A CRITICAL EVALUATION OF THE PRODUCTIVITY OF SOUTH AFRICAN SURFACE COAL MINES

by

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SUMMARY

The overall productivity of South African coal mines is in a downward trend and an increase in production. The report highlights the decreasing trend in world coal prices, which started in 1996, with no significant upturn in the market seen. With no market improvements foreseen, it is not logical to increase maintenance and operational costs. Further, it is not expected that an increase in productivity will be achieved through the increase of manning levels. The report suggests that an incentive scheme might be implemented to motivate the employees. The incentive can be in the form of a bonus fund or a performance-related pay scheme.

The report is one of the Coalftech 2020 research initiatives, which aimed to investigate the productivity of South African coal mines. The study focused on the different departments in the industry, such as mining, processing, and transport, and evaluated their productivity through various performance measures. The report concluded that an improvement in productivity is necessary to make the South African coal sector more competitive in the international market environment.

SOLI DEO GLORIA

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SUMMARY

During 1998, the general oversupply of coal continued with a 3.7% decrease in world coal demand and an increase in production. This resulted in the continuation of the downward trend in world coal prices which started in 1996, with coal prices dropping by another 13.8%. With no market improvements foreseeable in the immediate future, the South African surface coal mining industry will come under severe pressure to improve its labour and capital productivity levels and to reduce its operating costs in order to maintain its competitive edge.

The current state of the South African economy will also not make these improvements an easy task. With the labour sector putting more pressure on government to protect job opportunities in an industry that has long been known as one of the greatest providers of employment in South Africa, low economic growth rates and an ever-increasing trend towards globalisation, the surface coal mines will be hard-pressed to remain competitive and economically sustainable well into the 21st century.

As part of the Coaltech 2020 research initiative into the sustainable exploitation of the Witbank coalfield, this study focused on the different overburden stripping techniques used in South African surface coal mines and evaluated their efficiencies in terms of capital invested, labour productivity, production outputs, operational expenditures and other productivity measures.

These results were used to benchmark each individual South African surface coal mine with every other mine and with selected international mines in order to identify the critical performance areas that need to be improved upon in order to make South African surface coal mines more competitive in the international market environment.
On average, the South African surface coal mining industry recorded a lower overburden stripping productivity performance as determined from the analysis of a survey of mines in the Powder River Basin, United States of America, and in New South Wales and Queensland, Australia. The low productivity performance was mainly due to moderate labour and capital productivity performance levels.

Having identified the critical performance areas that need to be improved upon in order to make South African surface coal mines sustainable and competitive well into the 21st century, it is recommended that:

- Labour productivity be improved to be in line with the best international standards
- Capital productivity be improved to be in line with the best international standards
- The basis of this study be expanded to include all the surface mines in South Africa, thus enlarging the database and allowing cross-pollination of standards to improve productivity
- Newly planned surface mines be measured using the findings of this report to establish better mining investment guidelines for mine planners
- South African surface coal mines be re-evaluated on a yearly basis in order to set the standards for management to continuously improve their operations.
DIE KRITIESE EVALUERING VAN DIE SUID-AFRIKAANSE OOPGROEFSTEENKOOLMYNE SE PRODUKTIWITEIT
deur
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SAMEVATTING

Gedurende 1998 het die internationale oorvoorsiening van steenkool verhoog hoofsaaklik weens stygings in steenkoolproduksie, met 'n gepaardgaande verlaging van 3,7 % in die steenkoolaanvraag. Dit het die afwaartse druk op steenkoolpryse, wat in 1996 ontstaan het, 'n verdere hupstoot gegee en val steenkool pryse met 'n verdere 13,8 %. Met geen onmiddellijke verbetering in die internationale markstoestande binne die afsienbare toekoms nie, gaan die Suid-Afrikaanse oopgroeifamilieookbedryf onder geweldige druk te staan kom om sy arbeids- en kapitaalproduktiwiteite te verbeter en terselfdertyd bedryfskostes te sny net om sy voortbestaan te kan verseker.

Die huidige toestand van die Suid-Afrikaanse ekonomie gaan dit geen maklike taak maak nie; met die arbeidssektor wat groter druk op die regering plaas vir die beskerming van arbeidsgeleentheid in 'n bedryf wat vir jare bekendgestaan het as een van die grootste arbeidsektore in Suid-Afrika, laer ekonomiese groeiwerke, en 'n kontinue globaliseringsdryf, gaan die Suid-Afrikaanse oopgroeifamilieookbedryf dit moeilik vind om onder hierdie omstandighede op te kom petri en suksesvol te bly.

As deel van die Coaltech 2020 navorsingsinisiatief, wat die volgende voortbestaan van die Witbanksteenkolveld ondersoek, het hierdie verhandeling gefokus op die Suid-Afrikaanse oopgroeifamilieookbedryf se prestasies ten opsigte van kapitaal geïnvesteer, arbeidsproduktiwiteit, produksie-uitset, bedryfskoste en ander produktiwiteitsmeetpunte en was dit dienooreenkomstig geëvalueer.

Die resultate van die studie is gebruik om die individuele Suid-Afrikaanse oopgroeifamilieookmyne intern met mekaar, asook met 'n paar internasionale myne, te
vergelyk, om die kritiese areas vir verbetering uit te lig, wat Suid-Afrikaanse myne instaat sal stel om hul meer kompetenterend te maak op die internasionale arena.

Gemiddeld was die Suid-Afrikaanse myne se deklaagstropingsproduktiwiteit laer as die van geselekteerde myne in die Powder River Basin, Verenigde State van Amerika en New South Wales en Queensland in Australië. Die laer prestasie kan hoofsaaklik toegeskryf word aan die ondergemiddelde prestasies op arbeids- en kapitaalproduktiwiteit-vlakke.

Na die identifiseering van daardie kritiese meetpunte wat verbeter moet word om te verseker dat die Suid-Afrikaanse steenkoolbedryf kompetenter en mededingend gaan bly in die 21ste eeu, is die volgende aanbevelings gemaak:

- Arbeidsproduktiwiteit moet verhoog word om in lyn te kom met internasionale standarde.
- Kapitaalproduktiwiteit moet verhoog word om in lyn te kom met internasionale standaarde.
- Die invloedsfeer van die studie moet vergroot word om alle Suid-Afrikaanse oopgroefmyne in te sluit, om sodoende die kruisbestuwing van standaarde te bewerkstellig en tot verbeterde prestasie aanleiding te gee.
- Die bevindinge van die verslag moet met nuutbeplande oopgroefmyne vergelyk word om beter kapitaalinvestingsriglyne vir mynboubeplanners daar te stel.
- Die Suid-Afrikaanse oopgroefsteenkolbedryf moet op 'n jaarlikse basis herevalueer word met die doel om bestuur by te staan met die standaarde benodig vir aaneenlopende verbeterings.
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Symbols

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List of Abbreviations and Symbols

Abbreviations

- CAPEX: Capital expenditure
- ERM: Exposure Rate Measurements
- GPS: Global Positioning System
- IT: Information Technology
- KPI: Key Performance Indicators
- NSW: New South Wales (Australia)
- OEM: Original equipment suppliers
- OPEX: Operating expenditure
- PFP: Partial Factor Productivity
- PRB: Powder River Basin
- QLD: Queensland (Australia)
- ROM: Run-of-mine
- TPF: Total Productivity Factor
- USA: United States of America

Symbols

- h: hour
- km: kilometre
- m³: cubic metre
- Rm: rand million
- t: ton
Nomenclature/Definitions

BCM: Bank cubic metre
Blast gain: Material moved by chemical energy and never touched by any other equipment. It must be deswelled or expressed as a percentage.
Blasting: The activity of harnessing chemical energy in the form of explosives to fracture or break the in situ rock into a manageable size fragmentation
Bucket factor: Ratio between the available bucket capacity and the amount of the available bucket capacity that is filled with material during one pass, expressed as a percentage
Bush clearing: The activity of removing all groundcover vegetation prior to mining, including the removal of tree stumps and roots
Coal exposure rate: Linear advance over the cut width of the pit, measured in square metres
Coal removal: The activity of removing the coal in order to expose the parting or interburden in multi-seam operations
Digging availability: Operational and mechanical availability of the dragline to dig
Digging index: Effective utilisation of each cubic metre of bucket capacity, measured over every passing hour
Doze-over gain: Blasted material that is dozed to its final resting position (expressed as BCM)
Drilling: The activity of creating a shot hole by means of rotary and/or percussion drilling equipment
Hards: Material that requires chemical energy to break in order for it to be handled by standard mining equipment.
Haul distances: The distance that haul trucks travel from the shovel loading point to the dump site
Highwall control: The activity of controlling the highwall stability by means of chemical or mechanical energy
LCM: Loose cubic metre
Parting removal: The activity of removing the parting or interburden in order to expose the underlying coal seam in multi-seam operations
Powder factor: Mass of explosives used per BCM rock blasted
Pre-stripping: The activity of removing blasted material that cannot be accommodated by the primary stripping tool
Primary stripping: The activity of removing blasted material in order to expose coal.
Rehabilitation: The activity of levelling and/or profiling before revegetating the spoil material.
Rehandle: Material that is handled by the same equipment for a second time.
Softs: Material that can be freely dug or can be removed by mechanical means without the use of chemical energy.
Subsoil removal: The activity of removing all soft material other than topsoil.
Swell factor: Percentage increase in volume when in situ rock is subjected to mechanical or chemical energy.
TCM: Total cubic metres for equipment only (LCM + rehandle).
Topsoil stripping: The activity of removing topsoil as per the definition of topsoil contained in the Minerals Act, 1991.
Total BCMs: Sum of coal and waste BCMs mined.

Truck spotting time: Time (in seconds) taken from when a haul truck arrives at the loading shovel until it has positioned itself at the shovel ready for loading.

1.2 Geology

Southern African coal deposits occur in the following geological formations:

- Ventersdorp Supergroup
- Sprookskraal
- Waterberg
- Lemmer
- Pafuri
- Bophansberg

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