

## SECTORAL STUDY – MACHINERY AND EQUIPMENT

### 1 INTRODUCTION

The machinery and equipment sector has extremely important role to play in almost all primary and manufacturing sectors in providing and servicing capital equipment, while the manufacture of transport equipment ensures efficient distribution of goods. The value chain of the sector is complex, given that it obtains inputs from the upstream metal producers as well as the electrical and electronic sector and produces outputs for downstream manufacturers as well as for the machinery and equipment sector itself.

Globally, the sector is becoming increasingly linked with the electronics sector and is placing increasing emphasis on innovation and globalisation of production. Trade liberalisation in South Africa has resulted in greater exposure of the domestic sector to these global trends, which has resulted in an increase in imports and a shift in focus toward the aftermarket and services associated with the products.

The domestic sector has experienced an overall decline in employment since 1999 although there has been an increase in the number of casual, temporary and sub contracted workers.

## 2 PROFILE OF THE MACHINERY AND EQUIPMENT SECTOR

### 2.1 Industry Classification

The machinery and equipment sector contributes a significant proportion of the country's capital inputs. Machinery and equipment manufacturers provide capital inputs used in the handling, beneficiation, assembly and transport of other intermediate and final products, as well as the provision of value-adding services.

As capital inputs can include a wide range of different possibilities including 'ancillary' inputs such as infrastructure, factory shells and the like, organisations such as Trade and Investment South Africa (TISA) have defined this sector as involving the 'manufacture of equipment of a capital nature'. This report, however, has taken a narrower definition by sticking more closely to the Standard Industrial Classification (SIC) system codes for the manufacture of machinery and equipment. Importantly, transport equipment is also considered a part of the machinery and equipment sector analysed in this report.

The SIC major groups focused on include:

- The manufacture of general purpose machinery (SIC 356);
- The manufacture special purpose machinery (SIC 357);
- The building and repairing of commercial ships, boats and floating vessels (SIC 3841);
- The manufacture of railway and tramway locomotives and rolling stock (SIC 385); and,
- The manufacture of aircraft and spacecraft (SIC 386)<sup>31</sup>.

#### General purpose machinery

The group containing general purpose machinery contains the following products: engines and turbines (excluding aircraft, vehicle and motor cycle engines); pumps, compressors, taps and valves; bearings, gears, gearing and driving elements; ovens, furnaces and furnace burners; lifting and handling equipment, weighing machinery; and commercial refrigerating equipment.

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<sup>31</sup> The building of pleasure and sporting boats (SIC 3842) is excluded, as is the manufacture of motor cycles (SIC 3871), bicycles and wheel chairs (SIC 3872) and other unclassified transport equipment (SIC 3879). The manufacture of office equipment, accounting machinery and computers (SIC 358) is too small to be considered and professional and precision equipment (SIC 374, 375 and 376), household appliances (SIC 359) and electrical machinery are considered to be a part of the electronic and electrical engineering sector.

### **Special purpose machinery**

Special purpose machinery concerns the following machines: agricultural and forestry machinery; machine-tools; machinery for metallurgy; machinery for mining, quarrying and construction; machinery for food, beverage and tobacco processing; machinery for textile, apparel and leather production; and weapons and ammunition.

### **Commercial ships, boats and floating structures**

The building of commercial ships, boats and floating structures excludes the production of parts outside of major hull construction such as anchors, compression ignition engines and navigational instruments. Commercial ships and boats included here are ocean, coastal and inland water vessels; passenger vessels; fishing and fish processing factory vessels; tugs and pusher vessels; non-motorised vessels such as barges and stationery vessels such as lightships; non-navigational vessels such as dredgers and submersible drilling platforms; hovercraft; warships and auxiliary naval vessels such as troop carriers; vessels equipped for scientific investigation; pontoons, inflatable rafts, coffer-dams, landing stages, buoys, floating tanks, and other floating structures. Repairing of ships and other vessels includes the maintenance, overhaul and repair of these vessels and the breaking-up of ships.

### **Railway and tramway locomotives and rolling stock**

The manufacture of railway and tramway locomotives, including passenger coaches, goods vans, tank wagons, workshop vans and railway maintenance vehicles (such as workshops and cranes). The group also includes the manufacture of rolling stock such as bogies, axles and wheels; brakes and parts of brakes; hooks and coupling devices, buffers and buffer parts; shock absorbers (but not springs); wagon and locomotive frames; bodies and corridor connections. It also covers mechanical (including electro-mechanical) signalling, safety or traffic control equipment for railways, tramways, roads, inland waterways, parking facilities, port installations or airfields.

### **Aircraft and spacecraft**

The manufacture of aircraft and spacecraft includes the manufacture of heavier-than-air aeroplanes (motorised or non-motorised), lighter-than-air flying machines, balloons, spacecraft and spacecraft launch vehicles. It also covers fixed-wing, manned motorised aeroplanes, rotary-wing aircraft, gliders, hang-gliders and other non-powered aircraft, dirigibles and balloons used in aeronautics and meteorology. The spacecraft category includes not only the actual craft, but also spacecraft launch vehicles, aircraft launching gear, deck-arrestor gear, ground flying trainers and aircraft parts and accessories (fuselages, wings, doors, control surfaces, landing gear, motors, engines, propellers and specialised

parts of the major assemblies for installation on aircraft). Included in this group are the maintenance, repair and alteration of aircraft or aircraft engines.

## 2.2 Major products

A wide range of machinery and equipment is manufactured, assembled and/or supplied in South Africa. These products are used in a wide variety of sectors including mining, agriculture, forestry, civil engineering and construction, processing industries, utilities as well as the machinery and equipment sector itself. Historically, many of the products were produced for mining and other resource-intensive industry applications but have since been adapted for use in other manufacturing activities.

The Capital Equipment Cluster report uses customer needs as a basis for segmenting the types of products into the following categories; materials handling, environmental control, refining/ manufacturing process and drilling, digging and cutting (Blueprint Consulting, 1998). This report was supplemented by the Department of Trade and Industry in 2000. The main products produced domestically, according to these two reports are captured in Table 27 below.

Table 27. Major machinery and equipment identified by the Capital Equipment Cluster as domestically manufactured and assembled

Machinery & equipment grouping	Products
Materials handling	Hoists and winders; locomotives; rolling stock; hoppers; scraper winchers; conveyors; load-haul-dumpers; scissor lifts; utility vehicles; personnel carriers; earthmoving equipment; draglines; power shovels; pumps; valves; gates; stop cocks; articulated and rigid dump trucks; belt tensioning and efficiency systems; coal and aggregate handling systems; combine harvesters; bailers; timber handling equipment; forklifts; cranes
Environmental control	Heat exchangers; fans and ducting systems; electronic monitors; thermostatic controllers; cyclones and dust extractors; refrigeration equipment; hothouses; false work; formwork; filters
Refining/ manufacturing process	Crushers; screens; rod and ball mills; agitators; classifiers; thickeners; mixers; filters; flotation tanks; washers; scrubbers; separators; dewatering systems; water purification systems; pumps; electronic process control systems; power generation systems; tanks; vessels; silos; bins; furnaces; batching equipment; welding equipment; ovens; kilns; dyers; aerators; boilers
Drilling, digging and cutting	Exploration drill rigs; post hole cutters; coal cutters and continuous miners; drag lines and power shovels; hydraulic and mechanical support systems; wall and roof bolting systems; rock stabilisation and cementation systems; rock drills; hydraulic drifters; bore-hole drillers; ploughs; tractors; augers; guillotines

Source: Blueprint (1998) and dti, AIPA and Southern Hemisphere (2000)

## 2.3 Domestic companies

### GENERAL PURPOSE MACHINERY

#### Non-automotive engines and turbines

Turbines, a complex piece of equipment to manufacture requiring computer numerically controlled (CNC) precision engineering, are not produced in South Africa. However, turbo-machinery applications in the South African aerospace and power generation have seen the development of learning and potential capabilities in forming and machining turbine blades and vane guides, the possibilities of which have not yet been exploited.

Turbines are used as prime movers for ships, aircraft, and pumps and also as power generators. Non-automotive engines (for tractor, combine harvester, or earth mover application) in South Africa were until recently produced by Atlantis Diesel Engines (ADE). The company produced compression ignition engines for diesel fuel. Currently, all non-automotive engines are imported. ADE was set up by the Government in 1982. ADE produced Perkins diesel engines under licence and because of import restrictions had a captured market in many agricultural and commercial vehicle producers, as well as government military vehicle manufacturers. South Africa's reintroduction to the global economy increased the opportunity for ADE consumers to choose brands from their own family stables, resulting in the closure of ADE's compression ignition engine plant in 1998. Perkins compression ignition engines are now distributed through Barloworld Energy Products. ADE was bought by DaimlerChrysler during the 1990s and now focuses on supplying automotive components (engine blocks and crankshafts, in particular). The demise of ADE had a major impact on local competitors such as Bell and also had a negative affect on local content and working capital. There is no other producer of non-automotive industry engines in South Africa.<sup>32</sup>

#### Pumps, compressors, taps and valves

Of these four product groupings, South Africa's domestic capacity is most well established in pump and valve (and actuator) manufacture. Major pump companies include Sulzer SA, Weir-Envirotech, KSB Pumps - which supply slurry and other pumps to the mining industry – and Howden Pumps, which focuses mainly on pumps with agricultural applications. Pump manufacturers engineer castings supplied by foundries, fabricate additional steel inputs and assemble pumps with imported electric motors. Other companies, such as Barloworld Energy Products with their engine packages for pumps, have focused on component production.

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<sup>32</sup> For a thorough and informative article on ADE's decline and the impact of this on Atlantis see Stephanie Platt's article 'Another casualty of political folly' (October 2001), posted on the internet transport magazine Fleetwatch's website – [www.fleetwatch.co.za](http://www.fleetwatch.co.za)

Sulzer SA, a Swiss company, is the country's largest pump manufacturer, with a turnover for 2002 in the region of R330 million. Its major markets are the mines where the company claims to have between 85-90% of the domestic mine dewatering pump market (Engineering News, 11 October 2002). Weir-Envirotech also focuses on the mining industry providing slurry handling solutions.

Howden Pumps, the third largest pump manufacturer, has accessed lucrative export markets through incorporating new flexishaft design principles into their existing cavity pump range. Other companies, while focusing on the pump industry, offer turnkey or project management service to clients while not actually manufacturing pumps themselves. A prime example of this is Ian Dickie & Co who import Selwood auto-priming pumps from the UK, and then ensure their specification accuracy, assembly, installation and commissioning.

The domestic valve and actuator industry manufactures 32 different kinds of products. The industry is dominated by Ainsworth Engineering, Cobra Watertech, Dynamic Fluid Control, Premier Valves and Hydro Power Equipment. The main applications include mining, basic metals, pulp and paper, waterworks and petrochemical industries.

Related industries include waterworks treatment and dam-related equipment suppliers. Companies involved in water and wastewater treatment include Erwat, SAME Water, Enviro Options, Orbit Pumps, Lektratek Water, Gereg Sewage & Water Equipment, B&E Silica and Stewart Scott Process. Their product range includes mechanical aerators, mixers, sewage screens, portable water clarifiers, biofilters, pumps, valves and gates.

#### **Non-automotive power transmission equipment**

The industry is dominated by large, well-established distribution agents, principally Bearings International and Bearing Man. Some articulated chain production for mines (for example by Scaw Metals) and industrial application takes place. There is domestic production of industrial gears by Gear Ratio and Meshgear, as well as industrial brakes (for example, NCS Engineering). There is some assembly of bearings but no manufacture. Most domestically produced power transmission equipment is for the automotive sector and therefore falls out of the scope of this study.

South Africa does have a small hydraulics and pneumatics (and hydropower) manufacturing industry. This fluid-power industry is dominated by the Hytec Group, which offers a range of solutions including design, manufacture, installation, commissioning, aftersales service and repair. The company is also the sole importer of Bosch and Rexroth fluid-power products, following the merger of these two European companies into Bosch Rexroth. The group, through its Hytec Engineering subsidiary, also manufactures and repairs components such as cylinders. The company's expansion is tied to rationalisation in the local fluid-power market

as well the rapid growth in platinum mining. Other companies, such as Horne Hydraulics which produces hydraulic buffers, have focused on component supply. Again, their major brand, Oleo International, is imported.

The fluid-power market is considered to be experiencing real growth of 5%; however it is heavily dependent upon the importation of components and products (Mining Weekly, 26 July 2002).

### **Lifting and handling equipment**

South Africa has a well-developed domestic supply of materials handling machinery and equipment. This is a very broad industry incorporating a range of activities. Segmentation of the industry is difficult and not established in consensus. This review adopts the following segmentation:

- Lifts, escalators, hoists and moving-walkways
- Materials handling equipment for logistics and supply-chain management purposes (distribution centres, warehousing, just-in-time production systems, including forklifts and some conveyor systems)
- Materials handling equipment requiring heavy engineering or with heavy duty applications (such as cranes, derricks, dock levellers, containerisation equipment, mobile lifting cranes, straddle carriers, and some conveyor systems)
- Components to specialised heavy duty mining, quarrying and construction equipment such as buckets, shovels, grabs or scoops<sup>33</sup>

The use of pulley tackle and hoists, winches and capstans, and jacks can be found throughout the different industry segments.

Greater emphasis on just-in-time production and supply-chain networks have resulted in greater use of information technology in logistics systems, resulting in more sophisticated materials handling systems. Computerised stock management systems and precision resource planning have meant greater levels of factory automation when it comes to materials

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<sup>33</sup> These are often engineered and fabricated separately to actual mining, quarrying and construction equipment given differing conditions that this equipment operates under and the nature of the material handled. While most mining, quarrying and construction equipment is imported in fully-built up form, specialised components are domestically fabricated by contracted engineering works.

handling. This has included the development of articulated industrial robots to handle and manufacture products.<sup>34</sup>

The lifts, escalators, hoists and moving walkways industry is dominated by Schindler Lifts SA and Otis SA. Other smaller multinational companies present include Thyssen Lifts. The major products supplied in South Africa are geared lifts and escalators. There is little growth in the market, with the majority of revenue accruing from maintenance, resulting in companies discontinuing their manufacturing operations and focusing on installation and commissioning of imported lifts and after-sales service. The major buyers of lifting and handling equipment are logistics solutions providers. Logistics companies, such as LGA Logistics, Barloworld Logistics, Koch South Africa and Tibbet & Britten South Africa undertake development, design, project management, installation and commissioning of materials handling systems for their clients. Central distribution centres for major retailers of fast moving consumer goods require major logistics solutions.

The expansive mining and construction markets have attracted investment from global heavy engineering names such as Barloworld, Liebherr, Hitachi Construction, Daewoo, Komatsu Southern Africa, Safricon Industrial Equipment and Bell Equipment. Of these companies, Bell Equipment is the only company with domestic manufacturing capacity. The company currently employs 1300 people. Their after tax profit was also up by 29.1% in December 2000, which was especially notable as the exchange rate strengthened during the period.

Fluctuations in the exchange rate result in a devaluation of foreign assets, although a positive effect is the decline in the Rand equivalent price of Euro imports, which account for 50% of manufacturing costs. Many of the company's exports are invoiced in US\$ and the Rand/\$ strengthening during 2002 has put pressure on margins. The company is focusing on cost reduction, manufacturing efficiency, reducing warranty costs and increasing part sales and unit sales outside South Africa to its alliance partners John Deere, Hitachi and Liebherr.

There are further well developed import agency networks leading to the presence of Toyota and other materials handling suppliers. These companies will often contract a range of engineering works to undertake domestic fabrications of shovels, buckets, etc, to tailor-make products for South African customers and conditions.

A wide range of companies supply the harbours with their materials handling requirements. One company with strong local capabilities is DDL Equipment. This South African owned company focuses on the design and layout of dock loading equipment such as dock levellers and dock sealing systems.

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<sup>34</sup> For a more detailed discussion of the impact IT and materials handling consult Karel Smrcka's article in the 29 November 2002 edition of Engineering News, entitled "IT transforms the materials handling"

Major buyers of heavy engineering materials handling equipment include the ports, primary industries and civil engineering works associated with building and construction.

### **Refrigeration and air-conditioning**

This industry is well established and includes capacity in refrigeration design in the consulting engineer sector, strong contracting and installation capacity and a developed supply and (to a lesser extent) manufacturing industry. Although manufacture does take place in South Africa, most of the brands are imported and some are locally assembled. Local companies such as Defy Appliances Ltd have managed to establish brands in the local market, although there is a strong presence of aggressively marketed imports, particularly from East Asia (particularly LG Electronics) and Germany. Other companies with local manufacturing/assembly capabilities include Johnson Controls, Daikin Air Conditioning, Carrier SA, Recoil and Frigoglass South Africa, very few of which are involved in full-scale manufacture.

The contracting industry involves mainly small players who contract out actual fabrication and installation works. Major companies include Astar International, Airgro, IES (formerly Improvair) and Southern Air. Large contractors dominate output in the industry.

## **SPECIAL PURPOSE MACHINERY**

### **Agricultural and forestry machinery**

The major agricultural products on the South African markets are tractors, combine harvesters and balers, with tractors making up about 60% of the domestic agricultural market. About 80% of agricultural equipment is imported. Agrico, based in Lichtenburg, is the only South African company assembling tractors. The main reasons for the lack of local tractor production is the lack of tariff protection currently afforded to this product category as well as its exclusion from the MIDP programme. Bell Equipment produces agricultural, forestry and sugar equipment and import skidders from Deere Ag and Forestry in low volumes. Harvestech is a leading manufacturer in combine harvesting technology, although is mainly focused on the peanut and maize industries. Other notable companies include Howden Pumps, Petzetakis Africa (who produce plastic piping for irrigation works), Filmatic (who produce filling machinery) and HG Molenaar (who produce canning equipment and boilers).

South African manufacturers tend to be concentrated in the production of lower-end technology equipment, which is labour-intensive and suitable for a relatively low-skilled labour-force. There is a high degree of imported content in local manufacture.

Forestry equipment is dominated by the heavy engineering companies discussed under lifting and handling equipment above, which supply equipment fitted with grabs for moving timber.

Similarly with mining and quarrying equipment, these companies have domestic operations which engineer adaptations to their products for different uses, conditions and industries.

### **Machine tools<sup>35</sup>**

The South African machine tools industry has been dominated by foreign brands and, particularly since the sanctions era, has involved the importation of machine tools. Prior to sanction-related disinvestment, companies such as Haas M. Tools, Fadal, Ingersoll, Gleeson and Doall competed in the domestic market. The dearth of supply as a result of their withdrawal from South Africa was filled by East Asian machine tools companies, and Taiwanese companies now hold 65% of the computer numerically controlled (CNC) market (which is the largest section of the machine tools market, accounting for 70% of sales).

There is a growing used machine tool market in South Africa. Local production is estimated at only 4% of the total market, and this is mainly limited to components such as press breaks and guillotines. South Africa has one producer of CNC machine tools, Esamatic. The larger companies tend to be importers, such as Hi-Tech Machine Tools, which distributes Hyundai Machine Tools products in South Africa. There is an established industry providing consumables for machine tools, particularly cutting and drilling tools. Lasher Tools is the largest company, while Somta Tools is the largest South African owned company.

### **Mining, quarrying and construction equipment**

Surface mining, quarrying and construction are all dominated by the same competing companies: Barloworld Equipment, Barloworld Handling, Liebherr, Hitachi Construction, P&H/Minepro, O&K, Volvo Trucks, Daewoo, Komatsu Southern Africa, Safricon Industrial Equipment and Bell Equipment. Only Bell Equipment has domestic manufacturing capabilities and currently enjoys the largest share of the local market, with Barloworld and Komatsu achieving second and third place respectively. However, these companies will commission component production to local engineering works to develop customer-specific shovels, scoops, etc.

Underground mining has a different set of suppliers. The coal mining industry is dominated by Joy Mining Machinery, a large mining equipment manufacturer, which not only has its own engineering, fabrication and assembly works but also increasingly acts as a manufacturing base for its US-mother company, supplying to the East and Australia. Joy Mining Machinery dominates the market but has notable competitors in certain segments. For example, Swiss-company Wust Alpine import competing continuous miners and Ikhof and DBT supply competing longwall systems. Almost all of Joy Mining Machinery's equipment is supplied to

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<sup>35</sup> Information from this section is taken mainly from Lefakane (1999)

the coal industry. Platinum and gold extraction has historically been dependent upon drill operators and drilling rigs, although there are efforts to introduce trackless load-haul-dumpers (LHDs), in-stope drill rigs and continuous miners. The company introducing these innovations is multinational, Sandvik Tamrock. Rham Equipment has local manufacturing capabilities, particularly in roof-bolting equipment (using Caterpillar undercarriages). Other significant underground equipment suppliers are Tubular Track (which provide tracking systems) and EMM Mining (shuttle cars).

Huddy supply the diamond mining industry with a range of locally developed drilling equipment. It has also developed diamond processing equipment for cutting, polishing or grinding diamonds. The company has expanded to supplying other rock and drilling tools to the construction, underground mining and quarrying industries.

Minerals processing equipment involves a range of companies and is probably South Africa's most well developed equipment-supplying industry. Equipment supplying includes conveyor systems (notably Osborn Engineered Products), crushers, silos, screens (notably Joest), smelters (notably Pyromet Technologies), dense medium separator drums, cyclones (notably Multotek), spirals, floatation tanks, filters (notably Latham Engineering), dewatering pumps (notably Sulzer SA) and jigs and some who supply materials or components to this equipment, such Meshcape Industries (mesh) and Tru-Trac Rollers (conveyor rollers). There is a range of processing plant manufacturers who provide turnkey solutions. These include Osborn (regarding bulk materials handling), Mac's Engineering, Pyromet Technologies (regarding smelting plants) and Bateman BV amongst others.

The construction and civil engineering industries also have a well developed supply of locally manufactured equipment. There are also very large, diversified contracting companies present such as Concor, Murray & Roberts, Basil Read, Group Five, etc, (who also provide their own consulting engineering solutions) given the size and nature of construction and civil engineering projects (including building dams, roads, buildings, ports, etc).

Earth moving equipment has already been covered under lifting and handling equipment and surface mining equipment above. Construction earth moving equipment has similar applications to surface mining except the demands are not as great, thus the same brands compete in the construction earth moving industry.

Brick, block and paver making equipment manufacturing capacity exists and exporting occurs (notably Hydraform and Profile Engineering). Municipal works and construction equipment such as generator/lighting sets, concrete mixers and high pressure jets are produced by Ian Dickie & Co (Profile Engineering also produce concrete mixers). Land compaction has also attracted investment. Ian Dickie & Co manufacture smaller, manually operated compactors

whereas Landpac produce large, mobile compactors. Capacity also exists for scaffolding and formwork for concrete projects (notably PERI Wiehahn).

### **Food processing machinery**

The industry is dominated by Buhler SA, which imports machinery but produces components locally (such as conveyors, grain separators for mills, etc). The company claims to have 60% of the South African food machinery market and is particularly strong in agricultural products processing – milling equipment (for products for human consumption) and feeding milling equipment (for animal consumption). They compete with direct imports (particularly from Japan), as well as small engineering shops often involving ex-employees.

### **Textiles machinery**

All textiles machinery is imported, and most of these imports take place through domestic import agencies. The agencies all sell a range of brands along the entire process of textile production. There are about 65 global textile manufacturers competing in the South African market. The largest import agencies include Texmaco and Illies, but the entire importing industry is relatively small and does not employ more than 100 people.

### **Military equipment and aerospace**

The military equipment and ammunitions industry is dominated by Denel and its subsidiaries. Broader market involvement is found through the plethora of defence contractors which exist, many focusing on specialised electronics manufacture and supply. The three largest private sector defence contractors are Reunert, Grintek and Altech. The Strategic Defence Procurement Package (more popularly known as 'the arms deal') has been a major stimulus to the defence and defence electronics industries.

The Denel group split off from Armscor to become the government's military and aerospace technology company. The holding company is involved in investment, manufacturing and service provision in a wide range of activities including engineering, technology and electronics, property services and marketing. Denel is a major beneficiary of the arms deal. It reported a turnover of R 3 899 million in 1998 and employs 10 375 people (which is approximately 15% of the total industry).

## **TRANSPORT EQUIPMENT**

### **Building and repairing of ships**

The shipbuilding industry declined during the 1990s and is represented only by two major players – Southern African Shipyards and the newly created black empowerment company,

SAFreight Shipbuilding (also called SAFBuild, of which Southern African Shipyards is a joint venture partner together with SAFreight). The creation of SAFBuild, through its partnerships with Siemens, Electrowave and Grinaker LTA, has seen the return of these companies to shipbuilding.

Shipbuilding now only takes place at two shipyards, Cape Town harbour's FarOcean Marine shipyard and Durban's Southern African Shipyards; the former is constrained to building 45m vessels, making the Durban operation the only significant shipbuilder in the country. FarOcean Marine shipyard is the primary supplier of utility vessels in South Africa. Ship repair includes additional players, such as Dorbyl Marine IMAC (or DORMAC) (Hawes, 2002).

### **Railway and tramway locomotives and rolling stock**

Union Carriage & Wagons is South Africa's major locomotive and rolling stock manufacturer. Historically, their main focus was passenger carriages but they also the capacity to produce industrial wagons. Transwerk, a Transnet subsidiary previously focused on maintenance and refurbishment of locomotives and carriages, is now building carriages and wagons although they are primarily focused on non-passenger wagons. Dorbyl also has invested in non-passenger wagon manufacturing capacity and have partnered with Transwerk in manufacturing contracts. Electrical motor suppliers Siemens, Alstom, Bombardier and Hitachi all supply the manufacturers, although they import electrical motors.

## **2.4 Value chain**

The machinery and equipment sector does not exist as a single, coherent industry and has its activities classified under a range of different sectors including light engineering, automotive components and transport.

In addition, machinery is not bought in the same way as consumer goods and typically involves a range of producer services. Often, the procurement of machinery is a process involving different consultants, manufacturers and contractors – co-ordinated by a project manager or design engineer (who themselves may be a consultant to the buyer) all of whom provide specialist services towards the provision of the machinery or equipment.

For example, a mine wishing to procure a conveyor belt for the handling of crushed ore needs to procure (through internal department or firm of consulting engineers) the design of the conveyor belt (requiring structural, mechanical, electrical and possibly electronic engineers to do this application design), the manufacturing of the conveyor belt (the fabrication of metal structures, the rollers, the electrical or other motors – not to mention the non-metal components such as the actual belt) and the installation and operation thereof. Often, the buyer of the machine needs to procure the design of the positioning and arrangement of the

conveyor belt depending on their particular needs and factory space. All of this requires project management by engineers. Where this is the case, it is the design (application and arrangement) and project management of the manufacture, assembly and installation which is critical.

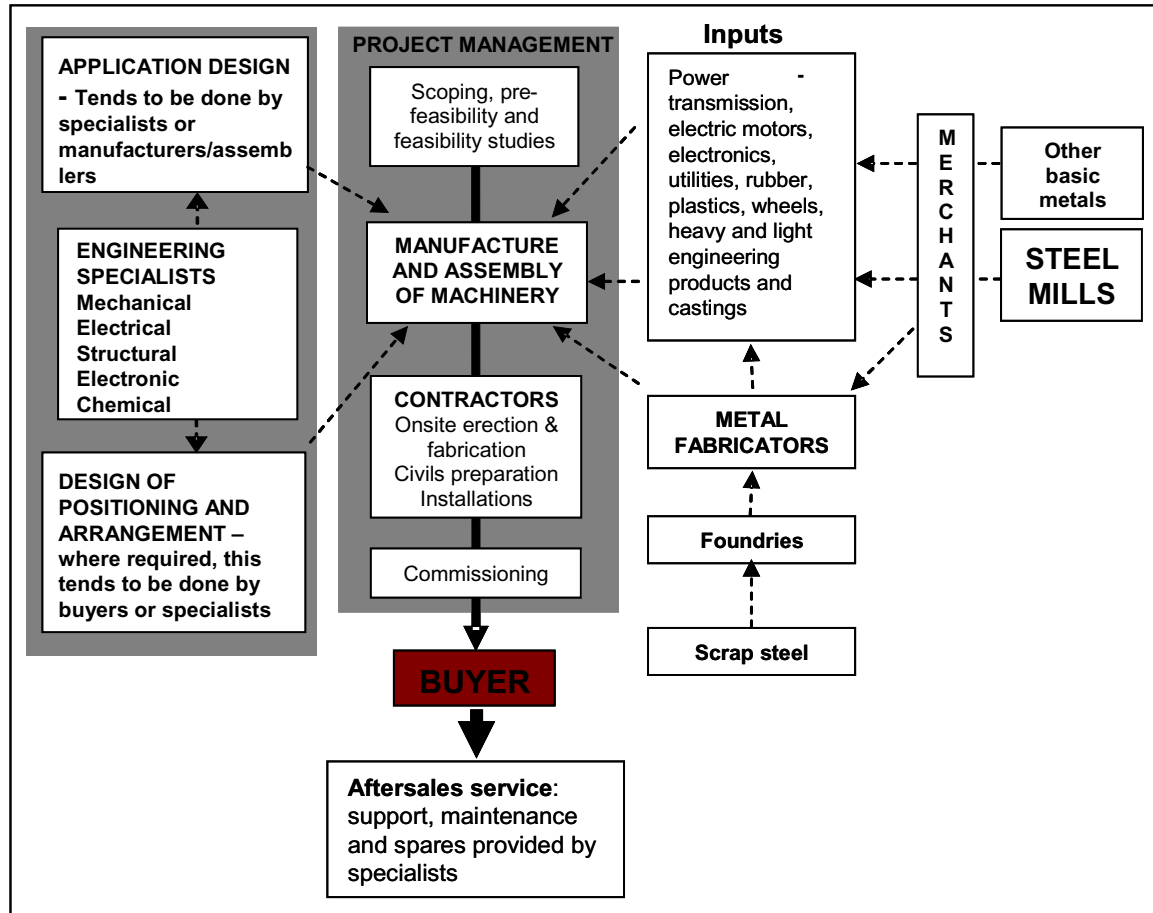
However, not all machinery and equipment is dependent on these project management processes, for example, some textile looms can be bought completely manufactured and assembled without any need for project management and arrangement design. The application design is procured at the same time as the actual loom is procured. The manufacture of machine tools follows a similar process. In some cases where metal fabricators have specialised in certain machinery or equipment manufacture and have achieved economies of scale in this regard, they may incorporate design competencies into their work and the buyer of the machine need only worry about arrangement and positioning design (even this design competency may be incorporated into the fabricator's services). Similarly, specialist firms of consulting engineers may integrate their services into application design and aspects of fabrication.

Manufacturers and traders of steel and foundry castings supply to the specifications of the design. Different types of machinery and equipment have different concentrations and ownerships of design, depending on their particular market characteristics and complexity of the technologies. Typically, machinery and equipment is branded by the owner of the design.

Inputs to the machinery and equipment sector include primarily products and castings from the heavy and light engineering sector, as well as products from the electrical and electronic engineering sector. These inputs are in turn derived from the basic metals sector.

The derived demand for machinery and equipment is in the form of intermediaries which are used in the primary sector, especially mining as well as the manufacturing sector. In South Africa, the export market is also a significant source of demand.

Figure 105. Value chain for machinery and equipment production



The value chain of the machinery and equipment sector therefore has a complex profile. As project managers and consulting engineers play a strong role in the choosing of metal fabrication, castings and component suppliers in the introduction production of machinery and equipment, they need to be considered in the value chain.

## 2.5 Industry association membership

The Metal and Engineering Industry Bargaining Council (MEIBC) has as its membership the majority of companies in the sector. It is estimated from SEIFSA and MEIBC membership data, that 1634 companies are involved in the manufacture and supply<sup>36</sup> of machinery and equipment. The review of a SEIFSA membership list of machinery and equipment-focused

<sup>36</sup> Not all SEIFSA associations require their members to be involved in manufacturing. As a result, some over time have shifted away from manufacture to the import of machinery and equipment but have still retained their membership.

associations generated on 1 November 2002 reveals that most of the companies are small companies. Details are found in Table 28 below.

Table 28. Membership of SEIFSA machinery and equipment associations by company size

SEIFSA ASSOCIATION	< 50 employees	50 – 250 employees	> 250 employees
Refrigeration and Air Conditioning Manufacturers and Suppliers' Association	15	7	1
SA Pump Manufacturers' Association	13	7	3
SA Valves and Actuator Manufacturers' Association	14	9	1
Materials Handling Association *	20	9	2
Lift Engineering Association	10	2	2
SA Refrigeration and Air conditioning Contractors Association (SARACCA) <sup>37</sup>	42	3	-
SA Founders' and Engineers' Association <sup>38</sup>	337	112	36

Source: SEIFSA membership data and SARACCA

\*This association is now defunct owing to lack of industry interest in membership.

In addition to the above associations, there are also several regional associations<sup>39</sup> whose members are drawn from across the metals and engineering industry and are thus not necessarily part of the machinery and equipment sector.

<sup>37</sup> Whilst not manufacturers themselves, members of this association undertake onsite fabrication of ducts, etc, during the erection, installation and commissioning of airconditioning and refrigeration equipment.

<sup>38</sup> This association has in its membership heavy engineering equipment suppliers and machine tool manufacturers but also foundries and non-equipment heavy engineering companies.

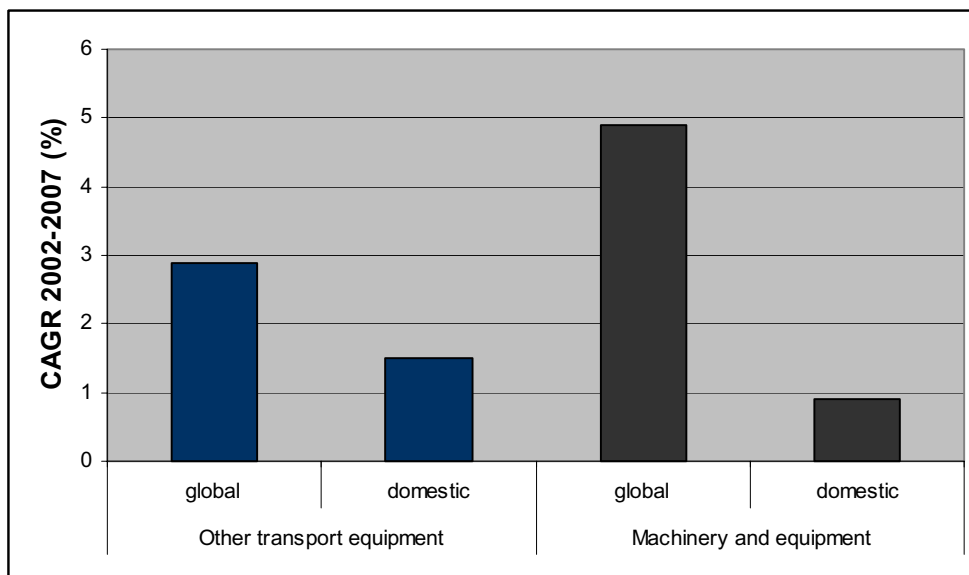
<sup>39</sup> Cape Engineers and Founders Association, Border Industrial Employers' Association, Natal Engineering Industries Association and Port Elizabeth Engineers Association

### 3 THE GLOBAL CONTEXT – MACHINERY AND EQUIPMENT

Globally, the machinery and equipment sector is a medium-size contributor to the overall performance of the metals and engineering industry output. Although the current outlook is better for non-electrical machinery than for transport equipment; the latter’s contribution remains significant but has experienced a decline over the past decades.

Together, non-electrical machinery and transport equipment contribute nearly half of all value added in the production and processing of metal products (International Labour Organisation, 2002). The ILO also notes that machinery (including electrical machinery) and transport equipment accounted for 17.1% of global exports in 2000 (this was down from 17.6% in 1990). Figure 106 shows that the output of the global sector is expected to outperform the South African sector over the medium term. This is due to the high levels of importation in the domestic sector which has resulted in less domestic manufacture.

Figure 106: Predicted growth in the domestic and global output of machinery and equipment and other transport equipment from 2002-2007



Source: ABSA, Bentley West/NALEDI analysis

The global employment structure is shifting from low-income countries to high-income OECD countries. This is due to the better performance of OECD countries’ more technology-intensive and capital-intensive sectors and the relatively poorer performance of the commodity-intensive sectors. The fabrication and preparation of simpler mechanical or electronic components requiring more labour-intensive production according to specified

designs is likely to be carried out in lower income countries where possible (e.g. aircraft components are sub-contracted to low-income countries). Industrialised countries are also responsible for the majority of exports. World Trade Organisation figures for 1997 for electrical machinery, non-electrical machinery, transport equipment and household appliances show that Western Europe (at 48%) and North America (at 21%) account for 69% of world exports, while Asia and Japan account for most of the rest. Africa and Central and Eastern Europe are not significant exporters of machinery and equipment.

There are a number of global trends impacting the machinery and equipment sector, resulting in its becoming increasingly knowledge intensive. The first is that of the rapid development of micro-electronics and automation, which has had a huge impact on the organisation and production techniques within manufacturing, inducing a shift from mass production towards the use of more flexible technologies based on low-cost electronics. This has resulted in rapidly increasing demand for automation machinery, which is of an increasingly high-tech nature. This entails machinery containing a combination of mechanical, electronic and computerised technologies, which necessitate closer integration between the machinery and equipment and electrical and electronic sectors and implies that the competitiveness of the machinery and equipment sector is partly dependent on the competitiveness and innovation within the electrical and electronic engineering sector. This is particularly relevant when imported machinery requires adaptation in order to work efficiently in specific local conditions. This trend has underpinned the increasing demand for high-tech machinery both globally and in South Africa.

The second global trend is the shift away from economies of scale and toward innovation. The increasing emphasis on research and design (R&D) involves networks of business, science and technology organisations and results in shorter product lifecycles and increased rivalry in the industry. The level of innovation is often higher than an individual company can feasibly achieve, making alliances a critical source of competitive advantage. Market leaders sustain competitive advantage through investing heavily in R&D and forming strong alliances both horizontally and vertically.

The third global trend is that of globalisation of production. The capital intensive nature of the machinery and equipment manufacture along with the shortened product lifecycle times requires that companies maximise their economies of scale by increasing their emphasis on global markets, as domestic markets are generally too small. This results in large multinational companies having dedicated plants that produce one type of product which is then distributed worldwide, creating economies of scales which enable price competitiveness.

## 4 DOMESTIC LANDSCAPE AND PERFORMANCE

South Africa's economy developed around the mining industry and to a lesser extent the agricultural, forestry, and other resource-extraction industries. The sector also attracted significant 'strategic' state investments such as Iscor, Sasol and Eskom to maximise the country's industrial development and at a later period, to protect and isolate the apartheid state from political vulnerabilities resulting from trade dependence on hostile countries.

This latter strategic shift by the apartheid government, which developed within the global Cold War climate, also led to the emergence of a powerful state military-industrial complex that designed and manufactured military equipment. Some of the apartheid government's strongest research and development capabilities were found in this military-industrial complex, headed by Armscor. It also led to the development of powerful military and industrial equipment suppliers such as Reunert. South Africa's locomotive and shipbuilding industries also emerged through strong state support, while a civilian aerospace industry emerged out of development spin-offs in military aerospace technologies.

Many of the equipment manufacturers supplying the mines started as engineering workshops providing the mines with maintenance and reverse engineering services ensuring the adequate adaptation of imported mining equipment to South African conditions. Under growing trade isolation and state import substitution industrialisation policies, these companies diversified into original equipment manufacturers. Import substitution industrialisation also forced the foreign investment of a number of global companies as direct importation of products became too expensive under heavy import tariffs. This foreign investment was also often further encouraged through generous tax and other incentives (such as negative real interest rates) to ensure profitable local operation.

This strategy led to a sizeable increase in local manufacturing capabilities in globally advanced technologies. It also caused the diversification of local equipment supply to other industries and applications, as goods became more and more expensive to import and difficult to obtain. Much of the equipment supplying mines and the resource-intensive sectors had easy application in other industries, with little adaptive engineering required. These conditions, combined with the difficulties experienced when trying to export at that time, resulted in the sector developing with a particular focus on the domestic industry.

Assisted by strong state protection and a growing mining industry which came to dominate global mineral production, the sector developed to become one of the larger employers within the metals and engineering industry during the 1960s and 1970s. State protection enabled the sector to become larger than the relatively small size of its markets would have otherwise allowed.

To some extent, the disinvestment during the mid to late 1980s damaged the sector, but foreign companies left a strong deposit of learning and skills in the country that allowed for the development of indigenous equipment.

This era, however, came to an abrupt end during the 1990s. The collapse in the gold price resulted in a decline in the mining industry for most of the 1990s which negatively impacted the sector. In addition to this, the sector was hit hard by South Africa's return to the global market with the new democratic government's policy switch from import substitution industrialisation to export-orientation and trade liberalisation. The reduction in tariffs in 1994 also contributed to the sector's present situation with the arrival of cheaper imported products. Many domestic companies were unable to compete internationally and in response, shifted their focus from manufacturing to importing products and instead providing services. These services include adaptive engineering, project management, installation and commissioning services, maintenance, leasing and support, which Edwards terms "value-added reselling".

These changes had a number of implications for domestic manufacturers; which were reflected in the interviews conducted and impact in varying degrees on the different industries within the machinery and equipment sector. They are as follows:

- The switch in domestic machinery and equipment buyers to global brands and global technologies. This trend has been less marked with state procurement and (to a lesser extent) transport equipment, where technological capabilities were historically sustained through strong state R&D support. This trend has necessitated that some locally-owned companies sell their operations to global companies or undertake the full or partial importation of global brands and supply or manufacture under licence. However, it should be noted that there are notable exceptions where domestic manufacturing expertise in a specialised niche product enables the company to secure market share.
- The switch in local offices of multinational companies from local manufacture to direct import of their brands and a shift in focus to the provision, installation, commissioning and after sales service support. As a result of the increased importation, domestic manufacturers have also tended to specialise production and reduce their own manufactured product ranges.
- Many companies have switched to export markets, which has been assisted to an extent by South Africa's integration into the Sub-Saharan African economy. Although many companies still consider the domestic market to be their primary focus, there has been increased emphasis on exports, mainly as a "crisis response" to the dramatic increases in imports.

As a result of the above events, a much-diminished machinery and equipment industry has emerged into the new millennium. The shift to exports, has given the industry some hope, as has the improved fortunes of the mining industry (particularly the rapid growth in platinum) although the growing presence of imports continues to beleaguer the sector.

Some aspects of general purpose machinery such as pumps, compressors, taps and valves; non-automotive power transmission equipment; lifting and handling equipment and refrigeration and air-conditioning are well-established in South Africa. Where local capacity exists, there is a moderate degree of rivalry although multinational companies and brands dominate the market. The national perspective on R&D expenditure has been poor, which is likely to be the case for the machinery and equipment sector, given the current state of the sector.

In contrast, most specialised machinery is imported due to the relatively small size of the domestic market and the strength of existing global brands. There is very little local machine tool manufacturing although South Africa has developed competence in the areas of defence and mineral processing equipment.

The domestic transport equipment industry is concerned primarily with the building of ships, locomotives and rolling stock. The large capital investment required to enter the industry inhibits new entrants, which combined with the decline that the industry has experienced over the last 10 years, has resulted in the industry being dominated by relatively few companies. Currently, 80% of the input materials for rolling stock are locally procured, although all the equipment required for the repair of rolling stock is imported.

Most machinery and equipment manufacture is done on a project basis, with specific adjustments for each customer, with only a small amount of batch jobbing taking place for general purpose machinery such as pumps in order to reduce lead times. The customised nature of the product results in a fluctuating demand pattern and a high degree of reliance on skilled artisans and engineers. Companies' erratic buying patterns make the management of supplier relationships difficult, resulting in an increased reliance on imported input materials. The uncertainty of demand forces companies to adopt multiple core competencies, moving beyond mere manufacture into the provision of after sales services. Companies also tend to favour a more flexible labour force both in terms of absolute numbers and multi-skilling.

Much of the design and technology of the sector's products are of foreign origin with elements of local adaptation design, although there are notable exceptions in the areas of ultra-deep level mining equipment, construction equipment, equipment for agriculture and forestry, utilities and processing equipment.

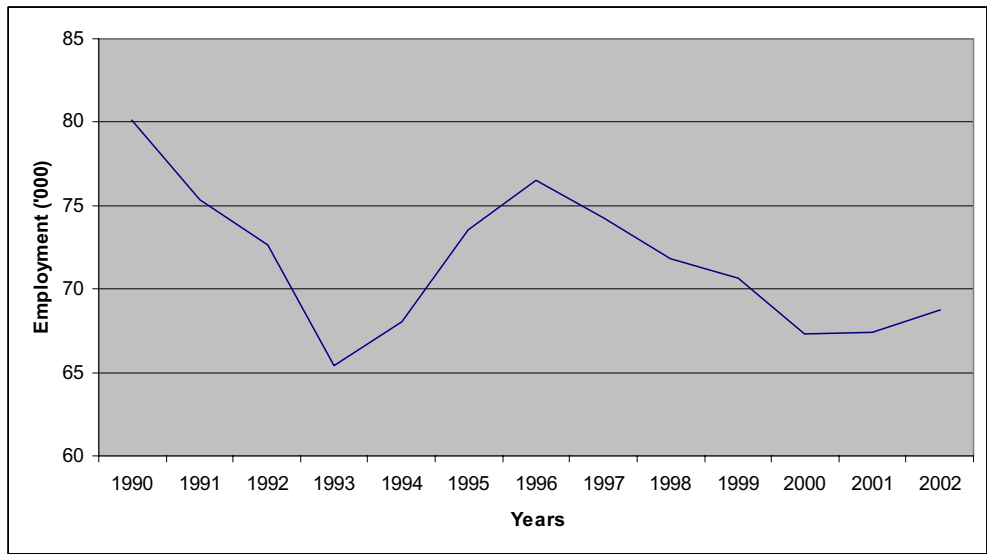
The increasing focus of global market leaders on innovation and R&D has resulted in a widening gap between domestic players and their larger global counterparts, making it increasingly difficult for South African companies to compete head on head and instead focusing on the provision of supply and support services for imported products.

### 4.1 Employment

Considering the trends in employment rather than the actual numbers of employees in the machinery and equipment sector, is likely to be more useful for forecasting future scenarios for the sector and is thus a more practical way of considering sector employment when devising strategies to retain and create employment within the sector.

Figure 107 shows that between 1990 and 2001, employment within the non-electrical machinery sub-sector has declined to a level of 68,711 in 2002.

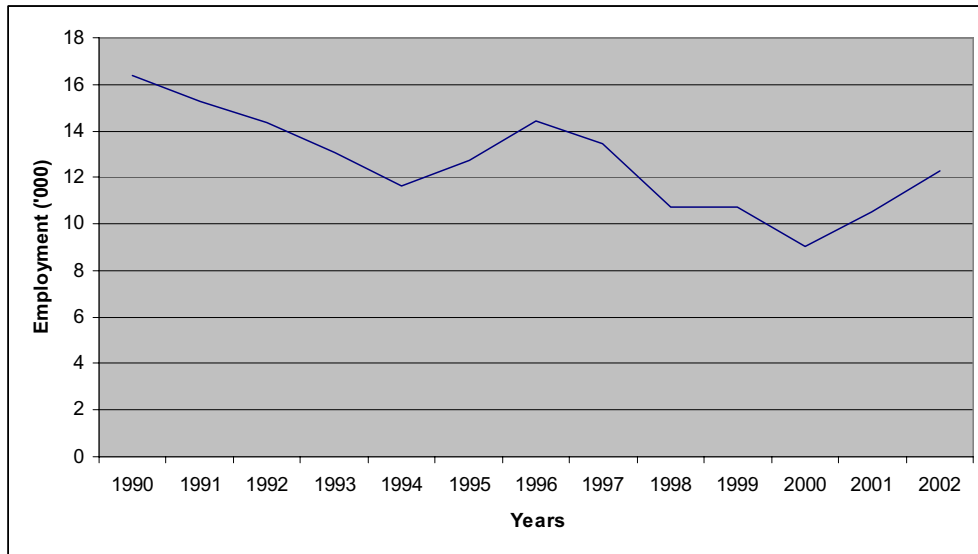
Figure 107. Employment in the non-electrical machinery sub-sector, 1990 – 2002



Source: IDC

More dramatically, Figure 108 illustrates that transport equipment's employment levels, have declined to a level of 12 252 employees in 2001.

Figure 108. Employment the transport equipment industry from 1990 – 2002



Source: IDC

Although official statistics show that the employment decline for both sectors had evened out by 2002, this is contradicted by the survey as highlighted in Table 29, which shows a decline in overall employment, largely due to a reduction in the number of permanent employees.

The survey found that a compound annual decline in employment of -5.0% occurred from 1999 to 2002. There was a drastic annual decline of -8.2% observed among permanent employees, which offset the large absolute and relative increases in the number of casual, temporary and sub-contracted workers. The sluggish growth in sales and fluctuating demand underpins this drive towards a more flexible workforce, as large companies are averse to taking on permanent workers they feel they will be obliged to retrench at a later stage.

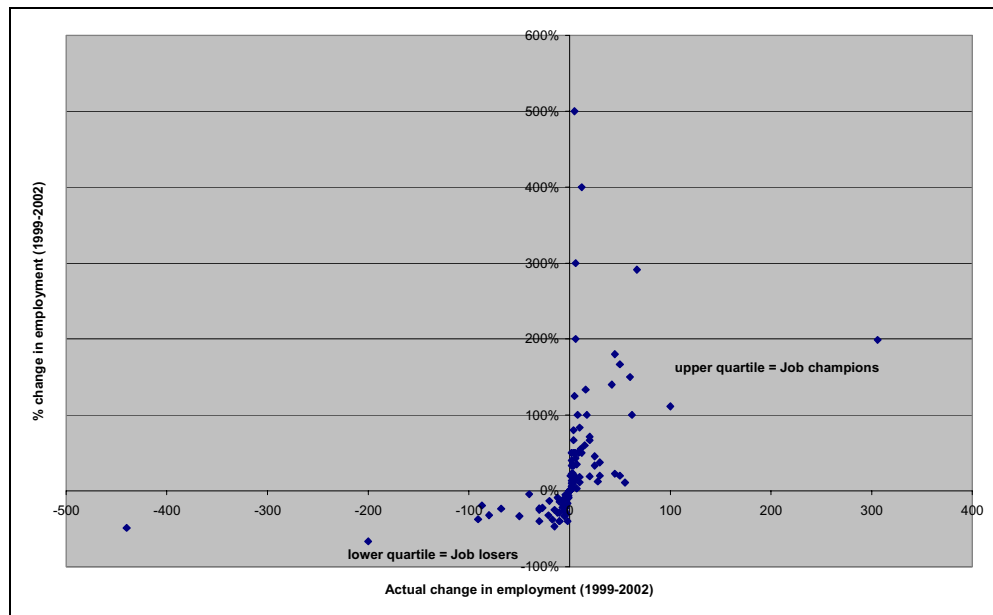
Table 29. Employment trends in the machinery and equipment sample from 1999 to 2002 by employment category

	Sample employment 1999	Sample employment 2002	Compound Annual Growth Rate
Permanent employees (f/t and p/t)	15 016	11 613	-8.2%
Casual employees	17	148	105.7%
Temporary employees	2	48	188.4%
Sub contracted labour	291	1 326	65.8%
<b>Total labour</b>	<b>15 326</b>	<b>13 135</b>	<b>-5.0%</b>

Atypical labour in the sector is not disguised permanent employment. Our survey found that very few incidences of such employees spending more than 3 months within a company.

Figure 109 affords a more detailed understanding of recent employment trends within the sector with the majority of companies clustering around the origin, reflecting that they experienced only slight fluctuations in employment over the last three years. The pattern of job creation appears to stem from small increases in the size of the workforce across many companies, whereas the job loss tended to come from fewer companies retrenching relatively more employees. The top quartile of companies in the upper right hand quadrant were grouped into the “job champions” category, while the bottom quartile of companies in the left hand quadrant fell into the group termed “job losers”. This formed the basis for exploring the difference in behaviour of job champions and job losers which is pursued later in the report.

Figure 109: Employment trends from 1999 to 2002 within the machinery and equipment sub sector\*



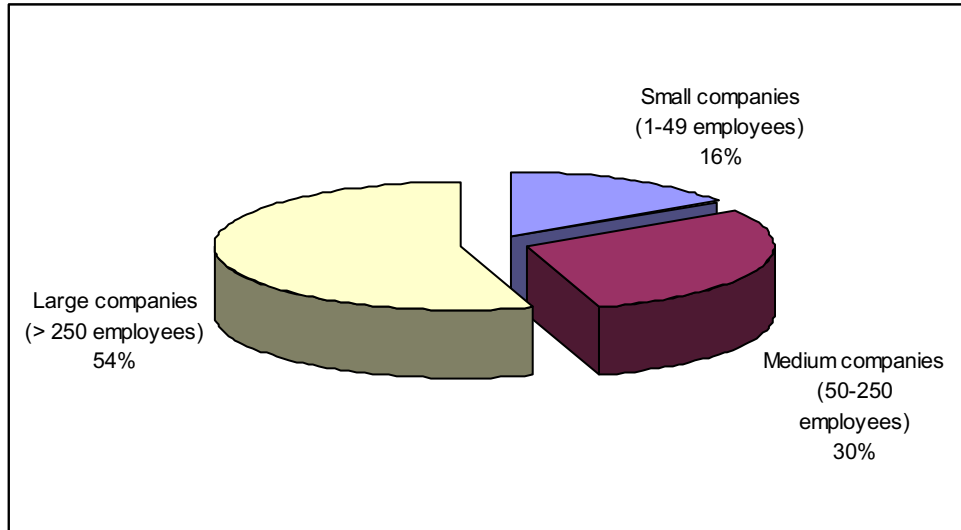
Many of the companies interviewed had undertaken retrenchment exercises in the past five years, but had not done so recently and if they were seeking to reduce their employment complement, this was being done through natural attrition rather than retrenchment. Thus although job shedding is likely to continue within the sector, it will be less severe.

However, it must be borne in mind that the survey was conducted before the currency strengthened in early 2003. Since a high level of exporting takes place within the sector; a persistent strengthening in the currency could negatively affect export markets. In addition,

exchange rate fluctuations are a double edged sword, with currency strengthening making importation cheaper and impacting negatively on the price competitiveness of exports.

Figure 110 highlights that large companies account for over half of all employment in the sector.

Figure 110. Employment contribution by company size 2002



#### 4.1.1 Outsourcing

Table 30 shows that as company size increases, there is an increased incidence of outsourcing.

Table 30. Outsourcing expressed as a percentage of turnover by company size for 2002

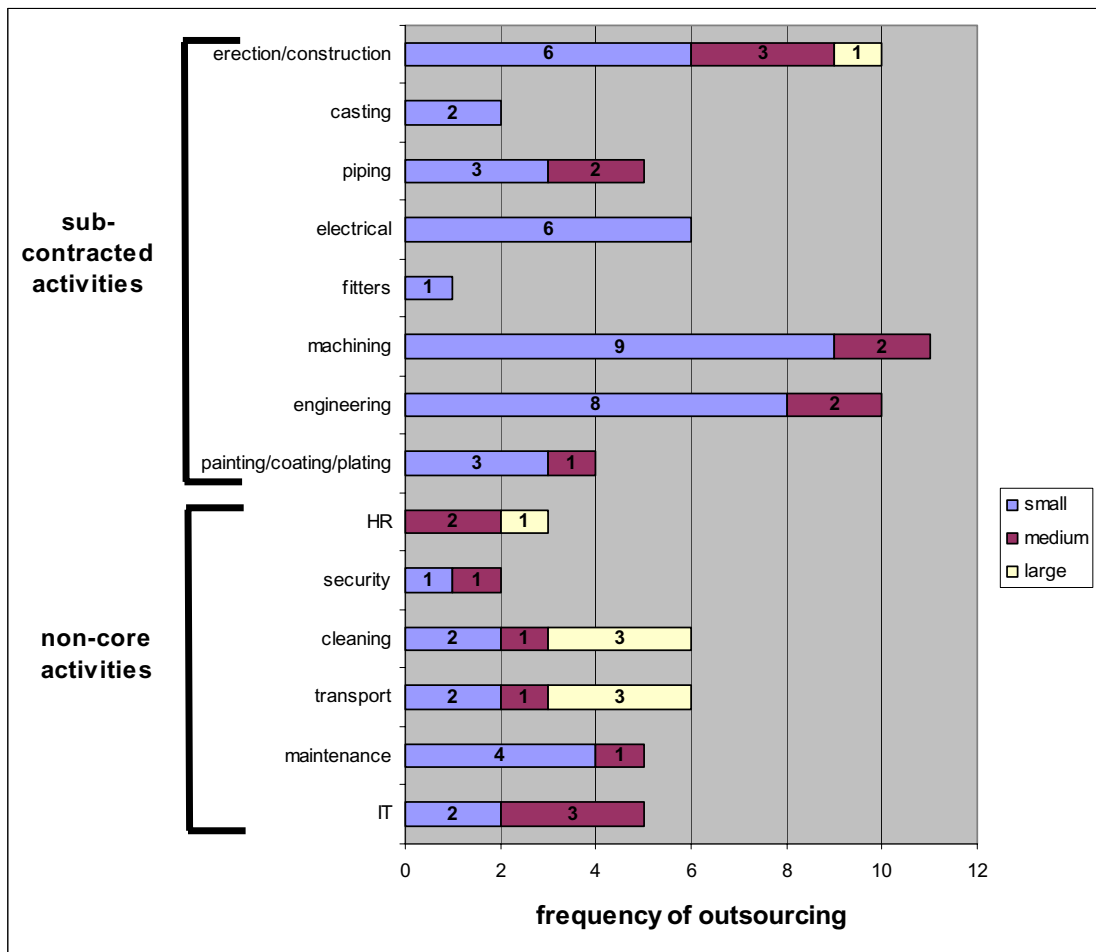
Company size	Incidence of outsourcing	Rand value of outsourcing (as a percentage of turnover)
Small	36.3%	6.5%
Medium	51.4%	12.7%
Large	66.7%	0.2%*

\*Accounted for by 2 companies

When considering the type of activities outsourced, a distinction was made between non-core activities and sub-contracted activities, with sub-contracted activities relating to the core activity of the company.

In general, the services outsourced tended to be sub-contracted and more technical in nature rather than generic non-core functions, such as cleaning and transport. This contrasts with the rest of the metals and engineering sectors where primarily non-core activities were outsourced. Figure 111 summarises the more commonly outsourced services. Small companies tended to outsource the more technical functions, with machining being the most commonly outsourced function, while electrical services and erection/construction were the second most commonly outsourced functions. Within medium companies, cleaning was the most commonly outsourced function, while Information Technology and transport were the second most commonly outsourced functions. Large companies tended to outsource transport, cleaning, construction and Human Resources.

Figure 111. Type of services outsourced among small, medium and large companies



The tendency to either outsource non-core activities or to sub-contract has different implications. Non-core activities are usually outsourced to reduce costs, providing the