

# Human Resource attributes influence organizational effectiveness in opencast mines

## Atributos de recursos humanos influyen en efectividad organizacional de minas

Padma Charan MISHRA [1](#); Manoj Kumar MOHANTY [2](#); Manmohan MALL [3](#); Uma Sankar MISHRA [4](#)

Received: 14/07/2017 • Approved: 10/08/2017

### Content

- [1. Introduction](#)
- [2. Literature Review](#)
- [3. Gap in research](#)
- [4. Summary of attributes under study in Indian massively deposited mines](#)
- [5. Research Methodology](#)
- [6. Attributes affecting productivities and organizational effectiveness of Indian opencast mines](#)
- [7. Summary & Conclusion](#)

### References

#### ABSTRACT:

After the super economic cycle from 2002 to 2010, the mining industry is trying to re-emerge and recuperate the lost ground by implementing various productivity improvement and sustainability measures. Aspects related to redefining the Human Resource (HR) issues are yet to be considered vital and almost no evidence of research carried out in last 5-years. This paper is making an attempt to explore the human attributes, which are directly and indirectly affecting the organizational outcomes.

**Keywords:** Indian opencast mines; HR attributes; Organizational effectiveness; Factor Analysis

#### RESUMEN:

Después del ciclo Super económico de 2002 a 2010, la industria minera está tratando de resurgir y recuperar el terreno perdido mediante la implementación de diversas medidas de mejora de la productividad y sostenibilidad. Los aspectos relacionados con la redefinición de las cuestiones de recursos humanos (RRHH) aún no se consideran vitales y casi no existen pruebas de investigación realizadas en los últimos 5 años. Este trabajo está haciendo un intento de explorar los atributos humanos, que están directa e indirectamente afectando los resultados de la organización.

**Palabras clave:** minas a Indias; Atributos de RRHH; Efectividad organizacional; Análisis factorial

## 1. Introduction

Mining is considered as 2nd basic primary sector economy. It provides vital inputs to numerous

industries. Mining has direct and indirect impact on economy. In 2010, the nominal value of world mineral production was nearly four times higher than it had been in 2002. This increase has in large part been driven by the unprecedented growth in China, India and other emerging economies coupled with the associated sharp rise in commodity prices (International Council on Mining & Metals, UK, October, 2012). The industry was experiencing super economy cycle. When the world was facing global financial crisis, mining companies were being sheltered due to prolonged super cycle. After the super cycle got over, the commodity prices have come off their highs, margins got much tighter and cost rationalization is once again became a critical issue (Chris Thomas, Partner, Energy & Resources, Deloitte, UK, 2013). The Industry started facing various problems. Productivity boost was required to regain ground lost over the super cycle or activities of mining, to continue to innovate to recover lost competitive advantage and to counteract rising real wages (Paul Mitchell & John Steen, 2014). The mining industry started facing a range of economic, technological, social, and environmental challenges all impacting on productivity and sustainability (Bearman, 2012; Prior *et al.*, 2012).

The opencast mining process is a chain activity. Each step in process has various inputs to proceed to next chain of actions. Inputs are in form of man, machine, material, money and time. During each mining activity there are always scopes for improvement. Judicious resources engagements are always there throughout each operational activity. The real focus is mostly on cost cutting measures, technology improvement, economies of scale etc. but Human Resources attributes are also no less important for organizational effectiveness and sustainability. The effectiveness of organization largely depends on the effective utilization of human resources. Literatures, in this regard, were examined from 1974 to 2012 to explore HR (Human Resource) attributes affecting opencast mining production and its effectiveness. There are no researches observed in addressing HR related attributes in this particular industry after 2012. Though the HR attributes plays a significant role in shaping the effectiveness of any organization, this study is an attempt to re-explore the influencing factors and their attributes addressing the misery of opencast mining field. The attributes so obtained were taken for redefining in the Indian opencast mines context considering few gaps came across during field study.

---

## 2. Literature Review

In this section, 12-articles consisting of 18-attributes were analyzed. These attributes were influencing productivity and organizational effectiveness in different countries. All those people's factors related to opencast mining fields are discussed here.

Human factors were being considered of great importance in tough fields like mining. Lawrence (1974) used different models like, Satisfaction-Performance Model (SPM), Performance-Satisfaction Model (PSM), Pressure-for-Production Model (PPM) and Performance-Rewards Cyclic Model (PRCM) to analyze and investigate causal link and relation of human factors on productivity. He identified Competence (C), Opportunity (O), Recognition (R) and Enrichment/Expectations (E) have impact on organizational effectiveness to address productivity to a great extent. Effect of *Unionization* investigated at USA coal mines in comparing mines having union and mines without any union. Byrnes *et al* (1988) used nonparametric tests and econometric approach in comparing two sets of mines from 1975 to 1978 with a sample size of 113. The nonparametric test result was 33 out of 35 mines had higher productivity with union and econometric approach indicated presence of union had positive effect on organization.

Every workplace is inimitable on different aspects, like people, environment, machinery configuration, performance strategies and job assigned. Within that work environment, familiarity is the specific work knowledge of almost within. Goodman and Leyden (1991) used samples from two mines and also used data of The Carnegie Mellon Coal Research Project, USA to test the effect of *familiarity* on group productivity. They used Random Assignment Process of Construction methodology on familiarity variables to observe an 11% increase in production level through increase in familiarity level with the staffing change during absenteeism of few workers of a group. Kumar and Huang (1993) used a simulation program SIMURES analyzing

various critical factors to find out the bottlenecks at Kiruna Iron Ore Mine, Sweden. Within 100-days, the program was applied for 1729-hours. The study indicates for 76% of system availability, *operator availability* factor has to be 95%.

The study of Akcakoca *et al* (2006) at Lignite Mining Company used methodology as Labour Productivity Management by Ratio (WPMR) model to evaluate *labour productivity*. Their emphasis was mining being a labour-intensive industry handling all raw materials and goods, labour responsibility is a sub-factor linked with labour productivity. The team of Topp *et al* (2008) estimated multifactor productivity of 08-mining sub-industries using neoclassical growth model in Australia with data sources from Australian Bureau of Statistics. The HR related attribute found influencing productivity was *work practices*.

Study of Akcakoca *et al* (2008) on Western Lignite Cooperation (WLC), Turkey's opencast and underground coal mines from 1991 and 2002 using linear regression–correlation analysis between production factor values (PFV) and productivity index values (PIV) to determine the most effectual parameters on productivity indexes. *Inadequate training* and *labour productivity* (over staffing) are attributes found sinking productivity and profit of company. Okely (2009)'s article explores *up to date training* is a key attribute in operation and maintenance of mining equipment will have power saving up to 20% in Australian Mining industry. Recommendation was to have sources with adequate information in panicking situations.

Bradley and Sharpe (2009) prepared a report on Canadian Mines collecting data from CSLC (Centre for the Study of Living Standards Research) database. Using Tang and Wang (2004)s' methodology and comparing data from period 1989-2000 and 2000-2009, observed decline in productivity had links with *workforce* and *labour relations*. The influx of untrained *workforce quality was found poor* and the level of mining education was poor during these periods.

Groeneveld and Topal (2011) used Monte Carlo Simulation (MCS) & Mixed Integer Programming (MIP) in Australian Gold mines to evaluate flexibility of mining design under uncertainty to observe *human capital* is one of the prominent attribute. Takahashi (2011) studied 21 opencast coal mines in Australia from 1985 to 2005 to eliminate demarcation of jobs between production and maintenance. He observed *multitasking jobs* can improve productivity from 27% to 33%. The expert panel GlobalData (2012), South Africa using both primary and secondary data from different strata of mines found *labour unrest* at platinum and gold mining industry cost around \$518 million and the coal, manganese, nickel and chromium industries lost around \$13 million in FT-2012.

**Table 1**

Summary of HR attributes affecting opencast mining production and its effectiveness

Author	Year	Country	Source of Data	Attributes
Lawrence	1974	South Africa	Research Journal	Competence
				Opportunity
				Recognition
				Enrichment/ Expectations
Byrnes et al	1988	USA	Research Journal	Unionisation
Goodman and Leyden	1991	USA	Research Journal	Familiarity on work environment
Kumar and Huang	1993	Sweden	Conference Paper	Operator availability

Akcakoca et al	2006	Turkey	Research Journal	Labour productivity
Topp et al	2008	Australia	Staff Working Paper	Work practices/ culture
Akcakoca et al	2008	Turkey	Research Journal	Training
				Labour productivity
Okely	2009	Australia	Trade Journal	Training
Bradley and Sharpe	2009	Canada	CSLS Report	Quality deterioration of Work force
				Labour Relations
Groeneveld and Topal	2011	Australia	Research Journal	Human Capital
				Legislative Changes
Takahashi	2011	Australia	Research Journal	Multitasking jobs
GlobalData	2012	South Africa	Report	Labour Unrest

### 3. Gap in research

During the field study many experts were consulted regarding the HR related attributes influencing organizational effectiveness. Three attributes found as gap for this study. Those attributes are *Safety protocol*, *Influence of local politicians* and *Alcoholism*.

### 4. Summary of attributes under study in Indian massively deposited mines

The attributes collected from literature reviews and gaps with a generalized nomenclature are mentioned below with variable code, which were tested in Indian environment.

**Table 2**

Table: 2 Summarized HR attributes influencing organizational effectiveness in Opencast mines

Variable Code	Sub factors
VAR01	Work culture
VAR02	Opportunity to deliver
VAR03	Labour laws
VAR04	Safety protocol
VAR05	Level of engagement
VAR06	Labour Unrest
VAR07	Skill Level of Operators
VAR08	Task Accountability

VAR09	Labour Productivity
VAR10	Working environment
VAR11	Skill building measures
VAR12	Multi-tasking
VAR13	Familiarity on work environment
VAR14	Influence of local politicians
VAR15	Union management relationship
VAR16	Alcoholism
VAR17	Recognition & Enrichment
VAR18	Attitude of worker

## 5. Research Methodology

Six massively deposited opencast/ surface mines from Odisha, Chhattisgarh and Jharkhand States of India were selected for this study. These mines are involved with iron ore, coal, bauxite and limestone & dolomite. Samples were collected from executive employees with minimum 5-years of experience in the opencast mining operations and retired experts with vast experiences. 104 respondents responded out of 120-samples selected. Secondary data (From Literature Review) and Primary (Field) Data collected through both interview (for gap searching) and questionnaire (for data analysis). Expert opinions were collected through structured interview method of 30-minute duration. Experts were asked open ended questions to note down the type of HR attributes prevalent in opencast mining they are/ were working.

Based on the expert opinions and literature reviews, 20-attributes were taken up for the pilot study. Two attributes got very low rating considering Indian scenario. Remaining 18- nos. of questions for 18-attributes was framed for data collection. The questions were framed based on the attributes (impacting productivity and organizational effectiveness in opencast mining) selected through literature reviews and experts opinions. Questionnaire was based on five point Likert scale and closed questionnaire (Yes / No type) for chi-square testing. Data so collected from the respondents were processed through SPSS software. Factors analysis was applied to find out the principal factors of the responsible related to human related attributes and Chi-square for testing of null hypotheses. Eighteen attributes were reduced to three principal factors in this study.

## 6. Attributes affecting productivities and organizational effectiveness of Indian opencast mines

Factor analysis was used to find out the vital factors (or drivers) affecting production and productivity in massively deposited opencast mines in India. To measure and reassure the internal consistency, reliability test was conducted on the 18-variables bearing a Cronbach's alpha of 0.913. The results inferred the questionnaire was measuring the attributes influencing productivity and organization effectiveness in massively deposited Opencast mines industry in India.

**Table 3**

Cronbach's Alpha and Reliability Statistics and Bartlett's Test of Sphericity

--	--

Case Processing Summary			
		N	%
Cases	Valid	104	100
	Excludeda	0	0
	Total	104	100
a. Listwise deletion based on all variables in the procedure.			
Reliability Statistics			
Cronbach's Alpha		N of Items	
0,913		18	

--

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0,917
Bartlett's Test of Sphericity	Approx. Chi-Square	1,02E+03
	Df	901
	Sig.	0

The explorative factor analysis is performed with Varimax rotation using principal component extraction method. The Eigen values of selected factors were greater than 1. The rotated component matrix is represented in table-4, total variance explained in table-5 and principal factors and sub-factors are in table-6.

The technique when initially submitted, numbers of variables got reduced from 20 to 18, two found redundant variables. The remaining 18-variables were factorized into 3- categories based factor-loading and the scores. The sorted rotated factor loading values with minimum of 0.5 or more were considered. Later on a matrix was formed to recognize the significant components that explain 70.58% of variation in the criteria affecting production and productivity. Generally, factor loading represents how much a factor explains a variable. Higher the factor loading, stronger is the influence of variables. Factor loading score of more than 0.70 were considered having high impact on the variables.

**Table 4**  
Rotated Component Matrix

Variable Code	Variables	Component		
		1	2	3
VAR01	Work culture	0,829		
VAR02	Opportunity to deliver	0,677		
VAR03	Labour laws			0,867
VAR04	Safety protocol	0,808		



11	Skill building measures	0,633	1,003	95,062			
12	Multi tasking	0,594	0,931	95,993			
13	Familiarity on work environment	0,417	0,881	96,874			
14	Influence of local politicians	0,316	0,781	97,655			
15	Union management relationship	0,299	0,71	98,365			
16	Alcoholism	0,202	0,652	99,017			
17	Recognition & Enrichment	0,156	0,551	99,568			
18	Attitude of worker	0,109	0,432	100			

**Table 6**  
Principal Factor and sub-factors

Variable Code	Sub factors	Factor
VAR01	Work culture	Organisational Climate
VAR02	Opportunity to deliver	
VAR04	Safety protocol	
VAR08	Task Accountability	
VAR10	Working environment	
VAR11	Skill building measures	
VAR14	Influence of local politicians	
VAR17	Recognition & Enrichment	
VAR05	Level of engagement	
VAR07	Skill Level of Operators	
VAR12	Multi-tasking	
VAR13	Familiarity with work environment	
VAR16	Alcoholism	
VAR18	Attitude of worker	
VAR03	Labour laws	Labour Issues
VAR06	Labour Unrest	
VAR09	Labour Productivity	



## 6.1 Description of principal factors

### **Factor-1: Organisational Climate**

Factor-1 describes the *Organizational Climate* component of attributes which comprised of eight attributes namely, Work culture, Opportunity to deliver, Safety protocol, Task Accountability, Working environment, Skill building measures, Influence of local politicians and Recognition & Enrichment. The factor loads of these eight sub factors have been 0.829, 0.677, 0.808, 0.619, 0.589, 0.829, 0.617 and 0.547 respectively. Work culture, Safety protocol and Skill building measures give impetus for maintaining effectiveness of any industry. Opportunity to deliver and recognition & Enrichment creates a healthy atmosphere. Influence of local politicians is a constant nagging affair in Indian environments.

### **Factor-2: Human Elements**

Factor-2 describes the *Human Elements* attributes which comprised of six attributes namely, Level of engagement, Skill Level of Operators, Multi-tasking, Familiarity on work environment, Alcoholism and Attitude of worker.

The factor loads of these six sub factors have been 0.541, 0.806, 0.714, 0.834, 0.692 and 0.781 respectively. Familiarity on work environment and skill level are high impacting attributes and requires constant encouragement. Attitude of workmen and multi-tasking jobs have significant impact organisational effectiveness. Alcoholism is a cultural disease observed in mining belt. Great care must be taken for judicious work engagement among workmen.

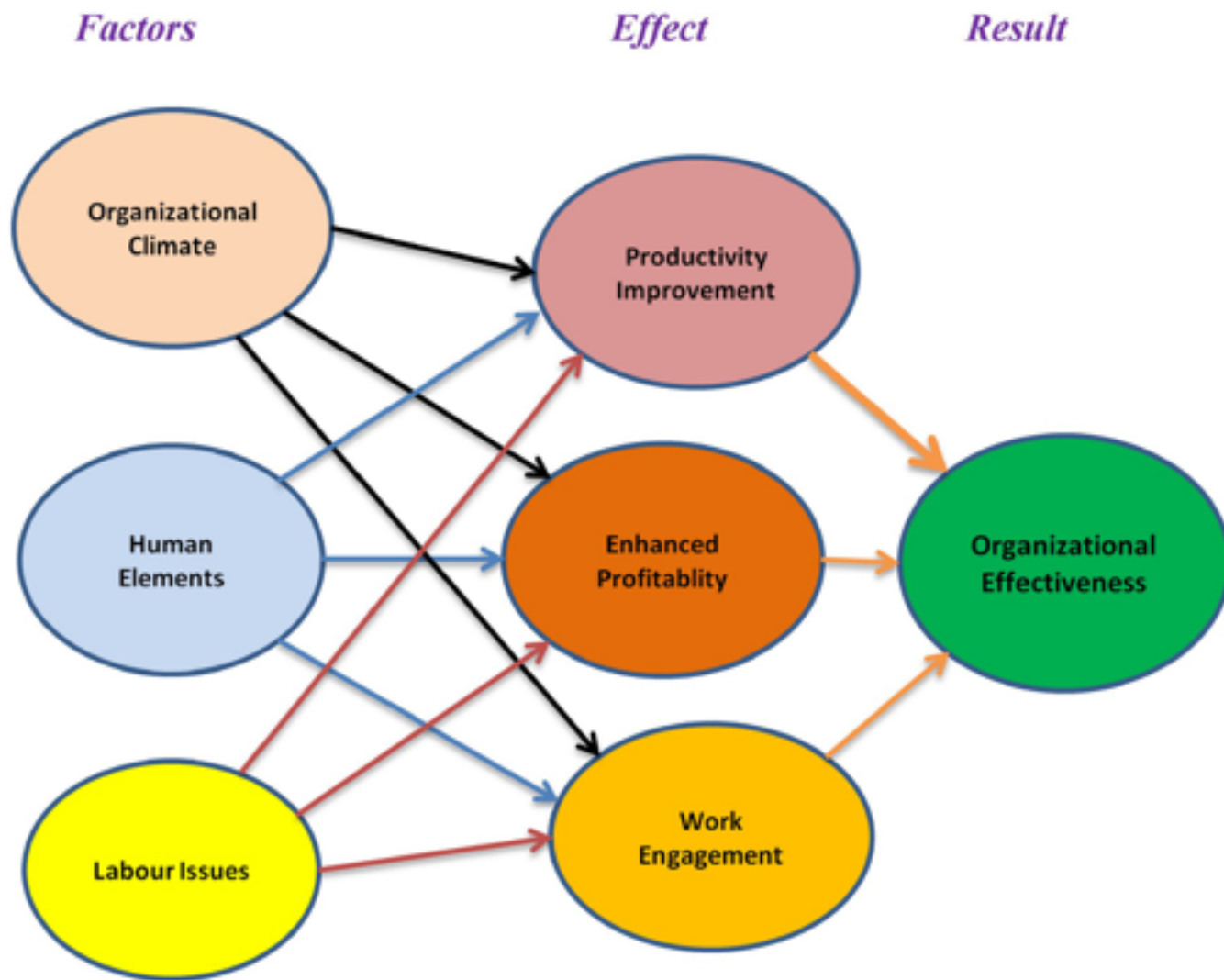
### **Factor-3: Labour Issues**

Factor-3 describes the *Labour related issues* comprising of four attributes, namely Labour laws, Labour Unrest, Labour Productivity and Union management relationship. The factor loads of these four sub factors have been 0.867, 0.822, 0.723 and 0.839 respectively. Labour laws are binding on organisations and sometimes are too taxing. There is hardly any flexibility. The labour unrests generally jeopardises all activities of organisations and creates an atmosphere of suspicions between employer and employees. The output per head of employee engaged should be more than an economic range for the sustainability of the organisation. The presence of union and role as a part of management is always welcome. The vigilant eyes of unions evolve positive approach from management.

## 6.2 Hypotheses

Following null hypotheses were framed based on the principal factor analysis and organizational output attributes. Each principal factor is associated with three organisational outputs i.e. improvement in productivity, enhanced profitability and work engagement of employees. So, nine null hypotheses were framed for testing. The research model is described as below in fig 1.

Fig 1. *Research Model*



### **Hypotheses based on the 1st principal factor – Organizational Climate**

$H_{01A}$ : Organizational climate has no impact on productivity improvement.

$H_{01B}$ : Organizational climate has no impact on enhanced profitability.

$H_{01C}$ : Organizational climate has no impact on work engagement of employees.

### **Hypotheses based on the 2nd principal factor – Human Attributes**

$H_{02A}$ : Human attributes has no bearing on productivity improvement.

$H_{02B}$ : Human attributes has no bearing on enhanced profitability.

$H_{02C}$ : Human attributes has no bearing on work engagement of employees.

### **Hypotheses based on the 3rd principal factor – Labor Issues**

$H_{03A}$ : Labor issues have no influence on productivity improvement.

$H_{03B}$ : Labor issues have no influence on enhanced profitability.

$H_{03C}$ : Labor issues have no influence on work engagement of employees.

## **6.3 Testing of Hypotheses**

In order to fulfill the identified objectives, the hypotheses mentioned above were tested in the present study:

**$H_{01A}$ : Organizational climate has no impact on productivity improvement.**

**Table 7**  
Descriptive statistics for hypothesis H<sub>0</sub>1A

VAR00001			
	Observed N	Expected N	Residual
0	31	52	-21
1	73	52	21
Total	104		
Test Statistics			
		VAR00001	
Chi-Square	16.962a		
df	1		
Asymp. Sig.	0,001		

a. 0 cells (.0%) have expected frequencies less than 5.  
The minimum expected cell frequency is 52.0.

It can be seen from Table: 7 that null hypothesis Organizational climate have no impact on productivity improvement and so rejected at 0.001 significance (Greater than 0.05 to ensure 95% confidence). Hence, it can be said that organisational climate attributes are having impact on organisational productivity.

***H<sub>0</sub>1B: Organisational climate has no impact on enhanced profitability.***

**Table 8**  
Table 8 - Descriptive statistics for hypothesis H<sub>0</sub>1B

VAR00002			
	Observed N	Expected N	Residual
0	38	52	-14
1	66	52	14
Total	104		
Test Statistics			
		VAR00002	
Chi-Square	7.538a		
df	1		
Asymp. Sig.	0,006		

a. 0 cells (.0%) have expected frequencies less than 5.  
The minimum expected cell frequency is 52.0.

It can be seen from Table: 8 that null hypothesis Organisational climate have no impact on enhanced profitability and so it is rejected at level 0.006 significance (Greater than 0.05 to ensure 95% confidence). Hence, it can be said that organisational climate attributes are having impact on enhanced profitability.

***H<sub>0</sub>1C: Organisational climate has no impact on work engagement of employees.***

**Table 9**  
Descriptive statistics for hypothesis H<sub>0</sub>1C

VAR00003			
	Observed N	Expected N	Residual
0	30	52	-22
1	74	52	22
Total	104		
Test Statistics			
		VAR00003	
Chi-Square	18.615a		
df	1		
Asymp. Sig.	0		

a. 0 cells (.0%) have expected frequencies less than 5.  
The minimum expected cell frequency is 52.0.

It can be seen from Table: 9 that null hypothesis Organisational climate have no impact on work engagement of employees and so it is rejected at level 0.000 significance (Greater than 0.05 to ensure 95% confidence). Hence, it can be said that organisational climate attributes are having impact on work engagement of employees.

***H<sub>0</sub>2A: Human attributes has no bearing on productivity improvement.***

**Table 10**  
Descriptive statistics for hypothesis H<sub>0</sub>2A

VAR00004			
	Observed N	Expected N	Residual
0	38	52	-14
1	66	52	14
Total	104		
Test Statistics			

	VAR00004
Chi-Square	7.538a
df	1
Asymp. Sig.	0,006

a. 0 cells (.0%) have expected frequencies less than 5.  
The minimum expected cell frequency is 52.0.

It can be seen from Table: 10 that null hypothesis human attributes has no bearing on productivity improvement and so it is rejected at level 0.006 significance (Greater than 0.05 to ensure 95% confidence). Hence, it can be said that human attributes are having impact on productivity improvement.

***H<sub>0</sub>2B: Human attributes has no bearing on enhanced profitability.***

**Table 11**  
Descriptive statistics for hypothesis H<sub>0</sub>2B

VAR00005			
	Observed N	Expected N	Residual
0	29	52	-23
1	75	52	23
Total	104		
Test Statistics			
	VAR00005		
Chi-Square	20.346a		
df	1		
Asymp. Sig.	0		

a. 0 cells (.0%) have expected frequencies less than 5.  
The minimum expected cell frequency is 52.0.

It can be seen from Table: 11 that null hypothesis human attributes has no bearing on enhanced profitability and so it is rejected at level 0.000 significance (Greater than 0.05 to ensure 95% confidence). Hence, it can be said that human attributes are having impact on enhanced profitability.

***H<sub>0</sub>2C: Human attributes has no bearing on work engagement of employees.***

**Table 12**  
Descriptive statistics for hypothesis H<sub>0</sub>2C

VAR00006			
	Observed N	Expected N	Residual

0	33	52	-19
1	71	52	19
Total	104		
Test Statistics			
		VAR00006	
Chi-Square		13.8856a	
df		1	
Asymp. Sig.		0	

a. 0 cells (.0%) have expected frequencies less than 5.  
The minimum expected cell frequency is 52.0.

It can be seen from Table: 12 that null hypothesis human attributes has no bearing on work engagement of employees and so it is rejected at level 0.000 significance (Greater than 0.05 to ensure 95% confidence). Hence, it can be said that human attributes are having impact on work engagement of employees.

***H<sub>0</sub>3A: Labor issues have no influence on productivity improvement.***

**Table 13**  
Descriptive statistics for hypothesis H<sub>0</sub>3A

VAR00007			
	Observed N	Expected N	Residual
0	37	52	-15
1	67	52	15
Total	104		
Test Statistics			
		VAR00007	
Chi-Square		8.654a	
df		1	
Asymp. Sig.		0,003	

a. 0 cells (.0%) have expected frequencies less than 5.  
The minimum expected cell frequency is 52.0.

It can be seen from Table: 13 that null hypothesis Labor issues have no influence on productivity improvement and so it is rejected at level 0.003 significance (Greater than 0.05 to ensure 95% confidence). Hence, it can be said that Labor issues have influence on productivity improvement.

***H<sub>0</sub>3B: Labor issues have no influence on enhanced profitability.***

**Table 14**  
Descriptive statistics for hypothesis H<sub>0</sub>3B

VAR00008			
	Observed N	Expected N	Residual
0	36	52	-16
1	68	52	16
Total	104		
Test Statistics			
		VAR00008	
Chi-Square	9.846a		
df	1		
Asymp. Sig.	0,002		

a. 0 cells (.0%) have expected frequencies less than 5.  
The minimum expected cell frequency is 52.0.

It can be seen from Table: 14 that null hypothesis Labor issues have no influence on enhanced profitability and so it is rejected at level 0.002 significance (Greater than 0.05 to ensure 95% confidence). Hence, it can be said that Labor issues have influence on enhanced profitability.

***H<sub>0</sub>3C: Labor issues have no influence on work engagement of employees.***

**Table 15**  
Descriptive statistics for hypothesis H<sub>0</sub>3C

VAR00009			
	Observed N	Expected N	Residual
0	35	52	-17
1	69	52	17
Total	104		
Test Statistics			
		VAR00009	
Chi-Square	11.115a		
df	1		
Asymp. Sig.	0,001		

It can be seen from Table: 15 that null hypothesis Labor issues have no influence on work engagement of employees and so it is rejected at level 0.001 significance (Greater than 0.05 to ensure 95% confidence). Hence, it can be said that Labor issues have influence on work engagement of employees.

All the null hypotheses are found to be rejected. Hence, we can conclude that organization climate; human attributes and labor issues are having influence on organizational outcomes i.e. improved productivity, enhanced profitability and work engagement of employees.

---

## **7. Summary & Conclusion**

Productivity if goes down, the reflections appear in their balance sheet of any organization. The effects are widespread which brings misery to many, from families to society as a whole.

Mining, one of the basic industries after agriculture, has tremendous potential to address employment, raw material to process industries, economy etc. The effectiveness of any organization depends on healthy productivity aspects. After the super economic cycle from 2002 to 2010, the industry putting more emphasis on issues related with productivity and sustainability other than HR-attributes. Human Resource issues though vital, remained untouched of research carried out in last 5-years. With principal factor analysis and Chi-square test, this paper has explored HR attributes influencing opencast mining productivity and the linkage between HR inputs with organizational outcomes.

This study has explored around 18-HR attributes which have direct and indirect impact on effectiveness and productivity in opencast mining industry of India. Prominent attributes are Work culture, Union management relationship, Labour laws, Familiarity on work environment, Skill building measures, Labour Unrest, Safety protocol, Skill Level of Operators etc. All those 18-attributes were categorized into three factors based on exploratory factor analysis, such as Organisational Climate, Human Elements and Labour Issues as principal factors. And these factors are directly linked with organizational outcome like improved productivity, enhanced profitability and work engagement of employees. The findings will be helpful in guiding top management to think beyond technology, product and process improvement. The human factors unpack one of the neglectful directions over last many years, which are required to be addressed simultaneously for the sustenance and effectiveness of the industry under study.

---

## **References**

- Akcakoca H, Aykul H, Taksuk M, Ediz I.G, and Dixon-Hardy D.W. (2006), Labour productivity model (WPMR system) and its application to the stripping area of Garp Lignite Enterprise in Turkey, Mining Technology, VOL 115, NO. 1, pp. 12-23
- Akcakoca H., Aykul H., Ediz I.G., Erarslan K. and Dixon-Hardy D.W. (2008), Productivity analysis of lignite production, Journal of the Energy Institute VOL 81 NO 2, pp. 76-81
- Bearman, R.A., (2012), Step change in the context of comminution, keynote paper: comminution 2012. Minerals Engineering, V. 43-44, pp. 2-11
- Bradley C. and Sharpe A. (2009), A detailed analysis of the productivity performance of mining in Canada, Centre for the Study of Living Standards Research (CSLS) Report, pp. 25-44
- Byrnes P., Fare R., Grosskopf S. and Lovel C.A.K. (1988), The Effect of Unions on Productivity: U.S. Surface Mining of Coal, Management Science Vol. 34. No. 9, pp.1037-1053
- Deloitte (2013), Tracking the trends 2013- The top 10 issues mining companies will face in the coming year
- GDMM0016VPT (2012), South Africa Mining Industry - Labor Unrest to Hamper Productivity, GlobalData, pp. 1-5
- Goodman P.S. and Leyden D.P., (1991) "Familiarity and Group Productivity", Journal of Applied Psychology, Vol. 76, No. 4, pp. 578-586



Groeneveld B. and Topal E. (2011), Flexible Open-Pit Mine Design Under Uncertainty, Journal of Mining Science, Vol. 47, No. 2, pp. 212-226

International Council on Mining & Metals (2012), The role of mining in national economies, UK

Kumar U. and Huang Y. (1993), Reliability Analysis of a Mine Production System - A Case Study, Proceedings annual reliability and maintainability symposium IEEE, pp. 167-172

Lawrence A.C (1974), The importance of human factors in mining productivity, Journal of the South African Institute of Mining and Metallurgy, pp. 399-404

Mine-engineer.com

Mitchell P & Steen J (2014), Productivity in mining- a case for broad transformation, Ernst & Young

Okely A. (2009), Managing the Downturn: Now is the Time for Excellence in Operations, Engineering & Mining Journal, [www.e-mj.com](http://www.e-mj.com), pp. 54-55

Prior, T., Giurco, D., Mudd, G., Mason, L., Behrisch, J. (2012), Resource depletion, peak minerals and the implications for sustainable resource management, Global Environmental Change 22 (3), 577–587.

Takahashi S. (2011), How multi-tasking job designs affect productivity: Evidence from the Australian Coal Mining Industry, Industrial and Labor Relations Review, Vol. 64, No. 5, pp. 841-862

Topp V., Soames L., Parham D. and Bloch H. (2008), Productivity in the Mining Industry: Measurement and Interpretation, Australian Government Productivity Commission Staff Working Paper.

---

1. Research Scholar, Institute of Business and Computer Studies, Siksha O Anusandhan University, Bhubaneswar, Odisha-751030, India. Email: [pcmishra71@gmail.com](mailto:pcmishra71@gmail.com)

2. Manager (Projects), Larsen & Toubro Limited, Kansbahal, Sundargarh, Odisha, India.  
Email: [manojacademics@gmail.com](mailto:manojacademics@gmail.com)

3. Assistant Professor, Centre for Management Studies, North Eastern Regional Institute of Science and Technology, Nirjuli, Arunachal Pradesh, India. Email: [mallmanmohan79@gmail.com](mailto:mallmanmohan79@gmail.com)

4. Associate Professor, Faculties of Management Studies, Institute of Business and Computer Studies, Siksha O Anusandhan University, Bhubaneswar, Odisha-751030, India. Email: [connectuma123@gmail.com](mailto:connectuma123@gmail.com)

---

Revista ESPACIOS. ISSN 0798 1015  
Vol. 38 (Nº 57) Year 2017

[Index]

[In case you find any errors on this site, please send e-mail to [webmaster](mailto:webmaster)]

©2017. revistaESPACIOS.com • ®Rights Reserved