5. Conclusions

The South African surface coal mining industry recorded the lowest stripping productivity performance when compared with the survey results from the mines in the USA, NSW and Queensland. This below-benchmark productivity performance was mainly the result of low labour and capital productivity performance levels.

The labour productivity indicators contributing to the South African surface coal mining industry's low labour productivity performance were:

- Large percentage of contractors employed on local mines, but not directly involved in mining operations
- Work practices
- Labour-intensive mining operations
- Large percentage of mine labour not directly involved with mining, i.e. support staff (due to the socio-economic responsibilities of South African mines)
- Work culture of local work force
- Moderate production incentive schemes.

The capital productivity indicators contributing to the South African surface coal mining industry's low capital productivity performance were:

- Truck-and-shovel performances
- Dragline performances.

The low truck-and-shovel productivity performance can be mainly attributed to:

- Labour practices
- Moderate truck-and-shovel utilisation
- Long haulage distances
- Not capitalising on the economies of scale associated with large mining equipment.

The dragline productivity performance can be mainly attributed to:

- Labour practices
- Underutilisation of excess digging capacity.

However, some individual South African dragline operations were found to be outperforming the international benchmark mines and were setting a world-class performance standard. Key performance indicators, implemented by management to track the performance of the draglines, assisted these mines in achieving world-class standards.

Very few mines planned and scheduled cast-blasting as the primary method of moving overburden. In general, mine management agreed that cast-blasting had great potential as a cost-effective stripping method and that it was not being fully utilised on most mines.

Due to the difficulty in obtaining the operating expenditure from the mines and the amount of subjective manual manipulation required, these results were not used for evaluation purposes. Coal exposure rate analysis was also not considered an appropriate productivity performance measure due to the difficulty in interpreting those results.

6 Recommendations

The recommendations made below are aimed at assisting the South African surface coal mining industry and Coaltech 2020 in achieving the higher productivity objectives.

6.1 Improve labour productivity

With profit margins becoming marginal, the future value of coal is locked up in volume and costs. Those mines that manage to increase coal output at marginal cost levels through mergers, acquisitions and re-engineering will benefit. Other labour-improvement initiatives, such as restructuring of the organisation, mechanisation of mining-related processes and outsourcing of non-core activities, could also improve labour productivity performances.

6.2 Improve capital productivity

6.2.1 Labour practices.

Investigating and implementing a production performance management scheme that will foster improved labour productivity, practices and efficiency without sacrificing mine health and safety could also improve labour productivity and ultimately capital productivity.

6.2.2 Equipment utilisation

In order to improve equipment utilisation, it is recommended that mines:

- Work on a **full calendar year**, thus reducing unproductive time to an absolute minimum. Some South African dragline operations are already setting the standards in this regard.
- Either fully utilise or permanently remove **excess mining equipment** and digging capacity from the mines. This will lead to better utilisation of the available mining equipment.

6.2.3 Mine planning (haulage distances)

Mine planning and production decisions should aim at optimising the current stripping activities and practices by:

- Optimising truck haulage distances to tips and dump sites.

6.2.4 Economies of scale

When current mining equipment is due for replacement, the mine must consider the latest proven technologies in mining equipment. In particular, the latest generations of trucks and shovels will improve the economies of scale of the mining operations. For example, the tons hauled per truck cycle on South African mines could be improved by up to 80% if local mines were to replace their existing truck fleets with the latest 360-t haulers. However, it is important to have an optimal truck-and-shovel match as a sub-optimal match will influence the truck loading times and ultimately the capital productivity of surface mining operations.

6.2.5 Key Performance indicators

Key Performance Indicators (KPIs) can be of great help to management in managing and improving a mine's productivity performance. KPIs for the measurement and management of material transportation, i.e. truck spotting times, dragline swings per hour, truck loading times, loading and hauling, and dumping parameters, could be implemented, tracked and monitored against the international benchmark on a regular basis.

6.2.6 Cast-blasting

Very few mines planned and scheduled cast-blasting as the primary method of moving overburden. In general, mine management agreed that cast-blasting had great potential as a cost-effective stripping method and that it was not being fully utilised on most surface mines. The possible benefits of cast-blasting should be established for every overburden blast. South African explosive suppliers provide this service to their customers free of charge.

6.3 Measure results against newly planned surface coal mines

As this study outlines the capital and labour investments on international best-practice operations, it is recommended that the findings of this study be used to measure the capital and labour investment on newly planned surface coal mines. The outcome could be used to update and improve the study results and the plans of the new mines.

6.4 Extend the survey to other surface mining operations

By extending this benchmark study to other surface mining operations, the exceptional best practices at these surface mines could be documented and transferred to South Africa's surface coal mines to further improve their current productivity performance.

6.5 Re-evaluate the South African coal surface mines on a yearly basis

The findings of this study reflect the productivity performance of South Africa's surface coal mines at a certain point in time. Due to the external and internal changes affecting the industry, its productivity performance will certainly change. In order to remain competitive and sustainable, it is important to know what the impact of these changes will be or has been on the industry. By monitoring the impacts of these changes, management could use the information collected for decision-making to achieve best practices.