a long-term solution.

According to the respondent, no single training approach addresses the projected numbers of artisans required within the time constraints, a combination of the following programmes will need to be implemented without further delay, in order to increase significantly the number of artisans of all trades available during the planned project period:

- Artisan to technician.
- AATP.
- Learnerships.
- Assessment and grading of current personnel.
- Skills gap training (Section 28).
- Brush-up/refresher training.
- Skills programmes.
- Unit standard specific training.

5.2.3.4 A brief overview of skills development practices within firms surveyed

A brief overview is presented below using the fieldwork material to provide a picture of skills development within a sample of metal and engineering firms in Gauteng.

Despite the skills development legislation being based on voluntary firm level training, the majority of firms (60%) appear to be effectively making use of the skills development system by working with MERSETA and instituting its strategic objectives and targets. It is important to emphasize that firms are also providing and training the skills which they require outside the MERSETA framework. Another positive result is that out of the firms that do not make use of the system and SETA for this sector, two firms had intentions of negotiating this in the near future. However, MERSETAs (2005: 41) research found that the industry's general reaction to skills development and contribution towards increasing and improving the supply of skills has not been adequate mainly due to the industry being made up of SMMEs that do not have enough capital for training. The sample in this research may have been biased in that the majority of firms interviewed were large firms. It should be emphasized that the small sample size of ten firms is not statistically representative of firms in the industry.

The case studies confirm that nearly all of the large firms took skills development initiatives very seriously around a host of skills but principally artisan skills (using similar institutional vehicles to advance skills development, such as apprenticeships; learnerships and skills programmes) and operated in-house technical training centres out of which trained artisans and other skilled workers emerged. In particular, two firms located in different value adding metal and engineering activities, namely Firms A and J, have been pace-setters with regard to workplace-based artisan training. Furthermore, these two firms were effectively training to supply excess labour to a wider network of firms in the economy. Most large firms interviewed that had trained artisans in the past still maintain doing so, although on a reduced scale.

Skills development and skills upgrading were not a big concern at the intermediate product producing firms and some of the finished product producing firms, which mostly fall within the small and medium employee class size. Of major concern was the fact that most of these smaller firms chose to support the provision of inconsequential skills at the expense of urgently needed skills development. The argument is that firm size which has a strong association with capital intensities has a definite impact on the degree and capacity of firm level training. Firms D and G that could only manage to sustain very modest internal training depended on recruiting or poaching staff. The firms that have built up a reputation of providing good and effective training are normally the ones subjected to poaching, confirmed by secondary analytical literature.

Reactions from firms across the spectrum suggest that developing a skilled workforce contributes immeasurably to the success which the firm enjoys.

5.2.4 Manufacturing, Engineering and Related Services SETA (MERSETA)

5.2.4.1 Support for metal and engineering firms

All metal and engineering firms interviewed fell under MERSETA but only 60% of the firms actually made use of the SETA. This finding was supported by SEIFSAs skills development manager who also reported that a significant proportion of firms in the sector do not make use of the SETA. The manager added that the majority of firms which made use of the SETA were larger firms (which coincidentally, according to MERSETA, form the minority of firms in an industry dominated by SMMEs) as smaller firms are constrained in terms of resources available and the lack of capacity to focus on any other endeavours apart from their core business.

In terms of MERSETAs contribution to skills development and training taking place in the firms, firms commented that the SETA was effective in:

- The development of a production qualification (Firm B).
- The registration of contracts and the development of WSPs (Firm C).
- Assisting with the funding of AATP contracts (Firm J).
- Accreditation of training providers and facilities (Firms C and J).
- The provision of quality assurance services (Firm J).

The above listed points can be appropriately summarized in the words of a respondent:

"The SETA was efficient in the provision of information, advice and other forms of support regarding skills development and training" (Interview, 2008l).

5.2.4.2 Inefficiency and expectation management

Of the sampled metal and engineering firms, 30% were of the opinion that MERSETA was inefficient. Firms criticized the SETA for poor administration, specifically, Firm A experienced extreme difficulties with regard to the processing of learner application documentation[60] while Firm B believed the SETA lacked the necessary structures to efficiently support sector skills development and training initiatives. Lastly, Firm C complained that the SETA lacked general business competency. Similarly, literature has found MERSETA to be guilty of poor performance, poor administration, poor financial management and poor governance, etc. (Patel, 2008b: 5).

Several firms (40%) believed the SETA could improve its administration, general operation and processes. SEIFSAs skills development manager believed the SETA could improve its quality assurance role and that the SETA should appoint people with a technical background. Lundall *et al.* (2008: 86) contends that "SETAs are bureaucratic and are usually staffed by non-technical people who do not understand the needs of the industry".

The training provider interviewed also raised concerns of poor SETA administration with regard to claiming using the levy-grant system as well as poor communication. Although the large parastatal which belonged to CHIETA was satisfied with the skills development and training support it received, it believed that in general SETAs' communication with employers is poor and that SETAs should work harder on relationship building and stakeholder capacity building. SEIFSA raised a similar concern urging MERSETA to improve their communication with firms and the industry at large.

[60] The functional & generic training manager followed up with further information on this matter and reported that administration problems with MERSETA has been resolved.

With regard to the above mentioned claims of inefficiency, MERSETAs projects general manager emphasized that expectation management was critical when dealing with employers. This could be due to the large scope of responsibilities which employers assume to rest with the SETA as part of its primary mandate which is to grow skills the sector. This would not be surprising as similarly in a study by Daniels (2007: 11), employers thought that SETAs were not doing a good job, more importantly though it was not clear whether employers understood the SETAs role and responsibilities. Furthermore, research has also indicated that the performance of SETAs is impeded by a need to meet multiple expectations that stretch well beyond the narrow mandate of workplace training (Johnston, 2007: 10). According to the projects general manager, employer perceptions of the SETA performing inefficiently and failing to meet expectations rest to an extent in a lack of employer understanding regarding the SETAs roles and responsibilities, which have been reviewed in Chapter 2.

However, it is important to note that the SETA did acknowledge the allegations of inefficiency raised and believed that the solution would be resolved by strengthening their front line staff and relationship managers. A positive reaction has been the restructuring which the SETA is undergoing, with an emphasis on operating in a corporate style and the establishment of a client services division with client liaison officers at regional MERSETA offices. The creation of the client services division along with the already effective projects division has geared the SETA to be more customer focused and responsive to the needs of the industry.

5.2.4.3 Challenges facing MERSETA

MERSETAs present key focus is the task of accurately determining scarce skills which are critical to the industry and then to support training in those areas through interventions. One such intervention is the ongoing alignment of discretionary grant funding criteria to favour skills development in these scarce and critical skill areas. To date though, there has been no definitive method to determine these scarce skills, so until they can be determined MERSETA cannot irrationally exhaust energy and funds.

On a similar note the respondent from Firm F perceived the SETA to be in possession of large amounts of potential funding which was not being spent at the expected rate in order to address the skills shortages. The respondent conveyed a view that the SETA was sitting on or stalling access to and distribution of these funds. This is supported by Maree's (2006: 27) finding that SETAs were unable to spend their monies on training, as out of the R3.1 billion received from levies up to 2004, only R1.6 billion, or 52%, had been paid out in grants.

As already stated above, the projects general manager responded that the primary reason for this was the fact that the scarce and critical skills of the sector had not been definitively determined, furthermore funds which had already been ring-fenced were allocated for specific projects linked to e.g. Jipsa. This concern raised, is further compounded by the slow uptake of discretionary grants, possibly due to the new way in which they are allocated. Lastly, MERSETA commented that the industry lacked the capacity for the uptake of large amounts of funding as there are too few training providers, assessors etc.

5.2.4.4 Skills shortages, training and SMME support by MERSETA

Not having definitively determined the skills shortages critical to the industry, MERSETAs experience and research has revealed the following as primary reasons for skills shortages within the industry.

Firstly, it blames the relationship or lack thereof between educational institutions, industry and the economy which has resulted in education and training institutions not enrolling students for qualifications according to industry and national demand for the skills contained in qualifications. Secondly, technical firms prefer to employ HE graduates with a minimum pass average of 60% but HE institutions continue to pass students with lower averages, which inevitably sets them up for unemployment. Both these issues illustrate the lack of responsiveness of educational and training institutions to industry needs. Thirdly, there has been an erosion of capacity for producing artisans and apprentices since the late 1980s due to various reasons including large parastatals stopping to train above their own requirements, which has already been unearthed in this study. Lastly, according to the projects general manager, SETAs and the new skills dispensation in the industry as a whole has resulted in firms placing all or most of their skills development and training responsibilities and provision exclusively on MERSETA and not themselves anymore. It is also crucial to bear in mind that the new skills dispensation has taken a long time to implement and compared to conventional skills development and training dispensations, is still young, in its current establishment phase.

In order to improve skills development and training within the industry, Firms H and I believed that MERSETA should set up a large training centre with high quality staff which would be run and funded by the government. Firm H believes this would be effective as grants are often awarded to firms whose core business is not training therefore training inevitably suffers as it is not the top priority. Similarly, Lundall *et al.* (2008: 95) recommends that MERSETA should establish and fund Regional Training Centres that it can operate on its own or in a joint venture with specific employers or an employers association such as SEIFSAs FUNDI Training Centre and Solidarity's SOL-TECH training initiative.

In the training environment a number of discrepancies exist between the components for specific learnerships. This is counter-productive and self-defeating (Patel, 2008b: 5). For example, the large parastatal raised the need for a standard national qualification for learnerships as different unit standards are used for boilermaker learnerships by MERSETA and CHIETA which means that a boilermaker would have to be retrained when switching between these two sectors.

MERSETA is proud of their development and introduction of the AATP which has reduced the amount of time taken to qualify as an artisan from 4 years to approximately 80 weeks. According to MERSETA, learnerships are to be packaged in level clusters in the same way in which apprenticeships were accelerated, this will be tested through AATP. In terms of adoption for training, apprenticeships are favoured compared to learnerships but the DoL is looking to equalize both as routes to becoming an artisan.

According to Firm A, MERSETA needs to increase involvement and support for small to medium-sized enterprises (which according to MERSETA represent 85% of firms contributing levies) as these are the firms struggling with skills development and training. MERSETA acknowledged the need to provide additional support to SMMEs as skills development and training products (learnerships and apprenticeships) were not feasible, as SMMEs are unable to release employees for long periods of training and they also cannot afford to take on too many unemployed people for training. Therefore, the SETA realized the need for tailor made solutions such as MERSETAs 3 to 5 day specific training using the 'voucher system'. The system is a web-based platform loaded with a range of short courses bearing credits with SAQA unit standards, all that employees/employers have to do is log on and select their course of choice as each SME has course/voucher allocations. There is a 2 to 3 day turn-around time between application and approval and the voucher which can be submitted at accredited training providers is valid for a period of 3 months. Additional SMME support includes the provision of:

- Dedicated Skills Development Facilitator (SDF) support to continue skills training beyond business registration.
- Subsidized training support.
- Business advisory support from the Small Enterprise Development Agency (SEDA) - a DTI initiative.
- Promotion of market access initiatives.
- Promotion of access to business expansion funding opportunities.

5.2.5 Levy-grant system

5.2.5.1 Workplace Skills Plans (WSPs)

Impressively, 80% of the firms interviewed had an active WSP in place, half of these firms were not certain what the WSP entailed as this aspect of skills development and training had been dealt with by a consultant while the other half considered the WSP to entail the provision of the following main requirements (confirmed in Chapter 2) to the SETA:

- Total payroll for a specific period which would be used to determine the 1% training levy to be paid and to ensure the claiming back of the grant.
- Identification of the firm's existing and future training needs.
- Reporting on completed and future training in terms of: the number of individuals trained; types of training; training timelines as well as resources etc.
- Reporting on the alignment of training initiatives to MERSETA guidelines.
- Reporting on the progress of training initiatives undertaken.

The adoption of WSPs differed amongst the firms as half of the sample was not sure of how long active WSPs had been in place, these were followed by a third of the firms having introduced these 8 years ago when MERSETA was established. Lastly, Firm H had been developing WSPs for 5 years.

5.2.5.2 The use of the levy-grant system

It was discovered that all the firms in the sample had a wage bill equal to or in excess of R500 000 and were paying 1% of this bill towards the skills levy. This pattern seems to be evident at SETA level too where MERSETA has been determined as the largest SETA in terms of levies collected, having received in the region of R457.7 million from 24 946 levy-paying companies in 2005 (Grawitzky, 2007: 18). With regard to the total percentage of grants claimed (Table 13), differing categories were discovered and these are tabled below.

Table 13: The percentage of skills grants (mandatory and discretionary) successfully claimed back by firms

Percentage of funds successfully claimed	Percentage of firms
Funds ≤ 50%	30%
70% ≥ Funds ≥ 50%	40%
Unknown	30%

It is a concern that 30% of the firms (largely SMMEs) were unable to disclose any information regarding the claiming of grants, this could provide further support for Maree's (2006: 26) finding that only 10% of the levy-paying small firms were claiming grants at the end of March 2004.

5.2.5.3 Developments in the levy-grant system

SEIFSAs skills development manager reported that on 1 April 2008 new discretionary grant criteria were introduced by MERSETA. The allocation of discretionary grants is now based on areas identified in the MERSETA SSP and the different sub-sectoral plans identified by the MERSETA chamber committees. Every firm registered with the SETA will now be evaluated against the following criteria (SEIFSA, 2008: 11):

1. The firm must be up to date with all levy payments unless legally exempted.
2. The firm must have submitted and received mandatory grants for the past 3 years unless legally exempted.
3. The firm must have an average pass rate of 70% for all training programmes implemented.
4. A fully functional training committee must be in place if the firm has more than 50 employees.
5. At least 50% of learners must progress to the next level of training or be permanently employed.

The firms will then be divided into three categories in order to determine the access to discretionary grant claiming from the SETA, these categories are briefly outlined below (SEIFSA, 2008: 11):

Category 1: If the firm complies with all five of the above listed criteria, a memorandum of understanding (MOU) will be entered into by the firm and MERSETA in order for the grants to be paid out.

Category 2: If the firm complies with 1 to 4 of the above listed criteria, different funding windows for different scarce and critical skills as well as NSDS indicators will be announced at least once a quarter.

Category 3: Firms which have never implemented any MERSETA programme or taken part in any MERSETA initiative will take part in advocacy campaigns where the SETA will assist these organizations to become quality providers of training in order to become eligible to claim discretionary grants.

5.2.5.4 Experiences and sentiments regarding the levy-grant system

Firms had varying experiences claiming grants in terms of the regulations and procedures governing this process, a third of the firms considered the process to be problematic largely due to difficulties in claiming discretionary grants. A third of the firms considered the process to be straightforward and successful while

the remaining third had delegated this part of skills development and training to consultants and as a result had no difficulties or concerns regarding this area.

It was alarming to discover that only Firm F viewed the levy-grant system positively while 70% considered the system to be an additional tax burden that withheld funding which should be redeployed to facilitate skills development and training. Similarly, two thirds of the sample did not perceive any benefit in the introduced tax concessions but only 20% of these provided the lack of learnership agreements as a reason.

According to Rasool (2008: 1), claiming grants using the levy-grant system is still viewed as excessively time-consuming, costly and burdensome. Furthermore, the system is criticized for fiscal leakage by round-tripping monies in a long-winded manner from levy-paying firms to the SARS, DoL, SETAs and then finally back into firms with non-training costs at each point in the activity chain.

Encouragingly, half of the interviewed firms considered grant claiming and tax concessions as drivers encouraging firms to embrace skills development, while the other half provided the following reasons for their differing sentiments regarding this issue:

- 10% felt forced to take part in skills development and training.
- 10% had already been embracing skills development and training prior to the introduction of grant claiming and tax concessions.
- 10% had mixed perceptions on this matter.

These pessimistic approaches and sentiments towards the use of the levy-grant system to embrace skills development and training are shared according to the DoL (2003: 2) by many SA employers who see the new skills development levy as a cost only. This is best communicated in the words of a respondent:

"It's a tax burden, I'll pay it and then leave me alone" (Interview, 2008e).

Lastly, according to the National Advisory Council on Innovation (NACI) (2003: 13), the skills levy is intended to support increased training, but at 1% currently, it is not sufficient to solve the current shortage in the supply of skills as international trends show that companies need to spend between 4% and 7% in order to be successful in addressing the current skills shortages and gaps.

5.2.6 Inter-firm, industrial, regional and international collaboration around skills development activities

According to MERSETAs CEO, the need to ensure collective and effective collaboration seems to be the most significant element in the skills development conundrum (Patel, 2008a). Based on information obtained from the presentation to the Skills Development Conference by Falkov (2008), effective business-led partnership models for scaling up apprenticeship/technical training are evolving.

The following section examines training collaborations at inter-firm, industrial, regional and international levels amongst the sampled firms which belonged to a larger and/or international holding company. Of the sampled firms, half belonged to a larger and/or international holding company and 80% of these were involved in one or more of the above-mentioned collaborations. No intermediate product producing firms were involved in skills development and training collaborations. Firms under a larger holding company made use of different forums to collaborate and exchange valuable information regarding skills development activities.

The different types and methods of inter-firm, industrial, regional training collaborations are numerous. Firm A is part of a joint initiative, along with SEIFSA and other technically oriented leading firms, called the Technical Skills Business Partnership (TSBP). This initiative aims at providing training to meet members' requirements and more importantly to train above these requirements, in order to address the current technical skills shortages and to prevent their re-occurrence in future. With regard to its national operations, Firm A also facilitates knowledge sharing through Knowledge Management Programmes (KMPs) which provide a platform for decisions to be taken on which types of training the Group should undertake as well as to exchange valuable training information. Furthermore, Firm A actively participates in the following: industry-based policy making as well as network forums with government structures in the labour field; various national and regional MERSETA structures as an employer representative; various industry and government forums advising and influencing the national science and engineering educational agenda. Lastly, the firm is a partner of the National Business Initiative (NBI) with its core focus being on skills, education and enterprise development.

According to Firm J, firms working together on specific projects share training information in forums on the number of trainees and best practices. Furthermore, this firm reported on the sharing of training material while the large parastatal has also noticed that training providers share training information and assessment documentation. Firm J is part of a collaboration of major iron and steel players called the Iron and Steel Training Federation which developed the Iron and Steel Learnership. Firms J and A subject matter experts

are also involved in unit standards generation and qualification design processes, thus ensuring that business needs are catered for. Lastly, according to one of the training providers, training providers and firms have been collaborating to secure host firms for trainees to complete the practical components of their training.

Regarding international collaborations, Firm A's KMP is not only limited to SA but also takes place internationally including other operations from all over the world. The firm holds regular KMP workshops at locations in nine countries. This international version of knowledge sharing involves the implementation of lessons learnt from international KMPs and other forums such as the IISI (International Iron and Steel Institute) and SAISI (South African Iron and Steel Institute) meetings. As a result of this programme the firms' SA Technical Training Centre was recognized as the best in the world and is now playing a crucial role in upgrading other international training centres.

Firm J makes use of US skills development interventions such as Wheel of Learning and internet applications such as Knowledge Online. Lastly, the large parastatal does all of its training in SA and then sends the trained individuals back to their place of origin example China, Dubai etc. to work on projects/operations.

Overall, inter-firm, industrial, regional and international collaboration allows firms to successfully facilitate the transfer of new technologies to and from other firms, to draw on technical support and to build skills bases. These research findings clearly indicate that participation in and the extent of collaboration differs greatly amongst the collaborating firms. According to Lundall *et al.* (2008: 95), employer associations should be encouraged to convince their membership (firms) that there are long-term economic and growth benefits from deepening inter-firm level collaboration, particularly in the area of skills development.

5.3 CONCLUSION

5.3.1 Firms and skills development

The findings indicate that interviews were conducted with ideal candidates in terms of the positions they occupied as well as the amount of experience gained. Similarly, the sampled firms were well established in terms of years of operation. Firms from Gauteng Province were included in the sample as, geographically, most metal and engineering firms in SA are situated in this province. Firms were sized according to their employee complements which ranged between 21-200+ employees. Occupational classifications among the firms in the sample were concentrated on artisans, shop-floor operators and machine operators. Three

categories of firms in terms of structure and core operations were included, namely, raw material processing firms; intermediate product producing firms and lastly, finished product producing firms. The sample was dominated by firms not participating in export trade.

This research yielded similar acknowledged scarce skills by the firms as the skills required in the metal and engineering industry detailed in a study conducted by MERSETA. Although the sample of firms was not representative of the entire population, this consistency in findings with the more extensive study is assuring in terms of the accuracy of information obtained from the research process. The only different acknowledged skill in short supply experienced by the firms but not listed in the study was riggers, this could indicate that this skills' shortage is especially critical to the finished product producing firms and not the entire metal and engineering industry. Respondents interviewed indicated on average that these shortages have existed for a period of five years this contrasts SEIFSA data which tracks the beginning to dramatic declines in apprenticeships in 1982. This discrepancy in findings could be explained by the fact that recently the problem has been exacerbated and the lowest apprentice intake levels recorded. The data also shows that apprentice intake has increased from 2004 to the present time but this growth will need to be maintained for a number of years in order to have a positive impact on skills shortages within the metal and engineering industry.

The respondents interviewed provided the following as principal reasons for the scarcity of skills:

- Dramatic decline in artisan training by parastatals and large private conglomerates.
- Social stigma attached to artisanal occupations.
- The lack of or inappropriate career guidance in secondary schooling.
- The educational system in SA.
  - The poor quality of public school education.
  - The poor quality of public FET colleges.
  - Supply problems regarding HE institutions.
- Outflow of SA skilled labour to other countries.
- An aged artisan workforce.
- Shortage of technical instructors, mentors and assessors.

Firms reported that skills shortages led to project losses, high staff turnovers and compromised product quality which all directly limit expansion. Furthermore, sourcing scarce skills limits the availability of funds to

facilitate expansion. With regard to exogenous factors impacting on the growth potential of firms, firms listed SA electricity shortages and import-parity pricing as the most considerable barriers to growth.

Differing skills development trends were observed throughout the sample of firms. Raw material processing firms are characterized by extensive skills development both in terms of volumes of training done as well as the number of differing skills development initiatives employed. The dominant methods of obtaining skilled labour for raw material processing firms include the following:

- CSI programmes.
- Various bursary schemes.
- Apprenticeships.
- Learnerships.
- Leadership/management development programmes.
- Various forms of practical experiential training.

Firms within this beneficiation stage make use of both skills development/SETA and in-house skills development initiatives. Firms within this beneficiation stage have the most skills development initiatives of the entire sample indicating that these firms take skills development seriously. These firms also happen to be the most successful, financially which could be one of the reasons why they are able to invest heavily in skills development. Firm A is the clear leader within this stage.

Intermediate product producing firms provide less skills development initiatives both in terms of volumes trained as well as types of training initiatives. These firms prefer making use of observation to identify training needs and then use coaching and mentoring to address these needs. The sample is dominated by a preference for in-house initiatives for core skills development while relying exclusively on training providers for non-core training. Firm D is the clear leader within this stage but it is important to note that this firm had no similarities with any of the above mentioned preferred training methods for firms within this class.

Final product producing firms offered more training initiatives than the previous stage and prefer coaching and mentoring; importing skills from abroad and apprenticeships. This stage of firms is also dominated by in-house methods of training. Firms I and J are the clear leaders in this stage but overall this group is similar to intermediate product producing firms.

Overall, the sample is dominated by in-house skills development initiatives, on-the-job training (coaching and mentoring) and lastly, apprenticeships. Firms A and J are the overall sample leaders.

5.3.2 Industry led skills development

It is important to consider skills development from an industry perspective which is dominated by MERSETA. MERSETAs biggest challenge is determining a definitive list of critical skills shortages within the industry which has rendered the SETA unable to channel funding for support in these areas. As expected only large firms (raw material processing firms) reported receiving observable support from MERSETA. This was a surprising finding as the SETA reported extensive support available to SMMEs as they constitute the majority of the industry. However, it is not clear if firms are making use of this support and whether or not it is effective.

The interviews revealed dissatisfaction regarding MERSETA which responded to claims/reports of inefficiency and poor administration by altering their corporate structure and governance in order to perform optimally. The SETA then proceeded to cite a lack of understanding and the need for expectation management from employers. Furthermore, the SETA unveiled new discretionary criteria which are based on areas identified in the MERSETA SSP and the different sub-sectoral plans identified by the MERSETA chamber committees. These claims/reports should be viewed with caution as two thirds of the sample had no problems making use of the levy-grant system.

Research from the firms and literature both indicate a requirement for MERSETA to establish and operate training institutions.

All firms except intermediate product producing firms participated in some form of collaboration within the following categories: inter-firm, industrial, regional and international. This indicates that firms recognize the potential economic and growth benefits which collaborations can facilitate.

5.3.3 Demand and supply of skills

This section commences by analyzing research findings regarding the demand and supply of skills within the sampled metal and engineering firms. This has been carried out in order to establish whether the skills shortage confirmed in the literature review is also evident in the sampled firms. It is important to note that this conclusion will be primarily drawn from quantitative data and supported by qualitative data where required. Finally, after comparing these two sections a result will be presented to either confirm or oppose a shortage of skills within the sampled metal and engineering firms.

In terms of the demand for skills, all of the firms included in the sample reported shortages of skills in terms of quantity and differing types of skills (specialization). Furthermore, respondents revealed that firms which previously produced skills above their own requirements (i.e. for the market) had begun closing down their training centre facilities, or had profoundly downsized.

Respondents also complained that supply was being impeded by a lack of technical career marketing to the youth (by government) as well as poor career guidance for Grade 11 and 12 learners in terms of the minimum requirements necessary to enter technical fields of higher education and training. Concerns were also raised regarding the limited pool of quality of mathematics and science learners being produced by the public school education system.

Additional areas of concern raised include, an ageing artisan workforce scheduled to exit the workforce soon; a lack of instructors which prevents training institutions from maintaining and increasing their training capacity; FET colleges were also reported to be supplying poor quality graduates. Similar to the literature reviewed, respondents confirmed the following:

- FET graduates struggle to gain access to employment.
- Technical skills are flowing out of the country into international markets.

Lastly, and on a more encouraging note, Firm A had invested in a Science Centre which had achieved substantial numbers of suitable candidates to enter technical HE programmes. Such initiatives would only boost sector wide supply of technical skills if many more firms had similar initiatives, which unfortunately, is not the case.

The research findings overwhelmingly indicate that demand far surpasses declining supply both in the long-term and short-term (marginal increases in supply were experienced recently). Furthermore, the respondents highlighted several issues impeding the increase of technical skills supply, therefore skills shortages were also revealed through the interviews conducted. The demand for skills is large while supply is marginal and far from seamless.

Finally, the next chapter draws together the conclusion of the thesis.

CHAPTER 6
CONCLUSION

6.1 CONCLUSION

6.1.1 Characteristics of the South African metal and engineering industry

Currently the metal and engineering industry is sustained by strong exporting in the automobile industry and state infrastructure expansion. The industry, dominated by Small, Medium and Micro Enterprises (SMMEs) is predominantly located in Gauteng which also happens to be the area where most value-added production occurs. Import-parity pricing and skills shortages were reported as the most considerable barriers to growth within this industry, this conclusion seeks to address the latter.

Three stages of metals beneficiation were considered in this study: raw material processing firms; intermediate product producing firms and finished product producing firms. These revealed that employment opportunities varied from low in the raw material processing firms to high in the intermediate and final product producing firms. The raw material processing and intermediate product producing firms are also capital intensive while the downstream producers employ most of the unskilled and semi-skilled labour.

Upstream producers of the beneficiation value chain have a high export orientation while the downstream producers supply the domestic market. The biggest concerns with the industry are the low levels of beneficiation which result in limited job creation as well as excessive exporting which takes place immediately after the raw material processing stage where low beneficiation occurs.

Skills shortages at artisan, technical, engineering and management levels were confirmed with artisans being the most critical skills shortage in the industry, these shortages are largely due to previous leaders in training having downsized their training operations. Furthermore, the industry's reaction to increasing and improving the supply of skills has not been adequate mainly due to the industry being made up of SMMEs that do not have sufficient resources to support training.

6.1.2 Skills development within the sampled firms

Firms and interviewees consulted were well established, in a sample dominated by firms not participating in export trade. It is however important to note that the firms which did export are the larger raw material processing firms whose trade performance is dominated by export trade. The majority of raw material processing firms were foreign-owned, while intermediate product producing firms were made up of

independent SA firms that have become entrenched in specific niche areas. Lastly, finished product producing firms were both locally and foreign owned.

With artisanal skills shortages being the most critical in the industry, it was crucial to assess the use of the three predominant labour market pathways to intermediate skilling, namely: the traditional apprenticeship route; Accelerated Artisan Training Programme (AATP) and lastly, Artisan Training and Recognition Agreement for the Metal Industry (ATRAMI). AATP was preferred in this sample due to the shorter training period which addresses the current need. It is important however to note that AATP is a short-term solution and that more is required in order to improve the quality and output of artisans.

Looking at skills acquisition in the sample more holistically, the dominant methods of obtaining skilled labour for raw material processing firms included:

- Corporate Social Investment (CSI) programmes.
- Various bursary schemes.
- Apprenticeships.
- Learnerships.
- Leadership/management development programmes.
- Various forms of practical experiential training.

Firms within this beneficiation stage make use of both the skills development system/Sector Education and Training Authority (SETA) and in-house skills development initiatives. Firms within this beneficiation stage dominate the sample in terms of skills development initiatives, indicating that these firms participate in skills development seriously. Interestingly these firms also happen to be the most financially astute which might be correlated to their heavy investments into skills development.

Intermediate product producing firms made use of observation to identify training needs and then addressed these through coaching and mentoring. These firms are dominated by a preference for in-house initiatives for core skills development while relying exclusively on training providers for non-core training.

Final product producing firms offered more training initiatives than intermediate product producing firms and prefer: coaching and mentoring; importing skills from abroad and apprenticeships. This stage of firms is also dominated by a preference for in-house methods of training.

The methods of obtaining skills employed in the individual stages confirm the literature reviewed. Overall, the sample is dominated by the following skills development initiatives:

- On-the-job training (coaching and mentoring).
- Apprenticeships.

Firms used a diversity of approaches to mitigate supply problems within the education system, these include more stringent aptitude measures, higher entry requirements and the use of CSI programmes to boost mathematics and science in potential candidates. Firms A and J are the clear sample leaders across all training initiatives but most importantly the findings indicate that larger firms train most intensively at artisan level. Reactions from firms across the spectrum though, suggest that developing a skilled workforce contributes immeasurably to the success which the firm enjoys.

Regarding skills shortages within the sample, respondents interviewed provided the following perceptions as the principal reasons for the scarcity of skills:

- Dramatic decline in artisan training by parastatals and large private conglomerates.
- Social stigma attached to artisanal occupations.
- The lack of or inappropriate career guidance in secondary schooling.
- The educational system in SA.
  - The poor quality of public school education.
  - The poor quality of public Further Education and Training (FET) colleges.
  - Supply problems regarding higher education (HE) institutions.
- Outflow of SA skilled labour to other countries.
- An aged artisan workforce.
- Shortage of technical instructors, mentors and assessors.

6.1.3 Skills development from an industry perspective

The perceived principal reasons for the scarcity of skills are largely focused on industry body and government led skills development initiatives which are considered in this section. A new skills dispensation has been introduced in the SA skills development arena in order to improve skills development within the country, however weaknesses of this new dispensation specific to the firms and the metal and engineering industry include:

- Difficulties making use of the levy-grant system.
- Limitations of the SETAs to spend funds on skills development in their own capacity.
- Poor administration in SETAs.
- Poor linkages between business, SETAs and education and training establishments.

As the dominant industry body related to skills development it is important to include the Manufacturing, Engineering and Related Services Sector Education and Training Authority's (MERSETAs) perspective in this conclusion. MERSETA has responded to claims/reports of inefficiency and poor administration by altering their corporate structure and governance and also citing a lack of understanding and expectation management from employers. The SETA is faced with the primary challenge of determining a definitive list of critical skills shortages within the industry in order to be able to channel funding to support training in these areas. Research from both the firms and literature indicate a requirement for MERSETA to establish and operate training institutions.

It is encouraging to find out that two thirds of the sample had no difficulties making use of the levy-grant system. Lastly, the SETA has unveiled new discretionary criteria which are meant to align support to areas identified in the MERSETA Sector Skills Plan (SSP) and the different sub-sectoral plans identified by the MERSETA chamber committees. The performance or impacts of which have not been investigated due to their recent introduction.

Positively all firms except intermediate producing firms participated in some form of collaboration which shows firms realize the long-term economic and growth benefits from collaboration, particularly in the area of skills development.

6.1.4 Large demand outgrowing limited supply

Demand trends indicate increasing demand for artisans, technicians, engineers and managers. Furthermore, all of the firms interviewed reported similar shortages of skills. Section 2.2.2 (the supply of skills) begins with dramatic decreases in apprentices taking place during the period 1985-2003. FET colleges had the least enrolments of all three HE institutions and poor job placements for graduates. Universities and universities of technology both experienced continuing declines in graduation/enrolment ratios. Overall, the large demand out-ways the marginal supply, therefore according to reviewed literature and findings, the industry and the sample interviewed are definitely experiencing skills shortages.

A state of equilibrium has not, but needs to be established between the demand and supply of skills within the metal and engineering industry.

6.1.5 Limitations and suggestions

Key limitations were encountered throughout the research process and also form the basis of suggestions, both are discussed briefly in this section. The use of non-random sampling and a relatively small sample size resulted in the sample not being statistically representative, hence the research findings could not be extrapolated to other populations i.e. provincial or national populations. Furthermore, the sample in this research was biased, in that the majority of firms interviewed were large firms which happened to be leaders in the industry in terms of skills development and training. For a more representative sample, random sampling should be employed.

Even though policy level skills development is referred to briefly in this study, from a literature and fieldwork perspective, this research was not comprehensive in its evaluation of skills development at a policy level.

With consensus around a critical shortage of technically skilled labour at the intermediate level in the industry and FET colleges being expected to be a significant supplier of these skills, more research is needed to fully understand how colleges contribute to the skills development needs of SA.

REFERENCES

Akoojee S (2003) Private further education and training. In Human Sciences Research Council *Human resources development review 2003: Education, employment and skills in South Africa*. Cape Town: HSRC Press

Akoojee S, McGrath S & Visser M (2008) Further education and training colleges. In A Kraak & K Press (eds) *Human resources development review 2008: Education, employment and skills in South Africa*. Cape Town: HSRC Press

ArcelorMittal (2007) *ArcelorMittal South Africa sustainability report: The lifeblood of a developing nation.* Accessed 7 November 2008, http://www.arcelormittal.com/southafrica/

Astro Tech (2007) *Inhouse training courses capture the market*. Accessed 17 January 2009, http://www.skillsportal.co.za/training/articles/668193.htm

Attwell P (2007) *FET colleges central to delivery of priority skills – Minister Pandor*. Accessed 8 December 2008, http://www.capegateway.gov.za/eng/your_gov/4186/news/2007/nov/163761

Badroodien A (2004) Technical and vocational education provision in South Africa from 1920 to 1970. In S McGrath, A Badroodien, A Kraak & L Unwin (eds) *Shifting understandings of skills in South Africa: Overcoming the historical imprint of a low skills regime.* Cape Town: HSRC Press

Barry B & Norton D (2000) The Skills Development Act: Transforming education and training for workers. *South African Labour Bulletin* 24(2): 6-11

Bennell P (1992) *Industrial training boards in South Africa: Performances and prospects*. National Education Policy Investigation (NEPI), Human Resource Development Research Group, Durban

Bezuidenhout G (2007) *Successful steel industry needs skills development – SEIFSA.* Accessed 1 September 2008, http://www.engineeringnews.co.za/article/successful-steel-industry-needs-skills- development-seifsa-2007 07-13

Castells M (2001) The new global economy. In J Muller, N Cloete & S Badat (eds) *Challenges of globalisation: South African debates within Manuel Castells.* Cape Town: Maskew Millar Longman

Chisholm K (2008) A radically new approach to effective career guidance in South Africa. Powerpoint presentation at the Steel and Engineering Industries Federation of South Africa (SEIFSA) Skills Development Conference, 9 May 2008, Johannesburg

Cloete H (2005) *South Africa works: Everyone's guide to understanding skills development in South Africa.* Stellenbosch: Rapid Access Publishers

Creamer Media (2008a) *Steel giant to raise prices by between 15% and 25% in April.* Accessed 5 February 2009, http://www.engineeringnews.co.za/article/steel-giant-to-raise-prices-by-between-15-and-25-in-april-2008-03-03

Creamer Media (2008b) *Transformation with growth – developing engineering and construction resources for the future.* Accessed 5 February 2009, http://www.engineeringnews.co.za/article/transformation-with-growth-developing-engineering-and-construction-resources-for-the-future-2008-09-12

Daniels R (2007) *Skills shortages in South Africa: A literature review*. Working Paper 07/121, Development Policy Research Unit (DPRU), School of Economics, University of Cape Town

DoE (Department of Education, South Africa) (2005) *FET colleges recapitalisation*. Presentation to the Education Portfolio Committee Meeting, 21 June 2005

DoL (Department of Labour, South Africa) (2001a) *An Introduction to the skills development strategy*. Second Edition. Pretoria: DoL

DoL (2001b) *Ensuring quality in education and training: The role of ETQAs.* Pretoria: DoL

DoL (2003) *Benefits of the skills strategy for employers*. Pretoria: DoL

DoL (2004a) *Skills Development Act of 1998*. Accessed 19 July 2008, http://www.labour.gov.za

DoL (2005a) *National skills development strategy implementation report: 1 April 2004 to 31 March 2005*. Pretoria: DoL

DoL (2005b) *New national skills development strategy unveiled.* Accessed 3 November 2008, http://www.labour.gov.za

DoL (2007) *Too much reliance on foreign skills not good for growing economy – Minister.* Accessed 16 February 2009, http://www.labour.gov.za/media-desk/media-statements/2007/too-much-reliance-on-foreign-skills-not-good-for growing-economy-minister

DTI (Department of Trade and Industry, South Africa) (2005) *Metals sector development strategy*. Pretoria: DTI

Du Toit R & Roodt J (2008) Engineers, technologists and technicians. In A Kraak & K Press (eds) *Human resources development review 2008: Education, employment and skills in South Africa*. Cape Town: HSRC Press

Falkov L (2008) Skills challenges facing industry: Considerations in an agenda for action. Powerpoint presentation at the SEIFSA Skills Development Conference, 9 May 2008, Johannesburg

Fisher G, Jaff R, Powell L & Hall G (2003) Public further education and training colleges. In Human Sciences Research Council *Human resources development review 2003: Education, employment and skills in South Africa*. Cape Town: HSRC Press

Fiske E & Ladd H (2004) *Elusive equity: Education reform in post-apartheid South Africa*. Washington DC: Brookings Institution Press

FRIDGE (Fund for Research into Industrial Development Growth and Equity) (2003a) *Study to facilitate the formulation of an integrated strategy for the retention and creation of employment in the South African metals and engineering sector.* Johannesburg: NALEDI

FRIDGE (2003b) *Study to facilitate the formulation of an integrated strategy for the retention and creation of employment in the South African metals and engineering sector.* Executive Summary. Johannesburg: NALEDI

George R (2004) *Marketing South African tourism.* Second Edition. Cape Town: Oxford University Press

Grawitzky R (2006) *SETAs – A vehicle for the skills revolution?* An external report commissioned by UCT's Development Policy Research Unit (DPRU)

HSRC (Human Sciences Research Council) (1985) *The HSRC/NTB investigation into the training of artisans.* Pretoria: HSRC

HSRC (1989) *The HSRC/NTB investigation into skills training in the Republic of South Africa.* Pretoria: HSRC

Isaacs S (2008) Herding cats: Challenges in the proposed new national qualifications framework environment. Powerpoint presentation at the SEIFSA Skills Development Conference, 9 May 2008, Johannesburg

Jansen J (1999) Why outcomes-based education will fail: An elaboration. In J Jansen and P Christie (eds) *Changing curriculum: Studies on outcomes-based education in South Africa.* Kenwyn: Juta

Jansen J (2001) The race for education policy after apartheid. In J Jansen and Y Sayed (eds) *Implementing education policies: The South African experience*. Cape Town: UCT Press

Johnston S (2007) *The skills revolution: Are we making progress?* Proceedings of a workshop on addressing skills shortages in the South African economy. Johannesburg: The Centre for Development and Enterprise

Johnston S & Bernstein A (2007) *Skills, growth and the migration policy: Overcoming the 'fatal constraint'.* Johannesburg: The Centre for Development and Enterprise

Kotler P & Keller K (2006) *Marketing management.* 12th Edition. New Jersey: Pearson Education

Kraak A (2004a) Training policies under late apartheid: The historical imprint of a low skills regime. In S McGrath, A Badroodien, A Kraak & L Unwin (eds) *Shifting understandings of skills in South Africa: Overcoming the historical imprint of a low skills regime.* Cape Town: HSRC Press

Kraak A (2004b) The national skills development strategy: A new institutional regime for skills formation in post-apartheid South Africa. In S McGrath, A Badroodien, A Kraak & L Unwin (eds) *Shifting understandings of skills in South Africa: Overcoming the historical imprint of a low skills regime.* Cape Town: HSRC Press

Kraak A (2004c) Rethinking the high skills thesis in South Africa. In S McGrath, A Badroodien, A Kraak & L Unwin (eds) *Shifting understandings of skills in South Africa: Overcoming the historical imprint of a low skills regime.* Cape Town: HSRC Press

Kraak A (2008) Three pathways to intermediate skilling. In A Kraak & K Press (eds) *Human resources development review 2008: Education, employment and skills in South Africa*. Cape Town: HSRC Press

Le Roux H (2007) *SA casts new skills-development die amid acute shortages.* Accessed 5 February 2009, http://www.engineeringnews.co.za/article/sa-casts-new-skillsdevelopment-die-amid-acute-shortages-2007-09-07

Lewis J (1984) *Industrialisation and trade union organisation in South Africa, 1924-55.* Cambridge: Cambridge University Press

Littler C (1982) *The development of the labour process in capitalist societies.* London: Heinemann

Lolwana P (2007) *National qualifications framework and further education and training / higher education interface.* Accessed 21 January 2009, http://www.saqa.org.za/docs/pubs/bulletins/bullvol8-1b.pdf

Lundall P (1995) Apprenticeship training in South Africa: Recasting the boundaries. *South African Labour Monographs* 2/95, Labour Law Unit, University of Cape Town

Lundall P (1997) The erosion of apprenticeship training in South Africa's metal and engineering industry. MA Thesis in Sociology, University of Cape Town

Lundall P, Maree J & Godfrey S (2008) *Industrial structure and skills in the metals beneficiation sector of South Africa.* Final report commissioned by the Department of Labour for the sector skills research project

Macun I (2000) Strategic planning contributing to skills development. *South African Labour Bulletin* 24(2): 38-42

Maree J (2006) Skills development for productive employment: Evaluation of the education, training and economic policies of South Africa. Unpublished research paper prepared for the 14th IIRA World Congress in Lima, Peru, 11-14 September 2006

Maree J, Lundall P & Godfrey S (2009) Metals beneficiation. In A Kraak (ed) *Sectors & skills: The need for policy alignment.* Cape Town: HSRC Press

McGrath S & Paterson A (2008) Enterprise training. In A Kraak & K Press (eds) *Human resources development review 2008: Education, employment and skills in South Africa*. Cape Town: HSRC Press

MERSETA (Manufacturing, Engineering and Related Services Sector Education and Training Authority) (2005) *Sector skills plan 2005-2010.* Marshalltown: MERSETA

MERSETA (2009) MERSETA proves its mettle. *Sunday Times: Business Times*, 19 April 2009

Miles M & Huberman A (1994) *Qualitative data analysis: An expanded handbook.* Sage: Thousand Oaks

Moleke P (2005) *A review of labour markets in South Africa: Education and training.* Employment & Economic Policy Research Programme, Human Sciences Research Council

Mouton J (2001) *How to succeed in your master's & doctoral studies: A South African guide and resource book.* Pretoria: Van Schaik Publishers

NACI (National Advisory Council on Innovation, South Africa) (2003) The potential impact of skills shortages on the innovative capacity of major capital engineering projects - discussion document. NACI (National Advisory Council on Innovation) & DST (Department of Science and Technology, South Africa)

Papier J (2006) All FETs are equal, but some are more equal than others. Unpublished seminar paper, University of Cape Town

Patel R (2008a) Scarce skills and the brain drain: Decelerating growth? Powerpoint presentation at the Automotive Industry Development Centre (AIDC), 9 June 2008, Pretoria

Patel R (2008b) *Getting training right beyond 2010*. Accessed 18 January 2009, http://www.iacsouthafrica.co.za/documents2008/Patel%20merSETA%20paper.pdf

Pauw K, Oosthuizen M & van der Westhuizen C (2006) Graduate unemployment in the face of skills shortages: A labour market paradox. Paper presented at the Accelerated and Shared Growth in South Africa: Determinants, Constraints and Opportunities Conference, 18-20 October 2006, Johannesburg

Pretorius C (2007) *Creating new opportunities*. Accessed 8 December 2008, http://www.mg.co.za/article/2007-04-24-creating-new-opportunities

Public FET (2007) *What is a NCV?* Accessed 8 December 2008, http://www.fetcolleges.co.za/fet-colleges.asp?PageID=33

Rasool H (2008) *Creating national skills strategies that work*. Accessed 16 January 2009, http://www.skillsportal.co.za/skills_guide/081013-hoosen-rasool-skills-strategies-that-work.htm

Ray M (2008) Educashen crysis: Wanted 68 000 engineers/artisans. *Finweek,* 7 February 2008

SAQA (South African Qualifications Authority) (2007) *NQF History.* Accessed 19 July 2007, http://www.saqa.org.za/show.asp?include=about/nqfhistory.htm

SEIFSA (Steel and Engineering Industries Federation of South Africa) (2008) Metals sector summit agreement signed. *SEIFSA News* Vol. 9 No 3, 30 April 2008

Spadavecchia O (2006) *Steps towards countering a serious skills shortage*. Accessed 3 November 2008, http://www.engineeringnews.co.za/article/steps-towards-countering-a-serious-skills-shortage-2006-10-27

Taylor N, Muller J & Vinjevold P (2003) *Getting schools working: Research and systemic school reform in South Africa.* Cape Town*:* Pearson Education in South Africa

Trade and Industrial Policy Strategies (TIPS) (2004) The SA small business sector 2004-2005: A statistical review. Accessed 15 June 2008, http://www.tips.org.za/files/AnnualSmallBizReview04_DataAndMethodology.pdf

van Rooyen M (2006) *What is in the FET colleges bill?* Accessed 8 December 2008, http://www.skillsportal.co.za/fet/848769.htm

Webster E (1985) *Cast in a racial mould: Labour process and trade unionism in the foundries.* Johannesburg: Ravan Press

INTERVIEWS

Interview (2008a) Personal interview with the Administration Support Services Manager of Firm A, 15 April 2008, Vanderbijlpark

Interview (2008b) Personal interview with the Functional & Generic Training Manager of Firm A, 18 April 2008, Vanderbijlpark

Interview (2008c) Personal interview with the Human Resources Development Manager of Firm B, 16 April 2008, Vanderbijlpark

Interview (2008d) Personal interview with the Training Manager of Firm C, 20 May 2008, Johannesburg

Interview (2008e) Personal interview with the Director of Firm D, 10 April 2008, Vanderbijlpark

Interview (2008f) Personal interview with the General Manager of Firm D, 10 April 2008, Vanderbijlpark

Interview (2008g) Personal interview with the Technical Manager of Firm D, 13 April 2008, Vanderbijlpark

Interview (2008h) Personal interview with the Managing Director of Firm E, 14 May 2008, Vanderbijlpark

Interview (2008i) Personal interview with the Human Resources Manager of Firm F, 9 April 2008, Vanderbijlpark

Interview (2008j) Personal interview with the Director of Firm G, 3 April 2008, Vanderbijlpark

Interview (2008k) Personal interview with the Financial Manager of Firm G, 3 April 2008, Vanderbijlpark

Interview (2008l) Personal interview with the Managing Director of Firm H, 9 April 2008, Vanderbijlpark

Interview (2008m) Personal interview with the Human Resources Manager of Firm I, 21 May 2008, Vereeniging

Interview (2008n) Personal interview with the Training Manager of Firm I, 21 May 2008, Vereeniging

Interview (2008o) Personal interview with the Business Development Manager of Firm J, 2 April 2008, Johannesburg

Interview (2008p) Personal interview with the General Manager: Industrial Relations, Security & HSE Energy and Chemicals of Firm J, 17 April 2008, Johannesburg

Interview (2008q) Personal interview with the Training Specialist of a Labour Supply Company, 16 May 2008, Johannesburg

Interview (2008r) Personal interview with the Projects General Manager of MERSETA (Manufacturing, Engineering and Related Services Sector Education and Training Authority), 4 June 2008, Johannesburg

Interview (2008s) Personal interview with the Employee Competence Specialist at a Parastatal, 14 April 2008, Sasolburg

Interview (2008t) Personal interview with the Engineering Training Manager at a Parastatal, 8 April 2008, Sasolburg

Interview (2008u) Personal interview with the Training Practitioner: Fitting & Turning at a Parastatal, 8 April 2008, Sasolburg

Interview (2008v) Personal interview with the Skills Development Manager of SEIFSA (Steel and Engineering Industries Federation of South Africa), 21 May 2008, Johannesburg

Interview (2008w) Personal interview with the Director of a training and development institution, 18 April 2008, Vereeniging

Interview (2008x) Personal interview with the Operations Manager of a training centre, 14 May 2008, Vanderbijlpark

Interview (2008y) Personal interview with the Marketing Specialist of a training centre, 19 May 2008, Meyerton

APPENDICES

APPENDIX 1: NQF CLASSIFICATIONS OF EDUCATION AND TRAINING LEVELS

NQF Level	Band				
	Higher Education and Training Certificates				
8 7 6 5	Higher education and training	Post-doctoral research degree Doctorates Masters degrees Professional Qualifications Honours degrees National first degree Higher diplomas National diplomas National certificates			Universities Technikons Colleges
	Further Education and Training Certificates				
4 3 2	FET	School/ College/ Trade Certificates	Private schools Government schools	Technical, community, some police, some nursing, private colleges	RDP and labour market schemes, unions, workplace, etc.
	General Education and Training Certificates				
1	Std 7/grade 9 (10 yrs)	ABET level 4	Formal schools, urban, rural, farm, special schools	Occupation, work-based training, RDP, labour market schemes, upliftment programmes, community programmes	NGOs, churches, night schools, private ABET programmes, unions, workplaces, etc.
	Std 5/grade 7 (8 yrs)	ABET level 3			
	Std 3/ grade 5 (6 yrs)	ABET level 2			
	Std 1/ grade 3 (4 yrs)	ABET level 1			
	1 yr reception				

Source: DoL 2001a: 20

APPENDIX 2: INTERVIEW SCHEDULE

Topic: An evaluation of skills development in a sample of metal and engineering firms in Gauteng
Purpose: For Masters in Workplace Change and Labour Law at the University of Cape Town
Name of firm: _____
Name of person interviewed: _____
Date of interview: _____
Contact details: _____

Opening statement: Recent research conducted by the Manufacturing, Engineering, and Related Services Education and Training Authority (MERSETA) in alliance with the Department of Trade and Industry (DTI) has revealed that there are severe skills shortages at artisan, technical and engineering levels, which is one of the major limiting factors concerning growth in the metal and engineering industry. The main objective of this interview is to establish whether there is suitably skilled labour available and to evaluate skills development in this metal and engineering firm.

1. INFORMATION ON INTERVIEWEE

QU1. Please provide your job title:_____

QU2. How long have you held such a position?_____

2. INFORMATION ON THE FIRM

A. Basic information

QU3. For how long has this firm been operating?_____

QU4. Briefly outline the structure of the firm by providing information on the holding company, subsidiaries and branches, etc._____

_____

_____

B. Size

QU5. How many persons are employed by the firm?_____

Note: By 'employed' I mean all forms of employment, whether permanent or not.

QU6. Approximately how many employees would be classified as:

Profession	Description	Number of employees
Engineers	Graduates with applicable degrees obtained at universities	
Technologists	Graduates with applicable BTech degrees and national higher diplomas from universities of technology	
Technicians	Graduates with applicable certificates and diplomas from universities of technology	
Artisans	Graduates with a recognised certificate of competency	

C. Atypical or non-standard employment

QU7. Has there been an increase in casual, temporary and sub-contracted labour over the last three years?

Yes/No

- If so, please specify the reasons_____

_____

_____

D. Management structure

QU8. Approximately what percentage of the firm's management are qualified engineers?_____

Note: QU9 to QU11 optional, depending on the answer to QU8, on whether the firm has management that are qualified engineers.

QU9. In which department(s) within the firm do most of these 'management engineers' work in?

_____

_____

QU10. Do they apply their technical skills?

Yes/No

- Please elaborate on the option selected_____

_____

_____

QU11. In your experience, why are engineers shifting into management positions?_____

_____

E. Metals beneficiation and the value chain

QU12. In terms of core operations which one of the following metals beneficiation stages does this firm belong to?

Metals beneficiation stages	Description	Yes	No
Stage 2 - Milling firms	Converts the ore or concentrate into an intermediate product (such as a metal or alloy)		
Stage 3 - Engineering or machine shops	Transforming an intermediate product into a refined, semi-fabricated product		
Stage 4 – Machine builders	Converts the processed metal further into finished products		

F. Growth, employment and investment

QU13. Is this a dynamically growing firm?

Yes/No

- Please elaborate on the option selected_____

_____

_____

Note: In terms of total profits and total production output etc.

QU14. Has the staff compliment grown, over the last year?

Yes/No

QU15. Will the staff compliment grow over the next three years?

Yes/No

- Please elaborate on the option selected_____

_____

_____

QU16. Is this firm highly capital intensive, investing huge amounts of money per job?

Yes/No

G. Core operations

QU17. Please provide a brief description of the firm's core operations, i.e. its core production process(es) and principal products?_____

_____

_____

QU18. Will the types of products that are produced undergo changes within the next three years?

Yes/No

- Please elaborate on the option selected_____

_____

_____

H. Location

QU19. What led to the decision to base this firm in Gauteng, instead of locating to any other part of the country?_____

_____

QU20. In terms of potential supply and recruitment of employees has your location in Gauteng been advantageous?

Yes/No

- Please elaborate on the option selected_____

_____

_____

I. Export trade performance

QU21. Approximately what percentage of the firm's output is exported?_____

QU22. Is this likely to change within the next three years?

Yes/No

- Please elaborate on the option selected_____

_____

_____

3. SKILLS REQUIREMENTS, CONSTRAINTS AND DEVELOPMENT

K. Skills in short supply, reasons and impact

QU23. Is this firm currently experiencing a shortage of skills?

Yes/No

- If not, why not?_____

_____

_____

Note: Proceed to Section M: Method(s) of obtaining skilled labour.

Note: QU24 to QU28 optional, depending on the answer to QU23, on the firm currently experiencing a shortage of skills.

QU24. If there is a shortage of available skills, which skills have been in short supply? (Read out options and tick table).

Engineering	Technicians	Trade	Management
Design & development ▪ Design & development engineers ▪ Electrical engineering designers ▪ Mechanical designers (CAD)	Drafting & design ▪ Draftsman	Repair & maintenance ▪ Electricians ▪ Coded & pipe welders ▪ Mechanics ▪ Millwrights ▪ Roll turners ▪ Instrument mechanics	Senior executive-strategic ▪ Production manager ▪ Black managers ▪ Business unit managers
Materials ▪ Chemical engineers ▪ Metallurgical engineers ▪ Black material engineers	Electronic repair & maintenance ▪ Millwright	Manufacturing ▪ Pipe welders ▪ Fitters & turners ▪ Power transformer specialist ▪ Ceramists ▪ Chrome platters ▪ Boilermakers ▪ Patternmakers ▪ CNC operators	Middle management ▪ Operations managers ▪ IT managers ▪ Production managers ▪ Project managers
Process ▪ Product engineers	Instrumentation & control systems ▪ Instrument mechanics		
Specialised ▪ Power transformer specialist ▪ Black engineers	Other • Contract technicians		
Traditional ▪ Mechanical engineers ▪ Civil engineers ▪ Electrical engineers ▪ Contract engineers			
Other (please specify) ▪ ▪ ▪	Other (please specify) ▪ ▪ ▪	Other (please specify) ▪ ▪ ▪	Other (please specify) ▪ ▪ ▪

Note: This question is not limited to the skills included in the table but includes all types of skills.

QU25. For how long have these shortages in skills existed?_____

QU26. Why are these required skills not being supplied?_____

_____

_____

QU27. What has been the impact of these skills shortages on the growth potential of the firm?

QU28. How do you envisage a shortage of skills will impact on the future plans of this firm?

L. Other constraints limiting growth

QU29. Are there any other constraints limiting the growth, quality and efficiency of the firm?

Yes/No

- If so, please elaborate

Note: a) Current electricity outages; b) differences in electricity prices; c) import-parity pricing (local firms being charged higher prices for basic metals); d) differential pricing (different customers charged at different prices per ton of steel) etc.

For downstream producer's b, c and d are applicable.

M. Method(s) of obtaining skilled labour

QU30. How does the firm obtain skilled labour that is required?

Methods of obtaining skilled labour	Yes	No
Skills development system and the relevant SETA		
Institutions		
Schools		
FET Colleges		
Universities of Technology		
University		
Bursaries		
Poaching		
In-house training		
Internationally		
Other (please specify)		

QU31. For the yes option(s) selected above, please provide further detail on the method(s) employed in obtaining skilled labour?_____

_____

_____

Note: Detailed procedure, justification, who and what sorts of training etc.

QU32. Will the method(s) of obtaining skilled labour change within the next three years?

Yes/No

- Please elaborate on the option selected_____

_____

_____

N. Training

QU33. How important is experiential training when recruiting individuals for technical occupations?

_____

_____

Note: Experiential training refers to training on-the-job.

QU34. Does this firm provide graduates with the opportunity to get the required experiential training?

Yes/No

QU35. How seriously does this firm take skills development of staff? _____

_____

_____

Note: QU36 to QU49 optional, depending on whether the firm has engaged in developing the skills of employees.

QU36. Does this firm tend to train in narrow firm-specific skills?

Yes/No

- Please elaborate on the option selected_____

_____

_____

QU37. How does the firm identify which employees need to be trained and what this training should entail?

_____

_____

_____

QU38. For the different occupational levels, what proportion of the firm's training activities is undertaken through:

Training activities	Percentage
Own training initiatives	
Skills development system and the relevant SETA	
Other (Please specify)	

QU39. Is this likely to change within the next three years?

Yes/No

- Please elaborate on the option selected_____

_____

_____

QU40. Which specific form(s) of training does the firm offer?

Specific form(s) of training	Yes	No
Apprenticeships		
Learnerships		
Skills programmes		
Programmes addressing SETA Sector Skills Priorities		
Other (please specify)		

QU41. Could you provide in as much detail as possible the specific form(s) of training that the firm offers?

_____

_____

_____

Note: Identify what skills are developed.

QU42. At what levels of the National Qualifications Framework (NQF) is this form(s) of training taking place?

_____

_____

QU43. What proportion of employees complete their skills training?_____

Note: QU44 optional, depending on the answer to QU40, on whether the firm undergoes apprenticeship training.

QU44. Which route(s) to becoming a qualified artisan do employees from this firm follow?

Different pathways to becoming an artisan	Yes	No
Traditional apprenticeship route		
An accelerated apprenticeship programme		
Artisan Training and Recognition Agreement for the Metal Industry (ATRAMI)		
Other (please specify)		

- Please provide a detailed description of the route(s) selected_____

_____

_____

Note: a) Age criteria, minimum education qualification, average training period, period block releases to attend NTC courses at an FET college, period practical training, trade test; b) competency-based modular training system.

For traditional and accelerated apprenticeship route (a) is applicable, and for the ATRAMI system (b) is applicable.

Note: QU45 to QU47 optional, depending on the answer to QU12, on whether the firm belongs to stage 2: milling firms of the metals beneficiation stages and also larger firms that train artisans.

QU45. Is this firm producing large numbers of artisans?

Yes/No

- Please elaborate on the option selected_____

_____

_____

QU46. Has this firm raised the entrance requirement for firm-based artisan training programmes?

Yes/No

- If so, why?_____

_____

_____

QU47. If poaching of skilled workers by smaller firms has occurred, how has this impacted on the firm?

_____

_____

_____

QU48. Does developing the skills of employees improve the growth and competitive ability of the firm?

Yes/No

- If so, how does the firm show this?_____

_____

_____

QU49. How does the firm ensure that its training provision (both internally and externally) corresponds to changes in prevailing production technologies?_____

_____

_____

O. Sector Education and Training Authority (SETA)

QU50. Which SETA does this firm belong to?_____

QU51. Does this firm make use of the SETA?

Yes/No

- If not, please provide detailed reasoning_____

_____

_____

Note: QU52 and QU53 optional, depending on the answer to QU51, on whether the firm makes use of the relevant SETA.

QU52. What has been the contribution of the relevant SETA to the training initiatives that this firm has been involved in?_____

_____

_____

QU53. What more could the SETA be doing with regard to training?_____

_____

_____

QU54. Has the Sector Skills Plan of the SETA had any impact on the training the firm provides?

Yes/No

- If so, what has been the impact?_____

_____

_____

QU55. Have you ever seen the Sector Skills Plan?

Yes/No

- If so, what do you think about it?_____

_____

_____

P. Training providers

QU56. Has this firm used training providers to fulfill its training needs?

Yes/No

- If so, please specify the training providers_____

_____

_____

Note: Services providers (SETA linked/independent).

Note: QU57 and QU58 optional, depending on the answer to QU56, on whether the firm has used training providers to fulfill its training needs.

QU57. If the firm has used training providers, were the learning programmes formally recognized and accredited?

Yes/No

- Please elaborate on the option selected_____

_____

_____

QU58. How effective have the training providers used by the firm been?_____

_____

Q. Levy-grant system

QU59. Does the firm have an active Workplace Skills Plan (WSP)?

Yes/No

- If so, what does it entail?_____

_____

_____

Note: A WSP identifies what skills are needed, who needs them, how they will get the skills and how much it will cost.

QU60. How many years has the firm had a WSP?_____

QU61. Does the firms wage bill equal or exceed R500 000 per annum?

Yes/No

Note: QU62 optional, depending on whether the firms wage bill equals or exceeds R500 000 per annum.

QU62. Does the firm pay the 1% skills development levy to South African Revenue Services (SARS)?

Yes/No

Note: QU63 and QU64 optional, depending on whether the firm voluntarily participates in the skills development process.

QU63. What percentage of the skills development levy is claimed back in the form of mandatory and discretionary grants?

Levy claimed	Percentage
Mandatory grants	
Discretionary grants	

Note: Mandatory grants (50% covers those employers who submit a WSP, appoint a skills development facilitator and submit annual training reports).

Discretionary grants (20% covers those employers who offer learnerships, skills programmes or who have programmes addressing SETA Sector Skills Priorities or scarce skills (firms have to apply with the latter)).

QU64. What has been the firm's experience regarding the regulations and procedures for claiming the levy?

_____

_____

_____

QU66. Has the firm benefited from the introduced tax concessions?

Yes/No

- If not, why not?_____

_____

_____

Note: R25 000 tax deduction when a learnership agreement is signed and an additional R25 000 when it is successfully completed.

QU67. Have these incentives (levy claiming and tax concessions) encouraged the firm to embrace skills development in the workplace?

Yes/No

- Please elaborate on the option selected_____

_____

_____

R. Inter-firm, industrial, regional and international collaboration around skills development activities

Note: QU68 optional, depending on the answer to QU4, on the structure of the firm in terms of the holding company.

QU68. To what extent do other firms under your holding company share information regarding skills development?_____

_____

_____

QU69. To what extent have firms in your industry/region collaborated successfully with respect to workforce training and skills initiatives?_____

_____

_____

QU70. In which way is skills development in this firm benefiting from international training collaborations?

_____

_____

_____

S. Quality of public education

QU71. In your estimation, since 1996 (when the South African Schools Act was passed), has the quality of public education:

Quality of public school education	Yes	No
Improved		
Worsened		
Stayed the same		

- Please elaborate on the option selected_____

_____

_____

QU72. How does the quality of public education impact on this firm?

QU73. When appointing individuals to technical skilled occupations which qualifications and higher education institutions does this firm prefer, and why?

QU74. Are the educational institutions responsive to the skills needs of this firm?

Yes/No

- Please elaborate on the option selected

QU75. In your experience, how credible are the programmes?

T. Government policy

QU76. Are there any aspects regarding government policy on skills development that have had a positive impact on this firm?

QU77. Are there any aspects regarding government policy on skills development that have had a negative impact on this firm?

QU78. Has Asgisa and/or Jipsa had an impact on the firm's training programmes?

Yes/No

- If so, please elaborate_____

_____

_____

Note: Asgisa: Accelerated and Shared Growth Initiative for South Africa. Jipsa: Joint Initiative and Priority Skills Acquisition.

QU79. Have you obtained more skilled labour in your firm as a result of Jipsa?

Yes/No

- If so, please elaborate_____

_____

_____

U. 2010 Soccer World Cup

QU80. In which way(s) will this firm be impacted by the upcoming 2010 Soccer World Cup?

_____

_____

_____

Marisa Ferreira Ribeiro
Department of Sociology, University of Cape Town
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APPENDIX 3: CONFIDENTIALITY AGREEMENT