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Analysis of Key Factors of Economic Performance Influencing Environmental Management - A Study of Indian Mining Industry

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ABSTRACT

This paper provides an insight of the relationship between economic performance and environmental management which is necessary for sustainable development and economic prosperity. The present paper uses factor analysis methodology for identifying the major factors relating to economic performance which also enhances environmental management in mining industry.The survey has been conducted in four subsidiaries of Coal India Limited (CIL) which are Bharat Coking Coal Limited (BCCL), Dhanbad, Central Coalfield Limited (CCL), Ranchi, Coal Mines Planning and Design Institute India Limited (CMPDIL), Dhanbad and Eastern Coalfield Limited (ECL), Asansol. This study identifies four factors, namely risk related driver, image related driver, societal related driver and efficiency related driver of economic performance which should be integrated with corporate strategy of the company for sustainable growth and development.

Keywords

Environmental management, risk related driver, image related driver, societal related driver, efficiency related driver, mining industry

Academic Discipline And Sub-Disciplines

Management

SUBJECT CLASSIFICATION

Environment Management

TYPE (METHOD/APPROACH)

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1. INTRODUCTION

Business organization is a critical factor in the world's economic and social development. More groups of society and environmental aspects get affected as the business grows and expands geographically and mainly society and environment near mining area gets more affected. Today, organizations are not evaluated only on the basis of their performance/output but also for their behavior as worldwide corporate citizens.

There is a strong link between Environment, Society and Economy. For enhancing economic performance of the company, society and environmental progress plays a key role. Welford (1996) has argued that there are benefits relating to the introduction of regional environmental management systems, which integrate environmental, economic and social factors. There are various literature in Indian and global context which explains that there is direct relationship between environment and business productivity. When considering environmental aspects in India, mining organization comes in one mind as in India mining is an important economic activity and it has an adverse effect on environment and society. The objective of the study is to identify and analyze the factors of economic performance which if integrated with environmental management of mining Industry would enhance the firm's performance. The paper is structured in the following manner: section 2 reviews the available related literature on the subject. Section 3provides study design and survey instrument used in this paper. Section 4 deals with analysis and discussion followed by the conclusion in section 5.

2. RELATED LITERATURE REVIEW

Considering environmental management in mining industry, Yakovleva (2005) found that mining operations not only affect the natural environment, but also influence societies in which they operate directly or indirectly via economic and environmental effects. Ghose (2003) concludes that cleaner production should be promoted in small-scale mining sector and has identified educational and training related initiatives to be undertaken to facilitate additional environmental improvement.

Mining activity is done by the workers who reside near the mining area. Productivity in coal mining industry is directly related to manshift (worker). To obtain efficiency in productivity, employee satisfaction and motivation is important for the workers working in mining industry.

Topp et al., (2000) found that labor productivity in mining is variable over time, because labor represents a comparatively small share of total inputs to mining. Hence even relatively small changes to output or labor inputs would lead to large changes in the level of labor productivity. Total productivity of the mining decline over a period was mainly due to reduction in labor productivity. Productivity of mining also depends on the livelihood of the labor working in the mining.

Mehta (2002) observed that in many countries that are active in mining activity have implemented their commitment to protect and upgrade the environment while improving their performance.

Ivanova and Rolfe (2011) asserted that the increased activity in mining generates impacts on local, regional and state economies related to the expenditure of mining companies on salaries for mining, development and exploration activities.

According to a report published by Greenpeace, titled "High risk, low return", it has been revealed that Coal India Limited has a record of repeated violations of environmental legislation in India. This hampers productivity and raises the threat of stranded assets with several mines facing closure notices

Firms should be evaluated not only on the basis of their output but also on the basis of enhancing performance keeping environmental aspects in mind. Wu (2009) suggested that those firms violating the environmental norms should be punished and those firms following the environmental norms and regulations should get reward and benefited.

Cernea (1999) has argued that the method of cost-benefit analysis, and the conventional project risk and sensitivity analyses used in projects entailing resettlement and rehabilitation in mining, are incapable of answering displacement's economic and financial challenges and in practice tolerate the structural under financing of resettlement operations.

Woolcock and Narayan, (2000) discussed that there is a need for more comparative research using precise measure of social capital to examine variations in poverty reduction, government performance, ethnic conflict and economic growth. Further he argues that economic growth is shaped by the nature and extent of social interaction between communities and firms.

Integrating environmental aspects with corporate strategy of organization would enhance the economic performance of company. Wagner (2007) has observed that for manufacturing companies in European countries, level of integration of environmental management with image related and market related drivers of economic performance is very high.

Ashraf (2012) has defined net operating profitability as Operating Income plus depreciation, and divided by total assets minus financial assets. Profitability is the primary goal of all business ventures and without profitability the business will not survive in the long run.

Kapelus, (2002) argued that if mining organization takes on a larger responsibility of local community than previously done, this would allow the government to target its development programs more effectively.

From the various literature reviews, it is observed that no study has been conducted to identify the key drivers of economic performance and environmental management in mining industry in India.

3. STUDY DESIGN AND SURVEY INSTRUMENT

3.1 Sample Selection

There were 102 responses and the response rate was 51 percent. In the present study the population size is the total employees working in Coal India Limited (CIL). Viewing the finite population in the present study, the convenience sampling technique was used for selecting middle and top level management class. Only four subsidiaries of CIL have been considered as sampling unit which are BCCL, CCL, CMPDIL and ECL. The sampling frame for the present study has been taken from the employee list of the four companies i.e. BCCL, CCL, CMPDIL and ECL. The total number of sample size taken for study was 200 which were calculated at 95% confidence interval.

Firstly the variables are identified which are suppose to influence the environmental management of mining industry and economic performance. These variables are largely adopted from the existing literatures and reports of mining industry which are in conformity with environmental management in mining industry. Some of the variables chosen are adopted from the integration of environmental management studies already done in context to manufacturing firms in European country. In addition, few variables have been taken by conducting unstructured interviews with some of the experts from mining industry. Thus we arrive at a set of twenty four (24) variables which have been incorporated in the questionnaire are explained in Table 1.

Table 1: Variables of economic performance related Drivers, their Notations and References

Sl. No.	Variables and their Notations	Reference
1	Local community welfare (LCW)	Woolcock & Narayan, 2000
2	Resettlement and Rehabilitation policy (RRP)	Cernea, 1999
3	Land acquisition policy (LAP)	Mehta, 2002
4	Employment generation for local community livelihood (EGLCL)	Unstructured interview
5	Programs involving the involvement of the local community in the development schemes launched by the organization (LCDS)	Kapelus, 2002
6	Public recognition and customer goodwill (PRCG)	Wu, 2009
7	Recruitment and staff selection policy (RSSP)	Wagner, 2007
8	Employee morale and employee motivation (EMEM)	Wu, 2009
9	Corporate image of the firm (CI)	Wagner, 2007
10	Environmental risk and Shareholder's return (ERSR)	Wu, 2009, Ivanova & Rolfe, 2011
11	Best management practices (BMP)	Needham and Ruppin, 1999
12	credit rating (CR)	Wagner, 2007
13	Management decision making process (MDM)	Unstructured Interview
14	Environmental friendly policies and technologies adopted (EFT)	Hilson, 2000 & Wu, 2009
15	Business risk (BR)	Unstructured Interview
16	Operational risk (OPR)	CIL annual report, 2011-12
17	Financial risk (FR)	Unstructured Interview
18	Technological risk (TR)	Hilson, 2000
19	Legal risk (LR)	Fernandes,
20	Innovative practices of business (INPB)	Wu, 2009
21	Profitability (PROF)	Ashraf, 2012, Shah and Shin, 2007
22	Business performance (BP)	Wu, 2009
23	Productivity (PROD)	Topp et al., (2000)
24	Market value and shareholder wealth maximization (MVSWM)	Wagner 2007, Ivanova & Rolfe, 2011

The survey questionnaire has been constructed with the above discussed twenty four variables (as shown in table 1) keeping the objective of the study. The questionnaire consists of brief outline of the background and objectives of the study. It precedes the set of questions, each of which express the level of integration of each variables with environmental aspects of mining industry. All 24 questions were closed-ended, based on likert-rating scale asking the respondents to indicate a level of integration. Typically, each question had five response categories ranging from 'very low to very high'. To conduct the analysis likert scale was used and each statement was assigned a numerical score ranging from 1 to 5 with 1 as very low to 5 as very high.

4. ANALYSIS AND DISCUSSION

Once the responses of the filled in questionnaire have been received, the scale reliability of the developed variables was tested by deploying the statistical test 'Cronbach's alpha' to the 102 responses received from 200 samples. In the present study content validity test has been conducted. Panel of experts have review the questionnaire and according to their suggestions items of the questionnaire have been re-designed. The Cronbach's alpha covering the 102 responses and 24 variables has come out to be **0.8799** which is well above the conventional reliability criterion of 0.7 and indicate that the constructs have statistically acceptable and have good range. A correlation coefficient matrix shows the high inter-correlations among the twenty four variables which motivated to conduct factor analysis.

4.1 Factor Analysis

For conducting factor analysis there should be at least four or five times as many observations (sample size) as there are variables (Basilevsky, 2009). This study has a sample size of 200 and 102 respondents which are more than eight times of twenty four variables. After testing the adequacy of the data and the variables, factor analysis is conducted with these twenty four variables, using the method of Principal Component Analysis (PCA). It is observed from table 2 that the communalities in this table are all high, which indicates that the extracted components represent the variables well.

Table 2: Communalities

Variables	Initial	Extraction	Variables	Initial	Extraction
LCW	1.000	.895	MDM	1.000	.831
RRP	1.000	.873	EFT	1.000	.810
LAP	1.000	.882	BR	1.000	.872
EGLCL	1.000	.786	OPR	1.000	.750
LCDS	1.000	.824	FR	1.000	.699
PRCG	1.000	.924	TR	1.000	.708
RSSP	1.000	.930	LR	1.000	.738
EMEM	1.000	.929	INPB	1.000	.875
CI	1.000	.887	PROF	1.000	.837
ERSR	1.000	.941	BP	1.000	.806
BMP	1.000	.835	PROD	1.000	.755
CR	1.000	.926	MVSWM	1.000	.770

The variance explained by the initial solution, extracted components, and rotated components has been displayed in Table 3. In the Total column, the eigen value of all the twenty four variables has been displayed. The **% of Variance** column gives the ratio value, expressed as a percentage, of the variance accounted for by each component to the total variance in all of the twenty four variables. Using the eigen value criteria, **four factors** are extracted whose eigen value is greater than one.

Table 3: Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	**7.149**	29.786	29.786	6.298	**26.241**	**26.241**
2	**4.994**	20.808	50.594	5.422	**22.591**	**48.832**

3	**4.179**	17.411	68.005	4.282	**17.843**	**66.674**
4	**3.763**	15.677	83.683	4.082	**17.008**	**83.683**
5	.474	1.975	85.658			
6	.443	1.846	87.504			
7	.410	1.709	89.213			
8	.398	1.660	90.872			
9	.312	1.299	92.171			
10	.277	1.155	93.326			
11	.268	1.115	94.441			
12	.227	.947	95.388			
13	.192	.800	96.188			
14	.184	.767	96.955			
15	.146	.607	97.562			
16	.121	.506	98.068			
17	.092	.383	98.451			
18	.087	.363	98.814			
19	.074	.309	99.123			
20	.067	.280	99.404			
21	.059	.244	99.648			
22	.047	.195	99.843			
23	.028	.117	99.960			
24	.010	.040	100.000			

In the second section of the table shows the four extracted factors whose eigen value is greater than 1. It can be observed from the table that the four factors explain nearly 83 percent of the total sample variability in the data. Further it can be observed that there is a wide range of variation in the proportion being explained by each factor. The first factor explains 26 percent of variance while the third and fourth factor explains only 17 percent variance. To enhance the interpretability of the factors, the varimax factor rotation method is used in PCA. This method minimizes the number of variables that have high loadings on a factor. The varimax-rotated factor-loading matrix is presented in Table 4.

Table 4: Varimax Rotated Factor Loading Matrix

	Component			
	Factor 1	Factor 2	Factor 3	Factor 4
CR	**.950**	.147	.042	.014
BR	**.930**	.071	.003	-.028
MDM	**.904**	.106	-.046	-.026
EFT	**.890**	.061	.088	.083
OPR	**.864**	.009	.043	.036
LR	**.850**	.106	.043	-.051
FR	**.832**	.006	-.049	.064
TR	**.830**	.030	.125	.057

RSSP	.017	**.962**	.047	.024
ERSR	.098	**.958**	.073	.091
EMEM	.126	**.955**	-.017	.038
PRCG	.108	**.944**	.098	.106
CI	.119	**.932**	.008	-.061
BMP	.010	**.901**	.026	.153
LCW	.053	.009	**.945**	.005
LAP	.067	.053	**.934**	.062
RRP	.071	.080	**.928**	.009
LCDS	.035	-.022	**.905**	.068
EGLCL	-.028	.083	**.882**	.027
INPB	.013	.062	.087	**.929**
PROF	.002	.102	.027	**.909**
BP	.010	.085	.001	**.894**
MVSWM	.030	.056	.022	**.875**
PROD	.059	-.007	.035	**.866**

4.2 Interpretation of Factors

From the varimax rotated factor matrix, the four factors that are extracted are analyzed and interpreted on the basis of their factor loadings. Those variables which have a loading of more than 0.55 *i.e*. 30 percent overlap in variance between the variable and the factor, are included in a particular factor. As a rule of thumb, a loading of more than 0.71(50 percent overlap) is considered excellent, 0.63(40 percent) very good, 0.55 (30 percent) good, 0.45 (20 percent) fair, and below 0.32 (less than 10 percent of overlap) poor (Bhaduri, 2002). In this study 0.55 is used as the cutoff for interpretation. Thus the results so obtained are fairly robust.

The first factor contains the items related to risk. There is operational risk in mining industry i.e. it can be system failure, people or process through which a company operates. A poor credit rating indicates that a company or government is at the risk of default. Similarly legal risk, technological risk, financial risk etc can be identified as the **'RISK' related driver of economic performance.**

The second factor is positively loaded with Recruitment and staff selection policy, Environmental risk and Shareholder's return, Employee morale and employee motivation, Public recognition and customer goodwill, Corporate image of the firm, Best management practices, . Public recognition and customer goodwill and corporate image variables depict the concern for the company's image. Having good recruitment and staff selection process, best management practices, providing optimum shareholder's return and high employee motivation in which community member's and stakeholder's also enjoys the benefit and healthy environment from it enhances the image of the company. Hence this factor can be identified as **'IMAGE' related driver of economic performance factor**.

The third factor is positively loaded with Local community welfare, Land acquisition policy, Resettlement and Rehabilitation policy, Programs involving the involvement of the local community in the development schemes launched by the organization, Employment generation for local community livelihood which is all related to the society/local communities settled near coal mines. Hence this factor can be identified as **'SOCIETAL' related driver of economic performance factor.**

The fourth factor comprises of the business performance, productivity, profitability, market value and innovative practices have high loadings. These predominantly refer to the profitability and efficiency of a company, hence the factor was labeled an **'EFFICEINCY' related driver of economic performance.**

5. CONCLUSION

Today it is necessary to bring together the essential ingredients i.e. economic and environmental progress, which is important for economic prosperity to increase with more efficient use of resources and lower emissions (Hendrik and Bidwell, 2000). Accordingly, the present work has identified the four key drivers of economic performance which should be integrated with environmental policy of mining industry for sustainable development which are societal related driver, risk

related driver, image related driver and efficiency related driver which should be integrated with environmental policy of mining industry for sustainable development.

The integrated framework may enhance the partnership and communication between the local citizens and the mining officials, creating networks. It may increase the understanding and awareness of sustainable development within the industry and among local mining communities. It would enhance the coordination among different governmental agencies at different levels as this study encompasses of major economical aspects and environmental policies. Environmental issues and economical aspects would be the key ingredients for major decision making process in mining industry. The study may provide an opportunity for management, accounting educators, educational programs designers and higher educational institutions to formulate the curriculum which should explain in detail about the importance of incorporating environmental policies with economical aspects dimensions that can be implemented in business schools and other higher educational institutions.

Limitation of the study is that the study covered only four subsidiaries of Coal India Limited for studying the level of integration of environmental aspects with key drivers of economic performance which may not represent the overall level of integration. Moreover the scope of the study can be widened to get exhaustive result. There can be some other factor which could not be considered in the course of the study.

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