

# **Gordon Institute of Business Science**

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**The impact of management operating systems on performance improvement  
through the lens of the coal mining industry, and its relevance to private equity  
turnaround management strategies**

**Rivoningo Pleasure Mnisi**

**Student number: 448294**

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## Abstract

Global mining productivity has hit new low levels and has been on an estimated 24% steady decline over the past decade. Productivity decline was rated the number one challenge in the mining sector. In this study we will examine the management operating system's impact on performance and its relevance to private equity turnaround strategies.

Through a literature review the following recommendations were identified: addressing the integration gap, embedding effective management operating systems, prioritising operational excellence, and integrating the number of participants in the mining value chain to improve performance. Following the literature review, three research questions were identified: Does the design and implementation of MOS impact operational performance improvement positively? What is the impact of MOS non-financial performance measures on business performance improvement? Is there a significant difference in EBITDA performance pre and post-MOS implementation? To answer these, the study was divided into two quantitative research phases: An online survey questionnaire to 59 MOS experts with a response of 32, to gain their opinions and comments on nine items; and the analysis of secondary data from four mining operations to examine the pre and post-MOS tonnage, EBITDA performance, and the correlation between tonnage output and direct operating hours.

The study found that when comparing tonnage output of the mine pre and post-MOS implementation, tonnage output post-MOS implementation was higher. Furthermore, EBITDA earnings pre and post-MOS implementation were sustained over the period under coal prices were reported to have dropped by almost forty percent. Moreover, the study found that MOS's strength lies in its ability to improve accountability and behaviours, influencing issues within management control and integrating all levels of the management teams. Ultimately, this improves productivity and performance. The study furthermore suggested that MOS is more relevant to turnaround strategies and private equity firms as a management tool for executing operational strategy, improving productivity and performance improvement, especially as far as “underperforming” companies were concerned.

**Keywords:** Balanced Scorecard (BSC), Management by Objectives (MBO), Management Operating System (MOS), Private Equity (PE), Turnaround

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Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other university. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

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## **Chapter 1: Research topic**

The impact of management operating systems on performance improvement through the lens of the coal mining industry, and its relevance to private equity turnaround management strategies.

### **1.1 Introduction**

According to various industry experts, economists and theorists, global mining productivity has experienced a steady decline over the past decade, having finally hit an all-time low due to mining companies having focussed primarily on output at any cost during the high commodity price boom (Boegman, Venables, Wyk, Naik, Meiring & Mammatt, 2013; Hopwood, Zoghby, Banham, Hughes, Ives & Quinlin, 2014; Lala, Moyo, Rehbach & Sellschop, 2015; and Mitchell, Steen, Moran, Bradbrook, Henderson, MacAulay & Kunz, 2014). This has led to productivity being the number one challenge in the mining sector. Productivity has thus been placed at the top of the agenda of various mining CEOs (Boegman et al., 2013; Hopwood et al., 2014; Lala et al., 2015; Mitchell et al., 2014).

### **1.2 Global view of the mining industry**

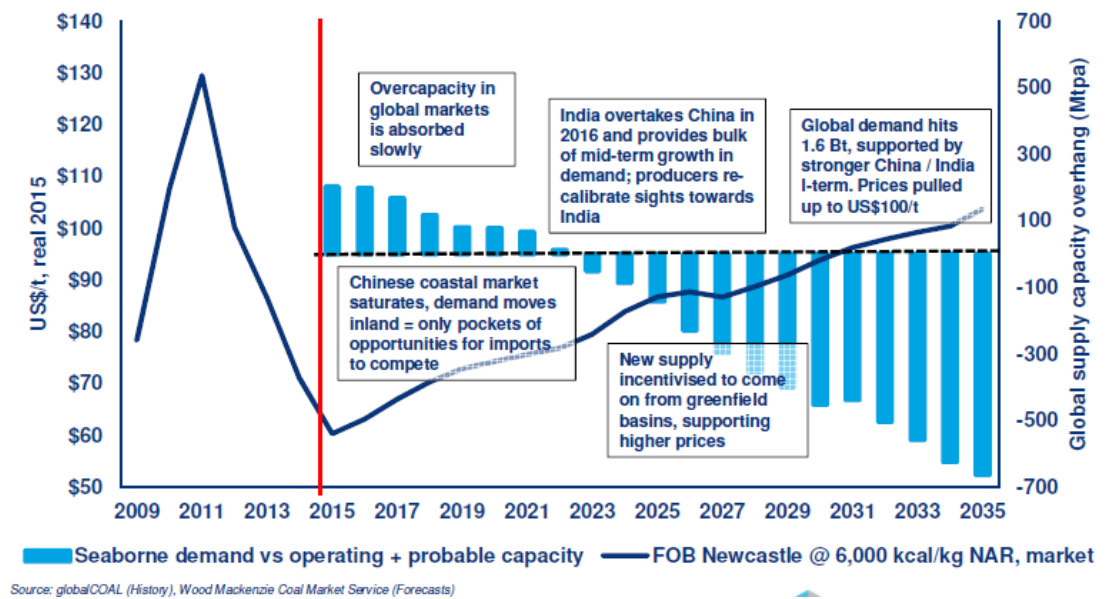
According to the latest MarketLine Global Metals and Mining report (2015), the global metals and mining industry market value has a worth of \$3,083.7 billion USD. The report highlights that, as higher levels of urbanisation lead to a greater commodity demand, the mining and metals industry is expected to grow by a further 23.9% in 2018 to be able to meet the demand.

Various factors such as labour, capital, economies of scale, resource decline, high operating expenditures, and low productivity were identified to be the main contributors, however, productivity decline was rated the number one contributing factor (Hopwood, et al., 2014; Lala et al., 2015; Mitchell, et al., 2014). Hopwood et al. (2014) also highlighted that due to this challenge, thermal coal mining costs rose from AUS\$61 per tonne in 2007 to AUS\$176 per tonne in 2012. In this same period, metallurgical coal prices dropped from AUS\$330 per tonne in 2011 to AUS \$150 per tonne in 2013 (Lala et al., 2015). In 2009, for the first time on record, thermal coal commodity prices price fell to under AUS\$80 per tonne in Australia (Hopwood, et al., 2014). This phenomenon is further supported in a study undertaken by Vernon, Soames and ParhamHarry (2008),

which proved, through the multi-factor productivity index metric, that mining output declined by 24% between 2001 and 2007.

In line with the above literature, the below graph by Mackenzie (2015) illustrates the extent to which coal prices have fallen over the past five years, as well as the future price forecast.

**Figure 1. Market balance and price forecast**



**Source: Trusted commercial intelligence (2015)**

Mining organisations during the commodity boom employed high-capital growth strategies that eventually led to a productivity decline as operations got bigger and became more difficult to manage due to complexity and a lack of focus on efficiency (Mitchell et al., 2014).

The question troubling the mining industry is what caused the productivity decline. Seeking an answer to this question, Mitchell et al. (2014) conducted research on the senior managers of big mining organisations and found that the top two contributors were accelerated growth and poorly integrated management systems. Accelerated growth meant a high amount of labour and high capital investments for expansion projects to mine lower mineral grades during the commodity boom, which resulted in a productivity decline because no consideration was given to how best the additional complexity should be managed (Mitchell et al., 2014).

According to Lala et al. (2015), the mining industry has started remedying this by reducing capital expenditure and labour costs, as well as performing other cost-cutting exercises. Many mining companies have achieved excellent results in cost reduction and are soon to reach a ceiling on cost reduction, leading the business to ask, “what next?” (Mitchell, et al., 2014). Cost-cutting initiatives are, however, believed to be unsustainable and often not enough to turnaround the productivity decline in the mining industry (Hopwood et al., 2014).

According to Hopwood et al. (2014), Mitchell et al. (2014) and Lala et al. (2015), a shift in focus is needed if the root causes of productivity decline in the mining sector are to be addressed. Hopwood et al. (2014), Mitchell et al. (2014) and Lala et al. (2015), suggested the focus shift to cover the following areas:

- Addressing the integration gap;
- Embedding effective management operating systems;
- Prioritising operational excellence and capabilities development programmes;
- Improving efficiencies through technology;
- Using analytics to uncover true cost drivers; and
- Focussing on innovation
- Implementing improved mining operating models between the various participants in the mining value chain.

Addressing the above issues will ensure that each element of the business, from resource mining to product delivery to the customer, is optimised, not on its own but as part of the business system (Hopwood et al., 2014; Mitchell et al., 2014).

According to Hopwood et al. (2014), Mitchell et al. (2014) and Boegman et al. (2013), mining countries such as Australia and South Africa have been hardest hit by low productivity levels, experiencing some of the lowest productivity levels in 50 years. The question that need to be asked is: What initiatives are being taken by mining operations in these two countries to turnaround these low levels of productivity? To answer this question, the researcher will examine the mining industries of these two countries in depth, using the 80/20 principle to focus on the highest gross domestic product (GDP) contributing commodities.

### 1.3 Overview of the South African mining industry

According to South African Chamber of Mines (SACM) (2014), the mining industry contributed 8.3% to the country's GDP during 2014. SACM (2014) published the following facts and figures about the South African mining industry:

- GDP contribution by the mining industry has declined from 21% in the year 1970, to 8.8% by 2013.
- Foreign exchange earnings in 2013 were R279.7 billion, showing an improvement of R9.5 billion from R270.2 billion recorded in 2012.
- The mining sector's investment opportunities (other than during the global financial crisis) were affected by the slump in commodity prices, regulatory uncertainty and infrastructure constraints.
- The mining sector accounted for 19.4% of private sector investment and 12.2% of total investment in the economy in 2013.
- Due to an increase in the total number of mining operations, total mining production was 4% higher in 2013 than 2012. The 4% growth in annual mining production followed a decrease of 3.2% in 2012 and a decrease of 0.9% in 2011.

The mining sector is a crucial contributor to the South African economy, and contributes greatly to foreign exchange earnings, job creation and economic activity. To sustain and improve the mining sector contribution to the South African economy, it is not only important to understand what caused the decline in productivity, but also to understand what the mining industry is doing to turnaround the integration gap, embed effective management operating systems, prioritise operational excellence and capabilities development programmes, and improve mining operating models to not only solve the problem, but prevent it from happening again in the future.

#### 1.3.1 Overview of the South African coal mining industry

According to Boegman et al. (2013), despite the decline in commodity prices, coal was the leading South African mining commodity revenue generator during 2013. Coal and platinum commodities exchanged top positions by sales value of South Africa's resources for the last two years (Department of Minerals and Energy & Mining Leaders, 2011). Coal remains a key strategic resource in South Africa, with more than 90% of the country's electricity and about 30% of liquid fuel production generated from coal (Department of Minerals and Energy & Mining Leaders, 2011). According to SACM

(2014), R35 billion per annum is generated from the steel-making industry, where coal is used as a chemical ingredient.

The coal mining industry in 2013 remained one of the industries which sustained its high job creation status, increasing the number of people employed in the local coal mining industry by 5.4%, to 87,768 in 2013 (SACM, 2014). According to SACM (2014), coal consumption grew by 3% in 2013, and currently boasts a 30.1% share of the global primary energy consumption market.

## **1.4 Overview of the Australian mining Industry**

According to MarketLine Metals and Mining in Australia (2015), the Australian metals & mining industry is valued at \$72.8 billion. The mining sector is important to the Australian economy, constituting nearly 10% of its GDP and 40% of its exports (Lovell C & Lovell J, 2013). The Australian mining industry enjoyed a very high demand and high prices, which shocked the market and led to higher numbers of new investments, and increased employment and profits from 1999 to 2009 (Verno et al., 2008). According to Vernon et al. (2008), the shock had a huge impact on the Australian mining multifactor productivity (MFP), which declined by 24% in 2008 due to a slow output growth over time, high growth figures in labour, and unsustainable higher capital injection.

### **1.4.1 Overview of the Australian coal mining industry**

According to MarketLine Metals and Mining in Australia (2015), coal mining comprises the largest segment of the country's mining industry, contributing about 48.4% of the industry's total value and currently accounting for around 16.6% of the global mining industry, representing a significant share thereof. It is also the second highest, after the steel and iron industry. The Australian coal industry was at its peak in 2013, with total revenues of \$35.3 billion (MarketLine Metals and Mining in Australia, 2015). According to Lovell C and Lovell J (2013), the Australian coal mining sector contributes approximately 25% of mining output and exports 75% of its coal, accounting for around a third of world coal trade.

## **1.5 Global view of the coal mining Industry**

According to AngloAmerican (2015), coal remains a key energy source for the following reasons:

- There is no material threat to the dominance of thermal coal before 2035, with all forecasts (under various climate change scenarios) indicating coal will remain a key energy source.
- Coal's share of the total power generation energy mix looks set to decline from 39% in 2015 to 35% by 2025, maintaining that level through to 2035. Despite significant improvements in renewables, coal remains significantly cheaper and is better able to meet the requirements for large-scale industrial development.
- Coal is preferred in key-growth regions such as India (50% of fuel mix), as it is economically viable, with abundant low-cost domestic resources available.
- Some 23% of the world's existing coal-fired generation capacity was installed in the last five years (principally in China), while more than half of the installed generation capacity is younger than 20 years.

Coal clearly represents a significant portion of the South African and international mining industry economy. It is therefore important for South Africa and academia to ensure that the sector is sustainable by attending to the root causes of the identified productivity decline.

### **Summary of the mining industry**

From the reviewed literature it is evident that the global mining industry is facing a huge challenge in productivity decline, mainly due to a lack of effective holistic productivity improvement approach in managing their complex mining operations designed mostly during the demand boom (Lala et al., 2015). Although a lot of effort has been dedicated to cost cutting, reducing operational expenditure and decreasing capital investments, this is not enough to turnaround the situation, and business is starting to wonder what next (Mitchell et al., 2014).

The literature review seemed to suggest that the next phase in remedying the productivity decline is addressing the integration gap, embedding of effective management operating systems, prioritising operational excellence and capabilities development programs, improving efficiencies through technology, using analytics to uncover true cost drivers, focussing on innovation and implementation of operating models between the number of participants in the mining value chain (Hopwood et al., 2014; Lala et al., 2015; Mitchell et al., 2014). Attending to these issues will ensure that each element of the business, from resource mining to product delivery to the customer,

is optimised, not on its own but as part of the business system (Hopwood et al., 2014; Mitchell et al., 2014).

Boegman et al. (2013) also highlighted that through implementing these turnaround strategies, mining organisations will become more agile and better able to transform to become global businesses with effective management systems that can integrate and ensure alignment between strategy, finance and operations.

## **1.6 Research objectives**

Mining countries such as Australia and South Africa have been hardest hit by low productivity levels, resulting in some of the lowest productivity levels seen in the past 50 years (Boegman et al., 2013; Hopwood et al., 2014; Mitchell et al., 2014). The decline has led to increased pressure on mining costs, resulting in declining Earnings Before Interest Tax Depreciation and Amortisation (EBITDA) and low return on investments in mining operations (Boegman et al., 2013; Hopwood et al., 2014; Mitchell et al., 2014).

According to the reviewed literature, the main contributor to the productivity decline is the gap which exists in how mining operations integrate people, finance, strategy and operations – referred to as the “integration gap”. The literature reviewed also suggests that to address this gap, management needs to develop effective management operating systems that prioritise operational excellence and capabilities development programmes to improve efficiencies, uncover true cost drivers through innovation, and implement integrated operating models in the entire mining business value chain (Boegman, et al., 2013; Hopwood et al., 2014; Mitchell et al., 2014). This holistic focus will help mining organisations to drive productivity across the various levels and functional departments of business, something that is currently non-existent (Lala et al, 2015).

Questions which arose from the literature review and which the research will attempt to address include the following:

1. Does implementing an effective “management operating system” result in improved performance for a coal mine?
2. How important are “management systems” to turnaround management strategies?
3. How does a “management operating systems” improve the integration gap and performance management in mining?



To effectively answer the above questions, the researcher will investigate current management systems and practices which have a holistic focus on productivity and performance turnaround to determine their relevance in addressing or remedying the productivity decline in the mining sector.

## **Chapter 2: Literature review**

### **2.1 Introduction**

To effectively answer the three questions identified in Chapter 1, the literature review in this chapter will delve deeper into the three main themes that emerged in the problem statement, namely management systems, operational performance management, and turnaround management strategies.

### **2.2. Management systems**

According to Bititici, Ackermann, Ates and Davies (2011), management processes and systems are crucial for sustaining performance improvements delivered by operational and support processes. In this chapter the researcher through, further literature review, will establish how management systems are designed, implemented and used in industry to determine their relevance and impact in addressing productivity decline and performance in the South African and Australian coal mining industries.

#### **2.2.1. Management operating system**

According to Khan (2012), a management operating system (MOS) is "a set of integrated policies, procedures, methods and tools used by management to plan, manage and lead people in their work outcomes to enable a company to meet its customer's requirements" (p. 47). Implementing an effective MOS creates greater transparency on business performance and enables organisations to free up staff and resources to focus on productivity and key priority performance indicators, as well as make the right decisions on time while providing the correct leadership and structure to effectively reach strategic goals and operational excellence (Khan, 2012; Lala et al., 2015).

According to Kaplan and Norton (2008), a breakdown in a company's management system is caused by a lack of an "integrated set of processes and tools that a company uses to develop strategy, translate it into operational actions, and monitor and improve the effectiveness of both" (p. 1). This view aligns to Khan's (2012) argument that developing and implementing a comprehensive MOS is key to the successful execution of business strategy and goals. This is mainly because management systems in organisations can configure and manage processes as an important lever in organisational productivity agility (Bititici et al., 2011). Khan (2012) further argued that to execute a business strategy successfully it is important for decisions made across all

levels of management throughout the business to be aligned and coherent. This will influence performance as it forces organisations processes to operate as an interconnected system rather than an individual process or activity (Bititici et al., 2011). Once an organisation is able to operate as an integrated system it can unlock dynamic organisational capabilities that will enable it to perform at higher levels (Bititici et al., 2011).

According to Khan (2012), there are three factors that make an effective MOS implementation, namely:

1. Organisational vision and strategy aligned to individual goals and incentives;
2. A continuous improvement culture that is supported by management and which encourages learning, problem solving and innovation; and
3. Superior performance of an optimised business value chain.

Kaplan and Norton (2008) referred to an effective management system as the “closed loop management system” because management systems can enable companies to develop their own strategy, translate it to achievable milestones, plan operations, and monitor and improve performance. However, according to Khan (2012), an effective MOS creates an alignment of objectives, making actions in each area that reinforce the strategy and goal of the organisation, thereby allowing employees and managers to identify areas which need more focus and raise actions to resolve the identified issues.

Kaplan and Norton (2008) also argued that most organisations underperform due to poor communication between strategy and operations, which eventually leads to strategy implementation failure due to a lack of balance between short-term and long-term performance requirements, making it impossible to sustain performance. To avoid this challenge, Khan (2012) suggested that an effective MOS be implemented with clear meeting time frames (annual, quarterly, monthly and daily/weekly), at all levels (board executives, senior managers, managers and supervisors), with clear objectives for decisions to be made.

### **2.2.2 Management by objectives**

According to Aksoy and Bayazit (2014), management by objectives (MBO) involves setting company-wide goals from the company corporate strategy, and establishing team and departmental level objectives while collaboratively setting individual-level goals

aligned to strategy and developing meetings to review performance, also giving feedback against these objectives. However, Dalcher (2014) argued that the main intention of MBO is to include subordinates in managers' own goals rather than to receive them from senior management. According to Zafor (2013), MBO enables “managers at different levels and their subordinates [to] work together in identifying goals and establishing objectives consistent with the organizational goals and work towards attaining them” (p. 82). According to Aksoy and Bayazit (2014), “the existence of a well-defined and measurable key performance indicators signals the existence of a formal and well-structured MBO system and it is also an indicator of transparency and understandability of performance criteria, which contributes to distinctiveness perceptions” (p. 509).

According to Krueger (2004), MBO is effective because it creates a collaborative relationship between managers and subordinates, which aids in planning and making subordinates aware of what is expected of them. It is believed that MBO achieves this through goal setting, participation in decision-making and objective feedback (Aksoy & Bayazit, 2014). Boulouta and Ntatos (2012), argued that a complete MBO system enables employees and managers to achieve their plans, which then automatically achieve those of the organisation. This could suggest that there is sometimes partial implementation of the system.

The introduction of MBO to business market as cited in Kyriakopoulos (2012) originated in the 1950s and 1960s from pioneers such as Chandler (1962), Selznick (1957), Ansoff (1965) and Drucker (1954); each of whom has been credited with the implementation of MBO. Historically the objective of MBO was to emphasise the importance of having clear objectives to productivity, profitability, market share and brand development to business (Kyriakopoulos, 2012). However, internal and external factors have changed the game of management and MBO has almost become redundant (Kyriakopoulos, 2012).

As a system MBO has been, and continues to be, widely criticised by academics such as Brim (2004), who argued that MBO does not work because it “emphasis the setting of goals over the working of the plan, underemphasises the importance of environment or context in which goals were set, does not address the importance of successfully responding to obstacles and issues essential to reaching a goal and finally that it failed to address the human aspect of performance”. Palmer and Dinesh (1998) both argued that MBO failure was due to its ignorance on the human factors, and the setting of rigid goal setting processes that led to partial implementation of the system. This view has not

changed and years later, academics such as Fulk, Bell and Bodie (2011) still argued that for improved MBO performance and successful implementation, MBO needs to incorporate team dynamics and evolve to team management by objectives.

The key implication of MBO is that objectives need to be understood, defined and measured to determine their ultimate achievement. This places more emphasis on goal definition rather than the holistic integrated business optimisation approach (Dalcher, 2014). The of lack of emphasis on MBO full systematic implementation approach, has led to a number of measures tracked in silos encouraging lack of interest in other aspects of the business and promoting sub-optimisation without concern for the overall business impact (Dalcher, 2014).

MBO furthermore creates “target fatigue” among middle managers due to demanding goals from senior executives (Aksoy & Bayazit, 2014). According to Dalcher (2014), MBO can also create poor quality setting of targets, and encourage resources to be diverted to meet these objectives through manipulation of data, unethical or unbalanced behaviour through whatever means because of the system over-emphasis of achieving goals instead of continuous improvement.

Brim (2004) argued that when management manage by goals and objectives, they create a problematic situation whereby subordinates only organise their work around the goal and objective, with minimum creativity and innovation. Zafor (2013) opined that this is still valid and argued that the main weakness regarding the approach of MBO is that it has a limited value unless rewards are tied directly to performance, encouraging bad behaviour. According to Krueger (2004), MBO should not be used for turnaround strategies unless it is integrated into other strategic management planning and implementation systems. Krueger (2004) further stated that strategic management should be implemented in a single big picture, rather than in a number of different objectives. The fact that MBO relies entirely on meeting one's objective is very narrow-minded and encourages silos (Joullie` & Spilane, 2015). To encourage innovation requires risk taking, which introduces the possibility of failure, and MBO is strongly against not meeting targets or objectives often referred to as failure (Joullie` & Spilane, 2015).

Kaplan (2010) is another MBO critic. He argued that MBO is a bureaucratic exercise which has been mostly used by human resources departments with a local goal-setting flavour that was operational and tactical, informed by business-level strategies and

objectives. According to Dalcher (2014), MBO's failure to view strategy as an ever-changing destination by advocating for fixation of goals and objectives makes it a system no longer suitable for strategic and operational management. MBO does not encourage the breaking down of silos in improving the productivity and operational excellence as it relies on sub-departmental optimisation, resulting in business optimisation, and lacks the holistic productivity improvement approach (Dalcher, 2014).

### **2.2.3 Balanced scorecard**

According to Kaplan and Norton (1996) the balanced scorecard (BSC) is a management system used to motivate and measure business performance through four business perspectives, namely financial, customer, internal business processes, and learning, which together provide a balanced picture of operating performance as well as future performance. The main benefits of the BSC come from the system's ability to translate strategy into operational terms, making strategizing a continuous process, greater alignment of various processes and services, competencies and units of an organisation (Kaplan & Norton, 2001). The origin of the BSC was meant to provide business with structure that could be used for performance measurement, developing and managing strategic objectives, and for managing strategy and future opportunities (Kaplan, 2010).

De Geuser, Mooraj and Oyon (2009) argued that for the BSC to be considered effective, it should have a positive impact on organisational performance through an improved integration of the management processes and empowerment of the employees. Kaplan and Norton (1996), when developing the BSC, noted that it is a holistic model of the strategy that allows employees to see how they can contribute to organisational success, because, if the model is wrong, individuals and departments will unknowingly fully sub-optimize their performance. According to Lala et al. (2015), to address the productivity decline challenge faced by the mining industry, organisations need to encourage a holistic view on the improvement of key priority productivity drivers. In contrast, the BSC encourages multiple measures, which dilutes focus on core productivity value drivers.

Since it was first publicised in 1996, the BSC has been extensively used by managers as a performance measurement tool since. However, there is insufficient evidence to link the BSC to superior financial performance when compared to a traditional performance measurement system (Davis & Albright, 2003).

According to Quattrone and Busco (2014), the BSC's weaknesses are due to the fact that it does not provide definitions of performance but only visualisations that act as ways (approaches, paths and modes) of performing these possible definitions. Hoque (2014) argued that the BSC is often difficult for organisations to integrate with other managerial control tools such as budgeting, and that the BSC can sometimes encourage the use of too many measures in a single scorecard, which can result in organisations measuring the wrong key performance indicators (KPIs). The BSC is complex and takes too much time in its formulation, forcing organisations to attempt partial implementation with minimum performance impact, thereby reducing it to merely a paperwork exercise (Palmer & Dinesh, 1998).

In light of these findings, Kaplan (2012) responded and acknowledged that the BSC should be used as the foundation of an entirely new system for strategy management and execution, which means the other systems can build onto it to improve on its weaknesses. This suggestion was welcomed by other academics, among them Perkins, Grey and Remmers (2014), who supported Kaplan's comments by arguing that the BSC cannot be thought of as a miracle management tool, and should rather be seen as an element of a firm's management system which could be helpful in answering how the firm is performing.

#### **2.2.4 Conclusion of management systems**

Through the literature review it becomes clear that MBO fails to view strategy as a changing destination by advocating for fixation of goals and objectives (Dalcher, 2014). MBO also places greater emphasis on goal definition on an individual level, rather than of the holistic integrated optimisation. Furthermore, it is rarely informed by business-level strategies and objectives. The combination of these factors may lead to a lack of interest in other aspects of the business and could stall organisational innovation and capabilities development (Dalcher, 2014; Joullie` & Spilane, 2015; and Kaplan, 2010).

There appears to be little evidence that the BSC can improve a firm's ability to manage its assets, although there was a significant performance improvement following the BSC implementation to (Davis & Albright, 2003; Perkins et al., 2014). The BSC's lack of focus on specific business value drivers reduced it to a performance management system to answer how the firm is performing, and therefore it does not qualify for use as a management model, but should rather be seen as an element of the management operating system (Khan, 2012; Perkins et al., 2014).

As discussed in Chapter 1, the next phase in turning around the productivity decline in the mining sector requires addressing the integration gap, the embedding of effective management operating systems, prioritising operational excellence and capabilities development programs, improving efficiencies (Hopwood, et al., 2014; Mitchell, et al., 2014; Lala et al.). Both MBO and BSC systems fail to provide sufficient theoretical evidence that they can be used to address the aforementioned mining sector challenges. Neither MBO nor the BSC recognises that operational excellence is not only about individual measures or goals, throughput, strategic alignment and measuring everything to create value, but rather, that it is about creating performance value through the involvement and alignment of the entire value chain's interactions, prioritising the key value drivers and making decisions aligned to overall business optimisation (Park, 2014). Following this argument, implementing an effective MOS could address the challenges faced by the mining sector because it operates in a closed-loop system. A closed-loop system creates greater transparency on business performance, prioritises performance drivers, enables organisations to free up staff and resources to focus on productivity in an integrated manner thus stimulating innovation through its set of integrated policies, procedures, methods and tools used by management to plan, manage and lead people enabling organisations to improve business performance (Khan, 2012; Kaplan and Norton, 2008).

**Research question 1:** Does the design and implementation of an effective MOS impact operational performance positively?

## **2.3 Operational performance management**

According to Braz, Scavarda and Martins (2011), “performance management is the process of quantifying efficiency and effectiveness” (p. 752).

### **2.3.1 Performance management systems**

According to Laughlin (2009), the need to manage performance will result in a performance management system (PMS). Koufteros, Vergheze and Lucianetti (2014) argued that for an organisation to be effective it must design a system that entails two types of uses for performance management, namely diagnostic use and interactive use. Diagnostic use is concerned with the review of critical performance variables in order to maintain, altering or justifying patterns in organisational activities, while interactive use is a forward-looking activity exemplified by active and frequent involvement of top



management envisioning new ways to optimise organisational resources for competitive advantage (Koufteros et al., 2014).

Due to their inherent design to yield information regarding functioning of resources, PMSs are ultimately responsible for maintaining alignment and integration between operational functions, value creation and strategy (Koufteros et al., 2014). Without a proper PMS, organisations will not understand how business processes function, perform or manage improvement (Khan, 2012).

According to Wouters (2009), in order for companies to have a developmental approach to performance management they need to involve employees in management to build employees' professionalism, transparency and ownership, which will ultimately result in a better belief in the PMS and overall commitment to performance improvement.

Khan (2012) cited several challenges typical to performance management, which include the following:

- Due to organisations having become good at fire fighting but not at eliminating the problem, current PMSs do not focus on measuring the effectiveness of actions;
- People do not know what is expected of them due to a lack of clear responsibilities and accountabilities;
- Performance feedback focuses on lagging indicators, which results in a lack of focus on where organisations are at any given point in time;
- There is no root cause to recurring problems, which causes a variability and poor performance predictability; and
- Strategic goals are not translated to all levels of management, which results in poor ownership and buy in.

Other academics such as Braz et al. (2011) argued that the design of a PMS is a vital part thereof, but not as important as implementing, using and reviewing or updating the system. Braz et al. (2011) further argued that PMSs need to develop a procedure for reviewing set measures according to the strategic approach through an effective mechanism that enable continuous improvement, agreement on actions and review measures for performance with responsible leaders to be successful. This kind of approach to PMSs brings about a significant change in the way information is managed,

making the management of information systems and change vital to performance management (Bititici et al., 2011).

### **2.3.2 Financial and non-financial performance measures**

According to Slehat, Alnimer and Abbadi (2013), various non-financial performance measures can be leading indicators for lagged accounting numbers, therefore improving non-financial operational measures tends to be quicker to show an improvement than financial performance measures. Khan (2012) argued that managing performance purely through financial measures is complex and always leaves a gap. Therefore, in order to fill the gap, non-financial measures can be more useful because they indicate problems earlier than accounting reports. However, non-financial measures can be misleading because they represent a portion of the entire integrated system that reflects what was easy to measure instead of what is important (Khan, 2012). Having both financial and non-financial performance in a PMS benefits the company, though financial performance measures continue to be the most important aspect of a PMS (Zuriekat, Salameh & Alrawashdeh, 2011). This is because non-financial performance measures applied value is limited and cannot be used to provide a satisfactory explanation for unbalanced relationships between a company's book value and its market value, and neither do they provide information required for business decision-making about the future (Milost, 2013).

Zuriekat, et al. (2011) found that there is an increase in the participation of managers and employees in PMS design because this enables them to find relevant information required to complete tasks and make decisions and contribute towards their organisational output measured by the level of their satisfaction.

### **Conclusion of performance management**

According to Kuzmina-Merlino and Kotane (2012), there is a gap in academic literature regarding non-financial indicators content, structures and in the methods to be used for measurement and evaluation. Thus, Khan (2012) argued that organisations typically focus on historical (non-financial indicators) reporting with little planning and executing, which creates a problem in linking execution and performance. The Bititici et al. (2011) and Koufteros et al. (2014) literature review furthermore supports this view, arguing that there is not enough literature to explain what PMSs are used for within organisations – in other words, diagnostics or interactive use. Koufteros et al. (2014) argued that, due to

this gap there exists little evidence that PMSs using non-financial performance indicators lead to improved business performance.

**Research question 2:** What is the impact of MOS non-financial performance measures on business performance improvement?

## **2.4 Turnaround management strategies**

### **2.4.1 Private equity firms' turnaround strategies**

According to Cuny and Talmor (2007), “private equity is an asset class which has received considerable recent attention due to its perceived exceptional returns” (p. 1). According to Hoskisson, Shi, Yi and Jin (2013), the evolution of the private equity (PE) industry can be classified into two waves. The first wave of the PE industry has been characterised by the introduction of the high-leverage financial engineering and the adoption of high-incentives scheme. In the second wave, PE firms have become more focussed on operations; their role having changed from financial engineers to operational engineers providing managerial guidance to buyout firms to improve value and profitability (Hoskisson et al., 2013).

PE strategies are fast being adopted by developing countries to accelerate the growth of organisations (Gadiesh, MacArthur, Bain & Company. inc, & Cruikshank, 2008). In the developed world, PE strategies are not only tools for private business but also for governments and public companies wanting to learn useful lessons and apply them to economic problems (Gadiesh et al., 2008). According to Barber and Goold (2007), PE strategies embody a combination of business and investment-portfolio management, with operational performance turnaround of their targets at the core of their success. PE buyouts create value largely through improving operations. However, there are other aspects of PE buyouts for improving a firm's performance, in other words, improving managerial incentive contracts and the use of higher leverage (Cuny & Talmor, 2007). According to Achleitner and Figge (2014), there are two key value drivers that explains PE operating performance improvement, namely improved incentive alignment and the provision of smart money, and operational engineering.

According to Vester (2011), the PE value creation process comprises four main phases, namely investment strategy, the actual buying process, the “improving phase” (also known as the turnaround phase under PE firm management), and the selling phase. For

the purpose of this research, the researcher will focus on the relevance of implementing an effective management operating system during the “improving phase” to bring about quick operational performance turnaround.

According to Vester (2011), in order to realise a business strategy, an organisation should have a programme that combines cost-cutting and revenue-growth-oriented strategies both focussed on continuous, company-wide improvement. This improvement system should be designed in such a way that it provides management visibility on where it should focus for improvement (Vester, 2011).

According to a study by Rogers, Holland and Haas (2002), PE firms achieve superior results on the businesses they operate on because of their focus on four key management disciplines, namely defining an investment thesis (in a three to five-year plan), using the right performance measures for each business, eliminating unproductive capital (both fixed and working capital), and focussing on optimising the business. McKelvey (2013) argued that it is the managerial discipline and strong operational performance and not financial engineering that explain PE's impressive performance. To realise the business turnaround it is important that strategic goals, market facts, tactical plans and performance measures are clearly articulated to motivate staff and ensure accountability (McKelvey, 2013). Articulating these goals helps ensure that the business does not waste time, money or management bandwidth, and that an integrated approach is followed in accelerating activities that influence or impact business performance (Gadiesh et al, 2008).

According to Couto, Divakaran and Caglar (2012), public companies have started adopting PE principles by using dashboards to track measures of business performance. However, for public companies to create real and sustainable operating and productivity improvements, they need to focus on several key points, namely value, cash flow, creating a sense of urgency, using analysis and thoughtful debate processes, establishing effective leadership, and incentives (Couto et al., 2012). According to Vester (2011), this could be achieved through managing and focussing on revenue and EBITDA growth, as the PE industry builds from its origin of leveraged buyout to operational and financial combined overall value creation approach.

According to Platt (2009), PE companies buy firms (either public or private companies) at a multiple of their EBITDA value. While the PE firm owns a company it seeks improvement in the firm's performance by fixing its infrastructure, compensation plan,

management, marketing and sales methods, and other areas of weakness (Platt, 2009). By achieving these, the company's revenues increase while its costs decrease. Consequently, its EBITDA increases (Platt, 2009).

#### **2.4.2 Strategic and operational turnaround management**

According to Gonzalez (2010), finding the correct turnaround management tool can lead to exceptional results due to the need for higher levels of expertise and resources required for successful turnaround implementation. The industry advocates the use of automated systems, technological solutions and software to enhance turnaround management effectiveness, although these are no substitute for leadership, people and team skills – all of which are critical for a successful turnaround implementation (Gonzalez, 2010). According to Collard (2010), businesses fail due to mismanagement. A study conducted by the Association of Insolvency and Restructuring Advisors (year) revealed that “only 9% of failures are due to influences beyond management's control and to sheer bad luck. The remaining 91% of failures are related to influences that management could control, and 52% are rooted in internally generated problems that management didn't control” (p. 6) (Collard, 2010).

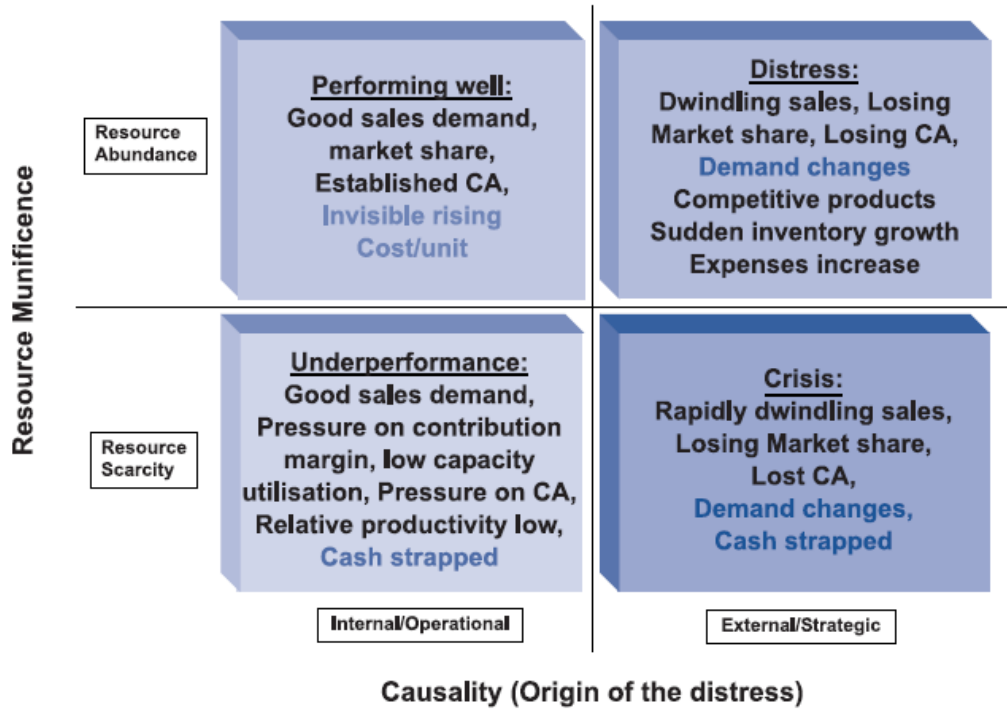
We do, however, need to acknowledge that managers face challenges when implementing turnaround strategies. This is mainly because some of the challenges faced when executing an organisational turnaround are unique and different from those of improving performance in a non-decline situation (Trahms, Ndofor, & Sirmon, 2013). The other challenge faced is the fact that managers must improve performance in a situation of scarce and dwindling organisational and environmental resources. According to Trahms et al. (2013), structural characteristics of an organisation, such as size and operating procedures, influence the success of a firm in the long-term. Additionally, ineffective top management team interactions or policies can lead to organisational decline.

#### **2.4.3 Strategy selection in a turnaround**

For the purposes of this research, the researcher will explore the subject of strategy selection in a turnaround situation based on the Pretorius (2008) model. According to Pretorius (2008), the need for turnaround strategies is not new, with most business ventures facing trouble and/or decline somewhere in their life cycle. Through his model,

Pretorius (2008) argued that turnaround strategies have four typical situations, namely performing well, underperformance, distress and crisis.

**Figure 2. Turnaround situations and their unique preconditions matrix**



**Source: Pretorius (2008)**

Pretorius (2008), combined resource munificence and causality results to create a turnaround matrix that is represented in four cells, each of which represents a set of preconditions. The four cells are: performing well, underperformance, distress and crisis. To understand where the mining industry falls within the matrix, we will explore each cell individually, according to the definition of each cell.

### Performing well

According to Pretorius (2008), companies that are performing well do not need a turnaround because they usually have a lot of resources and minimum causes of distress, and can operate normally, barring potential invisible inefficiencies. However they might be faced with the need for growing market share and establishing competitive advantage (Pretorius, 2008).

## **Underperformance**

According to Pretorius (2008), underperforming companies tend to suffer from limited resources and weak internal operations. The challenges faced by these kind of companies are usually because of contribution margin being under pressure, low capacity utilisation, inability to respond to demand speedily, productivity is low and the venture is cash strapped (Pretorius, 2008).

## **Distress**

According to Pretorius (2008), firms under distress are characterised by abundant resources but declining sales demand due to loss of competitive advantage. To turnaround performance attention will have to be given to growing market share. However the threat big due to growing demand for competitive or substitute products (Pretorius, 2008).

## **Crisis**

According to Pretorius (2008), the companies in crisis are characterised by scarce resources and cash flow. To turnaround firms under this quadrant, cash need to be injected to the organisation.

Based on the above model description and the mining literature review in Chapter 1, the mining industry falls within the underperforming cell. Because it is experiencing a productivity decline which is associated to weak internal operations. According to Pretorius (2008) for a successful turnaround, organisations in this cell need to cut costs, improve capacity, generate cash, outsource non essentials, improve production, and reduce assets.

### **2.4.4 Turnaround outcome measures**

According to Trahms et al. (2013), the final component of any turnaround model is measuring the performance outcome of the turnaround. However, there is still no agreement on how long the reversal of a decline should last to be considered a successful turnaround or how it should be measured (Trahms et al., 2013).

While some have argued that one year is sufficient to confirm a turnaround, other academics believe a minimum of three years of sustained positive performance is

required (Trahms et al. 2013). To value target companies and sell off their investments, PE firms generally use the simplest and yet probably the most common technique: the earnings-multiple method (Platt, 2009). This technique usually relies on EBITDA (operating income plus depreciation and amortisation), which is a commonly used evaluation method by financial analysts for purpose of business evaluation (Platt, 2009). EBITDA does, however, have a number of limitations, for example, it does not include changes in net working capital, and does not consider capital investments. Despite these weaknesses, EBITDA remains a better measurement for companies whose assets have longer lives, such as mining (Stumpp, Marshella, Rowan, McCreary & Coppola, 2000).

#### **2.4.5 Conclusion of turnaround strategies**

According to the reviewed literature, to achieve successful turnaround during the “improve phase” of the PE stages, it is important that strategic goals, tactical plans and performance measures are clearly articulated to motivate staff and drive accountability on operational performance (McKelvey, 2013). However, to achieve significant sustainable performance, Vester (2011) argues that turnaround process or “improve phase” on organisations should focus on operational improvement strategies that prioritise revenue and EBITDA growth. To achieve this, the business goal requires a sense of urgency, use of analysis, thoughtful debate processes, effective leadership and the alignment of incentives to business goals (Couto et al., 2012). Finally, according to Pretorius (2008) for a successful turnaround, organisations in the underperforming cell need to cut costs, improve capacity, generate cash, outsource non essentials, improve production, and reduce assets to improve performance.

**Hypothesis 3:** Is there a significant difference in EBITDA performance pre and post-MOS implementation?

#### **2.5 Conclusion of chapter 2 literature review**

From Chapter 1 we learnt that there is an “integration gap” that exists in the mining industry, which has strongly contributed to the productivity decline of the mining sector. We also learnt about the various management systems that could be used to address this gap, although the balanced score card (BSC) and management by objects (MBO) were both heavily criticised by academics for their lack of human touch, too many matrices integration, complexity, and lack of a structured approach in implementing a turnaround. Chapter 2 highlighted the developments in performance management



systems (PMSs) and their role in improving performance through utilising financial and non- financial measures which are critical in delivering a successful turnaround process.

The decline in mining productivity highlighted in the various business reports can be traced back to 1999, continuing until very recently, July 2015; a period where both MBO and BSC were highly adopted by industry and well covered in academia. The implementation of an effective management operating system (MOS) to address the integration gap and reverse the productivity decline is the most recommended solution rated by top mining business reports and consulting services, including Boegman et al. (2013), Lala et al. (2015), Hopwood et al. (2014), and Mitchell et al. (2014). That said, these recommendations lack sufficient backup or research in academia, although this research does present an opportunity to academically examine the recommendations.

In the same period, a number of academic articles and business reports were published highlighting the successes of PE firms. Most of the reports highlighted that these firms have managed to acquire underperforming assets and turn them around to good-performing standards. The researcher believes this approach by PE firms sets a new level of management and leadership standards from which other organisations can learn. This has brought about a new dynamic in management philosophy for public companies and an opportunity for the mining industry to learn from PE firms and vice-versa.

The growing appetite by certain mining organisations such as Xstrata and AngloAmerican to implement MOS could highlight the new trend towards management systems that integrate the entire business value chain to improve performance. It is for this reason that the research will systematically prove the cause and effect of MOS on performance.

## **Chapter 3: Research Questions**

### **3.1 Introduction**

According to the literature reviewed in Chapter 2, the opportunity for the mining sector to reverse the profitability decline trend lies in the effective implementation of an MOS to improve operational performance. Operational performance improvement or “improve phase” is regarded as the number one priority for both mining and PE firms for revenue growth and EBITDA improvement.

To assist in resolving the operational performance challenge faced by both PE firms and mining, the research proposes the following research question:

What is the impact of a management operating system on performance improvement through the lens of the coal mining industry, and its relevance to PE turnaround management strategies?

To answer this, the research objectives were combined with the reviewed literature and three objectives were identified.

### **3.2 Research Objective 1**

Research question 1: Does the design and implementation of an effective MOS impact operational performance improvement positively?

This question was answered through the online survey questionnaire. The Cronbach`s alpha test was conducted to statistically test for consistency and reliability.

All questions used in the survey questionnaire were also tested using the chi-squared test. (See appendix 1 for survey questionnaire)

### **3.3 Research Objective 2**

Through two sub-hypothesis tests, the research will answer the study research question 2: What is the impact of MOS non-financial performance measures on business performance improvement?

**Hypothesis I (a):** What is the association between direct operation hours to mine tonnage output?

H<sub>0</sub>:  $\rho = 0$  (There is no association between DOH and tonnage output)

H<sub>A</sub>:  $\rho \neq 0$  (There is an association between DOH and tonnage output)

The statistical method that will be used to test the above hypothesis will be the chi-squared method.

**Hypothesis I (b):** Is there a statistical significant difference in tonnage performance pre and post MOS implementation? A test for the difference between two means.

H0: There is no significant difference in tonnage performance pre and post-MOS implementation.

HA: There is a significant difference in tonnage performance pre and post-MOS implementation.

H0:  $\mu_{Ton A} - \mu_{Ton B} \leq 0$        $\mu_{Ton A}$  (mean Tonnage output post mos implementation)

HA:  $\mu_{Ton A} - \mu_{Ton B} > 0$        $\mu_{Ton B}$  (mean Tonnage output pre mos implementation)

### 3.4 Research Objective 3

A single hypothesis was formulated to answer the research question 3.

Hypothesis: Is there a significant difference in EBITDA performance pre and post-MOS implementation?

H0: There is no difference in mean EBITDA performance pre and post-MOS implementation.

HA: There is a difference in mean EBITDA performance pre and post-MOS implementation.

H0:  $\mu_{ebitda A} - \mu_{ebitda B} \leq 0$        $\mu_{ebitda A}$  (mean ebitda post mos implementation)

HA:  $\mu_{ebitda A} - \mu_{ebitda B} > 0$        $\mu_{ebitda B}$  (mean ebitda pre mos implementation)

The hypothesis test can therefore be classified as a difference between two means.

## **Chapter 4: Research Methodology**

### **4.1 Introduction**

The purpose of this research is to understand, by way of a quantitative research methodology, the impact of management operating systems on performance improvement through the lens of the coal mining industry, and its relevance to PE turnaround management strategies. In this chapter the researcher will explain the strategy for data collection and how this study can be replicated, as well as demonstrate the rigor of the research strategy.

According to Gray (2013), research methodology entails inductive discovery (induction) and deductive proof (deduction). The inductive approach entails data collection and the analysing of data to identify ascertain whether any patterns emerge which might suggest relationships between variables; while the deductive approach moves towards hypothesis testing, where the idea or principle will be confirmed, refuted or modified (Gray, 2013).

In this study, the researcher used inductive discovery methods to understand the impact of an MOS on performance, and the relationship between various performance indicators used to measure business performance through quantitative statistical methods.

### **4.2 Research design**

The research design is used to structure how all of the major parts of the research project for example, the samples or groups, measures, treatments or programmes, along with the methods of assignment, work together to answer the research questions/hypotheses (Page & Meyer, 2006).

The researcher used quantitative research techniques to test the identified hypothesis. This is because the use of quantitative methods enables the measuring of intervention and/or implementation performance outcomes, as well as the quantifying of understanding how senior MOS experts have experienced MOS (Palinkas, Aarons, Horwitz, Chamberlain, Hurlburt & Landsverk, 2010).

The research study used a combination of experimental and exploratory research methodologies to enable the researcher to compare between pre and post-MOS

implementation impact on performance improvement, and thereby understand the relationship between variables involved in MOS implementation (Gray, 2013).

According to Gray (2013) and Johnson and Onwuegbuzie (2004), there are numerous advantages to using quantitative methods, including the following:

- The generation of initial hypothesis;
- Control of variables allowing one to more credibly assess cause-and-effect relationships;
- Accurate measurement of outcomes;
- Generalisation from samples to similar populations;
- Quantitative methods may have higher credibility with people in power; and
- The research results are relatively independent of the researcher.

According to Johnson and Onwuegbuzie (2004), when using quantitative research, the researcher needs to be aware of several disadvantages, including the following:

- The categories used may not reflect local constituencies' understanding;
- The theories used may be different to local constituencies' understanding; and
- The researcher risk missing on phenomena happening recently due too much focus on theory or hypothesis testing, rather than on theory or hypothesis generation (the confirmation bias).

In this study, the researcher used an analytical, online survey questionnaire to answer research question 1. This research methodology enabled the researcher to place emphasis on a carefully selected population sample in order that the research could be generalised to other situations (Gray, 2013).

Due to the logistics involved in collecting valuable data between Australia and South African mining operations, the researcher used the survey questionnaire to answer research question number 1, as this will allowed the researcher to collect data from a number of people in a cost-effective manner (Saunders & Lewis, 2012). This could, however, have hindered the ability of respondents to provide other information which may have been valuable for the research (Gray, 2013).

According to Gray (2013, p. 17), the deductive quantitative research methodology process is as follows:

1. Organisational mission: Read and take into account.
2. Theory: Select a theory or set of theories most appropriate to the subject under investigation.
3. Hypothesis: Produce a hypothesis (a testable proposition about the relationship between two or more concepts).
4. Operationalise: Specify what the researcher must do to measure a concept.
5. Test by corroboration or attempted falsification: Compare observable data with the theory. If corroborated, the theory is assumed to have been established.
6. Examine outcomes: Accept or reject the hypothesis from the outcomes.
7. Modify theory (if necessary): Modify theory if the hypothesis is rejected.

To answer research question 2 and 3 hypotheses, the researcher followed the above deductive quantitative research methodology.

#### **4.3 Unit of analysis**

For the purposes of this research, the units of analysis used include the following:

- Tonnage output (operations production output measured in metric tons);
- Direct operating hours (DOH);
- Percentage and analysis of survey responses in numbers;
- Revenue and cost – all measured in South African rand (ZAR); and
- EBITDA – all measured in ZAR.

#### **4.4 Universe**

To effectively demonstrate the impact of MOS on performance improvement through the lens of the coal mining industry, and its relevance to improvement/ turnaround management strategies, the research universe was considered to be all the coal mines which have implemented MOS in South Africa and Australia. The data points were collected as daily measures (for research question 2), and monthly measures (for research question 3).

#### **4.5 Sampling method and size**

The research used quota sampling and snowballing methods, as the researcher sought to understand the impact of MOS from a certain group of MOS experts who have experience in managing or implementing a mine that went through an MOS

implementation. As such, the researcher selected the sample that best represented this character (Saunders & Lewis, 2012).

The research focussed on four coal mining companies (two from South Africa and two from Australia) that implemented the MOS between 2012 and 2015. To ensure a good representation from both countries, the researcher selected an equal number of representatives from each of the targeted operations, mainly targeting the senior leadership of each mining operation and the consultants working closely with them. By selecting this sample groups of senior managers, the researcher sought to ensure that the respondents were able to answer all of the questions from the survey questionnaire, thereby improving the quality of response and the feedback.

To answer research question 2, the period selected for the analysis was from 2012 to 2015, which included a period of a minimum of 12 months' daily stats. The data excluded abnormal shifts worked over weekends, holidays and voluntary shifts worked during mine off days, estimated to be approximately 100 data points per mine. A pre-installation period was defined to be a minimum period of six months prior to the official MOS start date, while the post-installation period was considered to be from the official MOS start date onwards.

To answer research question 3, the researcher used monthly EBITDA stats collected from the mine databases (secondary data from mine ellipse data base). The period selected for analysis for all the mining operations was a minimum period of 20 months prior to MOS installation, while a minimum of 20 months post-installation was required to be able to compute the necessary statistical tests.

In order to gain greater depth into the subject, the researcher integrated the survey data, participants' comments from the survey results, and secondary data from the mining operations. The study used primary data obtained from the survey questionnaire responses to answer question 1, and secondary data to answer question 2 and 3. However, to effectively answer the research questions in Chapter 6 and 7, the researcher intergraded the survey responses with the secondary data analysis. Abnormalities in secondary data, for example, days on which the mines were shut down, public holidays and weekends, was excluded from the sample data for the purpose of achieving consistency in the data being analysed.

## 4.6 Data gathering

The data gathering process was structured in two phases: Phase one – an online survey questionnaire to answer research question 1; and Phase two – the collection of secondary data from individual companies' databases to answer research question 2 and 3.

### **Phase 1: Online survey questionnaire data collection process**

The participants were asked to answer a structured online questionnaire to enable the researcher to answer the research question. The survey questionnaire was proofread before being sent via an email link to all participants. A pilot test was run on two senior mining consultants and two senior managers from one of the mining operations to remove any ambiguity and ensure there was clarity, logical sequencing and timing for all the questions. The results of the proofreading and pilot tests were used to structure the final questionnaire. The questionnaire was completed through an online survey development, cloud-based company called SurveyMonkey.

The questionnaire focussed on gaining insights from senior managers with previous MOS experience, or have implemented MOS in their organisations over the past three years. The researcher had to ensure that netiquette (correct discipline applicable to online questionnaires) was practiced during the data collection process to guarantee respondents understood the intention of the study and that they would provide accurate information freely (Saunders & Lewis, 2012). The questionnaire comprised nine multiple-choice questions and a comment box. After a survey period of one month (from 12 August 2015 to 5 September 2015) a total of 32 responses were received from a target of 59.

The respondents were not asked to disclose demographical questions because the researcher thought it would have encouraged bias response towards giving a positive picture for their respective geography or mine.

### **Phase 2: Collection of secondary data from individual companies' databases**

To answer research question 2 and 3, the researcher gathered secondary data for costs, financial (revenue and EBITDA) and non-financial data (DOH and production daily output) through each company's official ellipse database – an official data-capturing system used for all mine analysis and reporting both internally and externally. This



database keeps a record of all the company's financial and non-financial data, which is generally collected through electronic performance systems at the mine and verified by line supervisors before being captured on the ellipse system.

The data was independently collected from four different mining operations. The researcher conducted a data clean-up, which entailed removing all the abnormalities from the data, formatting the dates and number formats, and transferring the data from the databases to Excel files. This process took a full month, following receipt of the data.

Based on the confidentiality clause signed with each mining operation that participated in this research, the real names of each organisation have been disguised.

#### **4.7 Data analysis**

To analyse the primary quantitative data, the researcher used data matrix format, bar charts and data tables to examine trends and findings. Despite the data clean-up that was undertaken, the researcher again checked all secondary and primary data for errors before undertaking the analysis on a computer, using the SSP quantitative analysis tool (Saunders & Lewis, 2012).

**Research question 1:** Does the design and implementation of an effective MOS impact operational performance improvement positively?

To answer the above question, the researcher analysed data collected from the online survey questionnaire using the SSP tool. A bar graph was also computed for each question, enabling the researcher to analyse trends and patterns between respondents. To test for internal consistency and reliability, a Cronbach's alpha statistical test was also computed for survey questionnaire items that directly asked respondents to give an indication of performance improvement on productivity, direct operating hours and revenue. These questions were mainly designed to test for performance impact of MOS on the four various mining operations.

**Research question 2:** What is the impact of MOS non-financial performance measures on business performance improvement?

Formulae for mining operations' performance is as follows

“Tonnage output (Tons) = rate of production x time used”

- Tonnage output – measures the total tons produced, which are then sold for revenue generation
- Rate of production – measures the efficiency and productivity of the operation
- Time – measures the time allocated for production.

The variable that MOS seeks to control is rate of production which measures efficiency and productivity of the operations.

To answer the research question 3, the researcher developed two hypothesis (refer to chapter 3, under section 3.3), which was answered by conducting statistical tests of the below two key mining performance indicators,

- Time - namely direct operating hours (DOH), and
- Tonnage output – Coal mine tonnage output (measured in TON).

To answer H1 (a), a Pearson correlation was computed to determine whether DOH had an association or significant correlation to TON (tonnage output) for each of the four various mining operations. The correlation coefficient ( $r^2$ ) is an important indicator of the usefulness of the regression equation as it will be able to measure how strongly DOH and TON are associated (Wagner, 2012). Moreover, to answer H1 (b) the research compared mean average performances pre and post-MOS implementation, a mean paired samples statistics was computed for each of the four mines' tonnage output.

**Research question 3:** Is there a significant difference in EBITDA performance pre and post-MOS implementation?

To answer the above question, the researcher developed a hypothesis (refer to chapter 3 under section 3.4) which was tested through a paired samples *t*-test, conducted to determine whether there was a significant difference between the pre and post-implementation scores for the EBITDA variable (Wagner, 2012).

#### 4.8 Research limitations

The research limitations include the following:

- Research was based on a single mining commodity perspective and therefore could prove difficult to generalise to other commodities or industries.
- Results of the research were conducted on four companies which implemented MOS in different periods instead of six operations as initially planned.
- Research data comprises two Australian-based mines and two South African mines, which have different cultures.
- The research does not differentiate between open-cut and underground differences influence on the results. The main differentiator being that open-cast mining performance can be affected by weather, while underground is independent thereof.
- The research does not take into account the difference in timing of MOS implementations across the various sites. This could mean that the study disregards other initiatives which could have been taken by the various mining operations during MOS implementations.
- Availability bias. Due to a lack of access, the research has only looked at analysing four mining operations which agreed to cooperate in providing access to MOS experts and data related to MOS.
- The research assumes that the impact of uncontrollable factors such as price and mining geology are constants.
- Limited access to MOS experts beyond the coal mining industry.
- The survey questionnaire did not require geographical location or position of the respondents to establish their role in the organisations in the mining industry, therefore the context and business culture between the two countries could not be extrapolated.
- Due to the logistics involved in collecting valuable data between Australia and South African mining operations, the researcher used the survey questionnaire to answer research question number 1, as this allowed the researcher to collect data from a number of people in a cost-effective manner (Saunders & Lewis, 2012). This could, however, have hindered the ability of respondents to provide other information which may have been valuable for the research (Gray, 2013).
- Survey questionnaire items 2, 3 and 9 required respondents to provide feedback of performance outcomes based on their self-assessment. If the respondent did not know the answer to the question, they could have provided an incorrect measure of certain performance outcomes such as productivity, revenue and direct operating hours.

## **Chapter 5: Data analysis and findings**

### **5.1 Introduction**

In Chapter 3 and 4, the hypothesis and research methodologies were proposed in order to test and prove whether or not a management operations system (MOS) had impacted performance in the mining operations where they were implemented, and to understand how the implementation of MOS influences financial and non-financial performance measures. Chapter 3 and 4 further described the study universe and the methods in which data was collected.

In this chapter, the researcher will explain the outcome and the statistical test results of the data collected through the online survey questionnaire, along with the secondary data collected from the four mining operations.

### **5.2 Summary of the research**

The purpose of this study was to determine the impact of management operating systems on performance improvement through the lens of the coal mining industry, and its relevance to PE turnaround management strategies.

From the literature review, the following research questions were developed:

- Does the design and implementation of MOS impact operational performance improvement positively?
- What is the impact of MOS non-financial performance measures on business performance improvement?
- Is there a significant difference in EBITDA performance pre and post-MOS implementation?

The objective of the study was to answer these questions by way of a quantitative study targeted at 59 MOS experts, as well as through secondary data collected from the respective mining operations. To answer the first question, the researcher used the online survey questionnaire. To answer question 2 and 3, the researcher used secondary data collected from each of the four mines. All four of the mines used in the sampling had implemented an MOS in their operations at some point over the identified period (2012 to 2015).

### **5.3 Survey questionnaire results**

The survey comprised nine multiple-choice questions and a text box for participant comments. A total of 32 responses were received from the original sample.

The survey comprised nine questions, as follows:

1. How long has MOS been in place at your operation?
2. Has MOS improved productivity in your operation? If so, by how much?
3. How much has MOS improved your DOH, on average?
4. To what extent has MOS changed the way you manage the operation?
5. In which of the following areas has MOS helped your organisation improved the most?
6. In your view, which of the following strategies are more relevant/applicable to MOS?
7. When last was your company involved in a cost-cutting exercise?
8. In your view, prior to implementing MOS, what were the biggest challenges affecting productivity in your operation?
9. By how much did MOS improve you organisation's revenue (tonnage output)?

Each question will be examined in turn, the results both discussed and represented by way of a diagram. Where relevant, quoted responses from participants will also be included.

#### **5.3.1. Survey questionnaire descriptive statistics**

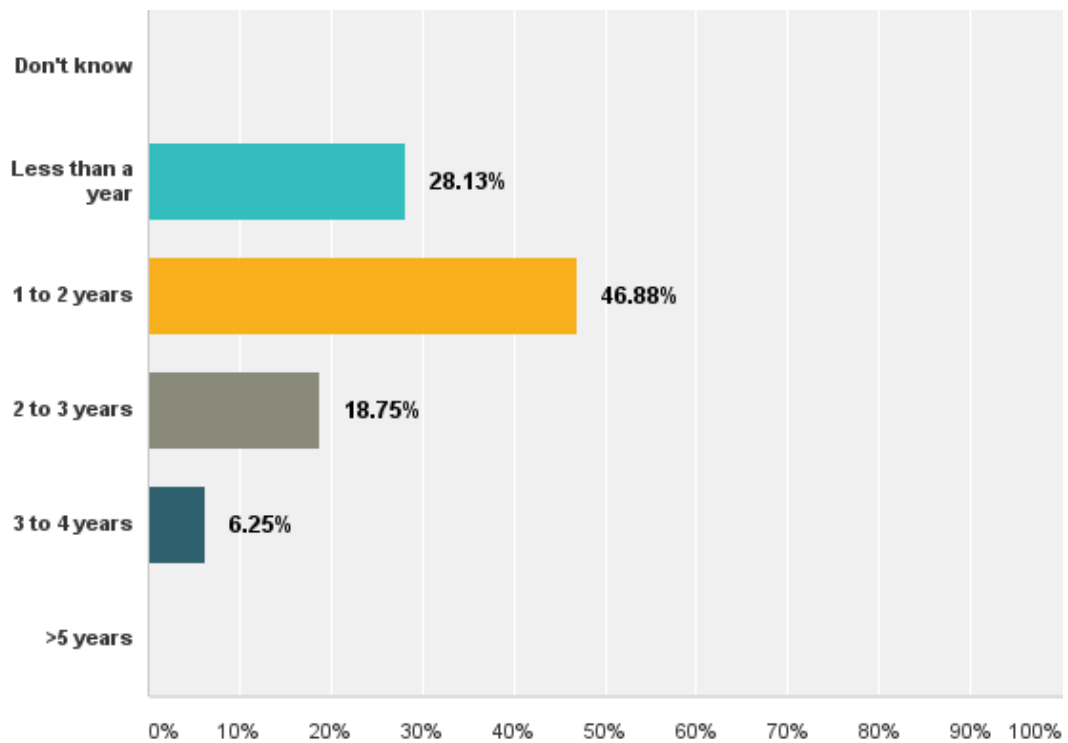
Research question I: Does the design and implementation of an effective MOS impact operational performance improvement positively?

##### **5.3.1.1 How long has MOS been at your operation?**

To understand the impact of time on MOS, the participants were asked to give an indication of how long the MOS been in place in their operation.

Survey question 1: How long has MOS been in place at your operation?

**Figure 3: MOS duration**



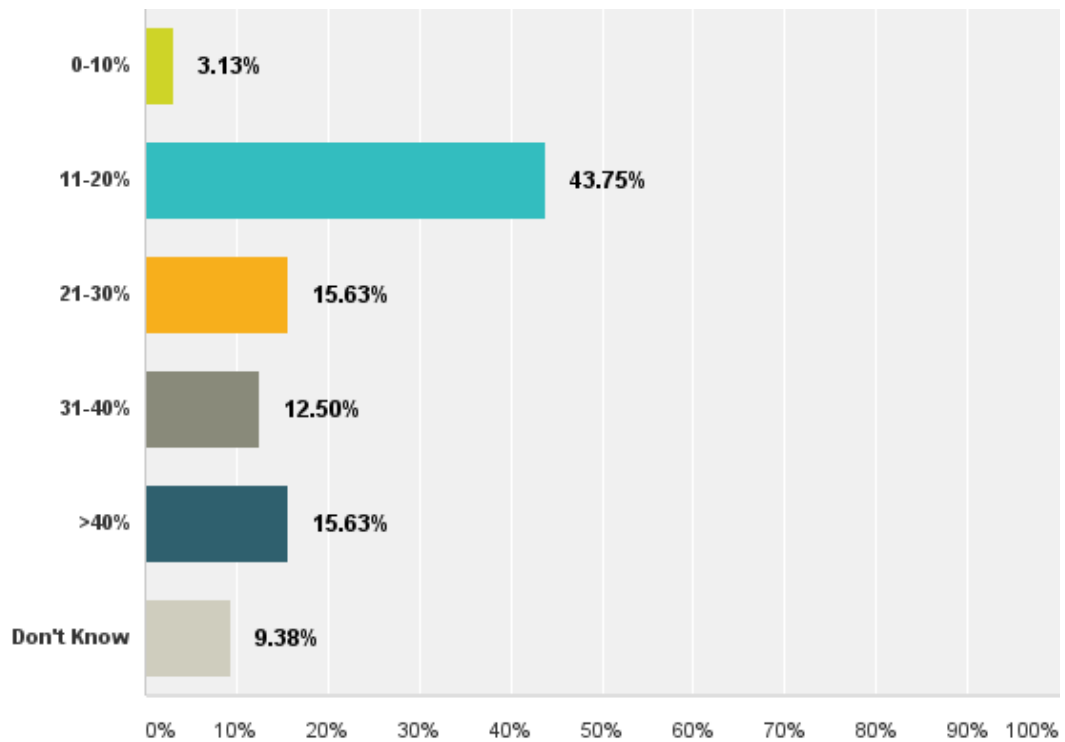
From the survey, 32 responses were received from all 32 participants (see Figure 3 above). The results showed that 47% of participants had between one and two years' experience in MOS within their respective operations. The second-highest group of participants was 28%, with less than one year of MOS implementation. The third-highest group was 19%, with these respondents indicating that they have had an MOS for a period of between two and three years. Only 6% of participants have had an MOS implemented in their operations for a period longer than three years.

### **5.3.1.2 Has MOS improved productivity in your operation? If so, by how much?**

To understand what kind of productivity improvements achieved by the various participants' operations, question 2 of the survey was structured to establish how much MOS improved productivity in the participant's organisation.

Survey question 2: Has MOS improved productivity in your operation? If so, by how much?

**Figure 4: Productivity improvement**



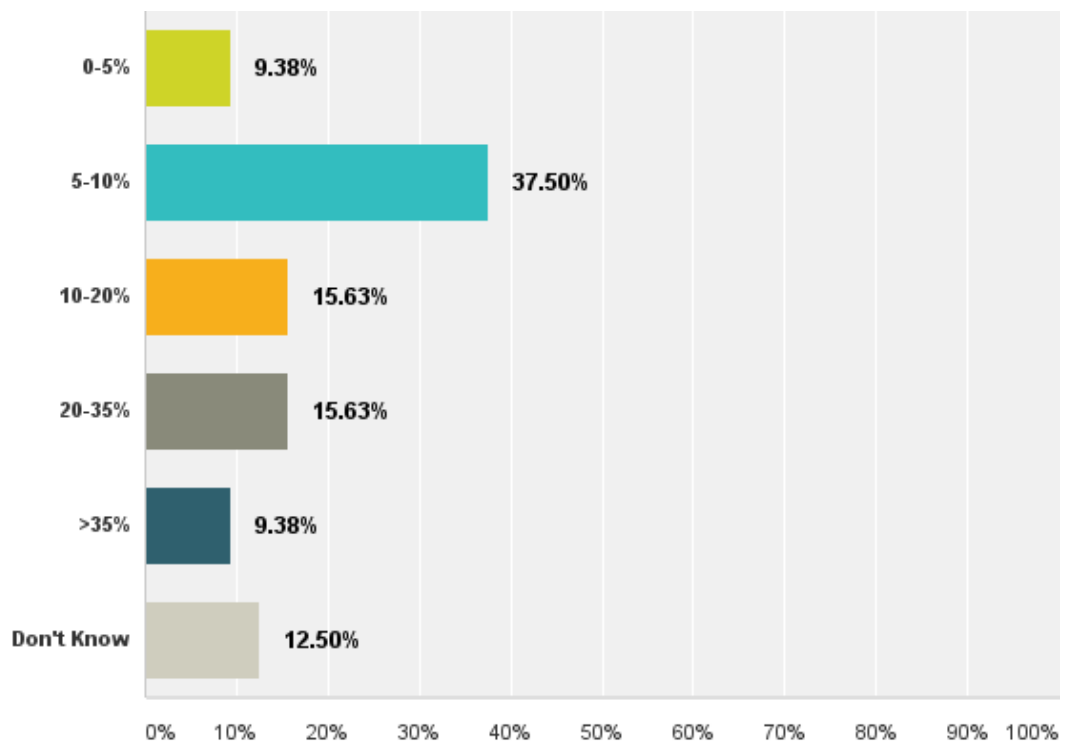
A total of 32 responses were received, with all participants responding to the question. The survey revealed that the majority of respondents (43.75%) have achieved 11% to 20% productivity improvement in their organisation through MOS installation. The second-highest group of respondents (15.63%) indicated that their operations achieved productivity improvement of between 21% to 30% and more than 40% through MOS implementation. The third-lowest group of respondents (12.5%) experienced the most improvement productivity, indicating that their operations achieved 31% to 40% productivity improvement. Some 3.13% of respondents indicated that their operations achieved 0% to 10% improvement, while 9.38% indicated that they did not know by how much MOS improved productivity in their mining operations. It is interesting to note that more than 82% of all respondents' organisations achieved a minimum of 11% productivity improvement through MOS.

### 5.3.1.3 How much did MOS improve your direct operating hours?

MOS is mainly driven through non-financial KPIs, which ultimately impact the financial results. Thus, the survey asked participants by how much (on average) MOS had improved their operations' DOH.

Survey question 3: How much has MOS improved your DOH, on average?

**Figure 5: DOH improvement**



From the survey, 32 responses were received, with all participants indicating their views on their operation's improvement regarding DOH. The majority of responses (37.5%) indicated that DOH in their operations improved by 5% to 10%, while two groups together comprising 15.63% of the respondents indicated that MOS had improved DOH in their operations by 10% to 20% and 20% to 35% respectively. Only 9.8% of the respondents' operations has achieved above 35% improvement in DOH, while some 9.38% of the respondents' operations had achieved 0% to 5% improvement on DOH. Some 12.5% of respondents did not know by how DOH had improved their operations, if at all.

Respondents' comment related to the question, as follows:



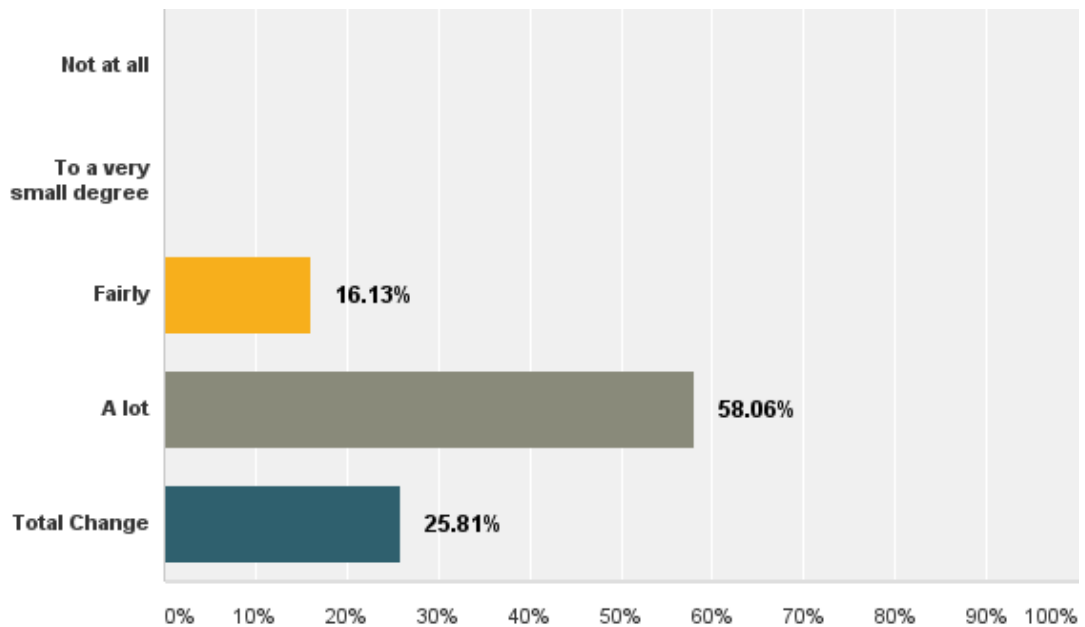
“The MOS drives behavioural change that converts into revenue increase”

### 5.3.1.4 To what extent has MOS changed the way you manage your operation?

To understand to what extent MOS brings about a change in an organisation's management strategy, the following question was asked.

Survey question 4: To what extent has MOS changed the way you manage the operation?

**Figure 6: Extent of MOS change in the operation**



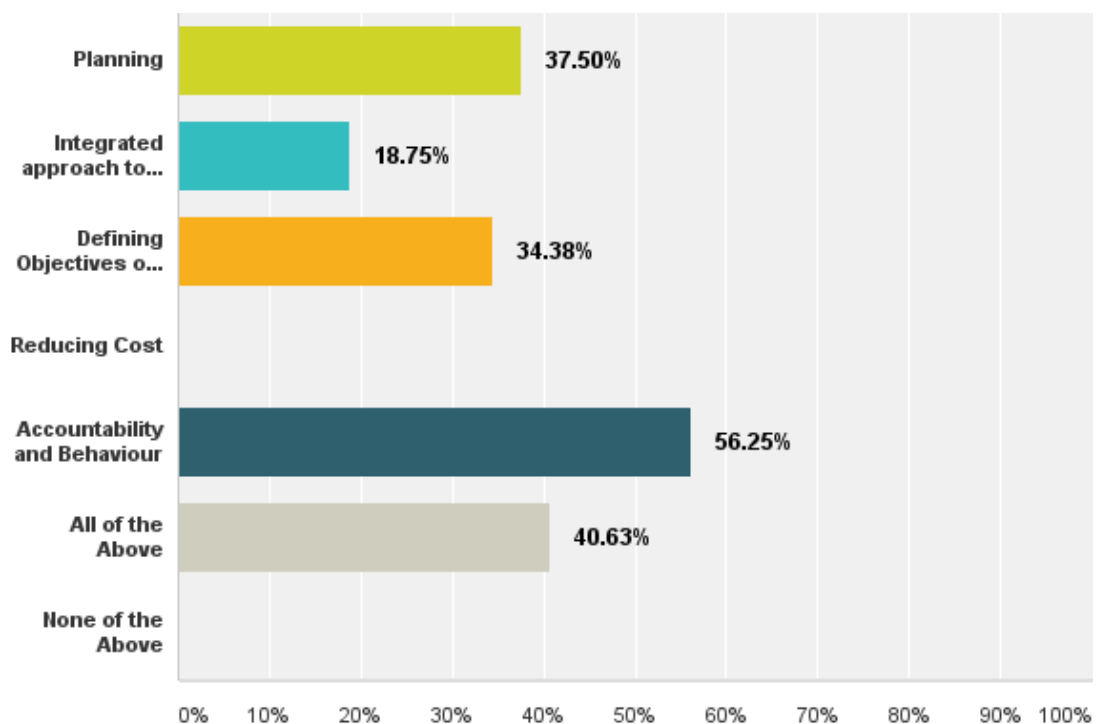
The majority of respondents (58.06%) indicated that MOS brought about significant changes in the way they managed their organisations, while 25.81% of the respondents indicated that MOS brought about a total change in the way they managed their business (see Figure 4 below). Interestingly, none of the respondents indicated that MOS changed the way their organisation was managed by a very small degree, or that they had seen no change at all.

### 5.3.1.5 In which of the following has MOS helped your organisation improve the most?

To understand the area in which MOS helps organisations improve the most through the changes it brings, the survey asked participants in which of the areas MOS had helped their organisations improve the most.

Survey question 5: In which of the following areas has MOS helped your organisation improved the most?

**Figure 7: Most improved MOS impacted areas**



The majority of respondents (56.25%) indicated that MOS's biggest area of impact in their organisations was in addressing accountability and behaviour. Some 40.63% of respondents believe that MOS improved all of the following in their operations: planning, integrated approach to business improvement, defining objectives or targets, reducing cost, and accountability and behaviour. However, there was also a higher belief among respondents that MOS has specifically improved their organisation's planning (37.5% of all respondents), integrated approach to business improvement (18.75%), and defining objectives or targets (34.38%).

In summary, more than 90% of respondents believe that MOS improves accountability and behaviour, more than 77% of respondents believe MOS improved planning, 69% of respondents believe that MOS improves the integrated approach to business improvement, and finally, 75% of respondents believe that MOS improved how business objectives or targets are defined.

The respondents' responses related to the question were as follows:

“Big improvement was clarity of task and clarity of accountability. Monitoring and close out of actions.”

“One negative element is that, essentially anyone can now micromanage anyone else and also criticise anyone else.”

“More alignment to the MOS from support functions such as maintenance.”

“Focus on the key departmental objectives and integration to ensure process management does not dominate in silos. People have to understand how they fit and the direct benefit to them. otherwise one risks it being another bolt-on system as opposed to the way we do business.”

“The biggest improvement opportunity for an MOS implementation is to ensure that the workforce – including management – understands that the MOS supports great leaders to do great things. It provides structured accountability and improved communication at all levels. It has been tried and proven time and time again, but needs good people to see the most benefit.”

“MOS is about accountability and behaviours. Agreeing to change is a democratic right, but installing change more than often becomes an autocratic one, meaning the following...MOS can allow you to be retrained, coached and as a last resort, disciplinary procedures....More than often the "consequences" of you not doing what you are supposed to be doing, or neglected to be doing...hasn't been agreed and installed up front.”

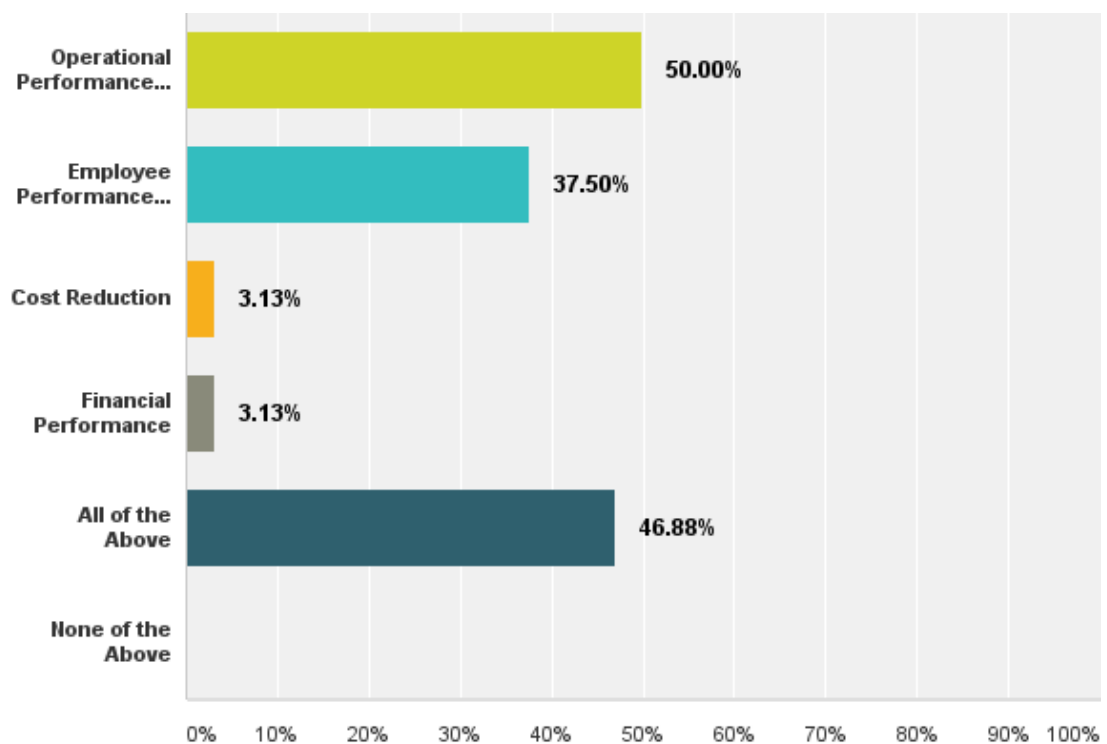
“Big improvement was clarity of task and clarity of accountability. Monitoring and close out of actions.” By respondent #

### 5.3.1.6 In your view, which of the following management strategies are more relevant/applicable to MOS?

In order to further understand the MOS management strategies and their relevance to MOS, through the survey repondents were asked to give their views on which strategies are more relevant or applicable to MOS.

Survey question 6: In your view, which of the following strategies are more relevant/applicable to MOS?

**Figure 8: Management turnaround strategies more relevant to MOS**



The majority of repondents (50%) believe that MOS was specifically key to operational performance turnaround. However, the second-highest group of respondents (47%) believed that MOS was applicable to operational performance turnaround, cost reduction and financial performance. There were also a few (3%) who indicated that they believed MOS was more relevant to solely operational performance turnaround and cost reduction.

Respondents' comments related to the question were as follows:

“MOS is a very good system, just to maintain the system, and make sure people are running with the system, don't let the system fall flat, keep on holding people accountable. I will recommend the system to any operation, to increase the safety and productivities.”

“MOS is not about fighting and shouting at each other, it's all about increased productivity and cost.”

“Must be driven from the top – management leadership and commitment.”

“Get the whole organisation involved as opposed to limiting it to selected functions and levels.”

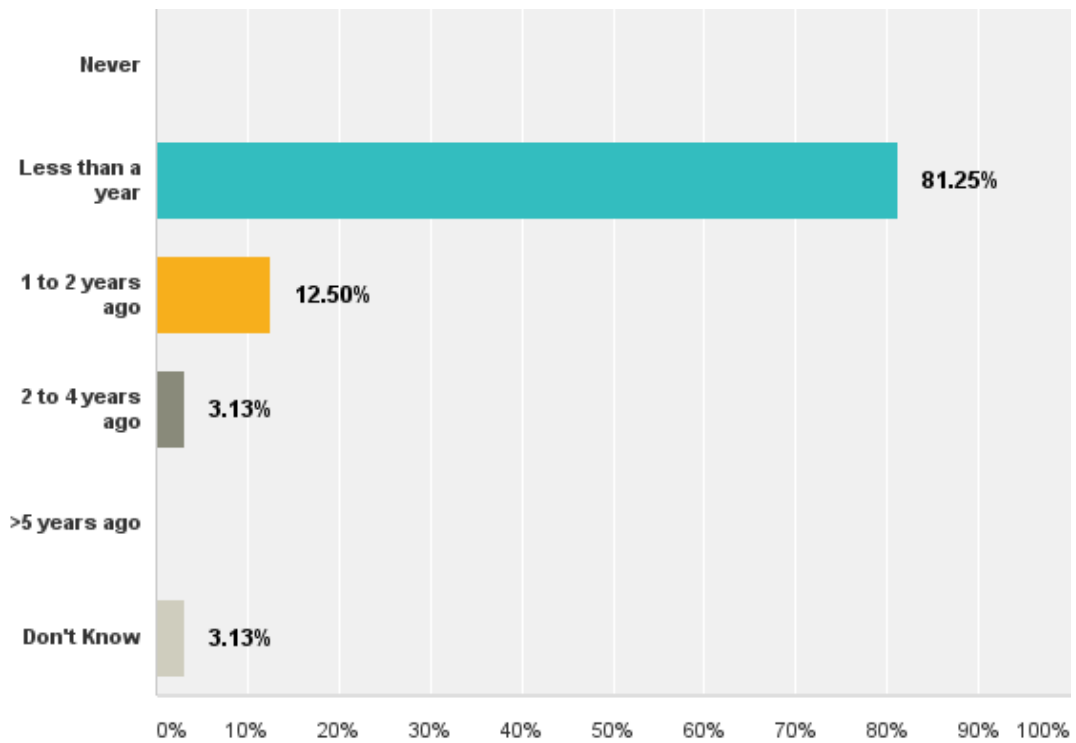
“The MOS is a combination of people, process and system maturity. We keep on saying that MOS is a behavioural model, however, I think the exact people competencies and the various processes that support people behaviour should be codified in support of MOS (in other words, training, performance management, recruitment etcetera).”

#### **5.3.1.7 When last was your company involved in cost cutting?**

To understand whether companies are still using cost-reduction strategies or if companies are deploying other cost-cutting measures while implementing MOS, we asked the respondents when last was their company was involved in cost-cutting exercises.

Survey question 7: When last was your company involved in a cost-cutting exercise?

**Figure 9: Period when last a cost-cutting experienced was experienced**



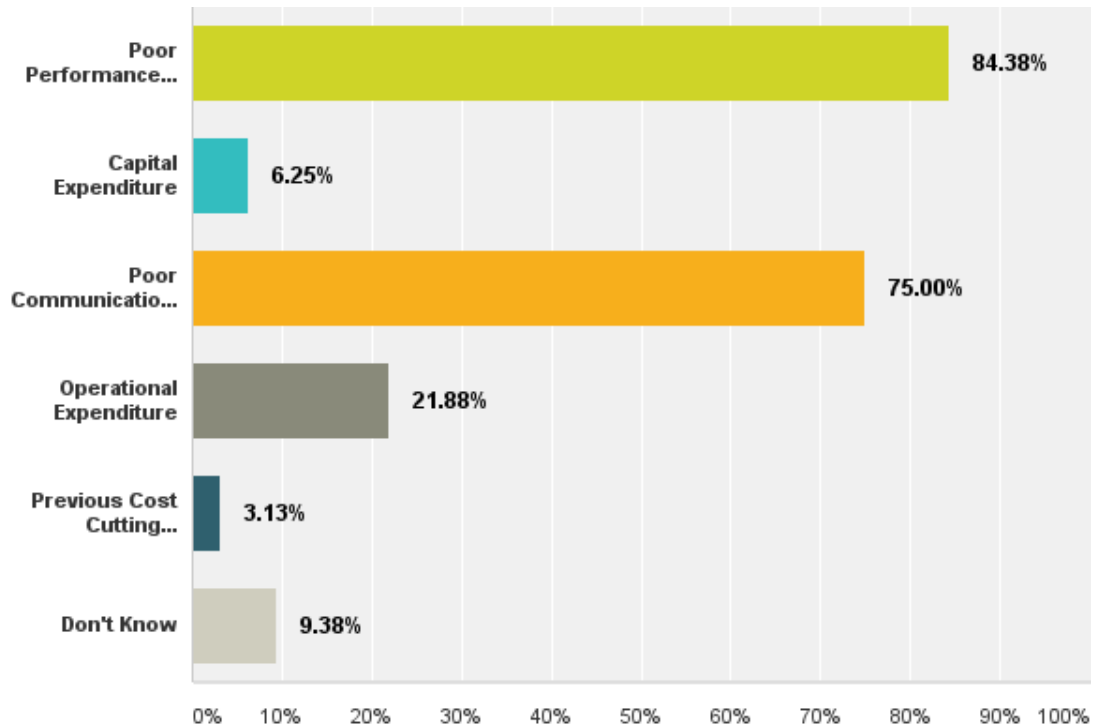
The majority of respondents (81.25%) indicated that they had conducted a cost-cutting exercise less than a year ago, with 12.5% indicating that they had undertaken a cost-cutting exercise in the past year or two. This means more than 93.75% of all respondents' organisations have conducted a cost-cutting exercise in the past two years, in conjunction with implementing MOS. However no respondents indicated that they had never experienced a cost-cutting exercise or that they had a cost cutting exercise more than 5 years ago.

### **5.3.1.8 Prior to implementing MOS, what was the biggest challenges facing operations?**

In understanding the benefits that MOS brings to an organisation, it is important to understand the challenges that the various companies were facing prior to implementing MOS. Through the online survey questionnaire, the respondents were asked to give their views on what the biggest challenges affecting productivity were, prior to MOS implementation in their organisation.

Survey question 8: In your view, prior to implementing MOS, what were the biggest challenges affecting productivity in your operation?

**Figure 10: Biggest challenges facing organisations pre-MOS implementation**



The majority of respondents (84%) indicated that their organisation's biggest challenge was poor performance management and poor communication (75%) between functional departments. There were two other slightly higher groupings, where one group indicated that their challenges were operational expenditure (22%) and capital expenditure (6%). Previous cost cutting exercises were shown to have had a lower impact (3%). However, about 9% didn't know what challenges their organisations faced pre-MOS implementation.

Respondents' comments related to the question were as follows:

“For the MOS to be effective, the environment that you put it in must be right. A poor culture will dominate any system”

“MOS highlights inefficiencies in the organisation, enabling management to take the correct action. MOS requires everything to work according to plan, highlight

the reason for variance plan and implement a counter measure to remove future occurrence of the problem.”

“Integrating the planning (scheduling) of equipment and maintenance into the Fewzion tool will provide an integrated approach, which will improve alignment and remove duplication.”

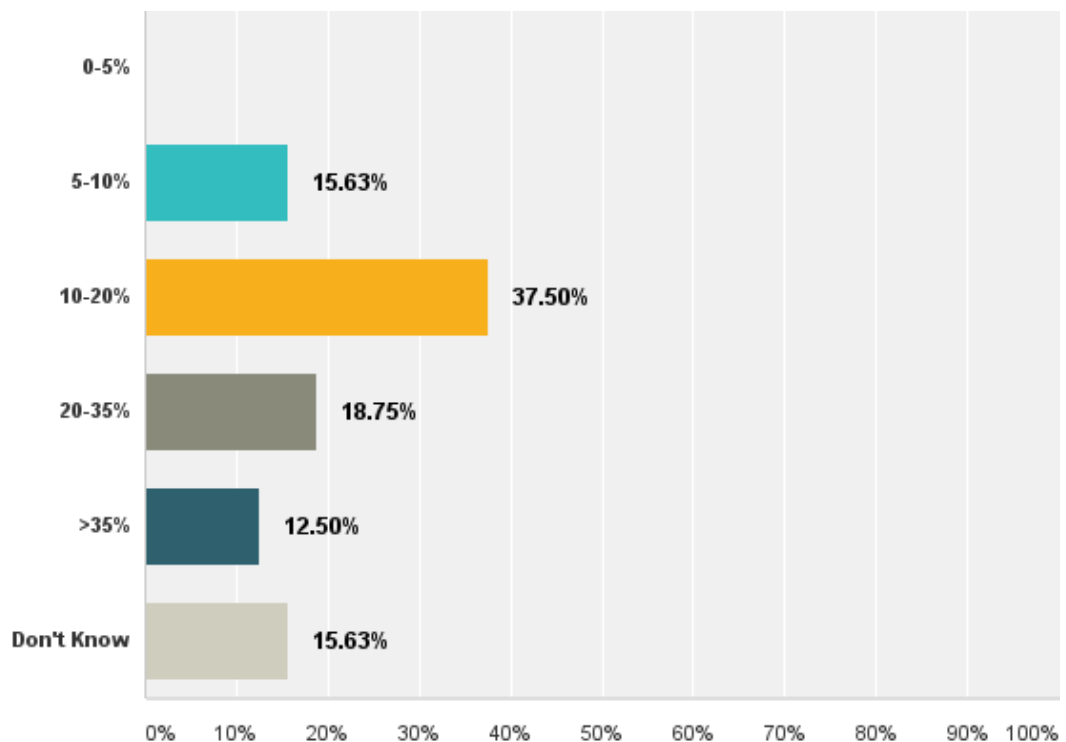
“Regular training/reinvigoration of MOS principles geared towards new employees in the business and delivered by MOS-aligned current employees. This does not happen at the moment.”

### 5.3.1.9 By how much did MOS improve your organisation revenue?

In order to understand the benefits of MOS to the various organisations, we asked senior managers and MOS experts what revenue improvement was realised in their operations due to MOS implementation.

Survey question 9: By how much did MOS improve you organisation's revenue (tonnage output)?

**Figure 11: How much MOS improved revenue**





The majority of respondents indicated that MOS has improved their organisation's revenue by 10% to 20% (37.5%). More than 30% of respondents indicated that they had seen revenue improvement of more than 20%. About 12,5% of respondents indicated that they have seen a more than 35% improvement in their organisation revenue. However, 15.6% of respondents indicated that they had seen only a small amount of improvement – 5% to 10% improvement.

### 5.3.2. Survey questionnaire chi-square results

Table 1: Survey questionnaire chi-square results

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	23.661 <sup>a</sup>	15	.071
Likelihood Ratio	24.072	15	.064
Linear-by-Linear Association	4.371	1	.037
N of Valid Cases	32		

a. 23 cells (95.8%) have expected count less than 5. The minimum expected count is .06.

A chi-square test of independence was conducted to determine if perceptions of whether an MOS has improved productivity depended on the length of MOS operation. The result was not statistically significant,  $\chi^2(15) = 23.66$ ,  $p = .071$ , indicating that the perceptions of whether MOS had improved productivity was independent of the length it has been operating.

### 5.3.3 Survey questionnaire reliability

Table 2: Survey questionnaire reliability statistics

Reliability Statistics	
Cronbach's Alpha	N of Items
.772	3

Cronbach's alpha was computed for survey questionnaire items 2, 3 and 9 (three items in total). The finding indicated acceptable internal consistency and reliability for these

items in the questionnaire,  $\alpha = .772$ . Items 2, 3 and 9 all measured the impact of MOS on productivity, or the rate of improvement thereof. For these questions, all of the responses were similar across respondents, therefore concluding that the respondents' views on productivity were consistent.

### **Summary of the online survey questionnaire results**

From the above descriptive statistics we can conclude that the design and implementation of an effective MOS does impact operational performance improvement. It does this by improving performance management, improving communication between functional departments (removing silos), and managing operational expenditure. MOS achieves these improvements by bettering planning, accountability, defining objectives or targets, and through the use of an integrated business improvement approach.

From the respondents' survey feedback, the trends seems to suggest that MOS brings about a great change in the way management improves productivity over a period of one to four years. Finally, the mining companies surveyed are fairly new to MOS, as the majority of respondents indicated that their operations had MOS for between one and two years. Furthermore, 80% of respondents indicated that they had undergone a cost-cutting exercise within the past year.

Survey questionnaire items 2, 3 and 9, which were aimed at examining the impact of MOS on performance, were found to be reliable when tested through Cronbach's alpha.

### **5.4. Mines correlation and paired statistical results**

The research compared the aforementioned metrics' as discussed in Chapter 4 under section 4.6 for each of the four mining operations tonnage output prior to MOS implementation and post implementation, and also examined whether there was a correlation between the DOH and TON.

#### **5.4.1 Mine 1 statistical tests**

##### **5.4.1.1 Mine 1 DOH and TON correlation results**

Table 3: Mine 1 DOH and TON correlation results

### **Descriptive statistics**

	Mean	Std. Deviation	N
Mine 1_DOH	11.23710	4.219944	985
Mine 1_TON	2713.55687	1287.474190	1011

### Correlations

		UCM001_DOH	UCM001_TON
Mine 1_DOH	Pearson correlation	1	-.050
	Sig. (2-tailed)		.158
	N	985	784
Mine 1_TON	Pearson correlation	-.050	1
	Sig. (2-tailed)	.158	
	N	784	1011

A Pearson correlation was computed to determine whether DOH related significantly to TON within Mine1. The result indicated the absence of a statistically significant correlation,  $r(784) = -.05$ ,  $p = .158$ , indicating that DOH ( $M = 11.24$ ,  $SD = 4.22$ ) was unrelated to TON ( $M = 2713.56$ ,  $SD = 1287.47$ ).

#### 5.4.1.2 Mine 1 Paired statistics results

Table 4: Mine 1 Paired statistics results

### Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Mine 1A (post MOS)	3293.12	153	1512.864	122.308
	Mine 1B (pre MOS)	2601.2810	153	1127.65481	91.16549

From the above paired sample statistics it can be concluded that when comparing mean tonnage output of the mine pre and post-MOS implementation, tonnage output post MOS implementation is higher, from 2601.28 tonnage output per day to 3293.12 tonnage output per day, signifying a 26% productivity improvement post-MOS implementation.

## 5.4.2 Mine 2 statistical test results

### 5.4.2.1 DOH and TON Correlation results

Table 5: Mine 2 DOH and TON Correlation results

#### Descriptive Statistics

	Mean	Std. Deviation	N
Mine 2_DOH	11.69339	4.488359	899
Mine 2_TON	2665.79277	1283.260149	941

#### Correlations

		UCM004_DOH	MINE2_TON
Mine 2_DOH	Pearson Correlation	1	.006
	Sig. (2-tailed)		.873
	N	899	613
Mine 2_TON	Pearson Correlation	.006	1
	Sig. (2-tailed)	.873	
	N	613	941

A Pearson correlation was computed to determine whether DOH related significantly to TON within Mine2. The result indicated the absence of a statistically significant correlation,  $r(613) = -.006$ ,  $p = .873$ , indicating that DOH ( $M = 11.69$ ,  $SD = 4.48$ ) was unrelated to TON ( $M = 2665.79$ ,  $SD = 1283.26$ ).

### 5.4.2.2 Paired samples statistics

Table 6: Mine 2 Paired samples statistics

#### Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Mine 2 A (post MOS)	3351.78	164	1421.916	111.033
	Mine 2 B (pre MOS)	2175.1951	164	1005.93467	78.55030

From the above it can be concluded that when comparing tonnage output of the mine pre and post-MOS implementation, tonnage output post-MOS implementation is higher,

from 2175.2 tonnage output per day to 3351.78 tonnage output per day, signifying a 21% productivity improvement post-MOS implementation.

### 5.4.3 Mine 3 statistical test results

#### 5.4.3.1 DOH and TON correlation results

Table 7: Mine 3 DOH and TON correlation results

#### Descriptive Statistics

	Mean	Std. Deviation	N
Mine 3_DOH	10.28892	4.904425	1011
Mine 3_TON	1693.02601	942.616607	1038

#### Correlations

		UCM005_DOH	UCM005_TON
Mine 3_DOH	Pearson Correlation	1	-.073*
	Sig. (2-tailed)		.043
	N	1011	776
Mine 3_TON	Pearson Correlation	-.073*	1
	Sig. (2-tailed)	.043	
	N	776	1038

\*. Correlation is significant at the 0.05 level (2-tailed).

Significant but relationship is weak may be because of the sample size. The result was technically significant, but the strength of  $r$  is incredibly weak (really miniscule). A Pearson correlation was computed to determine whether DOH related significantly to TON within Mine 3. The result showed a statistically significant correlation,  $r(776) = -.073$ ,  $p = .43$ , indicating that DOH ( $M = 10.29$ ,  $SD = 4.9$ ) was not related to TON ( $M = 1693.026$ ,  $SD = 942.617$ ).

#### 5.4.3.2 Paired samples statistics

Table 8: Mine 3 Paired samples statistics

### Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Mine3A (Post MOS)	1669.16	145	743.508	61.745
Mine3B_(Pre MOS)	1427.6483	145	894.13659	74.25400

From the above paired sample statistics it can be concluded that when comparing tonnage output of the mine pre and post-MOS implementation, tonnage output post-MOS implementation is higher, from 1427.64 tonnage output per day to 1669.16 tonnage output per day, signifying a 17% productivity improvement post-MOS implementation.

#### 5.4.4 Mine 4 statistical test results

##### 5.4.4.1 DOH and TON correlation results

Table 9: Mine 4 DOH and TON correlation results

#### Descriptive Statistics

	Mean	Std. Deviation	N
Mine 4 _DOH	10.63605	4.524860	1015
Mine 4_TON	2135.37154	1120.621410	1047

#### Correlations

		UCM006_DOH	UCM006_TON
Mine 4_DOH	Pearson Correlation	1	-.087 <sup>*</sup>
	Sig. (2-tailed)		.014
	N	1015	789
Mine 4_TON	Pearson Correlation	-.087 <sup>*</sup>	1
	Sig. (2-tailed)	.014	
	N	789	1047

\*. Correlation is significant at the 0.05 level (2-tailed).

A Pearson correlation was computed to determine whether DOH related significantly to TON within Mine 4. The result indicated a statistically significant correlation,  $r(789) = -.087$ ,  $p = .014$ , indicating that DOH ( $M = 10.63$ ,  $SD = 4.53$ ) was not related to TON ( $M =$

2135.37, SD = 1120.62). The result was technical significant, but the strength of  $r$  is incredibly weak (really miniscule).

#### 5.4.4.2 Paired Samples statistics

Table 10: Mine 4 Paired samples statistics results

Paired Samples Statistics		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Mine4A (Post MOS)	2565.92	146	1267.384	104.889
	Mine4B (Pre MOS)	1913.5616	146	827.51156	68.48534

From the above paired sample statistics it can be concluded that when comparing tonnage output of the mine pre and post-MOS implementation, tonnage output post-MOS implementation is higher, from 1913.64 tonnage output per day to 2565.92 tonnage output per day, signifying a 34% productivity improvement post-MOS implementation.

#### Summary of correlation tests and paired sample statistics

Based on the above analysis it is evident that there is a weak correlation between DOH and tonnage output. Therefore, we will accept the null hypothesis for H1 (a). However, the paired samples statistics conducted for the four mines showed evidence of improved productivity across all mining operations (mine 1, 2, 3 and 4), therefore we will accept the alternative hypothesis for H1 (b). Please refer to the hypothesis description in Chapter 4 under section 4.6.

### 5.5. Impact of MOS on EBITDA statistical analysis results

#### 5.5.1 Mine 1 EBITDA statistical analysis results

Pre-implementation period: December 2013 to April 2012 (21 cases)

Post-implementation period: January 2014 to September 2015 (21 cases)

Table 11: Mine 1 EBITDA statistical analysis results

### Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Mine_1_Pre	4904422073.5714	21	1958655545.95550	427413680.93743
Mine_1_Post	5196252837.1429	21	1286930517.32453	280831262.37087

A paired samples *t*-test was conducted to determine whether there was a significant difference between the pre and post-implementation scores for the EBITDA variable. The result for Mine 1 was not statistically significant,  $t(20) = -.530$ ,  $p = .602$ , indicating that the pre-implementation scores ( $M = 4904422074$ ,  $SD = 1958655546$ ) and the post-implementation scores ( $M = 5196252837$ ,  $SD = 1286930517$ ) were not statistically different from one another. Therefore, it may be concluded that the pre and post scores are similar.

### 5.5.2 Mine 2 EBITDA statistical analysis results

Pre-implementation period: October 2013 to December 2011 (23 cases)

Post-implementation period: November 2013 to September 2015 (23 cases)

Table 12: Mine 2 EBITDA statistical analysis results

### Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Mine_2_Pre	3058598368.7391	23	910030368.37344	189754449.03553
Mine_2_Post	3185751101.4783	23	711000212.53155	148253792.71047

A paired samples *t*-test was conducted to determine whether there was a significant difference between the pre and post-implementation scores for the EBITDA variable. The result for Mine 2 was not statistically significant,  $t(22) = -.645$ ,  $p = .525$ , indicating that the pre-implementation scores ( $M = 3058598369$ ,  $SD = 910030368.4$ ) and the post-implementation scores ( $M = 3185751101$ ,  $SD = 711000212.5$ ) were not statistically different from one another. Therefore, it may be concluded that the pre and post scores are similar.



### 5.5.3 Mine 3 EBITDA statistical analysis results

Pre-implementation period: December 2013 to April 2012 (21 cases)

Post-implementation period: January 2014 to September 2015 (21 cases)

Table 13: Mine 3 EBITDA statistical analysis results

		Paired Samples Statistics			
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Mine_3_Pre	3747539460.000 0	21	1769579253.9859 9	386153851.4102 0
	Mine_3_Post	3793777923.047 6	21	1837180920.7575 0	400905744.5095 2

A paired samples *t*-test was conducted to determine whether there was a significant difference between the pre and post-implementation scores for the EBITDA variable. The result for Mine 2 was not statistically significant,  $t(20) = -.086$ ,  $p = .932$ , indicating that the pre-implementation scores ( $M = 3747539460$ ,  $SD = 1769579254$ ) and the post-implementation scores ( $M = 3793777923$ ,  $SD = 1837180921$ ) were not statistically different from one another. Therefore, it may be concluded that the pre and post scores are similar.

### 5.5.4 Mine 4 EBITDA statistical analysis results

Pre-implementation period: May 2013 to February 2011 (28 cases)

Post-implementation period: June 2013 to September 2015 (28 cases)

Table 14: Mine 4 EBITDA statistical analysis results

		Paired Samples Statistics			
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Mine_4_Pre	4833964963.7857	28	2326074603.5113 4	439586780.84816
	Mine_4_Post	4211987950.2143	28	1836501752.0838 4	347066208.45345

A paired samples *t*-test was conducted to determine whether there was a significant difference between the pre and post-implementation scores for the EBITDA variable. The

result for Mine 2 was not statistically significant,  $t(27) = 1.293$ ,  $p = .207$ , indicating that the pre-implementation scores ( $M = 4833964964$ ,  $SD = 2326074604$ ) and the post-implementation scores ( $M = 4211987950$ ,  $SD = 1836501752$ ) were not statistically different from one another. Therefore, it may be concluded that the pre and post scores are similar.

### **Summary of EBITDA results**

Based on the above discussion it is evident that there is statistically no significant difference in EBITDA performance pre and post-MOS implementation. Therefore, we will accept the null hypothesis.

### **5.6 Conclusion of Chapter 5 results**

The results in this chapter confirmed all of the hypotheses and provided insights to develop arguments for all three research questions. The online survey questionnaire results gave insight especially into how the implementation and design of MOS impacts productivity, revenue growth and DOH.

**Research question 1:** From the above descriptive statistics we can conclude that the design and implementation of an effective MOS does impact operational performance improvement. According to the respondents, MOS impacts operational performance through improving performance management, communication between functional departments (removing silos), and managing operational expenditure. MOS achieves improvement through improving planning, accountability, behaviours, defining objectives or targets, and through using an integrated business improvement approach.

**Research question 2:** This question has been answered through hypothesis H 1 (a) and H1 (b). Hypothesis H1 (a) the null was accepted, which confirmed that DOH does not correlate with tonnage outcome. Hypothesis H1 (b) null was rejected, which proved that there is a significant difference between tonnage output performance pre-MOS and post-MOS implementation. This was also confirmed through the paired samples statistics conducted for all four mines, which showed improved productivity across all four researched mines post-MOS implementation.

**Research question 3:** This question was answered through a single hypothesis. Based on the results, there is statistically no significant difference in EBITDA performance pre and post-MOS implementation. Therefore, we will accept the null hypothesis. This could

be based on a number of internal and external reasons considering the macroeconomic environment that the mining industry is currently going through.

Chapter 6 will further explore Chapter 5's findings in the context of the literature reviewed in Chapter 2.

## **Chapter 6: Discussion of results**

### **6.1 Introduction**

In this chapter the researcher will further explore the research results findings from Chapter 5, together with the literature reviewed in Chapter 2 to draw further insight. The purpose of this chapter is to answer the research questions proposed in Chapter 1 and 3, through interpreting chapter 5 in light of chapter 2.

### **6.2 Research questions discussion**

#### **6.2.1 Research question 1**

According to Khan (2012), a management operating system is "a set of integrated policies, procedures, methods and tools used by management to plan, manage and lead people in their work outcomes to enable a company to meet its customer's requirements" (p. 47).

From the survey questionnaire results covered in Chapter 5, section 5.3 it was concluded that the implementation of an effective MOS does impact on operational performance positively. Cronbach's alpha was computed for three survey questionnaire items that related to performance on productivity, direct operating hours and revenue growth and was found to be reliable. This indicates that the respondents' response could be a fair representation about the performance results achieved in their organisations. In all these three survey questions majority of the respondents indicated that indeed MOS improved their operations positively. More than 75% of all survey respondents indicated that direct operating hours positively increased in their operations (figure 5) post MOS implementation, 84% indicated that MOS positively improved their organisation revenue by more than 5% (figure 9), and more than 86% also indicated that MOS positively improved their organisation productivity (figure 4).

The survey results showed that more than 53% of respondents indicated that MOS helped improve their organisation, in particular, the following areas:

- Effective planning
- Driving accountability and behaviour conducive for business turnaround
- Defining objectives and targets
- Integrated approach to business improvement.

The above findings confirm Khan's (2012) definition of MOS and the fact that MOS enables decisions to be made across all levels of management throughout the business, thus ensuring that the business is aligned and coherent. According to Kaplan and Norton (2008), a breakdown in a company's management system is caused by a lack of an "integrated set of processes and tools that a company uses to develop strategy, translate it into operational actions, and monitor and improve the effectiveness of both" (p. 1). According to Bititici et al. (2011), when an organisation has an interconnected system rather than an individual process or activity, it can result in dynamic organisational capabilities that enable the organisation to perform at higher levels.

In the literature review from Chapter 2, Khan (2012), identified three factors that make an effective MOS design, as follows:

- An organisational vision and strategy that is aligned to individual goals and incentives
- A continuous improvement culture that is supported by management, encourages learning, problem solving and innovation
- Superior performance of an optimised business value chain.

According to the results findings in Chapter 5, section 5.3, we found that, majority of survey respondents (47%), the main areas in which organisations experienced challenges prior to MOS implementation were as follows:

- Poor performance management
- Poor communication between functional departments (silos)
- Operational expenditure.

These findings suggest that MOS design has a strong effect on management, holding people to account, reviewing operational plans, translating strategy or plans to all levels of management, and integrating different departments.

These findings agree with Khan's (2012) argument that MOS creates an alignment of objectives, making actions in each area that reinforce the strategy and goal of the organisation, thereby allowing employees and managers to identify areas which need more focus. The findings also support Kaplan and Norton's (2008) argument that most organisations underperform due to poor communication between strategy and operation, which eventually lead to strategy implementation failures due to a lack of balance

between short-term and long-term performance requirements, making it impossible to sustain performance.

However, from the findings in Chapter 5, section 5.3, there were a few interesting outcomes which were not identified in the literature review. The results identified that the design and effectiveness of MOS does not depend on the following:

- The extent or period that the company has been involved in cost-cutting exercises, as there was no relationship between the period in which the operation underwent a cost-cutting exercise and the responses on productivity improvement, revenue improvement or DOH improvement.
- The period or period that MOS had been implemented in the operation, as there was no relationship between the years that MOS had been in place and productivity improvement at an operation.

The above observations are supported by the survey questionnaire findings that MOS implementation brings about plenty of change (58%), if not a total change (26%), in how managers manage the operation. This makes MOS highly dependent on management buy-in and the culture of the different operations, which could mean that for MOS to be effective, management has to see value in it, or alignment to business strategy or their own incentives.

The above findings are further supported by comments from survey respondents, as follows:

“The biggest improvement opportunity for an MOS implementation is to ensure that the workforce – including management – understands that the MOS supports great leaders to do great things. It provides structured accountability and improved communication at all levels. It has been tried and proven time and time again, but needs good people to see the most benefit.”

“People have to understand how they fit and the direct benefit to them otherwise one risks it being another bolt-on system as opposed to the way we do business.”

“For the MOS to be effective, the environment that you put it in must be right. A poor culture will dominate any system.”

“Must be driven from the top – management leadership and commitment.”

“The system can be improved by implementing incentives aligned to performance and by having a management team that is not satisfied by the status quo or management team that wants to improve performance or else it becomes a waste of time.”

The literature reviewed in Chapter 2 highlighted the following key strengths and weaknesses of MBO and BSC, which the researcher believes are important to consider when researching the effectiveness of a MOS design impact on performance:

### **Strengths:**

- According to Krueger (2004), MBO is effective because it creates a collaborative relationship between managers and subordinates, which aids in planning and making subordinates aware of what is expected of them.
- According to Zafor (2013), an MBO system enable “managers at different levels and their subordinates [to] work together in identifying goals and establishing objectives consistent with the organizational goals and work towards attaining them” (p. 82).
- The main benefits of the BSC come from the system's ability to translate strategy into operational terms, making strategising a continuous process, greater alignment of various processes and services, competencies and units of an organisation (Kaplan & Norton, 2001).

### **Weaknesses:**

- According to Brim (2004), MBO does not work because it places emphasis on the setting of goals over the working of the plan, underemphasises the importance of the environment or context in which goals were set, does not address the importance of successfully responding to obstacles and issues essential to reaching a goal and finally that it failed to address the human aspect of performance.
- Palmer and Dinesh (1998) believe that the MBO failure was due to its ignorance on the human factors and setting of rigid goal setting processes that led to partial implementation of the system.

- The key implication of MBO is that objectives need to be understood, defined and measured to determine their ultimate achievement, which places more emphasis on goal definition rather than the holistic integrated business optimisation approach (Dalcher, 2014).
- According to Dalcher (2014), MBO can also create poor quality setting of targets, encourage resources to be diverted to meet these objectives through manipulation of data, unethical or unbalanced behaviour through whatever means because of the system over emphasis of achieving goals instead of continuous improvement.
- MBO does not encourage the breaking down of silos in improving the productivity and operational excellence because it relies on sub-departmental optimisation resulting in business optimisation, and lacks the holistic productivity improvement approach (Dalcher, 2014).
- De et al., (2009), argued that for the BSC to be considered effective it should have a positive impact on organisational performance through an improved integration of the management processes and empowerment of employees.
- According to Quattrone and Busco (2014), the BSC's weaknesses are due to the fact that it does not provide definitions of performance but only visualisations that act as ways (approaches, paths and modes) of performing these possible definitions.
- Hoque (2014) argued that the BSC is sometimes difficult for organisations to integrate with other managerial control tools such as budgeting, and that the BSC can sometimes encourage a use of too many measures in a single scorecard, often resulting in organisations measuring the wrong KPIs.
- The BSC is complex and too much time is spent in its formulation, forcing organisations to attempt partial implementation with minimum performance impact and reducing it to a paperwork exercise (Palmer & Dinesh, 1998).

From the above strength and weaknesses of the BSC and MBO literature review findings, it is understandable why Kaplan (2012) acknowledged that the BSC should be used as the foundation of an entirely new system for strategy management and execution, which means the other systems can build onto it to improve on its weaknesses. This suggestion was welcomed by other academics, such as Perkins, Grey and Remmers (2014), who supported Kaplan's comments by arguing that the BSC cannot be thought of as a miracle management tool but rather, should be seen as an



element in a firm's management system that can be helpful in answering how the firm is performing.

Similarly to the BSC, as Krueger (2004) stated, the MBO should not be used for turnaround strategies unless it is integrated into other strategic management planning and implementation systems. This is because Krueger (2004) believes strategic management should be implemented in a single big picture, not in a number of different objectives.

Due to the structured approach for implementing MOS, organisations are able to create greater transparency on business performance, which enables them to free up staff and resources to focus on elements including productivity, key priority performance indicators, and making the right decisions on time while providing the correct leadership and structure to effectively reach strategic goals and operational excellence (Khan, 2012; Lala et al., 2015).

From the literature reviewed in Chapter 2, the survey questionnaire results in Chapter 5 and the above debate we can therefore argue that MOS builds on the foundation laid by the BSC and MBO. Through both addressing the BSC and MBO's weaknesses and complimenting their highlighted strengths, MOS has become a management system that is not just used to answer how a firm is performing and developing goals in silos, but rather, has become a comprehensive system that is crucial for the successful execution of business strategy and goals.

### **6.2.2 Research question 2**

Based on the results on Chapter 5, section 5.3, hypothesis H1 (a) null was accepted, which confirmed that DOH does not correlate with tonnage outcome. Hypothesis H1 (b) null was rejected, which proved that there is a significant difference between tonnage output performance pre-MOS and post-MOS implementation. Based on this outcome the researcher argues that the tonnage improvement realised post-MOS implementation could be due to the following:

- Improvement in efficiency (doing more with less);
- Improvement in productivity (higher output per hour while working similar working hours); and
- Reduced variation in tonnage output.

Furthermore, tonnage output is a function of rate (speed) and hours worked. Therefore, because there is no strong correlation between DOH and tonnage output, it supports the fact that an improvement in post-MOS was mainly due to actions directed on improving the rate (speed of production).

This could mean that the improvement in rate was not related to the amount of hours worked but rather, are dependent on performance management, communication, accountability and execution of actions where variance is identified. Thus, it supports the argument of Koufteros et al. (2014), who said that for an organisation to be effective it must design a system that entails two types of uses for performance management, namely diagnostic use, which is concerned with the review of critical performance variables in order to maintain, alter or justify patterns in organisational activities, and the interactive use, which is a forward-looking activity exemplified by active and frequent involvement of top management envisioning new ways to optimise organisational resources for competitive advantage. Based on the literature reviewed in chapter 2 and research results in chapter 5, it suggests that MOS implementation is designed to focus on effectiveness of actions and as a result, people are held accountable for their actions and have clear responsibilities, accountabilities, and performance feedback focused on lagging and leading indicators, which results in improved consistency on production, reduced variation, and better efficiencies.

The MOS implementation focus on raising actions further ensures that all management levels are proactive in eliminating recurring problems, and that strategic goals are translated to all management levels, resulting in improved speed of results delivery. This belief is further supported by Braz et al. (2011), who argued that for PMSs to be effective, one needs to develop a procedure for reviewing set measures according to the strategic approach through an effective mechanism that enables continuous improvement, agreement on actions, and reviews measures for performance with responsible leaders to be successful.

According to Mitchell et al. (2014), research on senior managers of big mining organisations revealed that the top two contributors to declining productivity in the mining sector were accelerated growth and poor integrated management systems. From the literature reviewed and from the findings in Chapter 5 we can argue that MOS has been successful in integrating the different business value chain functional departments, thus reducing the integration gap and embedding of effective management systems as it

addressed the weaknesses and built on the strengths of the MBO and BSC. This ensured that the MOS operations prioritise operational excellence, thus improving the productivity of mining operations.

### **6.2.3 Research Question 3**

As discussed in Chapter 5, section 5.4, from the four mining operations researched there was statistically no significant difference in EBITDA performance pre and post-MOS implementation. Therefore, the null hypothesis was accepted.

Having both financial and non-financial performance in an organisation PMS benefits the company, however, financial performance measures continue to be the most important aspect of a PMS (Zuriekat et al., 2011). This is because non-financial performance measures' applied value is limited and cannot be used to "provide a satisfactory explanation for unbalanced relationships between a company's book value and its market value, neither do they provide information required for business decision making about the future" p. 827 (Milost, 2013). It for this reason that the researcher investigated the impact of MOS on EBITDA as a performance financial performance measure, as it is the closest measure to profit, which is ultimately what drives business performance.

From the literature review in Chapter 2 it is important to note that mining organisations during the commodity boom employed high capital growth strategies that eventually led to a productivity decline as operations got bigger and became difficult to manage due to complexity and a lack of focus on efficiency (Mitchell et al., 2014). This has therefore resulted in high fixed-cost structures, as the non-profitable mining sub-sections were closed out when commodity prices dropped from \$130 USD in 2011 to almost \$60 USD in 2015 (Mackenzie, 2015).

Various factors such as labour, capital, economies of scale, resource decline, high operating expenditures, and low productivity were also identified as the main contributors, although productivity decline was rated the number one contributing factor as more equipment was available but not necessary used efficiently (Hopwood, et al., 2014; Lala et al., 2015; Mitchell et al., 2014). This opened the need for cost reduction initiatives. However, according to Lala et al. (2015), the mining industry has started working on this by reducing capital expenditures and labour, along with undertaking other cost-cutting exercises. Many mining companies have achieved excellent results in cost reduction and will soon reach a ceiling on cost reduction, leaving the business to ask

what next (Mitchell, et al., 2014). This view is furthermore supported by the survey questionnaire results, which indicated that 81.25% of all respondents' operations have undertaken cost-cutting exercises in the past year.

Based on the above literature findings, the researcher will therefore argue that the fact that there was statistically no significant difference in EBITDA performance pre and post-MOS implementation on the four researched MOS operations proves how successful MOS has been in these operations. The rationale behind being EBITDA earnings was sustained on the four examined mining operations whilst;

- Reduced commodity prices negatively impacted revenue
- Deeper and harder mining conditions negatively impacted performance
- High fixed-cost structures negatively impacted costs, and
- Increased labour costs negatively impacted EBITDA

Maintaining the same EBITDA under the above market conditions signifies strong MOS performance because, had the four researched mining organisations not implemented MOS, their EBITDA margins would arguably have been worse off due to the above-mentioned challenges impacting on revenue growth and cost. The researcher further argues that the impact of MOS on EBITDA should be judged based on the ability of MOS to sustain mining EBITDA margins instead of EBITDA increase. The researcher would furthermore like to state that under the current market conditions the main objective of mining operations should be to break-even and above in order to overcome the commodity price downturn.

According to Slehat, Alnimer and Abbadi (2013), various non-financial performance measures can be leading indicators for lagged accounting numbers. Therefore, improving non-financial measures tends to be quicker than enhancing a financial performance measure therefore a sustained EBITDA could also signify a delayed impact on finance as it was concluded that MOS improved productivity, costs and tonnage output in chapter 5. Khan (2012) argued that managing performance purely through financial measures is complex and always leaves a gap. Thus, in order to fill the gap, non-financial measures (operational measures) can be more useful as they indicate problems earlier than do accounting reports. However, non-financial measures can be misleading because they represent a portion of the entire integrated system that reflects what was easy to measure, rather than what is important (Khan, 2012).

### **6.3 Conclusion of Chapter 6 discussion**

Through the survey questionnaire results and discussions under chapter 5 section 5.3 and chapter 6 section 6.2 it was confirmed that the design and implementation of MOS impact operational performance improvement positively. This was mainly attributed to the fact that MOS improves planning and communication through its integrated approach to business improvement, structured systems that drives accountability and behaviour by focussing on raising actions to resolve identified issues through actively involving all management levels throughout the value chain. Furthermore it was also confirmed through the hypothesis test for DOH and TON correlation, pre and post MOS performance test, and EBITDA statistical tests that MOS improves the rate (productivity and efficiency of mining operations). This has resulted in improved tonnage output that translated into sustained EBITDA earnings during a period where coal market prices dropped by almost 40%.

## **Chapter 7: Conclusion**

### **7.1 Introduction**

This chapter will provide a summary of the research study, highlight noteworthy findings with specific reference to their relevance to PE firms' turnaround strategies, the impact of MOS on coal mine performance, and recommendations on how MOS can be applied to PE firms' turnaround strategies. The study will also highlight the limitations of the research study and make recommendations for future research.

### **7.2 Summary of the research study**

In the literature review we learned that global mining productivity has hit new low levels and has been on an estimated 24% steady decline over the past decade (Vernon et al., 2008). The decline in productivity was mainly attributed to the fact that mining companies focussed primarily on output at any cost during the high commodity price boom as they grew operations and mined previously unfeasible ore grades to take advantage of the commodity boom (Mitchell et al., 2014).

It is furthermore believed that mining companies' focus on the commodity boom through capital deployment and high capital growth led to a productivity decline as operations got bigger and became more difficult to manage due to complexity and lack of focus on efficiency (Mitchell et al., 2014). Although other factors such as labour, capital, economies of scale, resource decline, high operating expenditures, and low productivity were also identified as contributing factors, overall, productivity decline was rated the number one challenge in the mining sector (Hopwood et al., 2014; Lala et al., 2015; Mitchell et al., 2014).

In Chapter 1, various academically untested claims were made by business in terms of what they can do to turnaround the productivity decline. Several major recommendations that were regarded as the next level required to address the root causes of productivity decline in the mining sector were made. The recommendations made were as follows: mining companies need to focus on addressing the integration gap; the embedding of effective MOS; prioritising operational excellence; improving efficiencies through technology; using analytics to uncover true cost drivers; focussing on innovation; implementing operating models, and integrating the number of participants in the mining value chain (Hopwood et al., 2014; Lala et al., 2015; Mitchell et al., 2014).

However, in this study the researcher focussed on the role of MOS and its impact on performance and productivity. The research study also examined how MOS was different to, or complimented, other management systems, such as the BSC and MBO. Three research questions were therefore considered in Chapter 3; discussed and answered in Chapter 5 and 6.

### **7.3 Study findings and discussion**

Six findings about the impact of MOS on performance and its relevance to turnaround strategies were identified and discussed as follows:

1. MOS improves performance through active management and integration of all management levels.

In Chapter 5 and 6 it was proved that MOS improves operational performance mainly through improving performance management systems and improving communication between functional departments (removing silos). From the discussion in Chapter 6 the researcher believes that MOS achieves this by creating an environment and culture of planning, accountability and performance improvement, and by actively managing operational key performance indicators (both financial and non-financial). Active management means the implementation of daily, weekly, monthly, quarterly and annual structured meetings, where management is actively involved in the decision-making and strategy execution of short to long-term company goals, making the feedback loop very short. This finding is consistent with literature by Biticiti et al. (2011), Khan (2012) and Kaplan and Norton (2008), all of whom suggested that by operating as an integrated system, translating and communicating strategy, having focussed meetings, raising actions and making important decisions across all management levels, it is possible to unlock dynamic organisational capabilities and thereby enable the organisations to perform at higher levels.

2. MOS improves performance through designing routine management structures that continuously drive accountability and behaviour across the value chain.

Based on the literature review, it was understood that both BSC and MBO systems fail to recognise that operational excellence or performance is not only about individual measures/goals, throughput, strategic alignment and measuring everything to create

value, but also about creating performance value through the involvement and alignment of the entire value chain interactions, prioritising the key value drivers and making decisions aligned to overall business optimisation (Park, 2014).

From the research results in Chapter 5 and discussions in Chapter 6, the research study found that MOS addresses this gap through designing an MOS structure that ensures active involvement of all management levels in decision making, clear roles and accountabilities for all participants across the value chain, and a focus on few key priority performance indicators which are consistent across the different management levels. This claim was furthermore confirmed in Chapter 5 results under section 5.3 which indicated that 75% of all survey respondents believe MOS has changed the manner in which they managed the business positively (58% indicated major changes, 26% indicated that MOS brought about a total change on how they managed the business). Below are some direct quotes from the survey respondents suggesting how MOS has changed their management system:

“It provides structured accountability and improved communication at all levels.”

“MOS is about accountability and behaviours.”

“Big improvement was clarity of task and clarity of accountability.”

“MOS is a combination of people, process and systems maturity.”

3. MOS improves EBITDA performance mainly through improved accountability and people behaviour, integrated planning and active management across the value chain.

From the findings discussed in Chapter 6, section 6.5, there was no statistically significant difference in EBITDA performance pre and post-MOS implementation on all the sampled MOS mines. Given the huge drop in commodity prices, EBITDA was expected to have fallen by almost 40% due to coal prices dropping from US\$130 (in 2011) to approximately US\$60 (in 2015) as per figure 1. However, the four MOS operations examined in this study managed to sustain similar EBITDA earnings pre and post-MOS installation, over the period 2012 to 2015 – a period where commodity prices have fallen by almost 40%.



Due to the outstanding performance, the researcher can therefore argue that MOS could be used to sustain EBITDA earnings. Considering the expected future coal price recovery (refer to Figure 1), the researcher can furthermore argue that EBITDA of the four examined MOS operations could improve significantly as the price recovers exceeding pre-MOS installation EBITDA. According to the literature reviewed, management systems such as the BSC, MBO and other traditional turnaround tools have failed to prove their ability to manage assets and improve performance due to their various inherent weaknesses (Perkins et al., 2014). From the EBITDA results and survey results discussed in Chapter 5 and 6, the researcher argues that the success of MOS is associated with the fact that its structure addresses the weaknesses of the BSC and MBO in its performance-improvement approach.

4. MOS's ability to influence issues within management control and integrate all levels of the management teams and employees through a structured system with clear accountabilities and roles makes it relevant to turnaround strategies.

MOS implementation identifies that people leadership, accountability and behaviour are critical for a successful turnaround implementation. In chapter two literature review we learned that about 91% of all business failures are related to influences that management could control and that 52% are related to influences that management did not control (Collard, 2010). Based on the survey results depicted in Chapter 5 under section 5.4, the majority of respondents (58%) indicated that MOS helped their organisations the most in improving planning, integrated approach to business improvement, defining objectives/targets, reducing cost and improving accountability and behaviour. The researcher can therefore argue that MOS could be a useful tool in influencing challenges that are within management control. Furthermore, implementing MOS could assist in resolving the turnaround challenges, such as structural characteristics of an organisation, size and operating procedures, ineffective top management team interactions or policies which are major challenges that lead firms to a decline and affect turnaround efforts (Trahms et al., 2013).

5. MOS is more relevant to PE firms' turnaround strategies that are targeting "underperforming" assets.

In order to successfully turnaround the operations of an asset classified as "underperforming", organisations need to cut costs, improve capacity, generate cash and improve production (Pretorius, 2008). From the MOS results discussed in Chapter 5

under section 5.5 it was concluded that when comparing tonnage output of all the four MOS mines pre and post-MOS implementation, tonnage output post-MOS implementation was higher. In light of this evidence the researcher will argue that a MOS implementation is more relevant for turnaround strategies and could be adopted by PE firms targeting “underperforming” assets.

PE strategies embody a combination of business and investment-portfolio management, and at the core of the success of its strategy is performance operational turnaround of their targets (Barber & Goold, 2007). In the research results in Chapter 5, under section 5.4, the study confirmed that MOS is more relevant to operational performance turnaround, cost reduction and performance management. This could suggest that MOS can be adopted by PE firms and used to design a well-defined, clearly communicated business strategy that is measurable, therefore making it easier for PE companies to:

- Execute a business strategy and consistently meet or exceeds expectations by driving delivery of the business plan.
  - Have well-developed systems and processes in terms of reporting and performance – reporting of key information because management is actively involved in the daily running of the business and decision making enabling management to know the business drivers and cost structures intimately and be able to report on them regularly.
  - Develop leadership that operates the business at its full potential.
  - Prepare the company for exit by improving revenue and cutting costs.
6. MOS limitations in improving business performance or as a turnaround tool can be associated with its major focus on operational excellence and limited application to firms experiencing a decline due to issues outside operational control.

Value add or improve phase in PE mainly involves due diligence to benchmark performance against competition, 100-day plans to turnaround operational performance and management teams lock in or restructuring. Adding value to the investee companies may also entail financial engineering, changing marketing strategies, incentive alignment, eliminating unproductive capital both fixed and net working capital and provision of smart money (Achleitner & Figge, 2014; Rogers et al., 2002). In Chapter 5 under section 5.4, from the 32 MOS experts sampled, only 49% of respondents indicated

that MOS was more relevant to cost reduction and financial performance, while the majority of respondents (97%) indicated that MOS was more relevant to operational performance turnaround. This could be related to the fact that MOS does not provide clarity on how these elements could be improved beyond just improvement in operational performance.

From the above discussion the researcher can therefore conclude that MOS's relevance to PE strategies is mainly based on optimising operational performance through managing issues that are within management control. Therefore, MOS limitations could be the lack of ability to improve business performance through other means beyond operational performance, such as financial engineering, changing marketing strategies, incentive alignment, eliminating unproductive capital – both fixed and net-working capital – and the provision of smart money, which are also important in companies' turnaround strategies.

#### **7.4 Study implications to academia**

- The results and findings from this study contribute in establishing literature for the subject of MOS as there has been limited research on MOS to date.
- The study furthermore seeks to expand on academic knowledge of turnaround improvement and PE firms' value-add strategies by examining the relevance of MOS to PE turnaround strategies.
- The research also builds on the work of Khan (2012), by giving more insight into the impact of MOS on performance through comparing pre and post-MOS implementation of non-financial and financial performance measures, and the correlation of operating hours to revenue generation.
- The research furthermore expands the academic debate and understanding of the BSC, MBO, turnaround strategies and PE value-add strategies by providing researched findings of the weaknesses of these management systems and their relevance to performance improvement in business turnaround strategies.

#### **7.5 Study implications to business**

- This study seeks to establish the relationship between MOS experts' experience when implementing MOS and the results achieved by mining operations that have implemented MOS, thereby assisting business to find best practice

solutions to their challenges and reverse the productivity decline in the mining sector.

- The study also researched the link between MOS and financial performance of four mining operations to contribute to assisting businesses to find sustainable solutions on how companies can improve performance or sustain earnings in a price declining environment.

## 7.6 Research limitations

- Research was based on a single mining commodity perspective and therefore could prove difficult to generalise to other commodities or industries.
- Results of the research were conducted on four companies which implemented MOS in different periods instead of six operations as initially planned.
- Research data comprises two Australian-based mines and two South African mines, which have different cultures.
- The research does not differentiate between open-cut and underground mining operations. The main differentiator being that open-cast mining performance can be affected by weather, while underground is independent thereof.
- The research does not take into account the difference in timing of MOS implementations across the various sites. This could mean that the study disregards other initiatives which could have been taken by the various mining operations during MOS implementations.
- Availability bias. Due to a lack of access, the research has only looked at analysing four mining operations which agreed to cooperate in providing access to MOS experts and data related to MOS.
- The research assumes that the impact of uncontrollable factors such as price and mining geology are constants.
- Limited access to MOS experts beyond the coal mining industry.
- Limited academic articles written on the impact of MOS as the system is fairly new.
- Limited number of academic articles written about mining productivity in South Africa.
- The survey questionnaire did not require geographical location or position of the respondents to establish their role in the organisations in the mining industry, therefore the context and business culture between the two countries could not be extrapolated.

- Due to the logistics involved in collecting valuable data between Australia and South African mining operations, the researcher used the survey questionnaire to answer research question number 1, as this allowed the researcher to collect data from a number of people in a cost-effective manner (Saunders & Lewis, 2012). This could, however, have hindered the ability of respondents to provide other information which may have been valuable for the research (Gray, 2013).
- Survey questionnaire items 2, 3 and 9 required respondents to provide feedback of performance outcomes based on their self-assessment. If the respondent did not know the answer to the question, they could have provided an incorrect measure of certain performance outcomes such as productivity, revenue and direct operating hours.
- It is also possible that respondents could have confused the meaning of the following terms: productivity, revenue and direct operating hours as these were not defined on the survey questionnaire.

## **7.7 Recommendations for future research**

The following represent further opportunities for research:

- The research study investigates the impact of MOS on performance through the lens of the coal mining industry using quantitative research methods. As a result, there is a risk that the research may risk missing on phenomena happening recently due too much focus on theory or hypothesis testing, rather than on theory or hypothesis generation (Johnson & Onwuegbuzie, 2004). It is therefore suggested that a qualitative research study be carried out on the effective implementation of MOS to gain greater insight into the effective implementation of MOS, and generate more theory and hypotheses for MOS.
- From the literature review, a number of recommendations to improve productivity in the mining sector were suggested, including addressing the integration gap, embedding effective management operating systems, prioritising operational excellence, improving efficiencies through technology, and using analytics to uncover true cost drivers. However, this research study mainly focussed on the effective implementation of MOS. It is therefore suggested that a research study be conducted to explore and test the validity of the other productivity

improvement recommendations to further build on literature to assist business in reversing the productivity decline.

- From the research results it was furthermore discovered that the main drivers for performance improvement in MOS implementation is its ability to improve accountability and behaviour. The researcher would thus suggest that a further qualitative study be conducted to gain more insight into how accountability and behaviour impact productivity in the mining industry.
- When applying the Pretorius (2008) model, literature review findings and Chapter 5's research results it was discovered and discussed in Chapter 7, section 7.3.5 that MOS is more relevant to operational turnaround strategies for underperforming firms. It is therefore suggested to advance MOS literature by conducting future research studies on how MOS can be best applied to other strategic areas of business performance improvement for companies that are in a crisis, distress or performing well.

## **7.8 Conclusion**

MOS has successfully improved the revenue generation ability of four MOS mines and evidence has been provided that the system can be used effectively to turnaround organisational operational performance for “underperforming” firms.

MOS's ability to ensure that mining operations avoid an EBITDA decline during a price depressed market, makes it a tool that can be adopted by PE firms for operational performance turnaround to improve or sustain EBITDA performance. EBITDA performance is generally used by PE firms and financial analysts to value companies (Platt, 2009; Stumpp et al., 2000). Therefore, firms' ability to maintain stable EBITDA earnings during a price depression places a significant value on the firm as it proves its ability to sustain loan repayments and payback investors' capital in a shorter period, making it an attractive investment.

Based on the literature review and research findings, MOS's strength lies in its ability to improve accountability and behaviours which ultimately improves productivity of the mining operations. Furthermore MOS structures create an alignment of objectives between the various operational value chain participants and reinforces the organisation strategy by allowing employees and managers to identify and raise actions to resolve identified issues throughout the value chain reducing any delay in strategy execution.

The study furthermore suggests that MOS is successful as a management tool in executing operational strategy, improving productivity and performance because:

- It closes the gap identified from other management systems, such as BSC and MBO.
- It creates performance value through involvement and alignment of entire value chain interactions.
- It enables management to prioritise key value drivers, thus enabling them to make decisions aligned to overall business improvement and hold people accountable.

From the research study it also appears as if when prices are high during a commodity boom there is a tendency for organisations to lack focus on productivity, efficiencies and cost management. This is was proven through chapter 5 survey results under section 5.3 findings that highlighted that about 80% of the all the respondents organisations have been involved in cost cutting in just less than a year and about 70% of them indicating that their organisations has started implementing a management operating system in the past two years. Finally, to the fact that coal mining uses mass production methods and MOS was success in positively impacting performance in this industry, it therefore suggest that MOS could be easily replicated to other industries like manufacturing, banking, retail, construction, and government as a productivity or performance improvement tool.

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## Appendix 1: Survey Questionnaire

1. How long has MOS (Management Operating System) been in place at your operation?
  - a) Don't know
  - b) Less than a year
  - c) 1 to 2 years
  - d) 2 to 3 Years
  - e) 3 to 4 years
  - f) >5 years ago
  
2. By how much has MOS improved productivity in your organisation?
  - a) 0-10%
  - b) 11-20%
  - c) 21-30%
  - d) 31- 40%
  - e) >40%
  - f) Don't know
  
3. On average by how much has MOS improved your direct operating hours?
  - a) 0-5%
  - b) 5-10%
  - c) 10-20%
  - d) 20-35%
  - e) >35%
  - f) Don't know
  
4. To what extent has MOS changed the way you manage the operations?
  - a) Not at all
  - b) To a very small degree
  - c) Fairly
  - d) A lot
  - e) Total change
  
5. In which of the following areas has MOS helped your organisation improve the most?
  - a) Planning
  - b) Integrated approach to business improvement
  - c) Defining Objectives or Targets
  - d) Reducing cost
  - e) Accountability and Behaviour
  - f) All of the above
  - g) None of the above
  
6. In your view which of the following strategies is more relevant/ applicable to MOS?
  - a) Operational Performance Turnaround
  - b) Employee Performance Management
  - c) Cost Reduction
  - d) Financial Performance
  - e) All of the above
  - f) None of the above

7. In your view prior to implementing MOS what were the biggest challenges affecting productivity in your operation?
- a) Poor performance management
  - b) Capital expenditure
  - c) Poor communication between functional departments (working in Silos)
  - d) Operating expenditure
  - e) Previous cost cutting exercises
8. By how much did MOS improve your organisation revenue (tonnage output)?
- a) 0-5%
  - b) 5-10%
  - c) 10-20%
  - d) 20-35%
  - e) >35%
  - f) Don't know
9. Any comments about MOS (Text box)

## **Appendix 2: Informed Consent Statement for Survey Questionnaire**

Dear Participant

I am conducting a research study on the impact of Management Operating Systems on performance improvement through the lens of the coal mining industry, and its relevance to private equity turnaround strategies. To that you are asked to complete the online survey with 10 questions, and should take you not more than 5 min of your time.

I would also like to assure the company and the participant that all data collected will be kept confidential and that no names of the participant will be captured.

Participation in the online survey questionnaire is not compulsory, however participation will be deemed as consent.

If you have any concerns please contact my supervisor and I on the below contact details.

Regards,

Pleasure Mnisi

Contact number : +27 71051 9558

Email : pleasure.mnisi@angloamerican.com

Research Supervisor : Wanya Du Preez

Email : wdupreez@deloitte.co.za

Phone : 083 272 0892

GIBS MBA 2014:15 Part-time