CHAPTER 1

SCOPE OF THE THESIS

1.1 INTRODUCTION AND BACKGROUND

According to the Chamber of Mines of South Africa (COM) the South African mining industry had since its inception made an extremely important contribution to the social development and national economy of the country (COM, Annual Report, 2006 - 2007:12). It was and still is the largest industry sector in the country and is widely being recognised as a leading supplier, producer and exporter of a great variety of minerals (refer section 1.2.6 and table 1.2). It is a major employer and source of income to employees and the state (COM, Facts and figures, 2006 - 2007:13 and section 1.2.7.2). The industry played and still continues to play a valuable leadership role in many local and worldwide safety and efficiency improvement projects (refer section 1.2.7.1).

According to the Department: Mineral and Energy (DME) the South African mining industry provided the stimulus for the extensive development of an efficient physical infrastructure that greatly contributed to the development of related secondary industries in the country (DME, South Africa's Mineral Industry, 2004/2005:1). It holds, in comparison to total world reserves, a dominant position in many mineral reserves, production and exports (refer table 1.2). The industry developed a high degree of technical expertise and the ability to mobilise large amounts of capital for the development of new projects (DME, South Africa's Mineral Industry, 2004/2005:1).

Like other industries the industry also operates within industry-specific environmental factors and challenges. Its performance is adversely being affected by increasingly complex geological conditions, labour demands, local and global competition and the fluctuation in the R/$ exchange rate. In addition skills shortages, increasing social commitments, rising input costs, new laws, mandatory black economic empowerment and inadequate infrastructure and unreliable energy and water supplies further aggravate the situation (COM, Annual Report, 2004 – 2005:30-83).

With the advent of the democratic dispensation in South Africa in 1994 many new acts had been introduced. The Mineral and Petroleum Resources Development Act (MPRDA) was promulgated in 2003. The industry had since then to comply with all the changes, demands and challenges of the new and revised mineral acts (DME, South Africa's Mineral Industry, 2004/2005:3-4).

The South African mining industry had, for a very long period, been one of the leaders in the global mining arena. Global competition in the meantime increased significantly over the years and became a reality that should be efficiently managed in the future. More recently the opinion was expressed that the industry's position as a cheap supplier of various minerals to world markets is deteriorating at an alarming rate (COM, Annual Report, 2004 - 2005:22).

In spite of major improvement programs the industry is still loosing ground relative to the leading mining countries in the world (COM, Annual Report, 2004 - 2005:22). Mine management in general is of the opinion that existing management practices being utilised by the industry, are inadequate to enable it to manage in a comprehensive manner (refer section 4.2.1). It would appear that an all-inclusive management practice that could be utilised by the mining industry does not exist at present. It is perceived that none or not even a combination of the existing management practices would constitute a complete logically integrated management practice. With increasing globalisation and competitivity, competent management and employees are becoming more than ever before indispensable to the success of the South African mining industry.

The author of this thesis believes that the ideal management method should consist of an appropriate theory and procedure in order to be successfully applied by every employee in the South African mining industry on each level of the organisation. It should enable all the employees on all the levels in the organisation to comprehensively manage the achievement of the results required from each one of them. It implies that all the required work should be efficiently planned for, coordinated, integrated and executed by every employee on every level of the organisation. It is perceived that the industry is in dire need for such a management method. The question of whether and how such a method could be developed would form the crux of this thesis.

In this chapter the commencement, development, importance and role of the mining industry in the South African economy and the factors and challenges facing the industry are briefly discussed. The management practices applied since the inception of the South African mining industry up to the present and specifically an efficient management method perceived for the future would be researched. The research problem, hypotheses, questions and objectives of the study and the key attributes of the desired theory and derived method would be specified. Finally a proposed layout of the study would be given.

1.2 HISTORICAL DEVELOPMENT AND CURRENT STATE OF THE MINING INDUSTRY IN SOUTH AFRICA

1.2.1 The role of mining in the development of mankind

Mankind developed the ability to identify and utilise natural resources of one kind or another in order to manufacture elementary objects such as weapons and utensils for use in its daily activities. The sophistication and efficiency of these crude objects increased over a long period of time with the invention of more advanced stone utensils (Wells, 1961:66-79). The earliest stone tools to date, discovered in Southern Africa, date from the early Stone Age period of about 15 million years ago (COM, Annual Report, 2002 - 2003). Later Stone Age artefacts such as bored stones and grindstones were used for grinding ochre and food and for digging out plant bulbs. According to Kloppers (2001:5) primitive stone tools were discovered during the late twentieth century at the Park Town area in the present city of Johannesburg, indicating that humans inhabited this area approximately 1.2 million years ago.

The early settlers brought with them the knowledge of how to smelt iron and copper ores in furnaces fuelled by wood and self-made charcoal in order to manufacture crude tools, utensils and weapons. Ore deposits, where too deep to extract from the surface, were in many places exploited by means of a simple system of small tunnels and underground excavations or stopes (COM, Annual Report, 2002 - 2004:48). Ancient tin workings had been discovered north of the Limpopo River, at Rooiberg, Leeuwpoort and Weynek in the Waterberg District. Some of these workings extended to depths of 70 meters (Jeppe, 1946:6-7).

Ashton (1997:129) pointed out that mining, in its infant stages with relatively unproven methods, caused a lot of hardship to people but that it eventually resulted in much better living conditions for countries, peoples and communities. In Britain, one of the very first 'mining' countries in the early days, it was not regarded as unusual or unethical to use boys as young as eight years to work underground under dangerous and hazardous environmental conditions. In those days it was believed that the history of Britain's mining industry was the history of the rise of Britain to the pinnacle of industrial supremacy in the world. Its claimed riches and greatness were built on coal, the most important mineral asset of the country (McCutcheon, 1974:v).

It would appear that a country endowed with relatively large mineral deposits has an added advantage over less fortunate countries. It stands to reason that such a country could not only extract and export some of its excess minerals but that it could also beneficiate and utilise it for manufacturing purposes. It invariably creates employment and labour stability. South Africa is one of the leading countries in the world in the production and export of minerals to a great number of countries (refer section 1.2.6.2 and table 1.2). It still has large mineral reserves (refer section 1.2.6.1). Its rise to the status of a first world country in a relatively short period of time could to a large extent also be attributed to the contribution of its mining industry (COM, Annual Report, 2004 - 2005:14).

Mining materialised many centuries before the advent of the so-much-acclaimed Industrial Revolution. Unfortunately no exact record of the commencement of mining exists. The history and progress in mining expertise is most probably best described in Agricola's popular and detailed account of the mining discipline in his book '*De Re Metallica*' originally published in 1556 and translated in English in 1950 by Herbert and Lou Hoover (Agricola, 1556:1-638).

1.2.2 The geology of South Africa

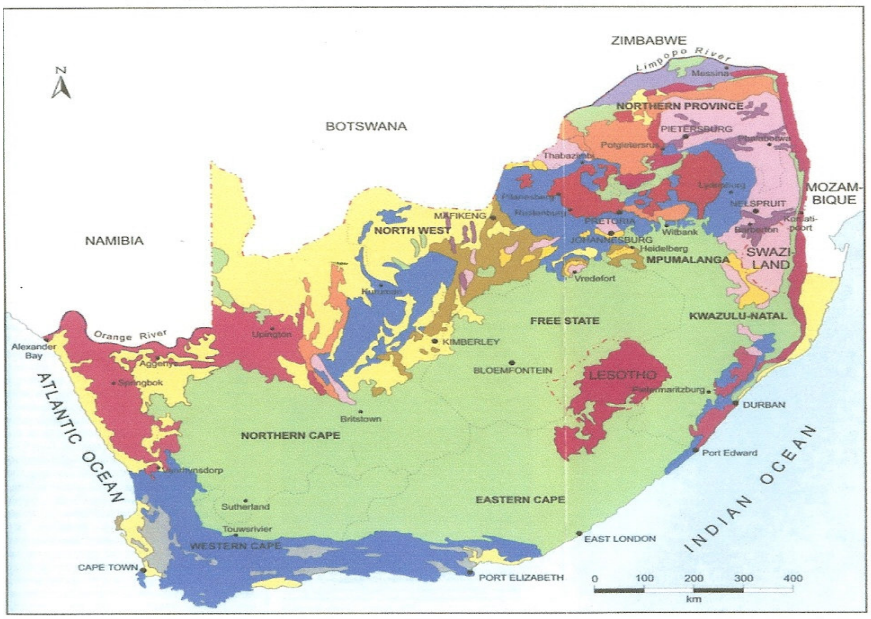
1.2.2.1 The geological history of Southern Africa

The geological history of Southern Africa dates back to approximately 3 700 million years ago (refer figure 1.1). The Central Rand Group strata, deposited between 3 074 and 2 714 million years ago, contained an estimated 82 000 tons of gold metal when it was discovered in 1886 (refer section 1.2.4.1). According to MacRae (1999:64) approximately 40 000 tons of this gold had been casted since then to the end of 1 999 (refer table 1.1).

Gold had been discovered and mined in the Barberton area since the 1870s. It was and still is predominantly being mined in the Witwatersrand area. Many more discoveries of different minerals were made in later years in many other parts of the country.

1.2.2.2 Main geological formations

The main geological formations were developed on the Kaapvaal Craton, which occupies the north-eastern part of the country (refer figure 1.1). At present most of these formations are being exploited.



Rock Types	Stratigraphy	Rock Types	Stratigraphy
Recent sediments	Tertiary, Quaternary	Igneous intrusions, etc (dolomite, limestone, iron formation, shale, quartzite)	Bushveld Complex
Volcanic' s (Basalt, rhyoiste)	Karoo Supergroup	Sediments, (dolomite, limestone, iron formation, shale, quartzite)	Transvaal Supergroup
Sedements (sandstone, shale, siltstone and dolerite	Karoo Supergroup	Lavas (basolt, adesite, porphyry)	Ventersdorp Supergroup
Granite, sediments (limestone)	Cape Granites Malmesbury Group	Metamorphics (gneiss, granuite, schist)	Limpopo Province
Sediments (sandstone, quartzite, shale)	Cape Supergroup Malmesbury Group	Sediments, volcanics (quartzite, conglomerate, lava)	Witwatersrand, Pongola Supergroup
Metasediments, metavolcanics (gneiss pegmatite, etc)	Namaqua-Natal Belt	Granites, tornalite, granitoids)	Archean Granitic Crust
Sediments (Arkose, conglomerate)	Waterberg Group	Sediments, volcanic"s (sandstone, congiomerate, komatitite, pyroxerite)	Greenstones Barberton, Murchison, Pietersburg
		Provincial Boundaries	

Figure 1.1: The geological map of South Africa

Source: Viljoen & Reimold (1999:2)

According to the DME (South Africa's Mineral Industry, 2004/2005:4-5) the mineral wealth of South Africa is largely contained in the geological formations of the:

a) Witwatersrand Basin which hosts a considerable portion of the world's gold, silver, uranium, pyrite and osmiridium,
b) Transvaal Supergroup containing large deposits of iron and manganese ore,
c) Bushveld Igneous Complex which contains more than half of the world's reserves of chrome ore and platinum-group metals (pgms) as well as considerable deposits of vanadium, iron, copper, titanium, fluorspar and nickel ore,
d) Palabora Igneous Complex containing large deposits of phosphate, iron, copper, titanium zirconium and vermiculite ores,
e) Karoo basins in the provinces of Mpumalanga, KwaZulu-Natal and Limpopo hosting extensive coal and anthracite deposits,
f) Kimberlitic, alluvial and marine formations hosting diamonds, and
g) Heavy mineral sand occurrences, containing titanium minerals, zircon and iron.

In South Africa relatively young deposits, ranging from 70 million years to a few thousand years ago, are abundant. Amongst these are the Kalahari Group sediments, coastal and shallow marine and lagoonal sediments as well as present and ancient river terraces. Many important minerals are concentrated in these alluvial deposits, including diamonds along the Vaal River and at the mouth of the Orange River.

South Africa is world wide renowned for its major reserve deposits and as a supplier of valuable minerals and metals to the world markets (refer section 1.2.6 and table 1.2). It is frequently being visited by interested parties from abroad. It has an abundance of unique geological features and is renowned internationally for this. Earth scientists from all over the world frequently visit the country. It had become increasingly important to optimise the utilisation of resources to the benefit of the country, its inhabitants and the world economies at large (refer Viljoen & Reimold, 1999:12-13).

1.2.2.3 Mineral deposits

The mineral deposits, in particular the older ones, provided valuable geological information and form a basis for the development of future exploratory initiatives. Previous courses of rivers, past plant and animal life and changes in sea level and the climate were determined by means of this newly developed geological science. In South Africa ample geological deposits exist. It mainly includes the major marine alluvial formations hosting diamonds and heavy mineral sand occurrences containing titanium minerals, zircon and iron (refer section 1.2.2.2 (g) and figure 1.2).

Diamonds together with many other minerals are contained in the alluvial deposits along the Vaal River and at the mouth of the Orange River. Heavy minerals such as titanium and zirconium are found in sand dunes and beach deposits at places around the coastline. Large reservoirs of natural gases were identified in recent sediments off the Southern Cape coast. Natural pan forming produced many pans in the country. Some of these pans, especially the salt pans are being

economically exploited. The Pretoria 'salt pan' north of Pretoria represents the Crater Lake in a 220 000-year-old meteorite impact crater (Viljoen & Reimold, 1999:13).

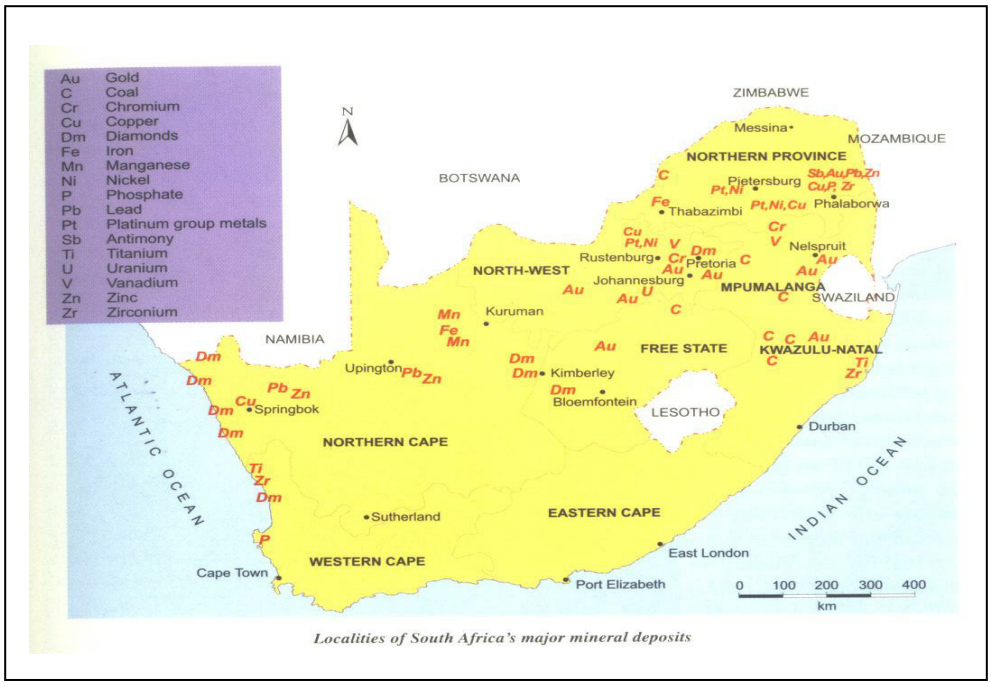


Figure 1.2: Major mineral deposits in South Africa

Source: Viljoen & Reimold (1999:13)

1.2.3 Commencement of the mining industry in South Africa

South Africa's involvement with minerals officially commenced in 1686 when Simon van der Stel, the first governor of the Dutch Settlement in Table Bay discovered promising copper ore deposits approximately seven kilometres east of the present town of Springbok in the Northern Cape Province (refer figure 1.3). In addition an insignificant coal deposit was discovered in 1699 in the Franschoek Valley to the east of Stellenbosch (Lang, 1995:13).

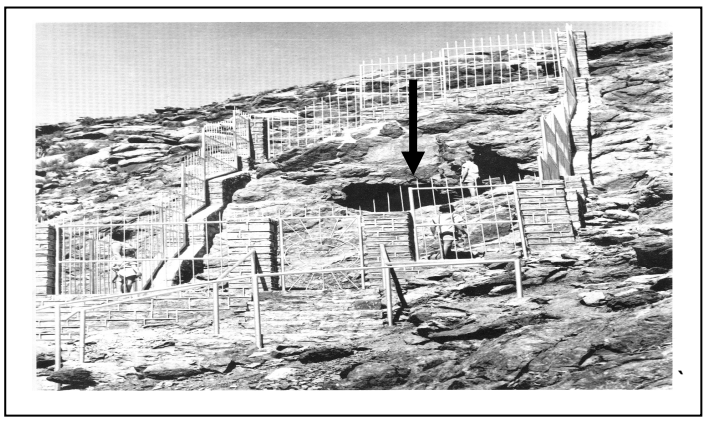


Figure 1.3: Historical monument – Simon van der Stel mine

Source: Van Niekerk (1984:5)

According to Lang (1986:6) modern mining in South Africa can be traced back to 1852 when systematic attempts were being made to recover the copper deposits in the Northern Cape discovered by Van der Stel in 1686. The first mine in South Africa, the 'Blue Mine' was established on the western outskirts of the present town of Springbok (refer figure 1.4). Initially the copper ore was transported in bags by means of wagons to Hondeklip Bay on the West Coast, the nearest navigable port to the sea. Since there were no decent roads a special road 'the copper road' had to be constructed. In order to minimise the losses of copper ore en-route and the cost of transportation a smelter was constructed where the ore was smelted and casted into bars for more economical transportation (refer figure 1.4).

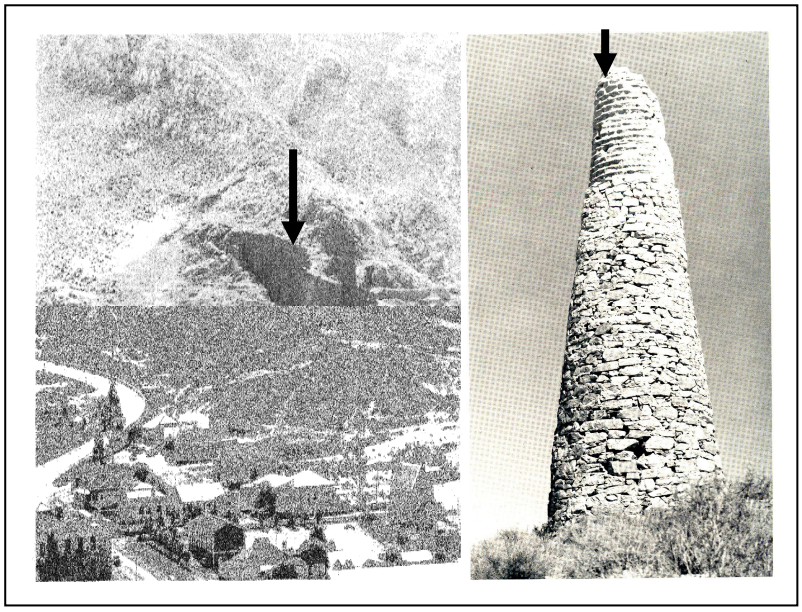


Figure 1.4: The 'Blue Mine' – First mine and smelter chimney in South Africa
Source: Van Niekerk (1985:9-11)

The fuel or firewood was supplied from local sources (Van Niekerk, 1984:9-11). The mine became the main source of employment mainly to the local inhabitants. Technical experienced staff was imported mainly from the United Kingdom. Since 1852 the mining industry grew from this one mine to a total of 993 mines and quarries in 2004 (DME, South Africa's Mineral Industry, 2004/2005:1).

In 1803, the British permanently occupied the Cape Settlement, which was under Dutch control for 150 years. Many of the farmers, tired of across border raids in the Eastern Cape and British rule, left their farms and began with the Great Trek to Natal in 1836. These Voortrekkers settled in areas unoccupied and areas acquired from the local chiefs. When Britain declared the Natal Province a Crown colony in 1844 the Voortrekkers trekked over the Orange and Vaal rivers and established the Republics of the Orange Free State and the Zuid-Afrikaanse Republiek respectively (Cartwright, 1962:12). These republics were declared independent Boer Republics in 1854 and 1852 respectively.

The Trekkers developed their farms and gradually established the basic infrastructure. At the end of the second Anglo-Boer War in 1902, the British took also permanent control over these Republics. In May 1910, the Union of South Africa was established. Most of the mineral deposits were discovered in these republics and are still being exploited to date. In 1994 a democratic dispensation was established in South Africa.

1.2.4 Development of the South African mining industry

The development of the eight largest mining sectors, employing an average of 430 437 people (94 per cent) of the total labour in the mineral industry and generating sales of R170.404 billion (89.43 per cent) of the total mineral sales in 2006 were discussed briefly (refer table 1.1). As the diamond sales income in South Africa was not available the value of the sales was estimated from the 2006 total world diamond sales value (refer COM, Annual Report, 2006 - 2007:18).

Year: 2006	Performance			
Main Mineral Sector	Production		Sales (Rbillion)	Labour
Gold	272.1	Metric tons	37. 443	159 984
Coal	244.762	Million tons	37.991	57 777
PGMs	307.5	Metric tons	65. 444	168 479
Iron	41. 326	Million tons	9. 928	8 848
Chromium	7.418	Million tons	2.302	7 901
Manganese	5.213	Million tons	2.246	3 340
Diamonds	15.4	Million carats	10.08 1)	20 115
Copper	109.6	Kilo tons	4.956	3 993
Total			170.404	430 437
Total Mining			190.545	458 600

Note: 1) = Calculated value (COM, Annual Report 2006 – 2007:18)

Table 1.1: Main mineral sectors

Source: DME, Minerals Statistical Tables (1985 - 2006)

1.2.4.1 The gold mining sector

The Lydenburg Gold Prospecting Company at Spitskop in the Eastern Transvaal first carried out successful alluvial gold mining in 1871. Alluvial gold was also discovered in 1873 at Eersteling, Lydenburg, Sabie, Pilgrim's Rest and Barberton (Scannell, 1988:3). Marx (1987:17) reported that gold was also discovered in November 1885 by Marthinus van Vuuren on the farm Ysterspruit near the present town of Klerksdorp. George Harrison and George Walker were generally being credited with the discovery of the major gold bearing deposits of immense values and quantities in March 1886 on the farm Langlaagte (refer figure 1.5 area indicated by arrow) a few kilometres west of Johannesburg (Viljoen & Reimold, 1999:33). These were deposited between 3 074 and 2 714 million years ago in the Witwatersrand Geological Basin and are regarded as the largest repository of gold in the world (Wilson & Anhaeusser, 1988:1). The occurrence was later found to be extending as far south as the present Klerksdorp and Welkom areas.

Mainly because of the steep gradients of some of the gold-bearing deposits (reefs) mining conditions changed relative rapidly with the resulting structural problems and increasing financial requirements. Fortunately the scope of mining geology and access to deep formations and new areas literally exploded worldwide after 1850 (Peters, 1978:7). Mining technology with newly invented tools such as the power hoist and the Cornish pump, created the possibility to open up deeper deposits so that theories of mineral zoning and structural control could at that time already be tested to depths in excess of 1 000 meters below the surface. In South Africa, especially in the Witwatersrand area, these inventions held great promise in the quest to efficiently exploit the steep declining gold bearing deposits and in general all deep mineral deposits.

The Southern Transvaal straddled the Witwatersrand watershed, surmounted by farms such as Randfontein (1) Roodepoort (2) Langlaagte (3) and Doornfontein (4). These farms are depicted in figure 1.5 immediately above the Witwatersrand. They had since 1886 been the major areas of gold mining operations and a few are to some extent being exploited to date.

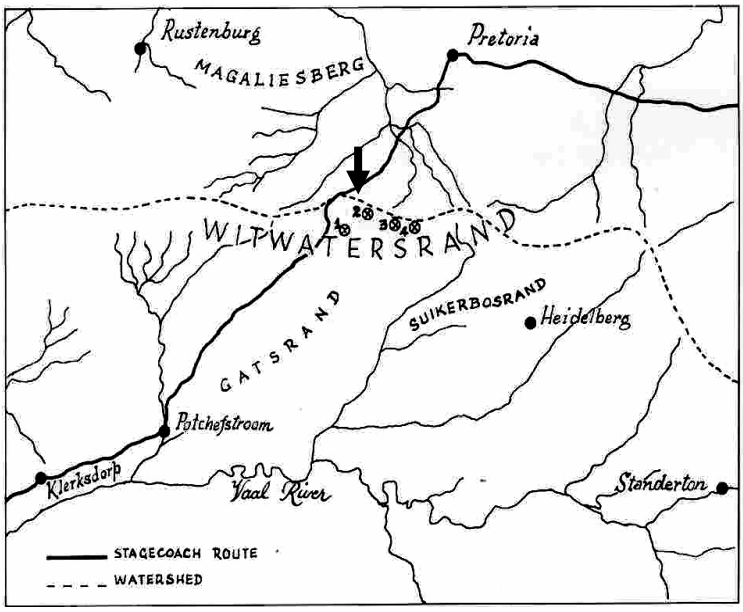


Figure 1.5: The Southern Transvaal in 1886

Source: Hocking (1986:16)

Huge amounts of capital, skilled and unskilled labour and new technologies were necessary to extricate the gold ore from the earth. It became evident, quite early in the development of the industry, that individuals could not economically mine the deep gold bearing deposits. Individual claims were amalgamated, on an average of 200 claims in size per producing company. The mining house concept that commenced on the Kimberley diamond fields was brought to the Witwatersrand where it, because of the huge capital requirements of establishing deep mining operations, developed to its final practical stage (Handley, 2004:79-80).

The gold mining sector was, since its commencement in 1886 until 2004, the largest mineral sector in respect of sales income at which time it was superseded by the platinum-group of minerals (pgms) sector. From 1887 to 1894 the sales from gold increased from £81 022 to £6 959 622

respectively (Cartwright, 1962:116). In 1961 the country was the top gold producer with 65.6 per cent of the total world output (Cartwright, 1962:326). Since 1985 the annual gold production has declined from 672.9 to 272.1 metric tons in 2006, the lowest level of production since 1931 (DME, Minerals Statistical Tables, 1985 – 2006:1). The decline can be attributed to increasing production costs, gradual depletion of the higher-grade ore, decreasing reserves of the existing mines and the restructuring and closuring of some uneconomical mines (COM, Annual Report, 2004/2005:20-22). Despite this sharp decline the South African gold sector still remains the largest single supplier of gold in the world (COM, Annual Report, 2006 - 2007:20).

The sales income from gold increased from R15.291 billion in 1985 to R37.443 billion in 2006 (DME, Minerals Statistical Tables, 1985 - 2006:1). It employed an average of 159 984 people in 2006 (DME, Minerals Statistical Tables, 1985-2006:22). From 1888 to 1944, the tons milled by the Witwatersrand gold mining industry increased from 114 000 to 58.504 million tons. During the same period the ounces of fine gold produced increased from 171 789 to 11.993 million ounces respectively (Jeppe, 1946:24-26).

1.2.4.2 The coal mining sector

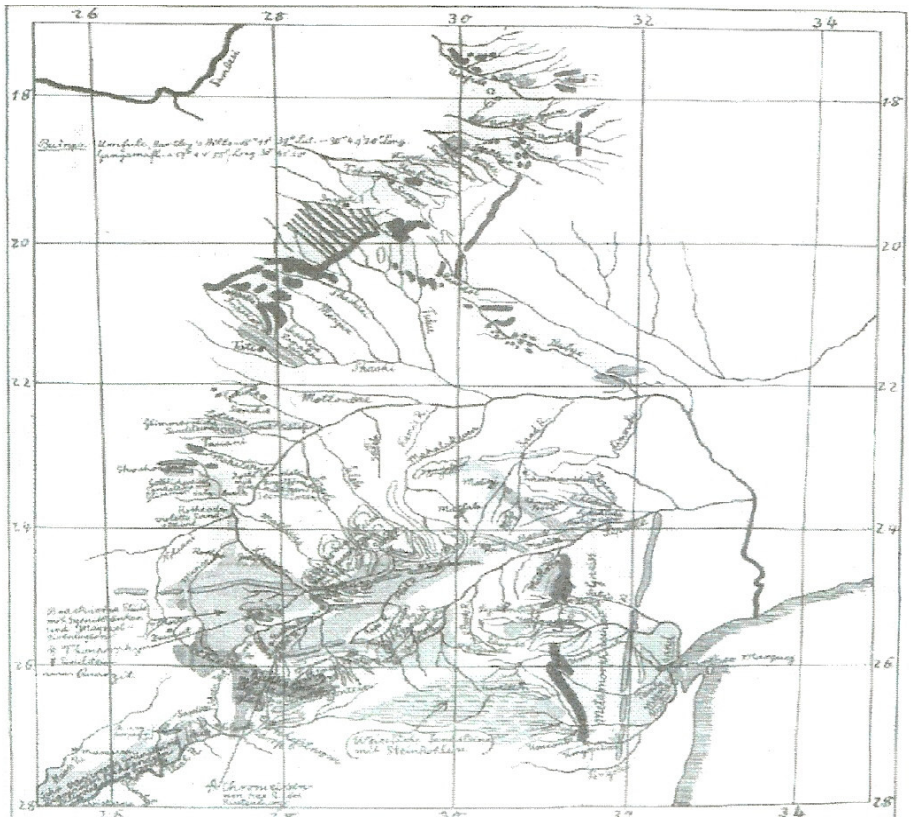
Coal mining, commenced in 1859 at Cyfergat near Molteno (Lang, 1995:13-17). According to Oosterhuis (Wilson & Anhaeusser, 1998:136) the first economical exploitation of coal commenced in 1870 from this now dormant coalfield. In 1877 the large deposits of Natal and the Transvaal were known and their value realised.

In 1872, coal had been discovered in the then Zuid- Afrikaanse Republiek. As from 1877, small quantities of coal were transported by ox wagon from the Wilge and Olifants Rivers near Middelburg to the Witwatersrand. George William Stow discovered coal in 1878 in Vereniging in the Republic of the Orange Free State (Leigh, 1968:13). Carl Mauch, a German geologist and prospector who travelled extensively in Africa and especially in Southern Africa produced the first geological map of Transvaal in 1870 (refer figure 1.6).

The mineable coal reserves of the country was calculated in 1952 and in 1959 at 74.872 and 79.882 billion Cape tons respectively. In 1972 the Petrick Commission, submitted their report on the coal reserves of the Republic of South Africa, to the then State President, J.J. Fouche. The total soft and hard coal reserves were then calculated at 81.274 billion mineable metric tons (Petrick et al, 1975:7).

The country's hard coal reserves of 48.9 billion tons were considered to be the world's fifth largest hard coal reserves (COM, Annual Report, 2006 - 2007:15). Initially coal mining was almost exclusively restricted to underground mining methods but a considerable amount is nowadays being extracted by means of the opencast mining method. Currently approximately 53 per cent of the total coal production emanates from opencast mining operations (COM, Annual Report 2006 - 2007:17). In 2006 the coal mining industry, with a production of 244.8 million tons and a total sales income of

R37.991 billion, was the second largest mineral sector in South Africa. It was ranked in the fourth place in the world as a coal exporter. It employed an average of 57 777 employees (refer tables 1.1 and 1.2).



The first geological map of the Transvaal, drawn by the German explorer, Carl Mauch, in the early 1870's showed extensive coal deposits lying along the Vaal River

Figure 1.6: First geological map of the Transvaal

Source: Lang (1995:48)

Coal provided approximately in 70 per cent of the county's primary energy needs in 2006. It accounted for 93 and 37 per cent of the country's electricity and local liquid fuel production respectively (COM, Annual Report, 2006 - 2007:15). The contribution of the domestic and industrial use of coal to the increasing global warming problem may result in a possible forced future decline in the consumption of coal and the resulting reduction in the production of this mineral.

1.2.4.3 The platinum mining sector

According to Viljoen & Schürmann (Wilson & Anhaeusser, 1998:534) recovery of the platinum group of metals (pgms), mainly as a by-product from the gold mining industry through metallurgical processes, commenced at the Witwatersrand during June 1919. It was by that time known to be available in the well-known extensive Bushveld Igneous Complex.

Platinum was panned in 1924 on a farm in the Lydenburg area. This was the first discovery of the Merensky Reef. The Bushveld Igneous Complex became the largest resource of platinum and associated minerals in the world. In 2004 it replaced gold as the largest export commodity.

The production of the platinum group of metals has increased from 121.7 metric tons in 1985 to 307.5 metric tons in 2006 (DME, Minerals Statistical Tables, 1985 - 2006:2). The total sales value for 2006 was R65.444 billion. In 2006 this sector employed an average of 168 479 people (DME, Minerals Statistical Tables, 1985 - 2006:22).

1.2.4.4 The iron metals mining sector

Iron is one of the most abundant elements in the earth's crust. Astrup et al (Wilson & Anhaeusser, 1998:402) listed the Sishen and Beeshoek Mines in the Northern Cape and the Thabazimbi and Palabora Mines in the Northern Province as the major iron-ore mines in South Africa. World steel production has increased by 9 per cent to 1.2 billion tons in 2006. South Africa was the 8th largest producer of steel in the world in 2006 at 41.326 million tons (COM Annual Report, 2006 - 2007:21).The demand for steel is still increasing annually world wide

This sector employed an average of 8 848 people (refer table 1.1). The sales income from steel increased from R474 million in 1985 to R9.928 billion in 2006 (DME, Mineral Statistical Tables, 1985 - 2006:5).

1.2.4.5 The chromium mining sector

According to Schürmann et al (Wilson & Anhaeusser, 1998:90) chromium was first discovered in 1865 by Carl Mauch in South Africa where the Bushveld Igneous Complex outcropped in the Hex River near Rustenburg. The production of chromites commenced in 1924 in the Steelpoort and Burgersfort areas. The Bushveld Igneous Complex contains the largest deposits of chromium in South Africa (Wilson & Anhaeusser, 1998:90). South Africa only became a major force in the chromium industry in the 1960s. The production increased from 3.699 million tons in 1985 to 7.418 million tons in 2006 (DME, Minerals Statistical Tables, 1985 - 2006:3). The total sales value in 2006 was R2.302 billion. In 2006 this sector employed an average of 7 901 people (DME, Mineral Statistical Tables, 1985 - 2006:23).

1.2.4.6 The manganese mining sector

Astrup and Tsikos (Wilson & Anhaeusser, 1998:450) stated that manganese ore was mined at Hout Bay near Cape Town early in the 1900s. In 1922 the manganese ore deposits near Postmansburg in the Northern Cape Province were being exploited. Shortly afterwards the massive Kalahari Manganese Field (KMF) further north was identified and in 1940 the Black Rock Mine, near the present town of Kuruman, was opened. The total South African manganese resources were calculated as over 1 000 million tons. The total world resources were estimated at 4 900 million

tons. In 2006 this sector produced 5.213 million metric tons at a total sales value of R2.246 billion (DME, Mineral Statistical Tables, 1985 - 2006:6) and employed an average of 3 340 people (DME, Mineral Statistical Tables, 1985 - 2006:24).

1.2.4.7 The diamond mining sector

Diamonds were discovered in 1867 in the kimberlitic pipes near the present town of Hope Town and in 1871 at the present town of Kimberley. Since then these mines produced diamonds in large quantities and value. The Premier kimberlite was opened in 1902 near the town of Cullinan approximately 25 kilometres east-northeast of Pretoria.

Fred Wells, a mine employee, found the largest diamond in the world on 5 January 1905 at the Premier Mine. It weighed 3 106 carats and was named the Cullinan diamond (Cartwright, 1977:60 - 61).

According to Möller (1999:126) the diamond fields, including the Kimberley Mines, were originally part of the Republic of the Orange Free State's geographical area but were shortly after the discovery of the diamonds illegally expropriated by Britain. The Republic was later, after it won the court case, remunerated with a mere R180 000 by Britain for the loss of this geographical area and the diamond fields (Möller, 1999:100-101).

In1928 extensive diamond bearing alluvial deposits were discovered on the West Coast, north and south of the Orange River estuary (Oberholzer, 1985:15). Since then many more discoveries were made. According to Lynn (Wilson & Anhaeusser, 1998:252) South Africa would remain to be one of the major suppliers of gemstones and industrial diamonds in the world for the foreseeable future.

The total world production of natural diamonds for 2006 with a value of approximately US$13.1 billion exceeded 171 million carats (Mct). South Africa's official rough diamond production was 15.4 Mct in 2006. The country is presently being rated, jointly with Angola and Canada, as the third largest in terms of the production of diamonds (COM, Annual Report, 2006 - 2007:18). The sales income for the diamond mineral sector in South Africa for the year 2006 was unfortunately not directly available and was consequently calculated at R10.08 billion from the total world production and sales (refer table 1.1). This sector employed an average of 20 115 people in 2006 (DME, Minerals Statistical Tables, 1985 - 2006:21).

1.2.4.8 The copper mining sector

According to Wilson (Wilson & Anhaeusser, 1998:209-226) several hundred copper ore occurrences were identified in South Africa. Most of these were not of economical value. A massive copper-bearing ore body was discovered near Prieska, where the Prieska Copper Mine was later established in 1968 (Hocking, 1999:141-146). The other identified viable deposits were at Palabora,

Messina, the Bushveld Igneous Complex, Soutpansberg, O`kiep Copper District, Aggeneys and Gamsberg and the Uitkomst complex.

In 2006 a total of 109 600 tons of copper was produced at a sales value of R4.956 billion (DME, Minerals Statistical Tables, 1985 - 2006:4). This sector employed an average of 3 993 people in 2006 (DME, Minerals Statistical Tables, 1985 - 2006:23).

1.2.5 Early mining problems encountered

Mining is, to a large extent, carried out under hazardous conditions unnatural to the human being (refer section 1.2.5.1 and 1.2.9.1). As an industry it requires specific mining methods and specialised equipment. The initial mining problems encountered with the inception of the mining industry are briefly discussed below.

1.2.5.1 Mining conditions

Prior to 1886 deep mining was not practiced anywhere else in the world. The first experience with deep mining, in excess of 2 000 meters, occurred on the Witwatersrand goldfields. Pritchard (2001:11) pointed out that mining as an important industry had the disadvantage of detrimental environmental and health consequences. It is a complex operation, involving high risks and uncertainties, which must be identified timeously and managed efficiently by all the responsible employees on all the organisational levels of the organisation.

Initially there were many unknown factors, which were directly and indirectly responsible for many small and major disasters. As a result of extensive research and constant vigilance on results of newly developed and improved applied techniques, equipment and practices, safer and more productive extraction methods were developed and introduced. Involvement from experienced consultants and contributions by local institutions and abroad further contributed to mines now being operated on a more scientific, economical, productive and safer basis (COM, Annual Report, 2003-2004:103-113).

1.2.5.2 Transportation

In the beginning the inadequacy of the transport systems presented serious problems. The stagecoach route running from Cape Town through Klerksdorp and Potchefstroom to Pretoria was the first official known route (refer section 1.2.4.1 and figure 1.5). In order to improve the transport system the ‘Rand Train’, running from Krugersdorp to the present town of Springs, was built and commissioned in 1891. In the same year, the railway from Pretoria to Johannesburg was commissioned. In 1892, the railway from Johannesburg to the Cape via the then Orange Free State Republic was completed. It was followed by the railway connections to Delagoa Bay and Durban in 1894 and 1895 respectively (Lang, 1995:21-27). These new transportation facilities not only boosted the mining industry but also the development of the country in general.

1.2.5.3 The early labour situation

Approximately 70 per cent of the white miners in the early days were from British and Australian origin. Most of the miners belonged to a labour union (Cartwright, 1962:155-186). According to Cartwright (1962:162) the House of Assembly of the new Union Government passed the Mines and Works Act in 1911. This Act reserved all skilled and some semi-skilled occupations in the mining industry for white workers only.

South Africa at the time had a serious shortfall in skilled and managerial occupations. It relied almost entirely on recruits with technical and engineering education from mainly Britain and Australia. The shortage in skilled technical labour, especially mechanics, miners and general labourers, took some years to overcome (Jeppe, 1946:24).

From 1899 to 1902, production on the gold mines was seriously interrupted by the Anglo-Boer war. After the war the mining industry was experiencing shortages of food supplies, capital, a damaged transport structure and a severe shortage of labour, especially skilled labour. As a result a total of 63 000 Chinese labourers was imported as from 1905 (Scannell, 1988:8). They were all repatriated by the end of 1910 mainly due to friction between them and the local people (Palestrant, 1986:85). The Chinese workers, however, were productive and contributed considerably to increasing the soaring of the gold output to £16 million in 1904, £20.8 million in 1905 and to £24.6 million in 1906 (Cartwright, 1962:138).

The first miner's strike, organised by the Transvaal Miner's Association as this union was then called, was in 1907. It came not long after the Transvaal Province had held its first election. The reason for calling the strike was over unilateral changes by the owners to the mutually negotiated labour agreement (Cartwright, 1962:159-160). In 1913, the first general strike over working hours, to some extent violent and with great loss in production, income and profit, took place. The most remembered industry wide strike, or the Rand Revolt as it was also known, took place in 1922. Due to the worldwide drop of the gold price caused by a worldwide recession and the increasing labour costs on the mines the mine owners unilaterally decided to lower the colour bar and to reduce the labour complement. The labour unions reacted to this unilateral decision by calling out a general strike, which lasted 83 days. The loss in production, income and profits to the mining industry was enormous. A total of 230 lives were lost and indescribable pain and hardship was caused to the families of the deceased and in general to that of the workers (Cartwright, 1962:196-209). The government suffered great losses in taxes.

1.2.6 Importance of the South African mining industry to the world

South Africa holds extensive mineral resources and ranks as a leading world producer and exporter of a large range of minerals (refer table 1.2). In 2004 the country produced some 59 different minerals from a total of 993 mines and quarries of which 49 produced gold, 28 platinum-group minerals, 64 coal and 145 diamonds (DME, South Africa's Mineral Industry, 2004/2005:1). It ranks

as one of the largest mineral producing countries in the world in many strategic important minerals. According to Ramontja (Mining Mirror, Vol. 17 no 6, 2004:21) South Africa contributed 15 per cent of the world's gold supply in 2003.

Commodity	Resource base ł		Production		Export	
	%	Rank	%	Rank	%	Rank
Aluminium +	*	*	2.7	9	4.2	7
Alumina-silicates	*	*	36.4	1	34.4	1
Antimony	6.4	4	3.2	7	*	*
Chrome ore	72.4	1	38.7	1	15.1	4
Coal ≠	10.2	5	4.93	5	9.3	4
Copper	1.4	14	0.7	16	*	*
Ferrochromium	*	*	40.5	1	50.9	1
Ferro-alloys of manganese	*	*	6.0	4	16.4	2
Ferrosilicon	*	*	3.1	6	2.1	7
Fluorspar	16.7	2	*	*	*	*
Gold	40.1	1	11.7	1	*	*
Iron Ore	0.9	9	3.0	7	3.8	6
Lead	2.0	7	1.2	13	*	*
Manganese	80.0	1	13.3	2	19.7	2
Nickel	8.4	5	3.1	9	*	*
PGMs	87.7	1	56.7	1	*	*
Phosphate Rock	5,0	4	1.7	10	*	*
Silicon Metal	*	*	3.2	8	3.7	7
Silver	*	*	0.4	17	*	*
Titanium minerals	18.3	2	19.8	2	*	*
Uranium	7.2	5	1.6	11	*	*
Vanadium	31.0	1	48,0	1	*	*
Vermiculite	40.0	2	39.6	1	*	*
Zinc	3.3	8	0.3	22	*	*
Zirconium	19.4	2	*	*	*	*

Note: ł Figures under resource base refer to metal production capacity, an equivalent of SAMREC's reserves. ≠ World hard coal reserves 2006 (BP Energy statistics) * Confidential or unavailable information

Table 1.2: South Africa's role in world mineral resources, production and exports, 2005
Source: COM, Facts & figures (2006: 8)

1.2.6.1 Mineral deposits

Concern had been expressed at the possible uncontrollable exploitation of the dwindling reserve base of South Africa. It was argued that it was a national asset that should be managed responsibly in order for the country to optimise the benefit of it for a longer term. According to geologists the reserve base of the country is not considered over-explored. Geological institutions in general maintain that there remains considerable potential for the discovery of large valuable deposits in the future in areas, which have not been extensively explored yet.

New technology enhanced the optimising of reserves. Exploration by various mining houses was ongoing as part of their annual commitment to secure adequate reserves for optimisation of their huge capital investments (DME, South Africa's Mineral Industry, 2004/2005:6).

1.2.6.2 Mineral resources

At present the South African mining industry controls, in some respects, the largest deposits of minerals in the world (refer table 1.2). The country holds the world's largest ore reserves of the platinum-group-metals (87.7 per cent), manganese (80 per cent), chromium (72.4 per cent), gold (40.1 per cent) and vanadium (31.0 per cent). It also holds significant reserves of titanium minerals, zirconium, vermiculite and fluorspar ore (COM, Facts & figures 2006:8). Substantial quantities of minerals and metals occur in coastal dune sands. These minerals and metals were being economically exploited at Richards Bay and Namakwa Sands (Wilson & Anhaeusser, 1998:1-4).

1.2.6.3 Production

The South African mining industry produced over 38 per cent of the world production in chrome ore, ferrochromium, platinum-group metals, vanadium and vermiculite (refer table 1.2). It is the leading world producer of alumina-silicate (36.4 per cent), chrome ore (38.7 per cent), ferrochromium (40.5 per cent), gold (11.7 per cent), pgms (56.7 per cent), vanadium (48.0 per cent) and vermiculite (39.6 per cent). In 2006 it produced substantial quantities of manganese, titanium and fluorspar minerals (COM, Facts & figures, 2006:8).

1.2.6.4 Export

The South African mining industry is one of the largest exporters of minerals in the world (refer table 1.2). In 2006 it exported 34.4 per cent alumina-silicate and 50.9 per cent ferrochromium to the world markets. It also exported substantial quantities of aluminium, chrome ore, coal, ferro-alloys of manganese, ferrosilicon, iron ore, manganese and silicon metal (COM, Facts and figures, 2006:8).

It mined over 60 different types of minerals of which the vast majority were exported to more than 100 countries in the world (COM, Annual Report, 2004 - 2005:14). Because the domestic markets are rather limited the majority of the country's mineral products are exported.

1.2.7 Role of the mining industry in the South African economy

1.2.7.1 Role in the development of the economy

The exploitation of minerals gave impetus to the development of South and Southern Africa as a region. The urban centres that grew around the mining industries created domestic markets that encouraged the growth of other secondary industries such as transportation systems and water and

electrical energy reticulation systems. Secondary and service industries grew and matured on the back of these demands (DME, South Africa's Mineral industry, 2002/2003:1).

The industry played a major role in the economic and social development of the country (refer section 1.2.7.2). It remains, through its major representative institution, the Chamber of Mines, founded in 1889, one of the leaders in worldwide policy setting of mining standards and research, job creation, employment, training and development of employees (DME, South Africa's Mineral Industry, 2004/2005:2).

The industry was and still is a major contributor to the upliftment and empowerment of previously disadvantaged communities of this country and to a large extent to the countries to the North. It still is playing a major role in the general economy in the country (COM, Annual Report, 2004 - 2005:14-63). The industry has developed specific unique engineering and mining abilities over the decades that were and still are very much sought after by many countries in the world. It is still extremely viable, vibrant, progressively focused and uniquely positioned to face and successfully overcome the current and future challenges that certainly would be facing the mining people of the future (COM, Annual Report, 2004 - 2005:15).

1.2.7.2 Contribution of mining to the national wealth

The Chamber of Mines of South Africa reported in its 2004 annual report that the mining industry, mainly supported by gold, coal, platinum and diamond production, had since its inception made an extremely important contribution to the national economy of South Africa (COM, Annual Report, 2004 - 2005:14). The Department: Minerals and Energy of South Africa supported this view when stating that the industry provided the stimulus for the extensive development of an efficient physical infrastructure and that it contributed in no small measures to the development of related secondary industries in the country (DME, South Africa's Mineral Industry, 2002/2003:1).

The Chamber of Mines (COM, Annual Report, 2006 - 2007:12) reported that in 2006 the industry:

a) accounted directly for 7.0 per cent of South Africa's gross domestic product (GDP),
b) directly accounted for 6.5 per cent of the total fixed investment and for 9.1 per cent of the total private sector investment versus 6.3 and 8.7 per cent respectively in 2005,
c) continues to act as a magnet for investment in South Africa,
d) contributed R140 billion to South Africa's exports,
e) concluded R24 billion worth of empowerment deals. Over the past 11 years a total of R91- billion worth of empowerment deals had been concluded in this resources sector,
f) moved about 100 million tons of bulk commodity ores for export on the rail system,
g) accounted for 6.3 per cent of those employees employed in the non-agricultural formal sector of the economy and 8.1 per cent of the total private sector of non-agricultural employment in 2006,
h) paid R40 billion in wages and benefits to employees which accounted for 5.4 per cent of the total compensation to all employed in the country in 2006,
i) paid R16.2 billion in direct taxes and a major portion of indirect taxes to the fiscus in 2006,

j) supplied through its coal mining sector 110 million tons of coal for the generation of electricity and 41.1 million tons of coal for liquid fuel production,

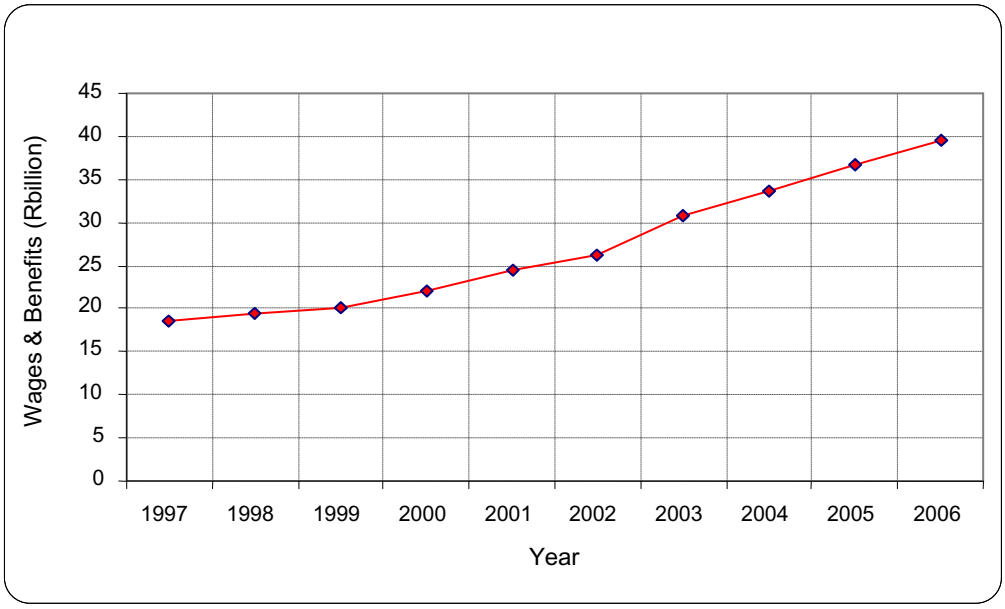


Figure 1.7: Total earnings – all mines

Source: DME, Mineral Statistical Tables (1985 - 2006:21)

k) was the world's largest producer of platinum group metals (pgms), gold, chromium, ferrochrome, vanadium, manganese and vermiculite,

l) accounted for a substantial amount of the supply and demand for energy. The industry consumed 15.3 per cent of Eskom's local electricity sales, and

m) directly employed an average of 458 600 workers in 2006, against 444 132 in 2005.

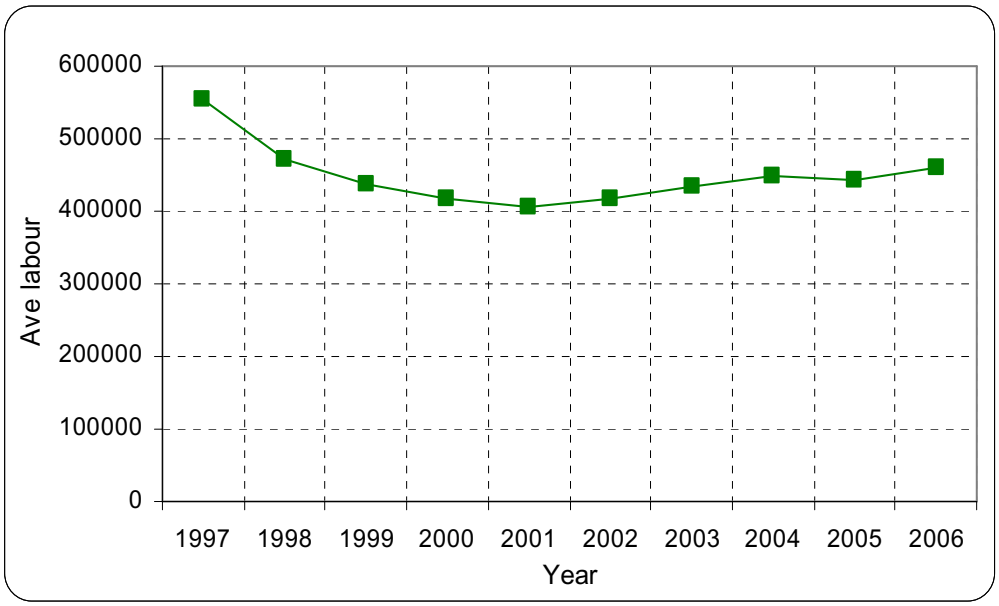


Figure 1.8: Average labour – all mines

Source: DME Minerals Statistical Tables (1985 – 2006:21)

The industry was also responsible for considerable infrastructure development, for example 3 000 km of railway line, three ports and a large amount of bulk handling infrastructure at other ports could mainly be attributed to the industry. It is making a considerable contribution to the development and maintenance of social infrastructure such as clinics, schools and other social facilities (COM Annual Report. 2004 - 2005:14).

1.2.8 The mining environment

All organisations operate within an environment in which specific role players or stakeholders have certain vested interests and which must be identified, respected and taken into consideration by the specific organisations. Carroll and Buchholtz (2000:65) defined stakeholders as individuals or groups that have interests or stakes in the organisation. Just as stakeholders are affected by the decisions of the organisations, organisations are affected by decisions of the stakeholders.

Mining organisations operate within specific internal and external environments with inherent risks that can change and may adversely affect the performance of the organisation. Ignorance of these factors can have disastrous effects on the performance and future survival of organisations and the employees, communities and secondary industries involved with it. All the employees on all the levels of the organisation should be able to timeously identify and manage the risks within their areas of accountability (COM, Annual Report, 2004 - 2005:42-48).

1.2.8.1 The internal environment

a) Main regulating bodies

The two main regulating bodies in the South African minerals industry are the Chamber of Mines of South Africa and the Department: Minerals and Energy, a governmental institution. The Chamber was founded in 1889. It is a voluntary, private sector employer's organisation.

The COM main aims are to nurture relationships with its stakeholders and to promote the interests of the South African mining industry (COM, Annual Report, 2006 - 2007:7). It is an association of mining companies operating in the gold, coal, platinum, diamond, manganese, copper, iron ore, zinc, lead and antimony mining sectors. It acts as the principal for the relevant mining employers (refer figure 1.9).

It represents the formal views of the members to the:

- various relevant opinion-forming and policy-making entities inside and outside the country,
- departments of South Africa's national and provincial governments (DME, South Africa's Mineral Industry, 2004/2005:2),
- various labour unions during the annual wage negotiations,
- unions during the determination of the conditions of employment, and
- communities during the establishment of future community projects.

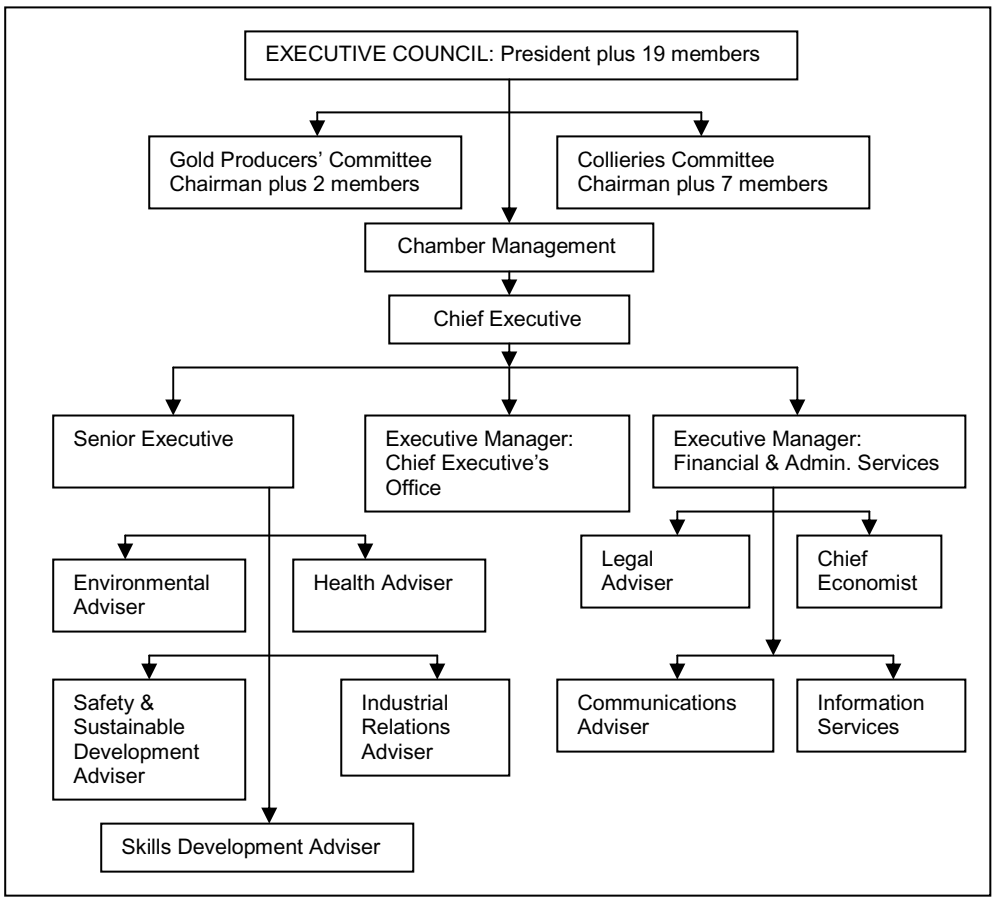


Figure 1.9: Management structure of the Chamber of Mines

Source: COM Annual Report (2006-2007:1)

The Department of Minerals and Energy is a governmental body, which represents the government's involvement in the mineral sector. Its main objectives are to:

- provide and maintain appropriate legal and fiscal environments to facilitate unimpeded exploration for mining, beneficiation and marketing of minerals in the country,
- provide and maintain efficient physical infrastructures such as roads, rail, air and harbour facilities, communications and health services, and electricity and water supplies, and
- control acceptable mining practices and optimum utilisation of available reserve deposits.

The DME is responsible for the administration of the Minerals and Petroleum Resources Act, 28 of 2002, which came into effect on the 1st of May 2002 (DME, 2004/2005:3). The Mine Health and Safety Inspectorate advocate the safe and responsible mining of minerals under healthy conditions. It is represented in the various provinces by Principal Inspectors. The Energy branch promotes the optimum and sustainable utilisation of energy resources by all operators.

The Minerals Development Branch (MDB) promotes the orderly and optimal mining and utilisation of mineral resources and is represented in the provinces by Regional Directors. The Council for Geoscience is responsible for geological mapping in respect of the identification, location, extent and nature of ore bodies. It also maintains a national data basis of the country's geoscientific data and information.

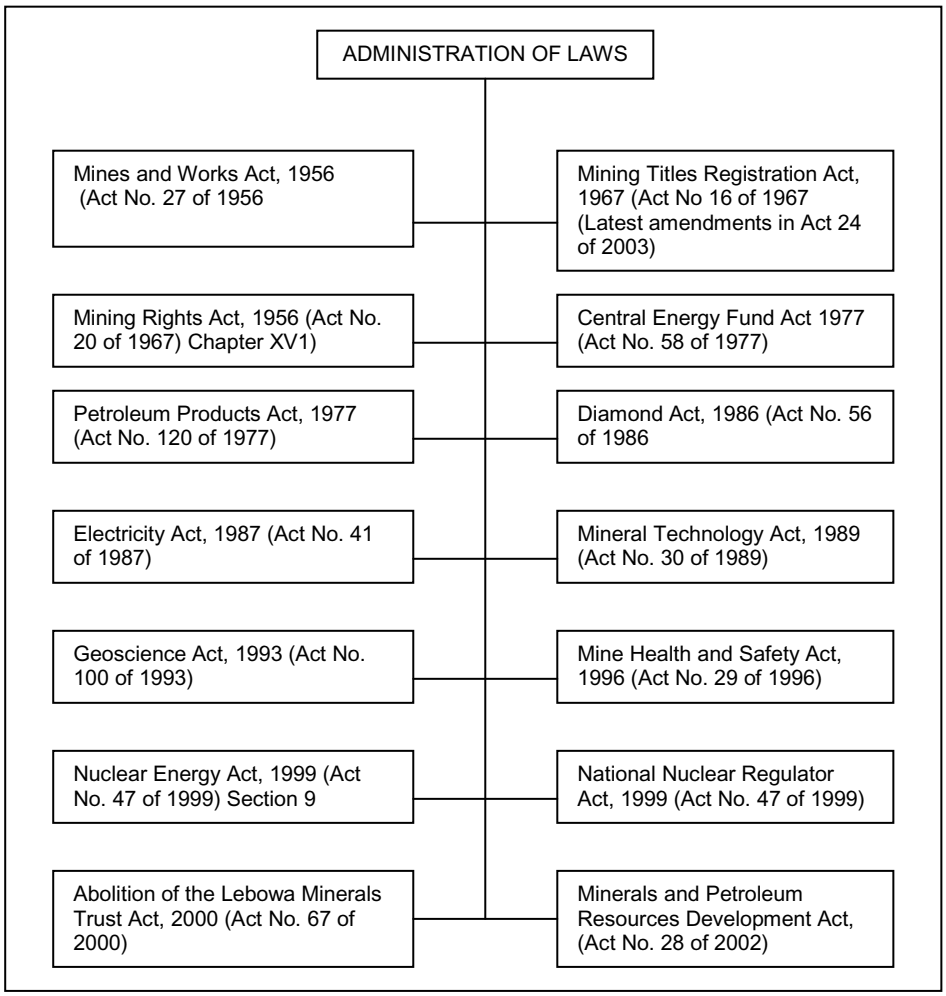


Figure 1.10: Summary of South Africa's Administration of Mineral and Mining Laws

Source: DME, South Africa's Mineral Industry (2004/2005:4)

Both the COM and the DME are instrumental in the endeavours to maintain acceptable health and safety performances in the mining industry. Each maintains a specific dedicated department responsible for the achievement and maintenance of their health and safety objectives (refer figures 1.9 and 1.10). All mining practices that could in any way have potential safety risks would have to be scrutinised and approved before it could be implemented. The roof bolt support procedure in collieries for example needs to be approved by the responsible principal inspector.

b) Legislation

The Mineral and Petroleum Resources Development Act (MPRDA) was approved and brought into effect on 1st May 2004. The industry declared itself supportive of the requirements of the introduced acts. It supports, through the Chamber of Mines, the sovereignty of the state over the mineral resources of the country, the expansion of opportunities to previously historical disadvantaged communities, the promotion of economic growth and mineral development and to provide employment, social and economic welfare as well as ecologically sustainable development (COM, Annual Report, 2003 - 2004:9).

c) Geological conditions

One of the most important and largely unpredictable factors to the operation and safety and health of the industry was the geological conditions. Each mineral sector is subjected to specific geological conditions peculiar to it that can sometimes result in conditions that could have serious consequences to the safety of employees, production performance and the viability of mines. Geological conditions can vary from mine to mine, area to area and within a specific mineral deposit being exploited. The conditions could change rapidly and unexpectedly which could result in the collapsing of the immediate environment and strata that could adversely affect the safety, productivity and output.

All the employees, particularly those employed in the dangerous underground conditions should be adequately trained to timeously identify and correct high risk factors. They have to take the necessary decisions in action in order to ensure safe performance.

d) Management and subordinate interaction

The organisational structure of a mine consists of different vertical and horizontal levels (refer figure 1.11). It is imperative that employees recognise and respect the relative organisational positions of these levels in the general management activities.

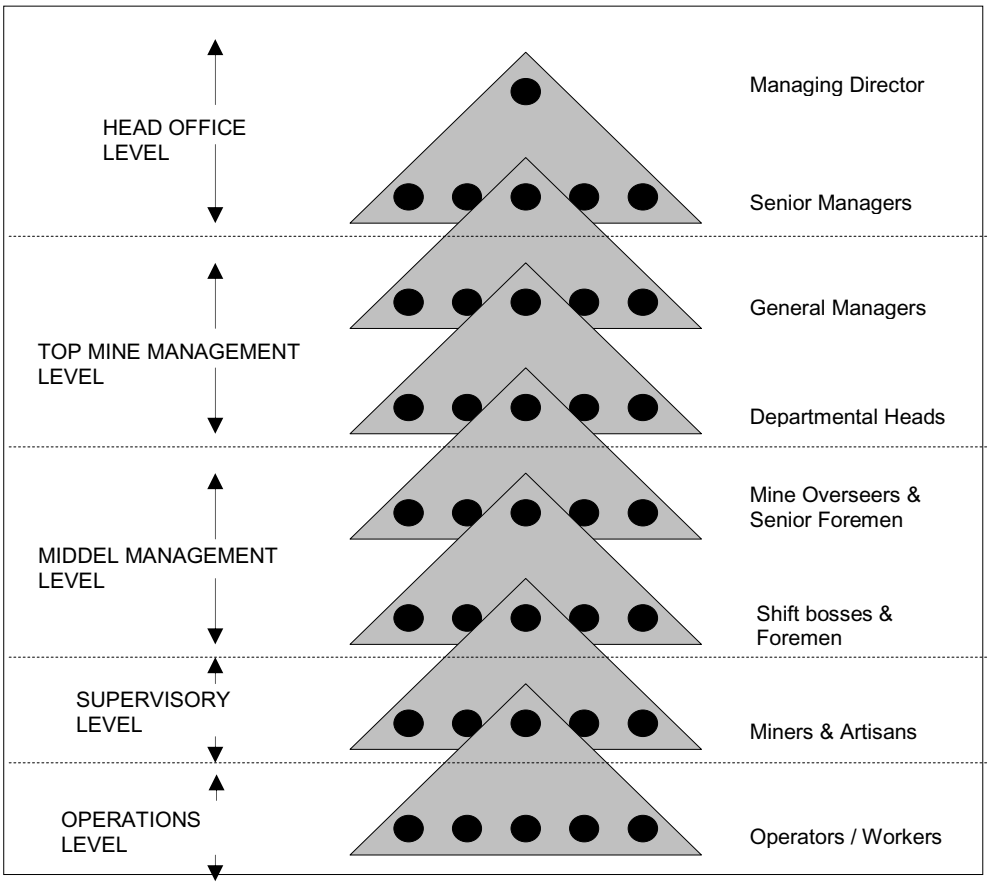


Figure 1.11: A typical simplified mining house organisational structure

The mining houses developed, since their inception, typical traditional organisational structures. Existing structures were largely steep autocratic type structures and are to some extent still legacies of the autocratic leadership culture from the late nineteen hundreds (refer figure 1.11). These structures were not developed from a scientific management logic. Mainly due to escalating increases in labour cost and the resulting pressure on cost control numerous exercises to cut labour almost at random were introduced. The resultant cost reductions were not necessarily the optimal long-term solutions.

For sound management and performance various necessary interactions between managers, subordinates, peers, supervisors and all other stakeholders must occur as the needs arise. Employees need to interact efficiently in order to affect proper integration, coordination of tasks and relations when determining or planning the most probable achievable results, responsibilities, reporting lines, performance standards and the control measures applicable to the specific situation.

The interaction between the employees in the organisation horizontally, vertically and across is a management aspect which, up to now, had not been addressed adequately (refer section 1.2.8.1 (a)). It is an activity, which is an absolute necessity for the efficient coordination and integration of tasks and the realisation of objectives in any organisation. It is imperative for efficient communication, reporting and supervision right through the organisation. The responsibility of management to ensure that the results required should be achieved can not be delegated or wished away in any organisation. The results of the organisation is the sum total of all the results of all employees. The organisation is the vehicle with which to optimally realise the organisation's objectives.

Stoner (1982:9) argued that organisations should:

"enable us to reach goals that would otherwise be much more difficult or even impossible to reach."

It follows that each employee has a specific role in the realisation of an objective that should support the objective of the section, department and the main objective of the organisation as a whole (refer section 5.3.12.4 and figure 5.7). Effective interaction between the employees, supervisors, peers and subordinates are indispensable. An efficient management method would ensure that effective structures and communication channels to facilitate this requirement are designed, instituted and maintained at all times.

e) Organised labour

Organised labour in the mining industry had come to stay. Legally it has specific entrenched rights, which must be recognised and respected by management. The unions, through their representative bodies, are definite stakeholders within the mining environment. Management must recognise these rights. It must cooperate and assist the unions with the necessary facilities and procedures to exercise their rights in an efficient and responsible manner. The industry should never abdicate its

professional right to manage and execute the duties associated with it. On the other hand unions have certain bargaining powers, which should be responsibly and productively utilised by the industry (COM, Annual Report, 2004 - 2005:61).

f) Customers

Customers are contractually entitled to agreed-upon services in time in the right quantities and qualities at the agreed costs. Continued excellent service at all times is imperative. Satisfied customers would tend to support the industry and even expand future business. Customer care is a very important aspect of the industry especially in the export business. The mining industry built over many years an exclusive customer base. It has to serve these customers in a way that would retain and increase their support for as long as possible.

Black and Porter (2000:73) emphasised that customers have specific powers and in a fierce competitive market have more power to negotiate lower commodity prices. The industry experienced with the increased global markets, that these markets were by no means a given. Lower prices had come to be one of the main bargaining issues. This means that the industry must at all times strive for lower production costs that could best be maintained with optimal management practices.

g) Immediate communities

According to Black and Porter (2000:76) any business has to operate in harmony with the communities within which it exists and abide by mutual agreements. There is no doubt that industries have definite obligations towards the societies in which they perform their business in addition to the owners and customers they serve (DuBrin, 1994:38). It should participate in activities of mutual interest and where practically possible, support and promote community interests (Bruning & Ledingham, 2000:159). The mining industry had historically been and still is involved in the provision of social services and infrastructure such as roads, schools and clinics to communities (COM, Annual Report, 2004 - 2005:14). The industry should maintain a sound relationship between itself and the communities (Crane et al, 2008:61).

1.2.8.2 The external environment

a) Globalisation

The world became a global village and organisations can no longer escape the influences of the global environment (Amey, 1986:54). It must face the reality of global involvement and competition. With an increasingly competitive global market the optimal utilisation of all the resources of the industry becomes vital. Economic globalisation required development in trade, finance and direct foreign investment by multinational corporations (Gilpin, 2001:5 & Mshonda, 2000:16).

b) Competition

Topping (2002:27) argued that it would be difficult to find an industry today that is not experiencing fierce competition. One of the first aspects that industries should determine is the nature and magnitude of competition (Black & Porter, 2000:71). According to Malecki (Ajami and Bear, 2007:19) competition and economic development today is extremely difficult to predict and control. Business should therefore develop more effective research and forecasting techniques.

c) Suppliers

Black and Porter (2000:73) argued that every business has specific suppliers some of whom can, by increasing their prices, adversely affect the profit position and survival of the business. In order to optimise its performance mine management needs to maintain close contact with existing and potential suppliers of consumables, equipment and specialised services. The industry can contribute considerably to the identification and development of equipment and consumables that could result in improved performance and the containment of costs. Suppliers on the other hand have to create and maintain sound relations with the mining industry in order to be in a position to identify the existing and potential needs of the industry.

d) Shareholders

Shareholders supplied the capital and are therefore entitled to an acceptable return on their investments. The more the investors trust the industry and the country the more investments would be attracted to the industry. Increased investments would result in the expansion of the industry with the resultant increasing of job opportunities, stability and prosperity of communities.

1.2.9 Challenges facing the mining industry

1.2.9.1 Health and safety

Mining is characterised by a relatively high accident rate (Lucas, 1969:4). The total number of fatal accidents for the South African mining industry decreased from 463 in 1994 to 202 in 2005 (refer figure 1.12). Rice (Edgecombe, 1998:202) of the United States Bureau of Mines advised the Natal collieries in 1928 to concentrate on the implementation of proper management principles, especially planning and controlling in order to improve safety. In order to stay with international thinking and practices on safety, the mining industry often employs international consultants for assistance and advice (Tempelhoff & Le Roux, 2004:2). The different mining groups also benchmarked themselves against the most successful mining industries in safety.

The industry had its ‘fair share’ of catastrophes. Some of the major incidents were:

a) The big explosion in October 1926 at the Durban Navigation Colliery (DNC) in Natal where 125 mineworkers were killed (Hocking, 1995:202).

b) A total of 437 men died in 1960 underground in the Coal Brook Colliery Disaster. This tragedy triggered intensive investigations into the design and stabilising of underground support methods and specifically in the coal-mining sector (Lang, 1995:140).

c) On 12 September 1983, a total of 63 mineworkers were killed in a coal dust explosion in the Hlobane Colliery in Natal (Edgecombe, 1998:218-219), and

d) In September 1986 a total of 177 mineworkers succumbed in the Kinross disaster (Jones, 1986:211).

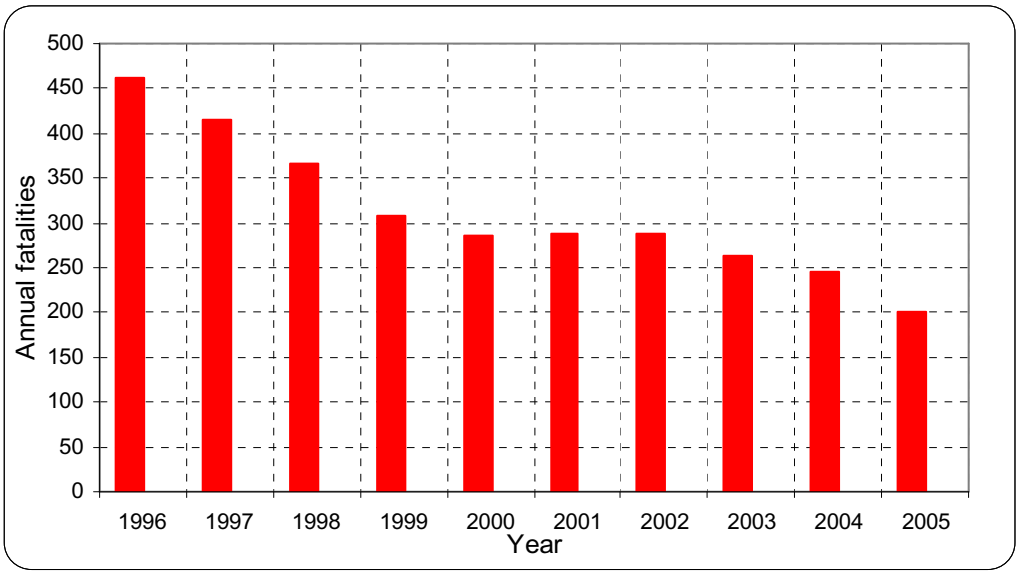


Figure 1.12: Total fatalities – all sectors

Source: COM, Facts and figures (2004:10) & DME Annual Report (2005 – 2006:16)

The mining industry is continuously striving to reduce the number of accidents. Researches were initiated resulting in more safe, healthier and productive mining methods. Since 2003 the industry is benchmarking itself against the safety performances of the main leading mining industries in the world: Australia, the United States of America and Canada. From this benchmarking drive it would appear that the percentage improvement required to meet the international benchmarks was showing improvements on a year-to-year basis with the exception of the gold, iron ore, limestone and the clay sectors. (COM of South Africa, OHS & SPC circular No. 42/06:5).

All possible practical affordable means are being made and employed to control, combat and eliminate diseases such as silicosis, HIV/AIDS, noise and occupational related diseases. The necessary conditions and practices conducive to promoting improved health need to be developed when and where necessary and maintained by the industry through the specific groups and individual mines (COM, Annual Report, 2004 - 2005:49-54).

Pienaar (2005:6) reported that 47 per cent of all deaths in South Africa for 2005 could be attributed to HIV/AIDS. Sunter (1996:35) warned that HIV/AIDS could overturn the demographic projections with devastating effects on the availability of labour, astronomical health and welfare costs, disrupting effects on families and productivity (COM, Annual Report, 2004 - 2005:52). According to

van Biljon (Sake-Rapport, May 4, 2008:3) too many workers are still being killed in the South African mines. Efforts to improve safety in the South African mining industry are continuing. The author is of the opinion that existing management practices are inadequate to supply the necessary management proficiency to further significantly improve on the overall performance in the industry. A comprehensive, practical and integrated management method is required that would enable each employee to deliver the results required from him safely and economically.

1.2.9.2 Containment of input costs

The industry, similar to all other business sectors, was and still is subjected to spiralling price increases of consumables, labour costs and government levies to name only a few. Many countries worldwide are today experiencing socially destructive inflation, misuse of economic resources and high unemployment rates (Friedman, 2007:3). Since many of the mining products are largely dependent on the R/$ exchange rate, any negative movement in this ratio would negatively affect the profit position and survival of the industry (DME, South Africa's Mineral Industry, 2004/2005:49). The appreciation in the R/$ exchange rate in 2003 for example resulted in a decrease of R20 billion in the South African mineral sales (COM, Annual Report 2004 - 2005:18).

In the recent past the cost pressures from domestic suppliers rose faster than inflation. The results were that most of the export sector was adversely affected by this trend. Many industries providing goods to export sectors are mainly monopolistic providers with little flexibility or price competitiveness. The result was that the price increases of these industries have generally risen faster than inflation (COM, Annual Report, 2004 - 2005:31).

1.2.9.3 Managing union demands

Mass action by unions, sometimes misused by political activists as pressure groups, can be disastrous to the optimisation of the results of mining companies (refer section 1.2.8.1 (e)). Stadler (1997:49) mentioned that during the 1980s political groups used unions to exert excessive pressure on the government of that time. Management practices should enhance responsible participation, involvement and commitment by the union and association members. It should give them a better insight into the operation of the company and the importance of their contribution to creating better performance results and increasing job security. It could be more likely then that the unions and worker associations would, as a result, be less inclined to withhold their labour unreasonably over issues that could negatively affect the company and their future.

1.2.9.4 Provision of sufficient competent labour

a) Cost of labour

The cost of labour, on a unit basis, for most mining companies became the greatest percentage of the unit cost of their products. This trend is increasing annually at an alarming and seemingly

uncontainable rate. It resulted in frequent labour retrenchments and even closures of parts or of whole mining operations in the past. Containment of the labour cost became one of the most urgent priorities in the management of the industry. For the period 1997 to 2006 the labour in the industry decreased by 17.1 per cent in numbers whilst the average salaries in real terms increased by 156.2 per cent per employee (refer table 1.3 & 1.4). It is interesting to note that the salaries have increased at a rate far in excess of the rate of labour reduction or rationalisation.

Year	Annual wages per worker R (in real terms)
1997	33 702
1998	41 130
1999	45 942
2000	52 994
2001	59 874
2002	63 051
2003	70 765
2004	74 973
2005	82 595
2006	86 346

Table 1.3: Wages in South Africa's mining industry (1997 – 2006)

Source: DME, Minerals Statistical Tables (1985 - 2006:21)

Flamholtz (1985:61) pointed out that human resource costs must be referred to as the costs incurred to acquire or replace people. It includes the total costs of advertising, employment, training and development and remuneration. Kerzner (1997:1) stated that in the past executives attempted to ease the impact of cost increases by embarking on massive cost-reduction programs. These practices, unless carefully planned, can result in some necessary tasks not being performed with disastrous consequences on the longer-term performance and survival of the organisation.

b) Employment.

One of the most popular solutions in practice to reduce and contain the labour cost increases was to introduce more capital intensive and technologically advanced methods. The resulting labour reduction increased the rate of unemployment, poverty, crime and the potential for civil unrest and anarchy. Unacceptably high unemployment rates would increase the social and political burden on a community and country. It invariably would lead to increases in social assistance and support from the state.

Baily and Okun (1982:144) argued that one of the prime responsibilities of any government is to promote maximum employment, production and purchasing power. Many governments fail to realise this objective. Visser (2005:21) commented that according to the 2004 national census the unemployment rate in the Republic of South Africa, as calculated by Statistics South Africa (SSA),

was 26.2 per cent. It represented a total of approximately 4.13 million people unemployed, out of a total of 15.8 million economically active people.

Year	Average number of employees in service			Earnings (R1 000)		
	Total	Males	Females	Total	Males	Females
1997	553 442	540 494	13 048	18 665 685	18 108 705	546 980
1998	471 832	459 829	12 003	19 406 377	18 822 867	583 510
1999	436 472	425 745	10 727	20 052 453	19 440 078	612 375
2000	417 559	407 183	10 376	22 128 314	21 428 573	699 741
2001	406 994	396 440	10 554	24 368 519	23 622 644	745 874
2002	415 988	404 543	11 445	26 228 418	25 356 228	872 190
2003	435 628	422 983	12 645	30 827 356	29 691 472	1 135 884
2004	448 909	435 152	13 757	33 655 942	32 328 754	1 327 187
2005	444 132	428 579	15 553	36 682 979	35 083 026	1 599 952
2006	458 600	439 906	18 694	39 598 234	37 626 787	1 971 447

Table 1.4: Labour Statistics – All Mines

Source: DME, Minerals Statistical Tables (1985 - 2006:21)

A growth rate of above 6 per cent per annum was suggested by the government to successfully solve the existing and expected future unemployment and poverty rates. The mining industry accepted this challenge (COM, Annual Report, 2004 - 2005:29). The industry's actual growth rate of 4.2 per cent for 2004 was still significantly lower than the government's growth target. The problem of high unemployment was seriously aggravated by the uncontrollable influx of illegal immigrants, mainly from the northern African countries.

c) Empowerment of employees.

The broad-based socio-economic Empowerment Charter for the South African mining industry, promulgated in May 2004, stipulated that historically disadvantaged South Africans should control 15 and 26 per cent of the mineral industry within 5 and 10 years respectively (DME, South Africa's Mineral Industry, 2004/2005:2). In the work situation the Equal Employment Act regulates empowerment.

Care should be exercised that this policy does not result in the lowering of work standards and performance. The danger of such an event can not be emphasised strongly enough. Normally employees should not be promoted unless they have acquired the necessary competency. Fritz (2001:15) stated that managers should allow subordinates only to function within the limits of their competency and delegated authority by agreement. Kouzes and Posner (2002:279) indicated that it is most important to recognise that each employee has a specific area of responsibility and has the right, provided that he is competent, to take the decisions related to his work.

When an employee is appointed in a position in which he is not adequately competent he would not be able to deliver optimal results and would contribute to the lowering of standards, supervision and

control with the resulting negative impact on company results and competitivity. This practice could eventually result in the closure of parts of the organisation or even the whole organisation.

d) Provision of skills

With the present government's emphasis on affirmative action and the imposition of the Equal Employment Act many white South Africans are leaving the country. The resultant skills drain and shortage poses a serious threat to industrial development, particularly in the mining industry and is seriously eroding the investors' trust in the future of the country. Employees should be adequately trained, developed and coached in the work situation. Caring for employees should be at the heart of anyone's coaching philosophy (Topping, 2002:97).

According to Professor Richard Stacey of the University of the Witwatersrand, engineering department, the lack of skills in the mining sector poses a serious threat and risk (Mining Mirror, January 2004, volume 16 No 7:15). Over the past few years the industry financed the development of key skills through mining bursary financial schemes to the amount of R60 million per annum. The industry contributed financially to attracting and retaining quality teaching staff at South African universities (COM Annual Report, 2004:121). Hartog and Van den Brink (2007:54) proved that individuals with more education perform better than individuals with less education. Many of these graduates would one day become leaders in their specific area of expertise of the industry. Charan (2008:8) emphasised that the development of strong leadership would be vital for the future success of the company.

1.2.9.5 Responsible environmental management

The MPRDA introduced drastic measures in order to rectify the past abuses by mining companies in respect of environmental rehabilitation (refer section 1.2.8.1 (b) and figure 1.10). It laid down specific procedures for orderly and acceptable future environmental management. Mine closures now demand an extremely high priority from both the government and the mining organisations. In essence it entails the planning and financial provision for the closure as part of the planning of the establishment and operating costs of a mine (COM, Annual Report, 2003 - 2004:91).

1.2.9.6 Compliance with legal and statutory requirements

The state's influence within the mineral industry is limited. It aims to support and promote equal opportunity and access to the exploitation of minerals by all citizens, to provide and maintain a legal and fiscal environment facilitating unimpeded exploration and mining, beneficiation and marketing of minerals and an efficient infrastructure (DME, South Africa's Mineral industry, 2004/2005:3).

Whilst the state acts as guardian over the exploitation of minerals it should itself refrain from the temptation to get overly restrictive and involved with the practical exploitation. Initiatives by the

government, for example, should be well contemplated in order to maintain investors' trust and support (Kayizzi-Mugerwa, 2003:228).

1.2.9.7 Managing comprehensively.

Organisations operate today in an era where taking on the risks of leadership became more important and complicated than ever before (Heifetz & Linsky, 2002:4). The South African mining industry's prime position for years as being a competitive and relative cheap supplier of minerals to the world markets is becoming under attack lately. It experienced a bad 2004-year in terms of commodity costs and profits (De Lange, 2005:21).

The reasons for this substandard performance were many. Van Biljon (2005:10) commented that the reason for the unacceptable performance can to a large extent be attributed to the fluctuating R/$ exchange rate. According to Sunter (1996:91) the key uncertainties in the industry revolved around the question of whether the world would move smoothly towards a frictionless international trading system or whether nationalisation and protectionism will get in the way. Drucker (1992:15) warned against the inherent dangers of protectionism to any industry. It is perceived that existing management literature does not provide the employee with the necessary managerial 'tools' to manage his work comprehensively in the practical situation. As a result the industry can not plan and manage for optimal performance.

1.2.10 Management practices in the South African mining industry

1.2.10.1 Introduction of the management discipline in the mining industry

The South African mining industry was largely founded, financed and developed by financiers, from German and British stock. Of the initial leading 25 entrepreneurs, 15 were Jewish mainly from Germany and Austria (Jones, 1995:5). It was then the era where the systematic and bureaucratic management approaches were the main recognised management practices in Europe and America (refer section 2.5.1.1 (a) and 2.5.1.1 (c)).

It could be assumed that either one or a combination of these approaches were automatically applied by some or all of these captains of the original mining industry and as a result became the predominant management practice in the specific company and ultimately the group. As new management approaches, such as the scientific and administrative management approaches entered the industrial scene they were most probably evaluated and implemented according to personal preferences (refer section 2.5.1.1 (b) and 2.5.1.1 (d)).

According to Holl (Association of Mine Managers of South Africa, Papers and Discussions, 1958 - 1959:805-834), when delivering a paper to the Association of Mine Managers of South Africa, training in the South African mining industry followed basically the same pattern than that in the rest of the world industry. In South Africa the Government Miner's Training School (GMTS), to

specifically train miners, was founded in June 1911. Since then technical training had gradually been extended to all unskilled and technical employees.

Supervisory training in the skills to perform accurate and regular control of technical work completed or in progress according to specific developed procedures or instructions as called by the industry, had become a speciality in mainly the gold mining industry. Work-study techniques, initially developed by Taylor with his scientific management approach, became popular and were extensively utilised in the mining industry to compile detailed standard instructions. These standard instructions were used to train the workers and supervisory personnel to efficiently perform and control the work completed and in progress on a daily basis.

Holl (Association of Mine Managers of South Africa, Papers and Discussions, 1958 - 1959:836) pointed out that human relations and training are complementary. Training increases knowledge, skills, and competencies and improved understanding of the needs of other workers and the company as a whole.

Management training in the mining industry was officially introduced in 1953. The first management course consisted of the four management fundamentals of planning, coordination, controlling and motivation. Since then training in the various aspects of management had been introduced right through the mining industry. Although it was a major step in the development of especially managers it was still considered as being far from adequate. According to Vermooten (Association of Mine Managers of South Africa, Papers and Discussions, 1958 - 1959:842) the lack of adequate managerial skills would pose a serious problem in future.

He commented that:

“A need which has been very difficult to meet in the past is that of training senior executives in the skills of management. Educational institutions provide facilities for technical training but hardly any for the training of potential managers in the art of management.”

In order to improve operational performance and promote safety in the industry the Mine Manager’s Certificate of Competency (MMCoC) was introduced in 1956. It was made compulsory by the Department of Mining as a legally required qualification for a person to be competent to be appointed to manage a mine, part of it or works (Hocking, 1999:207). The management part of the syllabus was based on the administrative management approach (The South African College of Mining). This certificate is still valid and a requirement for the appointment of a manager on a mine, whether in a junior or senior position. At this stage it would appear that the majority of the legally appointed managers are holders of this qualification only.

The industry used and is still making use from time to time of single topic management practices that came and are still periodically coming on the market (refer section 4.2.2 and 4.2.3). The administrative management approach, consisting of the main management functions of planning,

organising, leading and controlling, appears to be the most widely accepted and utilised approach in the South African mining industry to date (refer section 4.2.3.1 and 4.3.2). From discussions with top executives of most of the largest mining houses it would appear that the management part of the Mine Managers Certificate of Competency does not equip managers with adequate theoretical knowledge in order to perform their work efficiently (refer section 3.8.1). They expressed their concern and suggested that a comprehensive and integrated management method be introduced.

1.2.10.2 Management styles in the South African mining industry

Initially the management styles in the industry were strictly autocratic and militaristic, legacies of which are even still prevalent today in some groups. The autocratic style was partly as a result of the legacies of the bureaucratic management approach: the general prevailing concept of 'boss and worker' at the time and the strict supervisory procedures and standard instructions implemented and maintained by the industry to promote safety and productivity (refer section 2.5.1.1 c).

Because of the inherent dangers associated with mining, especially deep mining, tolerance with sub-standard performance could not be tolerated. Extensive use was made of mainly the scientific management approach in order to compile detailed operating methods, generally labelled as 'standard instructions' for the training of all workers and supervisory personnel to efficiently perform and control work completed or being performed. The management styles in the mining industry have kept pace with that of other industries and became much more accommodative in recent years. Holl perhaps best expressed the sentiment and attitude of management in this regard (Association of Mine Managers of South Africa, Papers and Discussions, 1958 - 1959:811).

He concluded that:

"I think it is correct to say that in doing any item of work one can do it so badly that it becomes uneconomic by virtue of the fact that it becomes completely useless for the intended purpose or the waste of effort and material renders it prohibitive from a point of view of costs. Similarly, on the other hand, an item of work completed to an absolutely useless degree of accuracy is bound to become equally uneconomic. The balance lies in the correct degree of accuracy enforced."

1.2.10.3 Perceived deficiencies of existing management methods

Haines (1999:12) argued that for optimal results the management work for the whole organisation needs to be performed comprehensively by all the employees on all the levels of the organisation at all times in a coordinated and integrated manner so as to optimally support the realisation of the objectives of the organisation. From this it follows that a comprehensive, practical and integrated management method would enable all the employees on all the levels of the organisation to efficiently plan, implement and control the work necessary to be performed in order to realise their objectives in the most efficient manner.

The industry, traditionally, was inclined to view the setting of safety performance standards and the achievement of safety results as separate from the normal planned production performance results (refer section 4.2.2 and 4.2.3). It should, however, be outcomes of the same production process or system and must be part of the total planning of the organisation and should not be planned and managed separately.

The perceived management deficiencies in the mining industry appear to be that:

a) existing management practices lack the necessary theory and relevant implementation procedures which would enable employees to manage in a comprehensive, practical and integrated manner on all the levels of the organisation,
b) a logical comprehensive, practical and integrated planning process and structure does not exist,
c) the classification, integration and coordination of the management functions, activities and the levels of planning into one comprehensive system can not be performed efficiently at present,
d) the many available management practices being utilised by the industry do not, even as a combination, provide management with the necessary managerial 'tools' to efficiently manage the complex mining operations on all organisational levels, and
e) the many different programs utilised, sometimes simultaneously on a mine and sometimes without the knowledge or involvement of all departments, could cause more harm than good.

1.3 THE RESEARCH PROBLEM

Field researches by the author into the efficiency of existing management practices and the degree of managerial competency of employees, on all the levels of a number of mining organisations proved that suitable practices for comprehensive, practical and integrated management did not exist. Employees appeared to be unable to efficiently plan their management work and to scientifically design and develop the necessary organisational structures.

The literature cited in this thesis and the academic reading associated with management practices and related management courses, seminars and workshops attended by the author over a period of more than 30-years in managerial positions did not reveal a single reference where existing management practices specifically addressed the development of comprehensive management practices. The theory and relevant implementation procedure for a comprehensive, practical and integrated management method that would solve all the managerial deficiencies identified in section 1.2.10.3 could not be ascertained. The problem was further emphasised by comments of several distinguished world-renowned management authors. Drucker one of the most renowned management thinkers over the past 60 years and labelled by the Harvard Business School as 'The pre-eminent management thinker of our time' is well known for his frank sentiments in this regard.

Drucker (1968:41) stated that:

"But what it is to manage a business, what it requires, what management is supposed to do and how it should be doing it, have so far been neglected."

Drucker was always interested and concerned with the work that management was supposed to do. He did not pay equal attention to the producers of the results – the workers. Consequently the emphasis on the basic management truth that results are and must be delivered by all the employees jointly as a team in the organisation was not really put into proper perspective by him. Allen (1973:46) stated that one could study management in an orderly and rational fashion only if one could develop the relevant taxonomy or principles of classification.

He argued that:

"However, this foundation has not been laid for management. We lack a system for sorting, categorizing, labelling, and defining new and old management information. A commonly understood classification of management work is a tool, which will prove indispensable to the progress of the management profession. Such a taxonomy will facilitate the communication and dissemination of new management knowledge and will provide the basis for a logical definition of management terms."

Rue and Byars (1989:49) stated that:

"While some progress was made, a unified theory of management has not been realized."

Callaway (1999:21) for example expressed the opinion that:

"It is in this quest for the one special management technique that will ensure success that has led to the seemingly never-ending supply of management theories. Each of these, in their own way, contains a grain of truth, yet to date none have provided all of the answers. These various theories and techniques can be compared to a series of musical instruments. Each has a unique style and ability, but when taken together and used as part of a larger activity, they develop a synergy that transcends their individual contributions. This is very much like the real-life scenario that many of us face every day."

Callaway (1999:1-2) further stated that for the managers, who felt the need to improve their management capabilities, or establish impressive bookshelves, there were and would always be books flowing from the learned consultants and academics on management styles or techniques. The themes of these books invariably promised, if implemented, immediate management successes and career advancement.

He was of the opinion that:

"At the very best these books promised pre-digested solutions, jumping on these bandwagons provide the manager a solution without having actually to think about the situation and formulate an original answer. Additionally, the implementation of these management solutions demonstrated to upper executives the manager's incisive insight and cutting edge thinking. This

is how job enrichment, quality circles, participative management, managing by objectives and many other milestones on the pathway to effortless success were inflicted on the innocent and unwary. This is not to say these techniques have no merit – quite the contrary, many were and continue to be quite relevant. The issue is that in and on themselves, they are limited. Like so many things in life they must be used in moderation and appropriately. All too often the uncreative or unskilled manager turns to these trendy management fads as a substitute for the analysis and creativity required for effective leadership and problem resolution."

More recently Drucker (2001:89), after many more years in the management fraternity and the publishing of more valuable work on management, concluded that:

"What is needed, therefore, is a redefinition of the scope of management. Management has to encompass the entire process."

Hellriegel et al (2005:8) in their 2005 'international student edition' argued that the manager has to perform the four basic functions of management: planning, organising, leading and controlling – the basic principles of the administrative management approach developed during the 1880s by Henri Fayol. The authors claimed that their book was totally designed on the most recent knowledge and views about the management discipline and proved that as Drucker and Callaway stated that the one special management technique still did not exist. In 2008 McDaniel and Gitman published their book 'The future of business. The Essentials' in which they still used the administrative management approach as the basis of their discussions.

The author of this thesis is convinced that most of the recent management literature and practices are to a large degree still supporting the administrative management approach. Existing management practices are not comprehensive, practical and integrated. This was possibly the reason for the basically continuous introduction of short duration programs by the industry. All the literature consulted concluded that the ideal management method did not exist at present.

Some of the main reasons why the author selected this topic for research were that:

- During the period, 1969 to 1970, the author was involved in the detail planning of the Elsburg Gold Mine Project. The planning procedures, utilised by the Johannesburg Consolidated Investment Company (JCI), the holding company, did not make provision for a comprehensive, practical and integrated planning process.
- In 1973 the author carried out a research at Sasol's Sigma Colliery for the purpose of compiling a dissertation for the degree, Magister in Business Leadership (MBL). The research indicated that there was not an integrated planning framework and a comprehensive and integrated management method on the mine (Stone, 1973:113).
- The author carried out the planning and commissioning of the modern Matla Colliery during the period, 1978 to 1981 without the aid of a comprehensive, practical and integrated management method because such a method did not exist at the time.

- During August 1986 the author attended a senior executive management course in strategic planning at the University of Columbia's Arden House satellite campus in the State of New Jersey, United States of America. The course was attended by a total of 94 delegates from 19 different nationalities from western and eastern countries. The author came to the realisation that the program leaders also advocated the same management practices and planning processes and structures, used in the South African mining industry. It would also appear that, according to the comments and contributions of the delegates attending the program, no uniform structures for planning and management exist in the Western and Eastern world countries.
- In 1997 the author carried out a mine-wide safety review on all the organisational levels at the Matla Colliery. The results indicated that employees on all the organisational levels in general rated their managerial competency unrealistically high and had an extremely inadequate knowledge of a comprehensive, practical and integrated management theory. The unacceptable high accident frequency rate and the general lower than planned performance in all areas of the colliery could mainly be attributed to the relatively low managerial knowledge and competency of the employees. A comprehensive, practical and integrated management method did not exist because the theory to develop such a method did not exist at the time (Stone, 1997:4).
- With the commencement of the closure of the Ermelo Colliery in April 1997, the author had already developed most of the main principles of the comprehensive, practical and integrated management method (Stone, 2000:1 - 87). The application of these principles resulted in that a total profit of R33 million compared to the original budget of a nil profit was realised and that no accidents occurred. This could be ascribed to the fact that the comprehensive, practical and integrated management method enabled every employee to determine the results required from him, develop his own objectives, and determine the tasks to be performed and to develop the relevant work procedures and control measures required. More effective delegation and integration could be achieved (refer section 6.2).
- A management competency survey on the Eyesizwe group of collieries was carried out by the author in September 2004. The results revealed that no formal logical integrated planning processes and structures existed on all the levels in the group. The managerial competency on all levels was extremely low (Stone, 2004:11).
- Throughout the author's 40 years involvement in the copper, gold, diamond and coal mining sectors he never came across a comprehensive, practical and integrated management method.
- The mining houses and therefore the industry still continue with the periodic introduction of single-topic short-lived management programs and practices as the only means to achieve the required results and improve managerial competency (refer section 4.2.2 and 4.2.3).
- During discussions with senior personnel of the main South African mining houses it was established that not one of the mining houses practised a comprehensive, practical and integrated management method. All agreed that a method that would enable all the employees on all the levels of the industry would be required in order to optimally utilise the resources at the disposal of the industry.

1.4 DEFINITION OF THE RESEARCH PROBLEM

It appeared that the industry was not positioned to optimise the resources at its disposal. The problem identified for further research was defined as follows:

A comprehensive, practical and integrated management method that would enable all the employees, on all the levels of the organisation, to plan and manage for the results required from each one of them in a comprehensive, practical and integrated manner at all times did not exist.

1.5 HYPOTHESES

1.5.1 Primary hypothesis

A comprehensive, practical and integrated management method did not exist in the South African mining industry.

1.5.2 Secondary hypotheses

1.5.2.1 The theory and procedure to implement a comprehensive, practical and integrated management method did not exist in the practical situation in the South African mining industry.

1.5.2.2 Existing management theories individually or combined were inadequate to develop the theory for a comprehensive, practical and integrated management method.

1.5.2.3 Existing planning processes and structures were totally inadequate to enable management to plan comprehensively on all the levels of the organisation and the organisation as a whole.

1.5.2.4 An empirical research methodology to effectively research the magnitude of the managerial deficiencies can be designed.

1.5.2.5 As a result of the lack of a comprehensive, practical and integrated management theory and procedure the managerial competencies of employees were unacceptably low.

1.5.2.6 Some components of the existing management theories can totally or to some extent or in combinations be modified and utilised to develop the theory for a comprehensive, practical and integrated management method.

1.5.2.7 Additional management theory required to develop a comprehensive, practical and integrated management method can be developed.

1.5.2.8 A procedure to implement the comprehensive, practical and integrated management theory in practice can be developed.

1.5.2.9 The procedure developed in this thesis will be sufficient to enable management to successfully implement the developed theory in practice in the South African mining industry.

1.5.2.10 The developed comprehensive, practical and integrated management method will completely comply with the management requirements in the mining industry.

1.6 THE RESEARCH QUESTIONS

1.6.1 Primary research question

The research question, which formed the crux of this thesis, was phrased as follows:

Does a comprehensive, practical and integrated management method for the South African mining industry exist and if not can it be developed?

1.6.2 Secondary research questions

1.6.2.1 Can the requirements for a comprehensive integrated management method be specified?

1.6.2.2 Can the relevant theory for a comprehensive, practical and integrated management method be identified from available existing literature?

1.6.2.3 Should all the required theory not exist would it be possible to identify the relevant management components of existing management theories that can be utilised to develop the theory for a comprehensive, practical and integrated management method?

1.6.2.4 Can the identified theories be utilised and where necessary adapted or modified to develop the theory for a comprehensive, practical and integrated management method?

1.6.2.5 Would it be possible to develop additional management theory to fill the identified deficiencies should adequate management elements not be identified?

1.6.2.6 Would the proposed theory fully comply with the theory required for the comprehensive, practical and integrated management method?

1.6.2.7 Can a logical comprehensive, practical and integrated management planning process and structure be identified from the literature or the practice, if not can it be developed?

1.6.2.8 Would it be possible to develop a procedure to implement the theory developed for the comprehensive, practical and integrated management method in practice?

1.6.2.9 Would the proposed method fully comply with the requirements for a comprehensive, practical and integrated management method?

1.6.2.10 Would the proposed method make the envisaged contribution to the improvement in organisational performance on all the levels of the mining industry?

1.7 OBJECTIVES OF THE STUDY

1.7.1 Primary objective of the study

Should it be proved that the theory and method for comprehensive, practical and integrated management did not exist in the South African mining industry the objective would be:

To develop the theory and procedure that would fully comply with the requirements for comprehensive, practical and integrated management in the industry.

1.7.2 Secondary objectives of the study

The secondary objectives of this study were to:

1.7.2.1 determine whether a comprehensive, practical and integrated management method does exist in the South African mining industry,

1.7.2.2 identify the relevant theory that can be utilised in the development of the theory for a comprehensive practical and integrated management method,

1.7.2.3 develop the necessary additional management theory required for the development of a comprehensive, practical and integrated management method for the South African mining industry,

1.7.2.4 develop a procedure to implement the comprehensive, practical and integrated management theory in practice,

1.7.2.5 prove that the proposed theory and procedure would fully comply with the requirements for a comprehensive, practical and integrated management method,

1.7.2.6 prove that the method is valid and practically applicable in all practical management situations in the South African mining industry,

1.7.2.7 prove that existing management planning processes and structures are inadequate to plan on a comprehensive, practical and integrated basis, and

1.7.2.8 develop from the newly developed theory an effective and integrated management planning process and structure.

1.8 KEY ATTRIBUTES OF THE DESIRED THEORY AND METHOD

1.8.1 Key attributes of the desired theory

The desired theory should:

1.8.1.1 contain all the necessary management components required to support the theory for a comprehensive, practical and integrated management method at all times, and

1.8.1.2 enable all employees to apply the theory in all management work required from them in order to deliver the results required from them.

1.8.2 Key attributes of the desired method

The desired method should consist of the appropriate theory and procedure to apply it in practice. It should enable the organisation and all the employees to:

1.8.2.1 manage at all times in a comprehensive, practical and integrated manner for the achievement of the results required from each of them,

1.8.2.2 plan comprehensively from the top down to the lowest levels of the organisation for the results required from each of them,

1.8.2.3 coordinate and integrate all the tasks with all the relevant stakeholders,

1.8.2.4 communicate comprehensively in all directions,

1.8.2.5 exercise effective control for the efficient achievement of the planned results,
1.8.2.6 react rapidly to any significant changes, and
1.8.2.7 integrate and computerise the individual and total plans.

1.9 THE RESEARCH PROCESS

The research comprised a theoretical literature research and an empirical research respectively. It was based on a combined method utilising the theories of Kothari (1990:13-40) and Hawkins and Weber (1980:115-225). The theoretical assessment comprised a literature study of all, as far as practical possible, recent and relevant available national and international management theories, researches and practices. Facilities such as libraries, journals and information locally and on the Internet were consulted. It was analysed and evaluated in terms of its practical applicability. It was finally summarised and formulated into a single representative view of available management practices.

The research design contained a clear statement of the research problem, procedures and techniques for gathering the required data, the population to be studied and the methods to be used for the processing and analysing of the data. It was in essence the vehicle with which the required data was collected, analysed, processed and presented in a manner that fully supported the solving of the research problem.

Kothari (1990:39) described research design as:

“the research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data. As such the design includes an outline of what the researcher will do from writing the hypothesis and its operational implications to the final analysis of data. More explicitly, the design decisions happen to be in respect of:
(i) What is the study about?
(ii) Why is the study being made?
(iii) Where will the study be carried out?
(iv) What type of data is required?
(v) Where can the required data be found?
(vi) What periods of time will the study include?
(vii) What will be the sample design?
(viii) What techniques of data collection will be used?
(ix) How will the data be analysed?
(x) In what style will the report be prepared?”

The design specified the relevant sources and types of information required to analyse and solve the research problem and the approaches used for the gathering and the analysis of the data. It, in addition, specified the time period as well as any possible foreseen restrictions.

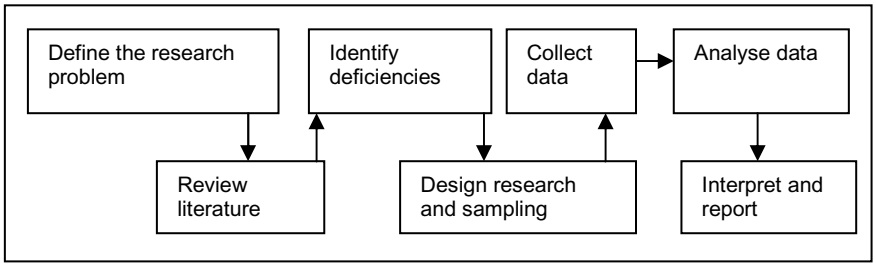


Figure 1.13: The research flow diagram

Means to overcome these restrictions were developed and formed part of the design. The design and methodology of the research were dealt with in more detail in chapter 3 of this thesis (refer figure 1.13). The research was entirely focused on the realisation of the research topic.

1.10 ORGANISATION OF THE STUDY

The analytical process that was followed in this thesis is graphically depicted in figure 1.14 below. It enabled the researcher to place the chapters in context with the overall objectives of the thesis and furthermore it indicated the relative positioning of each chapter. The thesis was designed to enable the most meaningful development and realisation of the objectives.

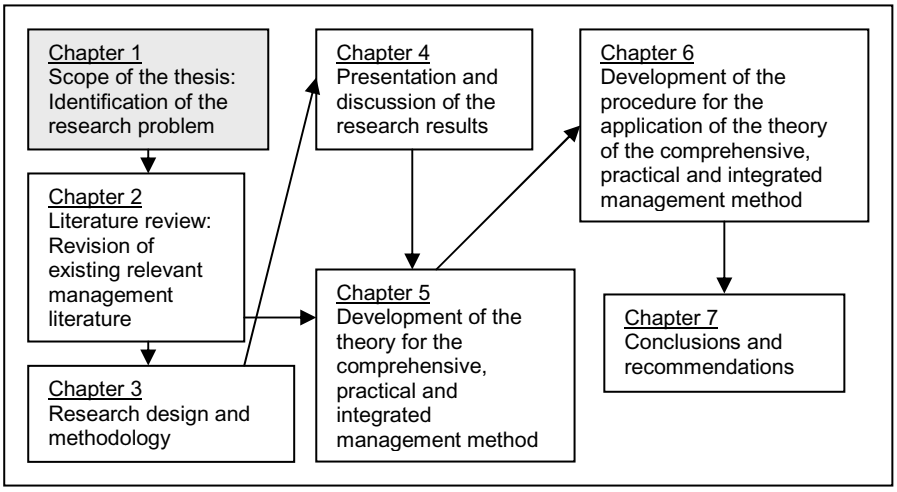


Figure 1.14: Chapter 1 in context to the overall thesis

The purpose with figure 1.14 was to provide the reader with a roadmap to the comprehension of the thesis. It shows chapter 1 as the structural overall approach to the research and the development of the thesis. Within the ambit of this chapter the key components of the thesis were explained in lieu of the objective to:

- research the existing relevant management literature for the existence of a comprehensive, practical and integrated management method,
- establish the situation with management practices in the South African mining industry,
- develop the additional theory should it be required,
- develop a procedure to implement the theory in the practical situation, and
- develop a comprehensive, practical and integrated management process and structure.

1.10.1 Chapter 1: Scope of the thesis

This chapter dealt with the:

1.10.1.1 introduction to and background of the South African mining industry,

1.10.1.2 historical and current state of the South African mining industry,

1.10.1.3 contribution of the mining industry to the economy of South Africa,

1.10.1.4 challenges facing the mining industry,

1.10.1.5 statement of the research problem,

1.10.1.6 objectives of the study,

1.10.1.7 brief description of the research process, hypotheses and research priorities, and

1.10.1.8 key attributes of the desired theory and the desired management method.

1.10.2 Chapter 2: Literature review

This chapter dealt with the:

1.10.2.1 statement of the requirements for a comprehensive, practical and integrated management method,

1.10.2.2 analysis of the most relevant management theories of the management discipline. The management practices, functions, activities and processes would be analysed, evaluated and discussed in terms of the requirements of a comprehensive, practical and integrated management method,

1.10.2.3 presentation of a concise evaluation of the literature reviewed,

1.10.2.4 identification of the perceived theoretical shortcomings of the literature, and

1.10.2.5 identification of the perceived theoretical management gap.

1.10.3 Chapter 3: Research design and methodology

In this chapter the:

1.10.3.1 research design and methodology was explained,

1.10.3.2 method of research was developed,

1.10.3.3 questionnaires were developed,

1.10.3.4 rating method was presented and explained,

1.10.3.5 questions in the questionnaire were explained, and

1.10.3.3 minimum sample sizes as well as the mechanisms to validate the results and findings were justified.

1.10.4 Chapter 4: Presentation and discussion of the research results

In this chapter the:

1.10.4.1 research results were presented,

1.10.4.2 research results were evaluated and discussed,

1.10.4.3 research results were compared against the stated requirements of the comprehensive, practical and integrated management method,

1.10.4.4 main patterns of the results were analysed and interpreted, and

1.10.4.5 deficiencies in practice were outlined.

1.10.5 Chapter 5: Development of the theory of the comprehensive, practical and integrated management method

In this chapter:

1.10.5.1 the elements of the relevant existing useful theories were identified,

1.10.5.2 additional theory was developed and proposed,

1.10.5.3 the developed theory was classified in a logical manner,

1.10.5.4 a comprehensive, practical planning process was developed and proposed, and

1.10.5.5 a practical planning structure for the industry was developed and proposed.

1.10.6 Chapter 6: Development of the procedure for the application of the theory of the comprehensive, practical and integrated management method

In this chapter:

1.10.6.1 a procedure was developed to implement the theory developed in chapter 5,

1.10.6.2 practical examples were used to illustrate the correct interpretation of the theory and procedure, and

1.10.6.3 the comprehensive, practical and integrated planning process and structure were used to ensure that the proposed method was correctly implemented.

1.10.7 Chapter 7: Conclusions and recommendations

In this chapter:

1.10.7.1 the main findings were summarised,

1.10.7.2 the attributes of the developed management method were compared with that of the administrative management approach.

1.10.7.3 the most important recommendations were proposed, and

1.10.7.4 topics for further in-depth research were outlined.

1.11 CONCLUSION

The South African mining industry survived and prospered for approximately one hundred and twenty years under fluctuating economical conditions, various political dispensations, volatile labour situations, a fierce competitive global environment and a relatively complex and mining-unfriendly environment. All indications were that the industry played an extremely important and supportive role in the South African economy in the past. It appeared that it will continue to be one of the most important role players in the South African economy for a very long period in the future.

Preliminary investigations indicated that the industry was utilising the same management practices that most organisations in the country and for that matter in many other countries of the world apply. There was, however, serious concern with the industry's performance in growth, productivity, containment of cost, competitivity and health and safety in general compared with that of prominent mining concerns in other countries (refer sections 1.2.9.1 and 1.2.9.7).

The perception was that available management practices were inadequate to enable the industry to manage efficiently in a comprehensive, practical and integrated manner. These management practices did not cover management work in a comprehensive, practical and integrated manner. Events such as unplanned risks, whenever they do occur, were therefore individually identified, analysed and evaluated normally by a separate department that not necessarily had the required experience, authority and accountability. Under these constraints it was impossible for the industry to optimise the available resources and potential of its employees. The safety in the mining industry still remains a matter of serious concern (refer section 1.2.9.1). The identification and evaluation of risks should be a continuous process and part of the planning and normal daily management work of every employee.

It was surmised that the inadequacy of existing management practices constituted one of the main reasons for the industry's deteriorating global competitivity. The development of an efficient management method for the industry, that would enable it to manage in a comprehensive, practical and integrated manner on all the levels of the organisation, was considered to be the solution.

In the next chapter the existing relevant available management theories and practices in the world, as far as practically possible, would be evaluated. The objective is to determine to what extent the literature complied or did not comply with the requirements for the theory for a comprehensive, practical and integrated management method and what additional theory should be developed.