International Journal of Commerce and Management Research
ISSN: 2455-1627
Impact Factor: RJIF 5.22
www.managejournal.com
Volume 4; Issue 3; May 2018; Page No. 45-53

Effects of Job satisfaction as an operational risk on mining productivity: A case of Konkola Copper Mine, Zambia

Victor Muchemwa[1], Dr. Asif Mahbub Karim[2], Dr. William Phiri[3]
[1] DBA Researcher, Binary, University Malaysia, Malaysia
[2] Professor, Dean, Binary Graduate School, Binary University Malaysia, Malaysia
[3] Acting Director, Directorate of Research and Graduate Studies, Chalimbana University in collaboration with the University of Zambia, Zambia

Abstract
The study was undertaken to establish safety and health hazards as operational risks affecting the mining productivity in Zambia. A case study of Konkola Copper Mine (KCM) was employed as a research design that adopted both quantitative and qualitative methods. The study targeted Konkola Copper Mine safety department employees as they provided responses that had high reliability and validity levels. The quantitative and qualitative data were analyzed using SPSS version 20.0 and thematic analysis respectively. The main findings of the study indicated a negative effect (coefficient = -0.399) of Wellness Programmes on mining productivity. Thus the research unearthed that an increase in any unit of Wellness Programmes would result in the reduction of mining productivity by 39.9%. The results further showed that the mitigation procedures at the mine were clear and elaborate though complex in nature. Further outcome of the study showed that health programmes remained a vital variable to mining productivity (P-value = 0.001 which is less than 0.05) justifying the significance of health programmes to productivity of KCM. Despite the safety and health rules not being significant at 0.05 or 0.1 the coefficient value of 0.155 however indicated that a unit increase in safety and health rules would increase productivity by 15.5% assuming other variables are constant. Other key variables such as the Accident Prevention Measurements (APM), Occupation Hazards Prevention (OHP), Safety Training and education (STE) and Organizational Safety Support (OSS) whose significance towards mining productivity were tested are best explained by the R Squared = 0.926 and the Adjusted R Squared = 0.893 in the multiple regression model respectively. Therefore and based on the findings, the study recommended to the mining firm (KCM) to enhance their employees` skills of managing safety and health issues as the later and former are potential risks to mining productivity.

Keywords: safety department, wellness program, employees' skill

1. Introduction: Background of the study

Konkola Copper Mine (KCM) formerly known as Nchanga mine was discovered in 1923. The KCM complex comprises of various mining operations and projects that are of importance to the mine and the national at large. Mining projects can and have contributed greatly to Zambia's economic and social development. The sector is also a significant source of government revenue and formal employment, both directly and indirectly. The sector is crucial in the continuity to attract investment in the country's growth, since it constitutes 62% of foreign direct investment. Zambia has a long history of mining and a large known resource base of copper, emeralds, and other deposits. It also has very good potential for further discoveries. Mining accounts for 12% of Zambia´s GDP and 70% of total export value of which 28% is from KCM (World Bank, 2015; CSO, 2016) [26, 5]. Many effects, however, including environmental pollution, environmental degradation, social and economic effects can result from mining projects (ICMM, 2014; ILO, 2015; Moyo, 2015).[8, 10, 16] Moreover, the Australian Institute of Metallurgy (2001) [2] attest that mining projects are typically followed by a number of technical, economic, environmental, social and financial consequences.

In order to understand the importance of managing mining operational risks, there was need to understand the various activities of a mining venture that had a bearing on the health and safety of the employees. ILO (2017) [9] indicates annual injury rates for wage workers in the SADC region ranging from 0.35 to 49.42 injuries per 1000 workers, with a median of 6.26 injuries/ 1000 workers. The data further indicates that the reported occupational fatality rate in the SADC region ranges from 0.85 to 21.6 fatalities /100 000 workers, with a median fatality rate of 14.02 fatalities/100 000 workers. A Ghanaian study of workers within the formal mining sector reported rock falls as the major cause of accidents. Amongst copper miners in Zambia, the handling of tools and materials (26%), falling of rocks and other objects (20%) and slips/falls (12%) were the major causes of injury. Amongst artisanal miners in Katanga, D.R.C., the handling of tools (51.5%), handling of heavy loads (32.9%) and falls (11.5%) were the main causes of injury. Additional research to identify significant predictors of employee safety in the mining industry is urgently needed. In developing countries such as South Africa, where there is considerable variation in the adherence to and enforcement of safety standards, mining injury rates are much higher than in developed countries. For instance, fatality rates in South African platinum mines are nearly double the global average. A multi-year study of 13,924 copper mining workers in Zambia reported 165 total injuries (ICMM and Chamber of Mines in Zambia, 2014) [11]. The estimated injury rate was 0.55 per 100 person-years, respectively, though non-fatal cases in that study were restricted to severe injuries, or injuries requiring medical attention with missing work day(s). A rate of 0.84 injuries per 100 FTE (approximately 0.84 injuries per 100 person-years) was reported in October 2009 among gold miners in South Africa (Lluis, Marc, Hernan, and Eduard, 2018) [13]. The rates of annual injuries in the in Zambia and region suggest that continuous improvement approaches are needed to improve operating efficiencies. This research therefore, focused on Konkola Copper Mine's operational risks in which health and safety were cardinal issues to consider.

2. Purpose of the Study

The study investigated and evaluated the manner in which the Safety and Health Environment (SHE) department of Konkola Copper Mines dealt with operational risks involving safety and health hazards that had the potential of impacting negatively on job satisfaction and mining productivity with a possibility of halting operations.

3. Statement of the Problem

The importance of operational risk management specifically safety and health hazard management cannot be over emphasized as their impact can be felt economically. A good example was the closure of Collum Coal mine on 20th February, 2013 by the Government of the Republic of Zambia (GRZ) due to failure of managing health and safety hazards and it ended up costing the investor and Zambian economy out of reasonable production of electrical power which would have enhanced productivity and help mitigate load shading on the Zambian electricity supply network. ``Mine accidents have remained a frequent occurrence in Zambia's mining sector with the latest being the underground tragedy that claimed four lives at Mopani Copper Mines (MCM) in Kitwe. The four miners, whose bodies took time to be retrieved by a rescue team, met their fate on Sunday 25th February, 2015 around 23:00 hours after being buried alive when a rock fell on them at South Ore Body Shaft. Such accidents have left many Zambians with more questions than answers as to whether mine owners in this key sector of the country's economy take issues of safety and health standards of their employees, contractors and the community seriously. The Government of the Republic of Zambia has demanded to know the cause of the accident''.

With the increase of mine accidents in the mining sector in Zambia there is an indication that Operational risks i.e. Safety and Health issues, if not managed effectively and efficiently can impact negatively on job satisfaction and productivity of the mine and grind the operations to a halt. Konkola copper mine (KCM) is one of the major producers of Copper and Cobalt, which are one of the main stay of Zambia`s economy, and as such the way in which safety and health issues are managed is critical to the profitability and survival of the mine, and also the Zambian economy at large.

4. Research Objectives

The study was guided by the following specific objectives:

- To identify type of operational risks that affect job satisfaction and productivity at Konkola copper mine;
- To evaluate the safety and health programmes and their impact on job satisfaction and mining productivity.
- To ascertain the effect of Job satisfaction as an operational risk on mining productivity at Konkola copper mine (KCM).

5. Research Hypothesis

H_0: There is no association between type of operational risks and mining productivity at KCM

H_1: There is an association between type of operational risks and mining productivity at KCM

H_0: Safety and health programmes have no impact on job satisfaction and mining productivity at KCM

H_1: Safety and health programmes have an impact on job satisfaction and mining productivity at KCM

H_0: Job satisfaction as an operational risk has no effect on mining productivity at KCM

H_1: There is an effect of job satisfaction as an operational risk on mining productivity at KCM

6. Conceptual framework

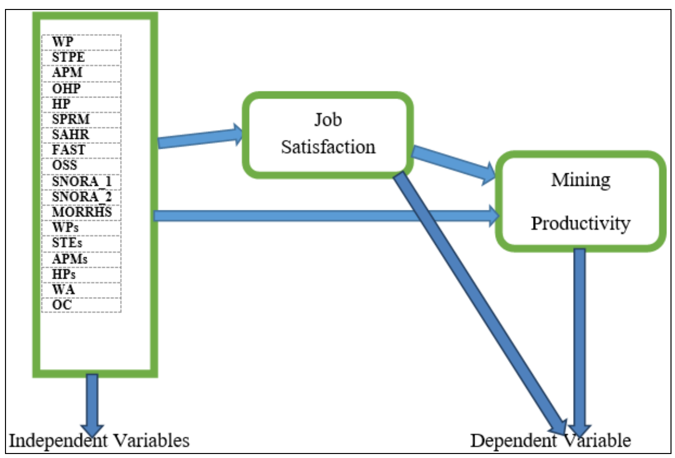

Fig 1

The figure above illustrates the relationship between dependent variables and independent variable. Job satisfaction and Mining productivity are dependent variables and the rest are dependent variable

7. Significance of the study

Operational Risks in mining i.e. Safety and Health have the potential of affecting job satisfaction and mining productivity with a possibility of grinding operations of the mine to a halt (Edwards, 1988; McLery *et al*, 1988; Makin and Winder, 2008; Stephenson, 1991; safety and health in Mines Convention, 1995) [6, 15, 14, 22, 20]. This can have a negative impact on the viability of the mine, and the Zambian economy. Therefore, the outcome of this study may increase the perception of operational risks among employees when dealing with the risks faced by the mine regarding safety and health hazards. The study may also improve effectiveness and efficiency in operational risk management thereby attaining positive job satisfaction and mining productivity. Additionally, other than creating an environment through which further studies may spring out, the study may contribute the body of knowledge and best practices in safety and health in the mining industry.

8. Literature Review

Relevant literature review followed the global, regional and local perspective model with themes and subthemes generated from research objectives.

8.1 Overview

Mining, by its nature, presents a range of safety and health hazards that are different from those in other sectors. Hazards, such as ground instability, are inherent in the underground environment. Others are introduced through complex mining activities and processes, which bring potential hazards into the underground environment including hazards from mobile equipment such as large vehicles that may limit visibility for the driver. Risks can increase as mines get deeper and more expansive. A report from Ontario Canada mine (2014) [18] indicates that if these hazards are not managed properly using appropriate controls, they can result in serious traumatic injuries, death or occupational illness. Therefore it can be argued that to significantly improve health and safety in mining and milling activities, there is need for consented effort from all teams to mitigate the risk associated with mining. There is also need for the safety system partners and mining sector stakeholders to identify and rank the hazards that pose the greatest risk and warrant the highest level of attention (Mrema, *et al*, 2015; Smith, Saunders and Lamontagne, 2013) [17, 21].

8.2 Safety and Health Hazards of Mining

Mining involves various activities and processes to come up with a finished saleable product. The nature of mining brings about safety and health hazards. Ontario Canada mine report (2014) [18] outline five main priority hazards that can create a range of health and safety issues as follow: worker fatigue, ground control hazards, occupational disease hazards, hazards associated with water management and hazards associated with mobile equipment. A detailed account of each one is given hereunder.

8.3 Worker fatigue

This is identified as one of top concerns of the mining sector and is it ranked as priority in risk management. Prial and Dey (2015) [19] indicate that worker fatigue has previously been a process of safety and health system. However given the current level of concern about this hazard, there is need to improve worker/employee participation in risk management activities in order to improve understanding of the extent to which worker fatigue affects job satisfaction and mining productivity as it results in injuries and fatalities. Worker fatigue is mostly as a result of irregular shift schedules. In order to improve on risk mitigation of worker fatigue, it is imperative to learn from progress other sectors have made in addressing worker fatigue issues. There is need to identify strategies that can be explored to address the problem of worker fatigue to enhance productivity. The paper is of the view that Zambian mining companies should invest heavily in innovative strategic technologies aimed at averting workers fatigue. Such technologies may include but not limited to fatigue monitoring system (such as Driver Safety System - DSS), Hazardous Area Signaling and Ranging Device (HASARD), Automated Temporary Roof Support (ATRS) and even the adoption of automated underground mining (Kuytu & Bolat, 2016) [12].

8.4 Ground Control Hazards

Ground Control Hazards emerge as a result of blasting which causes ground failure and seismicity as reported by The Auditor general’s report (2015) [23] and Chifungula, (2015) [3] There is need to consider the mine life to come up with an appropriate design of the mine that will reduce the hazards associated with seismicity and rock-bursting. According to Ontario Canada mine report (2014) [18]. improving and mitigating risk hazards through grounds control require the improvement of operational control methods. The mining sector in Zambia can benchmark with other mining firms from developed countries’ advanced technologies such as those that have been developed in South Africa, United States of America to mention but a few.

8.5 Appropriate Operational Control Methods

There is need for appropriate methods that will help reduce or minimize the occurrence of ground failure, of occurrence of seismicity and rock-bursting in underground mines. For instance, system such as the Automated Temporary Roof Support (ATRS) could be adopted in this regard. Due to the risk posed by ground failure, the Ontario Canada mine (2014) [18] indicated the need to improve the ability to identify any prediction for seismicity and rock bursting at the mine design stage including better reliance on risk assessment methods and better quality geotechnical data. The various process operational controls relating to distressing of blasting potables and the use of re-entry protocols following rock burst should be improved as this will bring about prudence in the way micro sonic results are managed and interpreted therefore contributing to effectiveness in the management of safety and health hazards (Alli, 2008; WHO, 2014 and ZACCI, 2014) [1, 25, 27].

8.6 Occupational Disease Hazards

Research by WHO (2014) [25] indicates that air bone hazards such as diesel particulate and silica in underground mining have been on an increase. It is important to limit exposure to hazards that can cause occupational illness including not limited to airborne hazards which require ventilation systems. The Zambian government has taken a stance to continuous address the occupational diseases hazards through the occupational safety and health Act No.36 of 2010 (The Constitution of the Republic of Zambia, 1991) [24].

8.7 Hazards Associated with Water Management

Water management remains an internal function to managing risks associated with water hazards. At the design stage of a mine a consideration of how water will drain away from the ore body, the passage of waste and chutes must be of great importance. There has to be a deliberate act to seal all holes that may cause unnecessary water in the mine. An accumulation of unnecessary water in the mine can ground a mine to a halt resulting in zero productivity as access to the mine would not be possible and all mining activities and process would be affected. A plan for water management in this case is vital as it will reduce water- related hazards. The mine management needs to come up with strategies such as sealing of exploration diamond drill holes that emanate from the surface and grounding fragmented rock masses that could become a passage/conduit for water transmission. There is need for training programs as well as ingestion programs where possible inclusion of converge systems to detect water that inadvertently enters ore and waste passes and chutes; and put the controls for pass control gates in position that are safely accessible. Water management programs should ensure safety of the mine by ensuring management of cracks subsistence of the mine surface is done profoundly to avoid accumulation of water in the mine (Australian Institute of metallurgy, 2001) [2].

8.8 Mobile Equipment Hazards

Heavy mobile equipment poses a hazard to mine safety. In the past 20 years, mobile equipment has displaced ground control issues as major sources of falaties and injuries in mining. Both underground and open pit mines make use of large mobile equipment that pose a hazard, especially in instances where the operator's visibility is distracted due to the size of the equipment (Hermans, 2007) [2]. Operators of the equipment are unable to see other vehicles and pedestrians and this results in unsafe working conditions as more fatal accidents and injuries occur due to inability of the operators to have a clear view of the physical work environment. There is need to embrace more technological detections that will contribute to a safe work environment. For example, mining safety systems such as Hazardous Area Signaling and Ranging Device (HASARD) can be employed. The relevant authorities should encourage research in this area to address the problem of hazards created by heavy mobile equipment.

8.9 Occupational Health and Safety in Mining (OHS in Mining)

Mining like any other industry in Zambia subscribes to Occupation and health and Safety (OHS) legislation. Globally, OHS is generally a new discipline that is still in its infancy stage, as statistics of accident and occupational diseases indicate low global access to it. In the current state, there is no express provision made in the Constitution of Zambia for the safety and health of workers. Nevertheless, under Part 3 of the Constitution which addresses the "Protection of the Fundamental Rights and Freedoms of the Individual", issues of public health and public safety have been alluded to in general terms. Further, Article 14 provides for the protection of individuals from forced labour. The only provision in the Constitution that is closely related to occupational safety and health is clause (1) of Article 24 which states that "A young person shall not be employed and shall in no case be caused or permitted to engage in any occupation or employment which would prejudice his health or education or interfere with his physical, mental or moral development…". In 1964, Zambia after gaining independence immediately became a member of the International Labour Organization (ILO). It since then ratified 39 ILO Conventions including the core conventions concerning the promotional framework for Occupational Safety and Health. Apart from the Safety and Health in Mines Convention (1995) [20], Zambia has not ratified the main conventions relating to Occupational Safety and Health and these endorsements still fall far below the scheduled 177 technical conventions. However, based on the legislative framework, Zambia relies on Main laws on Occupational Safety and Health enacted to provide health and safety to the working population. These laws provide guidelines in different sectors of industry on handling matters on safety and health.

9. Research Methodology

A case study of Konkola Copper Mine (KCM) was employed as a research design that adopted both quantitative and qualitative methods. The study targeted Konkola Copper Mine safety department employees as they provided responses that had high reliability and validity levels. The quantitative and qualitative data were analyzed using SPSS version 20.0 and thematic analysis respectively. The multiple-regression model equation was used to further analyze research outcomes which was derived from the function formula; $Y=b_0 + b_1X_1 + b_2X_2 + + b_nX_n$. In this model, y is mining productivity, b_0 is the constant or the y-intercept, X_1 is the first in dependent variable which is Wellness Programmes, the b_1 is the coefficient of X_1. The last independent variable corresponding to X_n is the last variable in the list of independent variable which happens to be Organisation Commitment and its coefficient $b_{n,}$ Based on this formula, our model will then be written as: Y=2.083 -

$$0.399X_1-0.077X_2+0.364X_3-0.004X_4+0.298X_5+0.26X_6+0.155X_7+0.308X_8-0.271X_9+0.094X_{10}072X_{11}+0.002X_{12}+0.065X_{13}-0.276X_{14}+0.044X_{15}+0.321X_{16}+0.17X_{17}+0.82X_{18}$$

10. Reliability and Validity

Reliability is an indicator of a measure`s internal consistency. Consistency is the key to understanding reliability (Zikmund, *et al*, 2013; Cox and Tait, 1998) [28, 4] A measure is reliable when different attempts at measuring something converge on the same result. The total number of items tested for reliability using Cronbach's alpha in the study were 19 as indicated in table 1 below. The 19 items also represent the independent variables for the study as explained in the hypotheses.

Table 1: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.890	.895	19

A reliability analysis was carried out on the perceived task values scale comprising 19 items.

Scale with a coefficient α 0.80 and 0.95 are considered to have very good reliability. Scales with a coefficient α between 0.70 and 0.80 are considered to have a good reliability and α value between 0.60 and 0.70 indicates fair reliability whereas α below 0.6 indicates a poor reliability (Zikmund *et al* 2013: 302) [28]. A Cronbach's alpha showed the questionnaire to reach very acceptable internal reliability with α = 0.890 indicating very good reliability. Most items appeared to be worthy of retention, resulting in a decrease in the alpha if deleted. The fact that the items were able to measure the intend purpose it indicated validity of the research instruments.

Table 2: Multiple Regression analysis for mining productivity and Job satisfaction as dependent variables

Mining productivity as Dependent variable							
MP	B	Sig	Const	R	R^2	F	F-Sig
		0.002	2.083	0.721	0.520	3.133	0.001
WP	-0.399	0.001					
STPE	-0.077	0.585					
APM	0.364	0.062					
OHP	-0.004	0.982					
HP	0.298	0.050					
SPRM	0.260	0.117					
SAHR	0.155	0.424					
FAST	0.308	0.048					
OSS	-0.271	0.089					
SNORA_1	0.094	0.311					
SNORA_2	-0.072	0.691					
MORRHS	0.002	0.988					
WPs	0.065	0.653					
STEs	-0.276	0.058					
APMs	0.044	0.774					
HPs	0.321	0.010					
WA	0.170	0.072					
OC	0.82	0.477					

Job Satisfaction as Dependent Variable							
JS	B	Sig	Const	R	R^2	F	F-Sig
		0.346	0.324	0.888	0.788	10.767	0.000
WP	-0.023	0.697					
STPE	-0.011	0.886					
APM	0.045	0.649					
OHP	-0.166	0.085					
HP	-0.128	0.105					
SPRM	0.086	0.319					
SAHR	0.072	0.475					
FAST	0.002	0.982					
OSS	0.023	0.775					
SNORA_1	0.032	0.506					
SNORA_2	0.192	0.047					
MORRHS	-0.025	0.709					
WPs	0.072	0.344					
STEs	0.159	0.038					
APMs	0.055	0.491					
HPs	0.166	0.010					
WA	0.238	0.000					
OC	0.156	0.012					

Mining Productivity as Dependent and Job Satisfaction as indep							
MP	B	Sig	Const	R	R^2	F	F-sig
		0.000	1.892	0.395	0.156	12.766	0.001
JS	0.503	0.001					

11. Findings and Discussions

The discussion of the findings were guided by research hypothesis derived from study objectives

11.1 Mining Productivity and Job Satisfaction

Three multiple regressions were conducted in line with the model as in the above table. The first one was involving mining productivity(MP) as the dependent variable and the following independent variables; Wellness Programmes(WP), Safety Training and Education(STE), Accident Prevention Measures(APM),Occupational azard Prevention(OHP),Health Practices(HP),Safety and Health Rules(SAHR), First Aid Support and Training(FAST), Organisational Safety Support(OSS), Nature and Scope of Mining Operational Risk first Group(NSOR), Scope and Nature of Mining Operational Risk first Group(SNSOR)_1, Scope and Nature of Mining Operational Risk Second Group(SNSOR)_2, Operational Risk Management Strategies Development to Ensure Viability of th Mine(MORRHS),Wellness Programmes Satisfaction(WPs), Safety Training and Education Satisfaction(STEs), Accident Prevention Satisfaction(APMs), Health Practice Satisfaction(HPs),Work Alienation(WA), and Organisation Commitment(OC).

Table 3: Item Summary Descriptive Statistics

Item Statistics			
	Mean	**Std. Deviation**	**N**
Wellness Programmes (WP)	4.08	.874	71
Safety Training and education (STE)	3.80	.839	71
Accident Prevention measures(APM)	4.30	.684	71
occupational hazards prevention (OHP)	3.80	.646	71
Health Practices (HP)	4.06	.754	71
Safety Procedures and risk Management (SPRM)	3.80	.821	71
Safety and health Rules (SAHR)	3.92	.692	71
First-AID supports and Trainings (FAST)	4.39	.643	71
organizational safety Supports (OSS)	3.79	.695	71
The scope and nature of operational risks at KCM associated with the following is minimal.	3.56	.952	71
The scope and nature of operational risks at KCM associated with the following is minimal.	4.11	.708	71
KCM has in place measure and practices which have minimized operational risk related to health and safety. (MORRHS)	3.89	.785	71
Wellness Programmes(WPs)	3.80	.786	71
Safety Training and education (STE)	3.73	.810	71
Accident Prevention Measures (APM)	3.92	.692	71
Health Practices (HP)	3.58	.856	71
Work Alienation (WA)	1.89	.887	71
Organizational Commitment (OC)	3.69	.803	71
Mining Productivity(MP)	3.62	.704	71

12. Descriptive Statistics Summary

The table 3 displays means and standard deviations for each of the question items in the questionnaire. If all the items are tapping into the same concept, the scores are expected to be fairly similar indicating Multicollinearity of the items. Any items that have scores which are quite a lot higher (or lower) than the others may need to be removed from the questionnaire to make it more reliable. In this case, item 17: 'Work alienation' seems to have a higher average score than the other items. This is because if we were to round off of the item to zero decimal, they would all be 4 except for item number 17. This appears consistent with observations made in the other tables. However, in terms of the understanding, Item number 17 has consistently shown this behaviour due to the fact that it weighs more on lower values. If a respondent feel that they are greatly alienated, they would pick a value from the Likert scale between 4 and 5, otherwise, they would go for the lower values. Alienation is a negative feeling, that is why in the questionnaire, the questions on the scale implies that the bigger the value the more negative the situation. This would explain the lack of correlation to the rest of the questions, which have a consistent meaning in terms of the value. On this basis, it would still be okay to maintain item number 17 despite the picture it has presented.

Table 4: Correlation of Mining Productivity with all Variables

Mining Productivity	Pearson Correlation
WP	-0.109
STE	-0.056
APM	0.059
OHP	-0.010
HP	0.014
SPRM	0.165
SAHR	0.226
FAST	0.304**
OSS	0.009
SNOR1	0.132
SNOR2	0.001
MORRHS	0.206
WPs	0.095
STEs	-0.106
APMs	0.226
HPs	0.417**
WA	0.136
OC	0.193

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

The correlation of Mining productivity with all the independent variables reviews that only two items are significant. These are HP and FAST the rest are not significant.

Model R=0.721, this value represents positive correlation between mining productivity and the group of the independent variables. From this value, it can be inferred that as the group of independent variables increased their value that is jointly moving from 1 to 5 where one is a value place to five being a high value place, mining productivity was proportionally moving. The figure 0.721 of the Pearson correlation appears to be closer to 1 than it is to 0. This can be inferred that the relationship observed is strong. R^2=0.520 which means that 52% of the productivity can be explained by the joint independent variables' influence on productivity. As to whether the model can be used to predict mining productivity based on the state of the independent variables, is question that can be answered by looking at the value of F and the F-sig which in this case is 3.133 and 0.001 respectively. Since the significant value=0.001 is less than 0.05, it can be concluded that the model is useful for making mining production prediction in the context of the independent variables.

The model equation will be derived from the function formula; $Y=b_0 + b_1X_1 + b_2X_2 + \ldots\ldots + b_nX_n$. In this model, y is mining productivity, b_0 is the constant or the y-intercept, X_1 is the first in dependent variable which is Wellness Programmes, the b_1 is the coefficient of X_1. The last independent variable corresponding to X_n is the last variable in the list of independent variable which happens to be Organisation Commitment and its coefficient b_n. Based on this formula, our model will then be written as:

$$Y=2.083-0.399X_1-0.077X_2+0.364X_3-0.004X_4+0.298X_5+0.26X_6+0.155X_7+0.308X_8+0.271X_9+0.094X_{10}-0.072X_{11}+0.002X_{12}+0.065X_{13}+0.276X_{14}+0.044X_{15}+0.321X_{16}+0.17X_{17}+0.82X_{18}$$

Examining the independent variables reveal that only four of the 18 independent variables where statistically significant. These are Wellness Programmes, Health Programmes, First Aid Support and Training and Health Practice Satisfaction. Wellness programmes has a P-value=0.001 which is less than 0.05. However, its coefficient implies that one-unit increase in the wellness programme results in a reduction of 0.399 in mining productivity. Health Programmes has a P-value=0.05 which is significant since it is not greater than 0.05. The implication of the coefficient of this variable is that one-unit increase in health programmes will result in 0.298 increase in productivity when all other variables are kept constant. First Aid Support and Training has a P-value=0.048 which is significant since it is less than 0.05. The coefficient value of 0.308 means that one-unit increase in this variable will result in 0.308 increase in mining productivity when all other variables are held constant. Health Programme satisfaction variable has a P-value=0.010 which is significant since it is less than 0.05. The implication of the coefficient is that one-unit increase in this variable under discussion will results in 0.321 increase in mining productivity.

Further examination of the variables show other variables which are significant at 0.1 level which implies 90% confidence level. These are APM, OSS, STEs and WA.

The b_0=2.083 and is significant since P-value=0.002 which is less than 0.05. This implies that when all the variables are equal to 0, the value of productivity will be 2.083. This represent a negative productivity on the Likert scale ranging from 1 to 5 where 1 is strongly disagree with good productivity, 2 is disagrees, 3 is neutral, 4 is agree and 5 is strongly agree.

13. Staff Job Satisfaction

The next model is for Staff Job Satisfaction and the same group of independent variable as in the previous model. The model major statistical values are presented in the table above. The Pearson Correlation Coefficient for this model R=0.888 which is very strong relationship. R^2=0.788 which implies that 79% of staff Job Satisfaction can be explained by the group of independent variable shown in the table above. To answer the question as to whether the model cam be used for prediction purposes, we can examine the F value and its corresponding significance. From the table the values are 10.767 and 0.000 respectively. This implies that the model is significant since its P-value=0.000 is less than 0.05. Substituting the observed coefficient values in the regression formula we get the following equation:

$$Y=0.324-0.023X_1-0.011X_2+0.045X_3-0.166X_4-0.128X_5+0.086X_6+0.072X_7+0.002X_8+0.023X_9+0.032X_{10}+0.192X_{11}-0.025X_{12}+0.072X_{13}+0.159X_{14}+0.055X_{15}+0.166X_{16}+0.238X_{17}+0.156X_{18}$$

Where Y is Job satisfaction and X_1 to X_{18} represents the independent variables in the order they are shown in the table. When examined, there five independent variables which are statistically significant at the significant level of 0.05. These are highlighted in the tables above.

14. Results of Hypothesis

Table 5

Hypothesis	Results	P-value
Wellness Programmes(WP) has positive effect on mining productivity	Supported	0.001
Safety Training and Education(STE) has positive effect on mining productivity	Not Supported	0.585
Accident Prevention Measures(APM) has positive effect on mining productivity	Not Supported	0.062
Occupational Hazard Prevention(OHP) has positive effect on mining productivity	Not Supported	0.982
Health Practices(HP) has positive effect on mining productivity	Supported	0.050
Safety and Health Rules(SAHR) has positive effect on mining productivity	Not Supported	0.117
First Aid Support and Training(FAST) has positive effect on mining productivity	Not Supported	0.424
Organisational Safety Support(OSS) has positive effect on mining productivity	Supported	0.048
Nature and Scope of Mining Operational Risk first Group(NSOR-1) has positive effect on mining productivity	Not Supported	0.089
Scope and Nature of Mining Operational Risk first Group(SNSOR-2) has positive effect on mining productivity	Not Supported	0.311
Scope and Nature of Mining Operational Risk Second Group(SNSOR) has positive effect on mining productivity	Not Supported	0.691
Operational Risk Management Strategies Development to Ensure Viability of the Mine(MORRHS) has positive effect on mining productivity	Not Supported	0.988
Wellness Programmes Satisfaction(WPs) has positive effect on mining productivity	Not Supported	0.653
Safety Training and Education Satisfaction(STEs) has positive effect on mining productivity	Not Supported	0.058
Accident Prevention Satisfaction(APMs) has positive effect on mining productivity	Not Supported	0.774
Health Practice Satisfaction(HPs) has positive effect on mining productivity	Supported	0.010
Work Alienation(WA) has negative effect on mining productivity	Not Supported	0.072
Organisation Commitment(OC) has positive effect on mining productivity	Not Supported	0.477
Wellness Programmes(WP) has positive effect on Job Satisfaction	Not Supported	0.697
Safety Training and Education(STE) has positive effect on Job Satisfaction	Not Supported	0.886
Accident Prevention Measures(APM) has positive effect on Job Satisfaction	Not Supported	0.649
Occupational Hazard Prevention(OHP) has positive effect on Job Satisfaction	Not Supported	0.085
Health Practices(HP) has positive effect on Job Satisfaction	Not Supported	0.105
Safety and Health Rules(SAHR) has positive effect on Job Satisfaction	Not Supported	0.319
First Aid Support and Training(FAST) has positive effect on Job Satisfaction	Not Supported	0.475
Organisational Safety Support(OSS) has positive effect on Job Satisfaction	Not Supported	0.982
Nature and Scope of Mining Operational Risk first Group(NSOR-1) has positive effect on Job Satisfaction	Not Supported	0.775
Scope and Nature of Mining Operational Risk first Group(SNSOR-2) has positive effect on Job Satisfaction	Not Supported	0.506
Scope and Nature of Mining Operational Risk Second Group(SNSOR) has positive effect on Job Satisfaction	Supported	0.047
Operational Risk Management Strategies Development to Ensure Viability of the Mine(MORRHS) has positive effect on Job Satisfaction	Not Supported	0.709
Wellness Programmes Satisfaction(WPs) has positive effect on Job Satisfaction	Not Supported	0.344
Safety Training and Education Satisfaction(STEs) has positive effect on Job Satisfaction	Supported	0.038
Accident Prevention Satisfaction(APMs) has positive effect on Job Satisfaction	Not Supported	0.491
Health Practice Satisfaction(HPs) has positive effect on Job Satisfaction	Supported	0.010
Work Alienation(WA) has negative effect on Job Satisfaction	Supported	0.000
Organisation Commitment(OC) has positive effect on Job Satisfaction	Supported	0.012
Job Satisfaction has Positive effect on mining productivity.	Supported	0.001

15. Mining Productivity and Job Satisfaction

The next model is a depiction of the relation between Mining Productivity and Job Satisfaction. The model's value is presented in the right part of the table. The R value=0.395 which indicates an average relationship between Mining productivity and Job Satisfaction. R^2=0.156 implying that 16% of Job Productivity is explained by staff Job Satisfaction. The group independent variables have a very strong correlation with Job Satisfaction and which means that this 16% that Job Satisfaction contributes is very significant. The model appears significant for making predictions going by the F value of 12.766 and F significant value of 0.001.

$Y=b_0+b_1X_1$

Where Y is mining productivity and b_0 =1.892 is the y-intercept b_1 is the coefficient of X_1 = 0.503 which is job satisfaction. The Coefficient of Job Satisfaction is very significant since P-value=0.001 is less than 0.005.

15.1 Job satisfaction as an ``Operational risk'' affect Mining productivity?

The overall satisfaction of an employee with his job is the result of a combination of factors and financial compensation is only one of them. Management's role in enhancing employees' job satisfaction is to make sure the work environment is positive, morale is high and employees have the resources they need to accomplish the tasks they have been assigned. Table 2 indicated that job satisfaction had strong relationship with mining productivity as noted from a Pearson coefficient correlation of R=0.888 which is closer to 1. Staff Job satisfaction was significant to mining productivity as its P-value was 0.000 which was less than 0.05

Much research evidence shows that employees who experience high levels of job satisfaction are also more productive. Studies conducted since the 1980s show links among employee satisfaction, productivity and corporate financial success. Employees who are happy in their jobs tend to work harder and are more motivated in their work leading to greater productivity. The table 3 indicated a Pearson correlation R^2=0.788 which interpreted that 79% of Staff Job Satisfaction was explained through various group independent variables that had an effect on the staff job satisfaction. One key element for businesses seeking an increase in productivity is to find out what makes employees satisfied with their jobs. It is important to give job satisfaction the same importance with as other operational risks as agreed with Hermans (2007) [7] who postulated the importance of equating of all operational risk management functions for purposes of enhancing productivity.

16. Conclusion and Recommendations

Staff job satisfaction comes through organizational commitment to meeting the expectations of the employees. Once the employees are satisfied, work alienation will be eliminated. Job satisfaction positively contributed to mining productivity as noted from table 2 that indicated that the activities of Job satisfaction influenced mining productivity by 16%. This indicated that the significance of the Job satisfaction activities to mining operations. If the mine was to ignore the various contents of organization commitment to meeting employees' expectation, it would have a negative impact on mining productivity. From the analysis and interpretation of the data it was quite evident that KCM was making positive efforts towards the management of safety and health issues. However, there was still need for continuous improvement especially considering the fact that any business organization, including KCM, would not want to lose people's lives and property. The following were recommendations based on study findings: 1. KCM should introduce a fully-fledged function dealing with the operational risks management. 2. KCM should employ full time Risk managers to deal with operational risk management function. 3. KCM should review the training that was given to personnel where accidents were more common than in other departments and areas.

17. References

1. Alli BO. Fundamental principles of occupational health and safety, International Labour Office, Geneva: ILO, 2008.
2. Australian Institute of metallurgy, The Minerals Institute, Australia: AUSIMM, 2001.
3. Chifungula A. Report of the Auditor General on the Management of Occupational Health and Safety, Lusaka, 2015.
4. Cox S, Tait R. Safety, Reliability and Risk Management. Butterworth-Heinemann: Oxford, 1998.
5. CSO. The monthly Central Statistical Office Bulletin, Lusaka: CSO, 2016.
6. Edwards JC. Cfd Modeling of Fire Spread Along Combustibles in a Mine Entry. Pittsburgh: PA, 1988.
7. Hermans A. Occupational Health and Safety in Mining-Status, New Development and Concerns, The Journal of the Southern African Institute of Mining and Metallurgy, 2007, 107.
8. ICMM. ICMM. Enhancing mining's contribution to the Zambian economy and society. Lusaka: Chambers of Mines of Zambia, 2014.
9. ILO. Your Health and Safety at Work, Introduction to Occupational Health and Safety, Accessed: 29th April, 2017. www.ilo.org/safework/info/instr/WCMS_113080/langen/index.htm
10. ILO. Zambia Country Profile on Occupational Health and Safety. Lusaka: ILO, 2012-2015.
11. International Council on Mining and Metals (ICMM) and the Chamber of Mines of Zambia, Zambia, 2014, 7-12.
12. Kuytu FY, Bolat HB. Conceptual Framework for Sustainable Mining Sector Evaluating Automation Technologies and Safety Risk, Dept of Logictics, Anadolu University Eskisehir, Turkey, 2016.
13. Lluis, Marc, Hernan, and Eduard. Analysis of Occupational Accidents in Underground and Surface Mining in Spain Using Data-Mining Techniques; Int J Environ Res Public Healthv. 2018; 15(3). MPMC5877007
14. Makin AMC, Winder A. new Conceptual Framework to improve the Approach of Occupational Health and Safety Management System, Safety Science, School of Safety Science, The University of New South Wales, Sydney, Australia. 2008; 46:935-948.
15. Mc Leroy, *et al*. Miners' Views About Personal Dust Monitors, Pittsburgh: PA, 1988.
16. Moyo D. Review of Occupational Health and Saftey, Organization in Expanding Economics, The case of Southern Africa, Annals of Global Health. 2015; 81:495-502.
17. Mrema E, Ngowi V, Mamuya S. Status of Occupational Health and Safety and related Challenges in Expanding economy of Tanzaia, 2015, Annals of Global Health. 2015; 81:539-54.

18. Ontario Canada Mine Report on Safety and Occupational Health Ontario-Canada, 2014.
19. Prial Dey. Health and Safety Hazards: Mining Health, Safety and Prevention. Ontario: Ontario Ministry of Labour, 2015.
20. Safety and Health in Mines Convention Safety and Health in Mines Convention, 1995, 176.
21. Smith P, Saunders R, Lamontagne A. Developing a framework understanding and measuring Occupational Health and Safety Vulnerability, Monash Centre for Occupancy and Environmental Health, Research Report. 2013; 1113-041-R1C.
22. Stephenson A. Managing Occupational Health and Safety: A Multidisciplinary approach: Thornton Bulterworth: London, 1991.
23. The Auditor General Report. Zambia, 2015.
24. The Constitution of the Republic of Zambia, 1991.
25. WHO. Occupational Health and Safety Summit Milestones; MHSC, 2014.
26. World Bank. Mining and environmental Remediation and implemented Project, 2016.
27. Zambia chambers of commerce Mining for Zambia, Lusaka: ZACCI, 2014.
28. Zikmund W, Barry J. Babin, Jon C. Carr, Mitch Griffin. Business Research methods, Cengage, 2013.