

Strategic Planning and Technology Management: A Case of Open Cast Mining Industry at Central Coalfields Limited in the state of Jharkhand

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Abstract: Technology aspect deals with the choice and implementation of the selected technology which affects the productivity and efficiency of the firm. The choice involves the commitment of resources for the appropriation, maintenance, deployment and abandonment of technological capabilities. The first one is the selection of appropriate & suitable technology and the second aspect is the effective management of the new technology. Indian Coal mining is still far behind in global standards in spite of implementation and use of best technologies. The problem lies in the implementation & its effective management.

Key Words: Technology Management, Opencast, Coal Mining, Central Coalfields Ltd. Effective management, Implementation

1. Introduction

Technological progress has changed the life of everyone today scenario and it has also changes made in the coal mining industries. In other words coal mining industry requires the high-technological power that is equipped with all the necessary machinery for raise the productivity of the coal.

Today in the dynamic business scenario it is the importance of the state of the art technology is observed to raise and enhance the productivity of coal mining to gain the desired production. Almost every industrial sector today warrants for the best use of technology in order to remain competitive for sustainability (Kalam, 2005).

The method is useful to extract the coal deposit near the surface. From this moment the coal exploration, extraction and delivery to the market has become secure, effective, clean and not harmful for the environment. Nowadays coal mining industries are greatly dependent on technology, organizations such as Globaltex Industries including applying all the advances of technology in their business (Noori,1990).

Researchers feel that the coal mining industries under government control lacks effective management of the new technology and not able to justify the returns on investment. The technology cannot play itself but it can bring a change and has to be supported by appropriate interventions and an advanced human skill (Which can be attained through training). There is no denying of the fact that the wrong choice of technology leads to dismal consequences affecting the overall health of the organization nonetheless the fact also lies in the effective management of technology (Narayanan, 2001).

Indian coal industries have witnessed a series of technological changes but it is still struggling in extracting coal suitable for the domestic consumption rather depending on the imported coal. The technology cannot be effective unless it has been supported by appropriate organizational changes as well as changes in human skills and training. Therefore assessment and evaluation criteria with respect to its cost effectiveness, availability of raw material and skill availability are needed to be established.

2. Objectives

Following are the important objectives of the present research paper

- To focus on the coal mining industries especially open cast mining and techniques being followed over there (CCL).
- To explore the strategies and methods adopted in a Coal mining industry for Effectiveness of innovative Technological management and its implementation.
- To highlight the development of technology in Indian open cast coal mining industries and pertains to finding out the reasons for low productivity of coal in CCL.

3. Research Methodology

The present study explores the strategies and methods adopted in a Coal mining industry for effective management of technology and its implementation. For this, we follow survey based empirical analysis; consists of data collection primarily via structured questionnaires. Factors effecting management of technology are identified by further by using factor analysis in Statistical Package for Social Science (SPSS) platform. For association relating to all identified factors, statistical test has been performed. Domain for data collection, we take one of the largest public sector coal units; namely CCL along with its seven open cast mines and designing part (named CMPDIL).The study pertains to find out the reasons for low productivity of coal in seven sites of CCL, These are Piparwar OC, Ashoka OC, KDH OC, Rajrappa OC, Urimari OC, Amlo OC, Jharkhand OC. A pilot survey was conducted to find out the various reasons of low productivity in opencast coal mines in CCL even after the adoption of technology. Thereafter certain parameters were being identified and were incorporated in the form of question in the

questionnaire. The respondents were selected through random sampling in the opencast mines. The target sample population was 385 from top and middle level management. For the purpose of the present research work the secondary data has also been considered.

3.1 Hypothesis of the Study

H_0 = *Technology is the only pertinent factor for enhancing overall productivity*

H_1 = *Technology is not only a panacea for productivity enhancement; effective management of technology is significantly important to make it more productive.*

The study identified the following important parameters which are relevant for the study.

- Planning for New Technology
- Level of Management for Adoption of New Technology
- Selection of Appropriate Technology
- Technological Skills Required for Adoption in Open Cast
- Safety Needs for Continuous Technology
- Real Time Training Needs for Technological Up Gradation
- Proper Manpower Planning for Technological Implementation
- Technological Barrier Due To Land Acquisition Issue
- Managing HEMM Technology In Open Cast
- Technological Effect on Environmental Issue
- Maintenance of Overall Equipment after Adoption of New Technology
- Financial Feasibility
- Continuous Monitoring of Quality
- Socio-Economic Issue on New Technology
- Real Time Transfer of Technological Change
- Cost Benefit Analysis
- Capacity Utilization of Machine after Adoption of New Technology
- Minimizing Wastage by applying New Technology
- Supply Chain Issue
- Market Feasibility

Obviously these factors are interlinked and a proper management of technology requires to be considered. The study was conducted over the five installed technologies identified for the research work which were being managed by CCL, Ranchi. The factors identified were based on the production report generated by CCL. The study identified the following possible factors which were relevant for study for effective management of new technology.

4. Literature Reviewed

Management of technology focuses on the principles of strategy and organization involved in technology choices, guided by the purpose of creating value for investors (Narayanan, 2007). Management of technology is an interdisciplinary field that integrates science, engineering and management knowledge and practice. The focus is on technology as the primary factor in wealth creation, it may encompass factors such as enhancement of knowledge, intellect, capital, efficient utilization of resources, preservation of the natural environment and other factors that may contribute to raising the standard of living and quality of life (Momaya, et.al, 2005).. Managing technology implies managing the system that enables the creation, acquisition and exploitation of technology and it influences different functional entities of the cooperation, research and development, design, production, finance, personnel and information. Its domain involves both the operational and strategic interests of the organizations (Khalil, 2010). The operational aspect deals with the day- to-day activities of the organization, while the strategic dimension focuses on the long term issues. Technology generates wealth when it is commercialized or used to achieve a desired strategic or operational

objective for an organization. While the underlying premise for the management of technology is the most influential factors that contribute to the system (Berman, 1992). Management of technology treats technology as the seed of the wealth- creation system and with proper nourishment and good environment seed grows to become a healthy tree (Boskin et.al., 1992). For effective management of technology, three important factors have to be considered. First, there is always a time- lag between the development of technology and the commercialization of a product or service borne out of that technology. Second, it is very difficult to foresee the future while making evaluation and planning. Third is the readiness and abilities of engineers to draft ideas and concepts and manage development (Natarajan, 1999). It is a potential weak spot in management systems by putting emphasis on the strategic objective of the organization. It guides management to improve productivity, increase effectiveness and strengthen the competitive position of the enterprise. The technology management is not simple it requires a coordinated effort to create a creative system design which further will produce novel products and services.

The organized efforts in the field of technology management began 1950s, onwards, when R&D as well as modern management ideas were developed (this was a period characterized by plentiful resources to R&D). During 1960s and 1970s there was an interest in the entire corporate world to understand innovation and its proper application, however in the twentieth century, it slow down as a result of the impact of global competition and the economic crisis of United States.

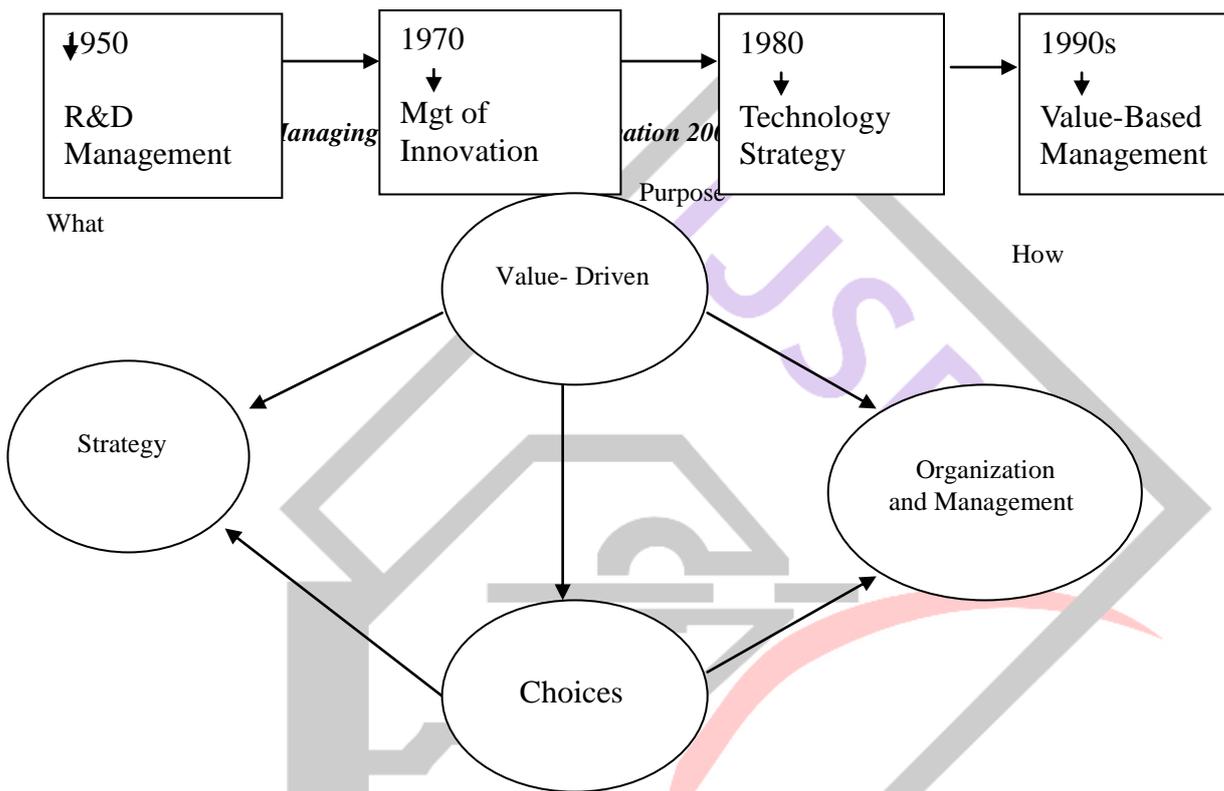


Figure: 2 Sources: (Narayan. V. K, *Managing technology and innovation 2007*)

Now days, new advancements in technology are driving even higher levels of performance and material management-especially in open-pit, or surface, coal mines, where miners are focused on removing the most of the material as quickly and safely as possible. As dragline operators work to extract coal, simply by glancing at an in-cab display that shows the position of the bucket and tub relative to the design plan, as well as whether each dig point is above or below plan.

5. Innovative Business Management and CCL

The success of any business lies in the effective combination of three factors: 5 M's, their Innovative Management and related technical inputs, amongst the factors mentioned the innovative management matters the most since the creation and adoption of business and technologies needs to be managed in an innovative way for proper and desired results. A wrong choice of management technique for a product or process can have serious implications on the health of the organization. Therefore assessment and evaluation with respect to its cost effectiveness, availability needs to be established. Innovative Management can be an interaction between strategic HR practices and innovation performance from the knowledge-based view. HRM practices refer to organizational activities directed at managing the pool of human resources and ensuring that the resources are employed towards the fulfillment of organizational goals.

Human resources are the source of achieving competitive advantage because of its capability to convert the other resources (money, machine, methods and material) in to output (product/service). The existing business environment requires companies as well as their HR teams to think out-of-the box, and come up with innovative approaches to survive the downturn and hold employees together. Innovative approaches would motivate the employees in companies to utilize their set of skills and

knowledge through their effort realizing firm's business strategy. This approach to innovative human resource management is likely to contribute to improved economic performance of the firm.

Innovative arrangements also have the potential to increase employee morale, thereby improving performance through reduction in grievances and through greater effort and diligence.

Another aspect of innovative business management is technology management that allows organizations to create and manage their technology fundamentals to create sustainable and incremental competitive advantage. The technological aspect of innovative business management creates a platform which fosters the understanding of technology and the need of technological change.

Innovative business management and technology management creates value for the customers and therefore the organization should argue on technological advancement and its withdrawal for overall organizational success. This study explores the strategies and methods adopted in Coal mining industry for effective Management and Management of new technology and its implementation. For this purpose one of the public sector organizations namely Central Coalfields limited and their open cast as well as CMPDI(Central Mine Planning Design Institute Ltd), located at Jharkhand is being selected. After the actual survey of the site and literature review it was found that the actual production was less than the targeted production of these opencast mines.

The main reason behind this was managerial issue related to the human resource for lacking in effective management for growing the production. The productivity of opencast mines is low because of lack of innovativeness, improper technology, misuse and non-availability of materials, scarcity of power, shortage of explosives, defective layouts and poor working conditions. Poor planning and lack of management also adds to the productivity problem. The problems related to the productivity of coal mines is mainly due to the following reasons

The internal Reasons

- i) Technology employed
- ii) Shortage of skilled , Labour Unrest and Absenteeism
- iii) Maintenance of equipments.

The External Reasons

- i) Power and Explosive
- ii) Law and order
- iii) Wagon availability
- iv) Land acquisition
- v) Lack of capital investment.
- vi) Environmental Issue.

Due to the above mentioned reason the results obtained are mentioned below. The tables mentioned below specify that except for one instance in the remaining cases the actual production of the open cast mines are less than the estimated one.

The results obtained were alarming as despite the modern technological import and modern labor relation terms estimated target was not achieved.

Table 1: Production of Coal in Seven Sites of CCL (in figures of Million Tonnes)

| Sl NO | Site | 2007-2008 (Mt) | | 2008-2009(Mt) | | 2009-2010(Mt) | | 2010-2011(Mt) | | 2011-12(Mt) | | 2012-13(Mt) | |
|-------|--------------|----------------|--------|---------------|--------|---------------|--------|---------------|--------|-------------|--------|-------------|--------|
| | | Target | Actual | Target | Actual | Target | Actual | Target | Actual | Target | Actual | Target | Actual |
| 1 | Piparwar OC | 10.00 | 8.00 | 10.00 | 8.50 | 10.00 | 9.51 | 9.75 | 9.00 | 10.00 | 9.90 | 11.30 | 11.49 |
| 2 | Ashoka OC | 6.5 | 6.30 | 9.50 | 7.10 | 9.00 | 7.60 | 8.75 | 8.030 | 8.10 | 7.72 | 8.00 | 7.80 |
| 3 | KDH OC | 4.5 | 4.01 | 3.50 | 3.14 | 3.70 | 3.51 | 3.50 | 3.451 | 3.70 | 3.60 | 2.00 | 1.55 |
| 4 | Rajrappa OC | 3.00 | .85 | 1.20 | 1.00 | 1.25 | 1.10 | 1.1 | 1.101 | 1.25 | 1.13 | 1.00 | .76 |
| 5 | Jharkhand OC | 1.0 | .81 | 0.85 | .92 | 0.85 | .60 | 0.95 | .606 | 0.85 | .71 | .49 | .47 |
| 6 | Urimari OC | 2.0 | 2.33 | 2.00 | 2.44 | 2.25 | 1.51 | 2.50 | 2.039 | 2.25 | 1.95 | 2.30 | 2.22 |
| 7 | Amlu OC | 2.50 | 1.43 | 1.20 | 2.81 | 2.00 | 3.12 | 3.00 | 2.041 | 2.70 | 2.30 | 1.50 | 1.15 |

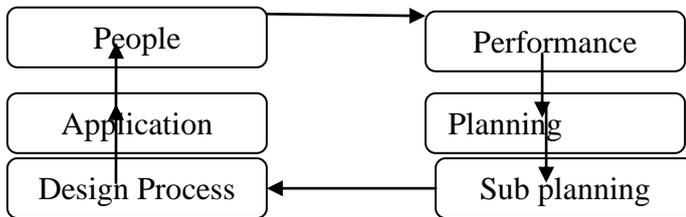
(Source: P&P Dept.CCL, Ranchi)

To the above result, following are the proposed solutions

- Innovative Business Management
- Innovative technological Management

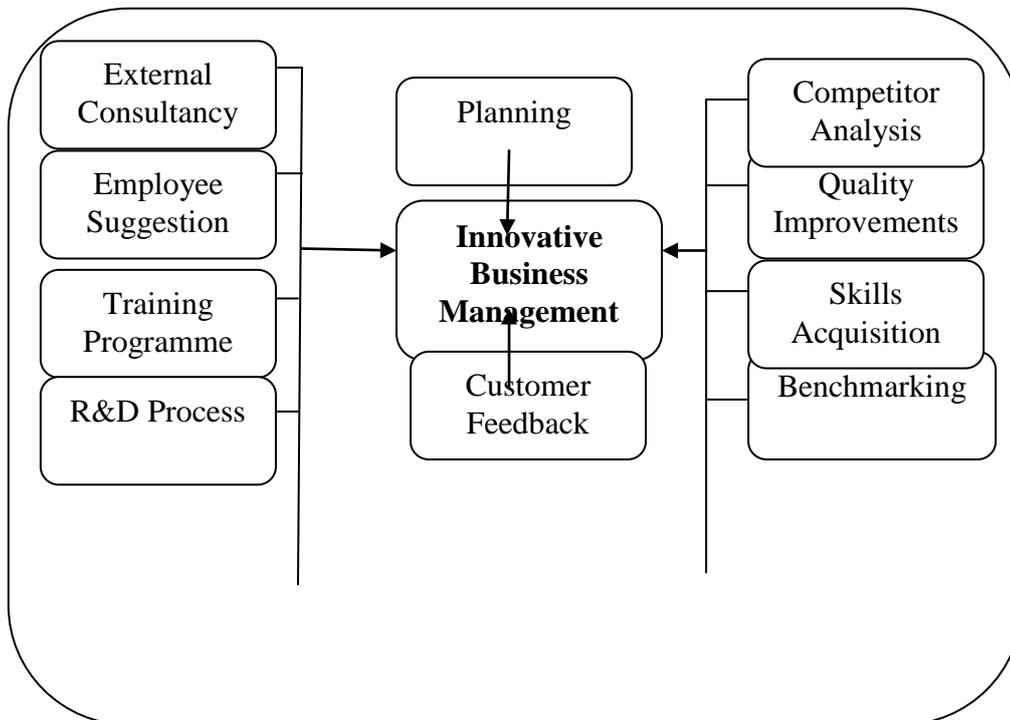
5.1 Process of Implementing Innovative Business Management Practices

Innovative business management is about incremental changes to products, services and processes. It involves all managers in every department from Finance to Customer Services. The following procedure can be used to start the innovative management practices in Central Coal Field Limited



Proposed Model – 1: Starting innovative management practices inside organization

5.2 Theoretical Framework for Implementing Innovative Business Management Practices



In order to develop a sound management system, the Central Coal Field Limited should have effective Human Resource Management practices. HRM practices refer to organizational activities directed at managing the pool of human resources and ensuring that the resources are employed towards the fulfillment of organizational goals (Zeleny, M.1986). The sources of innovation are many and varied but they need to be collated, coordinated and managed as a source of valuable information for introducing innovative management practices inside an organization. A successful innovation culture embraces all aspects of a business and should be managed as effectively and efficiently as any other core business process. The model drafted below shows the process of implementing innovative business management inside Central Coal Field Limited

6. Innovative Technological Management

Technology aspect deals with the choice and implementation of the selected technology which affects the productivity and efficiency of the firm. The choice involves the commitment of resources for the appropriation, maintenance, deployment and abandonment of technological capabilities. These technology choices determine the character and extent of the firms’ principal technical capabilities and the set of available product and process platform.

Technology strategy focuses on the kinds of technologies that a firm selects for acquisition, development, deployment or divestment. The commitments surrounding technology selection define technology strategies. Technology strategies embrace both the hardware and software elements of a technology.

Following technological up gradations have been initiated and installed at the opencast mines

- Installation and commissioning of mobile inpit coal crushing and conveying in Piparwar OCP (6.50 MTY).
- Installation and commissioning of 10 cum and 25 cum Shovels and 85T Dumpers in different OC mines
- Installation of Rapid Loading System in selected Dhori Colliery.
- CCL is exploring the possibility of setting up pit head Power Plant near North Karanpura coalfield in joint sector with private party.

Despite the above effort related to technical aspect the actual production of the coal from opencast mines is less than the targeted ones; this result is due to the mismanagement and underutilization of technology.

Table 2. - Hypothesis Test of Effective Management of New technology

| Parameter ↓ | Location → | Unit | | | Total |
|---------------------|----------------|-------|------|-------|-------|
| | | OC | CCL | CMPDI | |
| Some What Important | Count | 51 | 7 | 5 | 63 |
| | Expected Count | 36.8 | 14.9 | 11.3 | 63.0 |
| Important | Count | 81 | 36 | 34 | 151 |
| | Expected Count | 88.2 | 35.7 | 27.1 | 151.0 |
| Highly Important | Count | 93 | 48 | 30 | 171 |
| | Expected Count | 99.9 | 40.4 | 30.6 | 171.0 |
| Total | Count | 225 | 91 | 69 | 385 |
| | Expected Count | 225.0 | 91.0 | 69.0 | 385.0 |

| Chi-Square Tests | | | |
|--|---------------------|----|-----------------------|
| | Value | Df | Asymp. Sig. (2-sided) |
| Pearson Chi-Square | 17.443 ^a | 4 | .002 |
| Likelihood Ratio | 18.627 | 4 | .001 |
| Linear-by-Linear Association | 8.886 | 1 | .003 |
| N of Valid Cases | 385 | | |
| a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.29. | | | |

Technology can only improve the efficiency of the organization but lack of effective management of technology defeat the entire purpose (Lema, and Price, 1995; Momaya, 2005). Chi-Square test for important factors separately for Open Cast Mines (CCL) and Head office (HO) of CCL and CMPDI are shown in the table.

Table 3. Identified Factors Result

| Parameters | Open Cast Mines (CCL) | | | Head Office (CCL and CMPDI) | | |
|---------------------------|-----------------------|------|-----------|-----------------------------|------|-----------|
| | Value | d. f | (P-Value) | Value | d. f | (P-Value) |
| Planning for Technology | 8.240 ^a | 6 | .221 | 6.133 | 1 | .013 |
| Management level | 10.667 | 6 | .099 | 5.173 ^a | 1 | .023 |
| Selection of technology | 12.465 ^a | 12 | .409 | .062 ^a | 2 | .969 |
| Maintenance of Equipments | 5.154 ^a | 6 | .524 | 3.137 ^a | 1 | .077 |
| Technological Skills | 8.467 ^a | 6 | .206 | 1.628 ^a | 1 | .202 |

| | | | | | | |
|-------------------------------|--------------------|----|------|-------------------|---|------|
| Proper Utilization of Machine | 3.158 ^a | 6 | .789 | .003 ^a | 1 | .546 |
| Real time Training Needs | 3.693 ^a | 6 | .718 | .529 ^a | 1 | .467 |
| Management of HEMM | 11.714 | 12 | .469 | NA at HO | | |
| Management of Manpower | 13.678 | 12 | .322 | NA at HO | | |
| Supply Chain Issue | 14.978 | 12 | .243 | NA at HO | | |
| Tech. effect on Environment | 4.451 | 6 | .616 | NA at HO | | |
| Technological Advancement | 3.443 | 6 | .752 | NA at HO | | |

The responses given by CCL, CMPDI and OC coal mines in the state of Jharkhand as shown in table no -1&2 revealed that Effective Management of technology is highly important to enhance the production of coal. After Calculating the Chi- Square Value comes to be 17.443 at 4 degree of freedom and p value is .002, which is greater than the tabulated value at 0.05 at 95% confidence level, so it is significant as shown in table no 2. So Null hypothesis is rejected and results shows that Effective management of technology may play the vital role to enhance the production. Technology can only improve the efficiency of the organization but lack of effective management of technology defeat the entire purpose. If effective management of technology is not done properly, so it affects the production.

7. Conclusions

Despite of having modern feet of technology and machines the output of the company is not as per the estimated target also the decision making procedure of CCL Management and their employees are not as competitive according to the market and demand. These actual results can be related to following points

- [1] Poor Information Processing
- [2] Insufficient Skills
- [3] Lack of Social and Institutional Infrastructure

There is a need of fast and efficient information processing system which should assimilate the International, National, internal and external information into the applicable and workable solutions as the departmental delays and human error leads to information blockage and due to this the entire operation is affected. Human Resource needed to be trained properly as the poor and insufficient skills results into low productivity, mismanagement and misguided decisions. The weakness of social and institutional infrastructure in terms of support, cooperation, operative effectiveness etc should be strengthen to provide the backbone support to the organization especially to the washeries , Warehousing Section , Operations and Industrial Relations.

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