

Review of Literature: Productivity Improvement Systems in the South African Mineral Exploration Industry

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Abstract

The South African mineral exploration industry is capital intensive and the rewards are great for mining companies, surrounding mining communities, and the economy of the country. Globally, markets have witnessed an upsurge in the value of skill as the nucleus of businesses is on discovering the right individuals and developing their skillsets in alignment with technological requirements, objectively to sustain productivity and achieve competitive feasibility. However, even though the mining industry is largely concerned with the area of human capital investment and employee motivation, there are perennial causes of considerable deviation that seem to undermine the importance of productivity systems in enhancing productivity. A qualitative (inductive/ subjective) research approach was followed. The research study set out to explore the literature on the following research constructs - human capital investment, employee motivation, and productivity. Results of the reviewed literature revealed that productivity systems play a significant role in the growth of productivity.

Keywords

Human Capital Investment, Employee Motivation, Mining, Productivity.

1. Introduction

The mineral exploration industry faces a serious challenge whereby mining houses undermine the significant impact that perennial causes of deviation (internal and external factors) from expected productivity have on productivity improvement drivers. According to a study conducted by Makhubedu, Anyadiegwu and Mbohwa (2017), International and national business markets utilize productivity improvement drivers to enhance productivity. In this regard, the success of mining houses depends largely on the quality of their human resources (Sebutsoe and Musingwini 2017; Pinigina et al. 2017).

Statistics SA (2022) report that the real gross domestic productivity (GDP) decreased by 0.7% during the second quarter of 2022. The minerals council South Africa (2021) reported that a significant role is played by the mining industry in South Africa's economic development. Even though the mining industry has seen a recovery in the growth of production of approximately 11.2% compared to a low base in 2020, the mining production indexed over a 20 year period showed that the industry had not improved in comparison to the 2000/ 2006 period and continued to struggle to reach the 2015 levels (base year = 100). In the second quarter of 2022, the mining industry in South Africa reported a 3.4% decline in production output (Mining Review Africa 2022).

A report by the daily maverick revealed that mining productivity decreased by 9% in the year to November of 2022 (Stoddard 2023). This gradual decline can be attributed to prevalent power outages/ load shedding as they continued to impact negatively on the productivity output of the mineral exploration industry. Another challenge that faces

mining houses is unemployment. It is reported that the unemployment rate in South Africa increased from 30,8% in quarter 3 of 2020 to 32,5% in quarter 4 of 2020, the highest level since the beginning of the QLFS in 2008 (Statistics SA 2020). In addition to the covid-19 epidemic, the country was under lockdown at the time.

The South African mineral exploration industry is capital intensive and the rewards are great for mining houses and the surrounding mining communities (Amponsah-Tawaih and Dartey-Baah 2011:62). Secondly – evidence from relevant studies explored suggest that human capital (training, education and healthcare) and employee motivation (employing motivationally inclined incentive schemes) are major drivers of increasing workforce productivity (Olayemi, 2012; Awan and Sarfraz, 2013; Adekola, 2014; Boroujerdi et al. 2014; Chikabwi, Chidoko and Mudzingiri, 2017).

ProductivitySA (2020) report that stakeholders articulate productivity in numerous ways from efficiency to effectiveness, rate of absenteeism and turnover, to employee motivation (job satisfaction and loyalty) and so forth. Heizer and Render (2016) defined productivity as the ratio of outputs (goods and services) divided by the inputs (resources, such as labor and capital). The importance of human capital is to equip labour force with knowledge and skill base that support implementation of organizational objectives. Human capital contributes towards global and national economy by increasing the rate of employment (Productivity S A 2020).

According to The World Economic Forum (2017), using the Global Human Capital index for 2017, reported that on average, sixty-two percent of the world has developed human capital (skill development). Using this index, 130 countries were ranked based on their levels of human capital development. WEF (2017) further reported that countries such as Norway, Finland and Switzerland came in first, second and third respectively while super power countries such as the United States of America (USA) were ranked 4th and Germany 6th. Africa is the lowest ranked continent when it comes to Human capital. South African has the second largest economy in Africa but came in at number eighty-seven in the world.

1.1 Problem statement

As highlighted by Statistics SA (2021), South Africa's gross domestic product (GDP) dropped by 0.7%. Furthermore, the Minerals Council of South Africa (2021) revealed that, apart from an increase of roughly 11.2% compared to a low base in 2020, the mineral exploration industry struggled to reach the 2015 levels (base year = 100). In addition, productivity growth of the mineral exploration industry has been on a downward trajectory over the past few months of 2022 as reported by (Mining Review of Africa 2022; Stoddard 2023). It is noteworthy that the South African mining industry is also faced with a number of challenges that adversely affect productivity growth. Thus, having a negative adverse impact on the gross domestic product (GDP) and economic development of the country.

1.2 Research aim, objective and question of the study

The study examines the role of identified productivity improvement systems in influencing the productivity growth of South African mineral exploration companies in South Africa.

Research Objective:

To explore identified productivity improvement systems and their influence on productivity growth of mining companies within the mineral exploration industry in South Africa.

Research Question:

How does productivity improvement systems influence productivity growth of mining companies within the South African mineral exploration industry?

1.3 The scope of the study

The study focusses on productivity improvement systems within a South African mining context. However, the study also draws focus on Africa and global mining companies. In addition, the study seeks to highlight the significance of underlying challenges that seem to impede productivity improvement of mining companies, downplaying the

importance of human capital (skill development) and employee motivation (using motivationally inclined incentive schemes) in improving productivity and efficiency.

1.4 Importance of the study

The study intends to magnify the importance and benefits of implementing identified productivity improvement systems (human capital and employee motivation) within the mining industry. Furthermore, a lack of confidence associated with neglecting underlying prevalent (endogenous or exogenous) challenges that seemingly hamper aggregate productivity growth, undervalues the significant impact that identified systems have on productivity. It then becomes paramount that mining companies have greater insight into these perennial causes of deviation from expected productivity.

Literature Review

A Brief Historical View of Mining in South Africa

It was around the 19th century in the Witwatersrand basin that the Republic of South Africa began its transition from agriculture to precious minerals, thus positioning itself on the African continent, as a powerhouse. The minerals industry played a significant role in growing South Africa's economy (Antin 2013). The minerals industry began to draw foreign investors in the early 19th hundreds, thus creating employment opportunities than any other industry (Masia and Pienaar 2011). A watershed moment for South Africa came in 1886 during the discovery of the Witwatersrand goldfields, establishing the Republic of South Africa (RSA) as a more revolutionized and industrialized state. The economy of South Africa improved considerably due to availability of gold markets, and gold being expensive (Harrison and Zack 2012).

Mining Process

Mining is a process undertaken by extracting unprocessed mineral deposits from underneath the earth. There are two types of mining processes – surface (open pit mining) versus underground mining. The distinction between surface and underground mining operations, from an efficiency and cost-effective perspective, is that, contrary to underground mining, surface mining requires less human labour force and systematization in order to extract mineral deposits from underneath the earth (Amponsah-Tawaih and Dartey-Baah 2011:62). In their raw form, precious minerals are known to contribute significantly towards the growth of countries industries, which are both developing and developed (Muduli and Barve 2016:223).

Mining Cycle

Global mining industries view minerals as the source of wealth. A Mining Cycle consists of a connection of consecutively linked phases representing a series of operations that must be implemented before mineral deposits can be extracted and processed. Sebutsoe and Musingwini (2017:200) inform us that a traditional mining cycle consists of four basic steps – exploration, development, 'stopping/ production', and closure (as depicted in figure 1 below). Out of the four steps, stopping/ production (which is a process that entails extracting precious minerals from an underground mine shaft), for the purpose of the research study, it is considered a heart that not only pumps blood into the whole mining cycle, but ensures a return on investment.

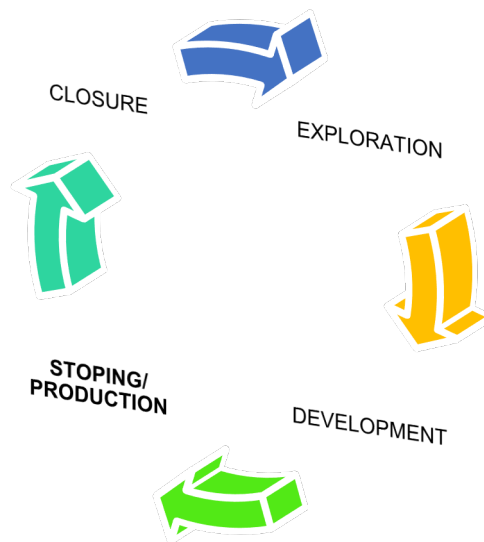


Figure 1. A typical view of the mining cycle
Source: Sebutsoe and Musingwini (2017)

A typical mining system is a methodical process that incorporates a series of aligned mechanical equipment, characterized by throughput, inextricably depended on each phase functionality and significantly impacted by independent variables contained in each mining operation. The mining system – winning equipment (a Shearer/ cutting machine used for underground longwall mining and concerning the surface/ open pit mining, a bucket-wheel excavator is used), mine loading and hauling, main conveying equipment (a conveyor system to move material for surface and underground mining), transfer devices and stockpile/ burner feeding equipment (Dinescu and Andras 2014).

A typical mining process includes the size of a team, number of teams, team productivity, type of reef mined, depth below mine surface, face advance, and face length related to important Key Performance Indicators (KPIs) – conventional stopping (extraction of minerals/ ore from underground) measured in centared (m^2) produced (Sebutsoe and Musingwini 2017). The entire mining map is based on one premise, to significantly increase operational productivity (Willis, Dixon, Cox & Pooley 2019).

1.5 Definition of Productivity Improvement Systems - Human Capital and Employee Motivation

According to Dubrin (2009:377), the concept of human capital goes beyond human development; it empowers the workforce, instilling some degree of self-worth, recognition and social status. Thus improving the technical knowhow of personnel, job efficiency, quality of the product, overall productivity and supporting company innovation (Aysha et al. 2012). Literature explored articulate the concept of human capital as any form of knowledge or skill – inborn or external, acquired over a given period of time through some form of schooling that individuals in a population possess and their contribution towards productivity (Yamoah 2014; Navruz-Zoda and Shomiev 2017; Makhubedu et al. 2017).

According to Bozovic and Bozovic (2019) employee motivation can be explained as the ability demonstrated by management to augment the needs and interests of employees within the working environment and influences worker performance. It has been reported by Jain, Gupta and Bindal (2019) that motivation is a key concept that focuses on bringing out the best in employees to attain organizational goals.

The Theory of Human Capital

To get a comprehensive prospect on the significance of the concept of human capital on workforce productivity, the study explores the following theories – neo-classical economic theory also known as the Solow growth model, and human capital theory as they are aligned to the research constructs of the study. These theories, in particular the theory of human capital informs this research study. Human capital investment as a driver of aggregate productivity output

is founded on Friedman's neo-classical ideologies, and the conceptual theoretical approach to economics, by the Chicago-School of Economics (Cornachione 2010).

According to Afiouni (2013), conventional economics informed us that human capital was a physical input that did not require any form of education nor training. The common principles that are associated with economics are supply and demand, inflation, production/ consumption of goods and services, and economic growth rather than a concept that develops strategic and better ways of improving workers' social well-being. Economic frameworks also demonstrate the importance of human resource development in improving performance. Human capital theory is not just an approach applied in economics, it covers an extensive range of concerns that workers could potentially have, and subsequently proposes comprehensive policies that deal with those human concerns (Tan 2014).

A crucial component that is required for operational functionality within any organization is capital (Awan and Sarfraz, 2013). The theory of human capital is central in illuminating the association concerning human capital (education, training and healthcare) and employee productivity (Marimuthu, Akokiasamy and Ismail 2009). Capital comprises of the following constituents, business assets, physical/ tangible resources, bank accounts to name a few, but at the nucleus lies human capital, a significant factor for sustainable productivity development (Heizer and Render 2006).

1.6 Employee Motivation in the Mining Sector

Motivation is an important concept in achieving mining objectives and organizational success (Schultz and Küsel, 2018). However, there are challenges in managing and motivating personnel within the mining industry as miners have unique characteristics, values and drives (Moodley et al. 2018). This is a universal challenge that confronts mining companies and managers worldwide. This hinders operational productivity, profit optimization, and growth in economy.

Mining personnel play a significant role in organizational success (Kuranchie-Mensah and Amponsah-Tawiah, 2016:256). Varma (2017) hypothesized that operational challenges that mining organization's face on a day-to-day basis, in trying to reduce miners' turnover and improve operational productivity, are due to a lack of motivation and commitment shown by mining management. However, the responsibility does not only lie with management.

Du Plessis et al. (2015:12) mention that employees', who are highly motivated, tend to be more productive, influencing positively organizational growth. From a theoretical perspective, scholars and managers have extensively explored the concept of employee motivation as a managerial tool that organizations employ as a driver of productivity within the workplace (Crispen, Michael and Tendai 2011; Chaudhary and Sharma 2012; Makhubedu et al. 2017). However, Dubrin (2009) alluded that this drive largely depends on monetary value – how well compensated employees are in realizing expected production output. According to Yamoah (2014) organisations employ motivationally inclined incentives to acquire the best out their employees. The concept of motivation changes inner attributes such as self-confidence, self-esteem, decision making of personnel etc.

1.7 Productivity Improvement System Challenges – Human Capital and Employee Motivation

The explored literature suggest that, from a human capital perspective, prevalent challenges that hamper the application of human capital involve lack of education (knowledge) and inadequate training (skill development) of mineworkers, lack of proper health and safety standard within the working environment, and lack of proper supervision. Further challenges include lack of concentration, emotional and physical stress may affect consistency of employees (Saunders 2013; Evans and Lindsay 2017; Delgado, 2019; Mafundu and Mafini 2019). Heizer et al. (2017:453) money is a significant factor when it comes to psychological and financial motivation. From a motivational point of view, poor salary/ remuneration, low job satisfaction, low self-esteem, lack of proper infrastructure, lack of proper maintenance and lack of financial aid from the government as challenges that have an adverse impact on productivity of mineworkers (Ravi 2015; Makhubedu et al. 2017).

1.8 Factors that undermine the impact of Productivity Improvement Systems

According to Horberry et al. (2013), the minerals industry, which covers the exploration, development, production and transportation of precious minerals – coal, copper, iron and gold, is perceived by the world as the most multifaceted and treacherous working environments (Eiter, Steiner and Kelhart 2014). After agriculture, the minerals industry is the second most revered and largest contributor towards world economic development (Amponsah-Tawiah and Dartey-Baah 2011).

Historically, research studies have exposed some internal and external aspects that counteract the improvement in productivity and performance. The following factors – labor unrest/ protest, (absenteeism - without permission) and technology (fear of technological job cuts) have been identified by this study as prevalent within the South African mining industry.

1.8.1 Labor Unrests

According to the Labor Relations Act (LRA) defines a strike as a group of employees refusing to work because of work-related grievances they may have with their employer (Bhoola 2011:16). The South African Institute of Race Relations (IRR) (2013) reported that, in 2013, the minerals industry in South Africa was plagued by unsanctioned protests that cost the sector approximately 15 billion rand during the 2012 – 2013 financial year. Sadly, 34 mineworkers lost their lives due to the events that were exhibited by law enforcers in Marikana - Rustenburg (Twala 2014:65). Labor protests continue to negate the mineral industry's ability to sustain operational productivity (Makhubedu et al. 2017).

Absenteeism (without permission)

Absenteeism is not an isolated problem that challenges the South African labor market. It is perceived, particularly within the workplace as a universal problem that significantly influences inversely on productivity output (Forbes 2013). The term “absenteeism” can be described as the number of days an employee is absent (lack of physical presence) relative to the number of days that an employee is authorized to be present at work (Gouws 2015:11). This interpretation is synonymous to the general explanation of absenteeism within the minerals industry. Absenteeism can be categorized into two aspects – with permission versus without permission (Makhubedu et al. 2017). The research study draws literature from without permission as it leads to a disruption of operational functions equating to a weakening workforce productivity, affecting organizational production output, and not meeting organizational profitability (Molopyane 2013:1).

In 2010, News24 reported that absenteeism was the highest across all sectors in South Africa. Data was collected from 60 local businesses, approximately 180 000 employees submitted their sick notes. The statistics derived from the data gathered indicated that absenteeism within the mining sector accounted 3.1 percent, 2.8 percent in the medical industry, 2.7 percent by government employees, and the financial sector accounted 1.7 percent. Software Company Corporate Absenteeism Management Solutions (CAMS) released these results. The Steel and Engineering Industries Federation of Southern Africa (SEIFSA) (2018) reported that absenteeism accounts for approximately R16 billion annually in South Africa. This can be attributed to a number of factors that prevent people from going to work – illness/ other medical reasons, depression, burnout, stress and low morale to name but a few (Forbes 2013).

1.8.2 Industry 4.0 - Technology

Wahab, Rose and Osman (2012) asserted that technology can be viewed in a variety of ways due to organizational goals and objectives, underlying theoretical perspectives, and different research areas. Thus, this would encourage scholars, businesses, government and the private sector to hold different views. Since the early days of technological development, technology has been defined, applied, understood and comprehended somewhat differently (Caroll 2017). Technology has become much more complex than we had anticipated, according to Cloete (2017). Until the late 1900s, the term technology was rarely used.

Sacasas (2017) argue that the term “technology” was commonly used loosely in society and in most cases, as a short and artless way of defining an instrument such as a device/ gadget – telephone, laptop, etc. Technology comprises of critical components – infrastructure (ability to receive and transmit/ communicate, without this ability, there is no technology); attitude (having a correct attitude that deals with finding practical ways of solving problems); social system (ability of offering services by an organization); and culture (identity, desires, and values) (Cloete 2017).

A wave-like of industry 4.0 is currently sweeping across South Africa and with it comes uncertainty. The announcement of industry 4.0 by Klaus Schwab and the World Economic Forum (WEF) sparked a debate on possible technological disruptions and technological unemployment/ job cuts (Lee, Yun, Pyka, Won, Kodama, Schiuma, Park, Jeon, Park, Jung, Yan, Lee and Zhao, 2018). In a country where unemployment is at an all-time high of 32,5% (Mahlaka 2021), this announcement fueled the perception that RSA's unemployment will increase as a result of employees being replaced by machines. Technology has impacted companies productivity systems adversely as businesses have to restructure and reconfigure their operations in accordance with industry 4.0 in order to realise

market feasibility (da Silva et al. 2022). According to Vrontis et al. (2022) due to a lack of knowledge and funding, only a few companies use technology to improve their workplace practices.

2. Research methodology

Academic research requires a thorough review of past and current literature as it plays a significant role in future research and development. To answer the research objective, “*how does productivity improvement systems influence productivity growth of mining companies within the South African mineral exploration industry?*”, a qualitative (inductive/ subjective) research approach was followed. Literature was reviewed using critical national and global articles, journal publications, books and government documents that related to the research topic. Focusing on numerous research platforms such as Google scholar, Elsevier, MDPI, Emerald publications etc. to broaden the scope.

3. Literature review findings

The above explore literature demonstrated how instrumental identified productivity improvement systems are in driving productivity within any organization (Marimuthu et al. 2009; Aysha et al. 2012; Adekola 2014; Boroujerdi et al. 2014; Jali 2015; Chikabwi et al. 2017). Investing in human capital and motivating employees is an effective means for mining companies to improve labor performance, improve organizational productivity, thus attaining market and financial feasibility. In alignment with the research objective of the study and in accordance with the reviewed literature, table 1 below highlights some of the empirical findings between identified productivity improvement systems (human capital and employee motivation) and productivity.

Table 1. Findings for the impact of productivity improvement systems on productivity

Author(s)	Research topic	Findings
Awan and Sarfraz (2013)	<i>The Impact of human capital on Company performance and the mediating effect of employee's satisfaction.</i>	Their results revealed that there was a strong relationship between human capital investment and performance.
Morris (2015)	<i>An industry analysis of the power of human capital for corporate performance: Evidence from South Africa</i>	The results showed that human capital efficiency improves organisational profitability through induced production and quality of service.
Jali (2015)	<i>The Impact of pay on productivity and motivation on general workers in South African platinum mines</i>	The results reveal that the biggest motivator that drives mineworkers to be productive in South Africa was remuneration.
Samwel (2015)	<i>Role of Employee Motivation on the Production of Mining Companies in Geita Gold Mine, Tanzania.</i>	The results reveal that monetary motivation was significant in motivating mineworkers
Du Plessis et al. (2015)	<i>Effective motivation practices that could enhance employee performance in the mining industry</i>	Authors' findings indicate that remuneration, safety, social welfare, supervision, and equity were the five main motivational factors that motivated mining staff in Laos and New Zealand.
Petrova et al. (2018)	<i>Possibilities for Personnel Development in the Mining and Quarrying sector in Bulgaria</i>	Researchers' results suggest that human capitals lead to higher labor productivity in the mining and quarrying sector and ensure a greater value added.
Ekhsan et al. (2019)	<i>The impact of motivation, work satisfaction and compensation on employee's productivity in coal companies</i>	Found that there was a motivation had a significant influence on employee's productivity.
Okazaki (2020)	<i>Complementarity between Mechanization and Human Capital: How Did Machines and Educated White-Collar Workers Enhance Labor Productivity in Prewar Japanese Coal Mines?</i>	His findings reveal that the higher the education level of white-collar workers was, the larger was the impact on the labor productivity of blue-collar workers.

4. Summary, discussion and conclusion

Based on the discussion above, the identified productivity improvement system involving human capital and employee motivation play a crucial role in improving employee performance. Thus, enhancing productivity growth of the company. This leads to the organization achieving market and financial feasibility. However, it is important to take note that there are challenges involving involve lack of education, inadequate training, lack of concentration, emotional and physical stress poor salary/ remuneration, low job satisfaction, low self-esteem, lack of proper infrastructure that underestimate the significance of productivity improvement systems within the working environment. Further challenges include labor unrests/ protest, absenteeism without permission, and technology. This ideology is supported by literature as revealed in table 1 above. Therefore, the study recommends that mining companies implement identified productivity systems within their working environment. Furthermore, mining houses should be aware and try to curb identified perennial causes of deviation such as unsanctioned labor unrests, absenteeism particular without permission, and fear of augmenting technology within the working space that seem to impede growth in productivity. If not, these challenges will continue to undermine the significant impact that these systems have on productivity growth.

5. Future research

The research study does not account for all productivity improvement systems and factors that undermine the significant impact that productivity systems have on productivity growth of mining companies. In addition, the study only employed a qualitative review of the literature. This limits the study's generalisability to other mining houses in South Africa, Africa and possibly abroad. Thus, opening up future research prospects. Research in the future should focus on quantitatively integrating these systems and not focus of them individually to assess the impact that they have on productivity growth of mining houses within the mineral exploration industry.

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