Techno-Managerial factors influencing Productivity of tailings Dewatering Plant

Doctoral Thesis Submitted

In partial fulfilment of the requirements for the award of the degree

of DOCTOR OF PHILOSOPHY

In

MANAGEMENT

By

George Francis Osta

UID No: 16JU11300008

Under The Guidance of

Dr. Mahua Banerjee
(Research Co-Supervisor)
Professor
XISS, Ranchi

Dr. Hari Haran
(Research Supervisor)
Professor,
ICFAI University, JharkhandRanchi

ICFAI UNIVERSITY
JHARKHAND, RANCHI
August, 2023

THESIS COMPLETION CERTIFICATE

This is to certify that the thesis entitled "**Techno-Managerial factors influencing Productivity of Tailings Dewatering Plant"** submitted by **Mr. George Francis Osta**, in Partial fulfilment of the requirements for the award of the Degree of Doctor of Philosophy is an original work carried out by him under our joint guidance. It is certified that the work has not been submitted anywhere else for the award of any other Degree or Diploma of this or any other university. We also certify that he complied with the plagiarism guidelines of the University.

Dr. Mahua Banerjee
(Research Co-Supervisor)
Professor
XISS, Ranchi

Dr. Hari Haran
(Research Supervisor)
Professor
ICFAI University, Jharkhand
Ranchi

PLAGIARISM REPORT

Word Count: 17038

Plagiarism Percentage **7%**

DECLARATION OF AUTHORSHIP

I declare that this thesis titled "**Techno-Managerial factors influencing Productivity of Tailings Dewatering Plant"** submitted by me in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy in Management by the ICFAI University Jharkhand, Ranchi is my own work. It contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text. I further state that Icomplied with the plagiarism guidelines of the University, while preparing the thesis.

George Francis Osta

UID: 16JU11300008

Flat No. D 4, Laiba
Residency, Cheshire Home
Road, Bariatu,
Ranchi- 834009

Date: 13th December, 2023

Place: Ranchi, Jharkhand

ACKNOWLEDGEMENT

At first, expressing my sincere prayers & thanks to the Almighty God, without whose Grace, nothing could come into existence including, here this dissertation too.

For me, this journey of Ph. D. was an opportunity having full of learnings and, I am thankful to the ICFAI University Jharkhand (IUJ) for enabling me pick up my academic pursuits in line with my industrial experiences. Too many distinguished people have contributed in one way or another to the completion of this research;

Sincere appreciation and dedication of thanks go to my research supervisor or Guide Dr. Hari Haran, who had been giving me the full support and encouragement for the completion of this dissertation, towards a meaningful research study, throughout my Ph. D. journey. And, also to my co-supervisor Dr. Mahua Banerjee for her valuable support & guidance. I would also like to extend my sincere gratitude to the research and development committee of the university for their constant support and constructive feedback during my progress. Many thanks to Dr. Bhagabat Barik, Dr. Satyendra Kishore, Dr. Dilip Kumar, Dr. Raj Kumar M, Dr. Rumna Bhattacharya, Dr. M Jha, Dr. Sweta Singh, Ms Pritha Chaturvedi. I would like to give special thanks to the Honorable Vice Chancellor Dr. Raman kumar Jha and Ex Vice Chancellor Prof O R S Rao and, Registrar Prof. Arvind Kumar for their inspiration & unconditional moral support. I am highly indebted to my colleagues for their assistance in collecting data and all the respondents for giving their valuable time & active participation. I am thankful to all Tata Steel executives & consultants for their valuable input suggestions and guidance. Special thanks to Shri Arjun Kumar, my Managing Director for his keen interest towards this research study. Last but not least, I am extremely thankful to my wife, my sisters & brothers, my son and daughter in law for their support in completing this research project.

(George Francis Osta)

Date: 13.12. 2023
Place: Ranchi, Jhakhand

ABSTRACT

In any Organization, People are the greatest asset, whatever innovative system or processes can be developed or change, ultimately any Organization needs its People for the implementation and further improvement.

As per Robbins (2003), any organization is a coordinated & conscious social unit comprises of people and their work functions and efforts in a consistent way towards any target or some objectives. This clearly shows that people are the lives of organizations. Thus, all Organizations are a physical entity and its people are the lives

It does not matter, what's the size of the organizations, what matters for the world is how efficiently an organization is running and what drives in productivity and efficiency. There are a lot of study and research works done by researchers and academicians to find out how Organizations can be more productive and every day new secrets or findings of Productivity are getting added to it. In organizations, new practices and policies are getting implemented and other ways & means also experimented to make their employees motivated and happy to work. This research study is focused on Technological and Managerial working factors aspect of Tailings Dewatering Plants (TDP) to enhance their Productivity. This study helped to find the significant Technological and Managerial factors impact on their Productivity or Performance.

Many studies have been done on Productivity enhancement thro performance of people or employees working in an organization considering behavioural aspects mainly, but limited attention is given to study Technological and Managerial working factors in any organisation. There are various Technological and Managerial factors which influence the Productivity.

In mining and mineral industry, huge volumes of mine waste tailings are generated in ore beneficiation process in India and around the World. To address the Environmental sustainability, installation of Tailings Dewatering Plant and optimisation of its Productivity are the needs of the hour. This study describes the influence of Technological and Managerial factors and their significance on Plant Productivity of Tailing Dewatering Plant in line with the Mineral ore beneficiation processes.

The study was carried out in major Dewatering Plants (DWP) in India, which is an economy where not any research on Dewatering Plants Productivity enhancement based on Techno-

Managerial factors has been carried out. This case study is carried out in the organisations, which is associated with Tata Steel & run by M/S Naresh Kumar & Co. Ltd on Build, Own and Operate (BOO) basis. Here, the population comprises of total 250 employees and, the sample size of 205 respondents from various departments of the organization and other stakeholders which include Operation & Maintenance, Logistics, Human Resources, Internal & External Consultants, Tata Steel concerned professionals. As per the local community is concerned, many employees belongs from the same & their responses are well taken. Key performance indicators for those Organizations, practicing Total Productive Maintenance (TPM) under lean manufacturing philosophy is OEE (overall equipment effectiveness). For sustainable manufacturing, OEE is regarded as a key measure of considerable relevance.

As per the findings are concerned, all though both Technological as well as Managerial factors are significantly important based on various demographical factors, but 'Safety initiatives' emerges as one of the key issue, which needs to be pin pointed and focussed.

KEY WORDS: Tailing Dewatering Plant (TDP), Overall Equipment Effectiveness (OEE), Dewatering Plant (DWP), Total Productive Maintenance (TPM).

Table of Contents

1.1. Introduction 12
Background of the study 12
Factors Affecting Performance / Productivity 14
A.Technological Factors: 15
B.Management Factors: 15
1.2.Motivation for the Study 15
1.4.Scope of the Study 16
1.5Organization of the study/Thesis outline ..... **Error! Bookmark not defined.**
3.5.2 Herzberg's Motivation/ Hygiene Theory (Two factors theory) 42
3.7.1 Sample Frame 48
Population Distribution 48
3.7.3 Sampling Technique 48
3.7.4 Sample Size 49
3.8.1 Primary data 50
3.8.2 Secondary data 50
4.1Introduction 54
4.2Scales Assessment 54
4.4Demographic details 55
4.4.2 Gender of Respondents 56
4.5Test of Reliability andValidity 61
4.5.1Reliability Test 61
4.6Findings in relation to Objectives ..... **Error! Bookmark not defined.**
4.9Test of Hypothesis 90
4.9.1 Correlation 91
4.9.6. Discussion of findings 94
4.9.7 Summary 95
5.1.Introduction 97
5.2.1 Summary ofFindings 98
5.4Major recommendations 101
5.5Limitations of the Study 102
5.6Scope for future research 102
5.7Conclusion. 104

LIST OF TABLES

Table 3.1: Details of respondents as per the locations of Dewatering Plant	43
Table 3.2: Population Distribution	44
Table 3.10: Data analysis framework	47
Table 4.3: Details of respondents as per the locations of Dewatering Plant	50
Table 4.5.1: Reliability Statistics	55
Table 4.5.2: KMO and Bartlett's Test	56
Table 4.6.1: Analysis of the influence of Technological and Managerial Factors	57
Table 4.7:Technological Factors	63
Table 4.1.1: Standard Operating Practices (SOP)	64
Table 4.7.1.2: Safety Initiatives	65
Table 4.7.1.3: Technological Learning's or Innovation Management	67
Table 4.7.1.4: Plant layout Orientation	68
Table 4.7.1.5: Materials Management	68
Table 4.8: Analysis of Management Factors	71
Table 4.8.1.1: Leadership	72
Table 4.8.1.2: Management of change	73
Table 4.8.1.3: Team work	74
Table 4.8.1.4: Motivation	76
Table 4.9.1: Correlation	78
Table 4.9.3: Model Summary	79
Table 4.9.4: ANOVA	80
Table 4.9.5: Coefficients	80

LIST OF FIGURES

Figure 3.1.0: Conceptual Framework for factors influencing Productivity of Tailing Dewatering Plant.	40
Figure 4.4.1: Age wise Distribution of the respondents	51
Figure 4.4.3: Qualification-wise respondents	52
Figure 4.4.4: Respondents demography based on their working experiences (in years)	52
Figure 4.4.5: Distribution based on association with no's of Plant in their Career	53
Figure 4.4.6: Respondents demography as per their experiences in no's of Dewatering Plants	54
Figure 4.4.7: Respondents demography as per their experiences in working in Dewatering Plant	54
Figure 4.6.1: Analysis of the influence of Technological and Managerial Factors	57
Figure 4.6.2: Age-wise Analysis of Technological and Managerial Factors	58
Figure 4.6.3: Analysis of Technological and Managerial factor based on respondents Educational status	60
Figure 4.6.4: Significance level of Technological and Management factors as per the respondents Working experiences	61
Figure 4.6.5: Significance level of Technological and Management factors as per the respondents Experience in working in Dewatering Plants	62
Figure 4.6.6 Significance level of Technological and Management factors as per the respondents Experience in no's of Dewatering Plants	62

LIST OF ABBREVIATION

Acronym	Full Form
1. TDP	Tailing Dewatering Plant
2. SOP	Standard Operating Procedures
3. DWP	Dewatering Plant
4. OEE	Overall Equipment Effectiveness

CHAPTER 1

INTRODUCTION

1.1. Introduction

The main reasons for the study is highlighted in this chapter. It also gives the statement of the problem, objectives of research, research questions, and significance of the study, background information of problem, scope and how the study is organized.

Study background

In Worldwide, since current environment is very competitive & challenging, so every organization aspires to be successful as much as possible (Mudor and Tookon (2011).

Further, each organizations are putting much efforts to overcome the challenges of job satisfaction and fulfillment of tasks & assignments, assigned to their people so trying to make good human relationship too (Fisher, 2012). So in the present environment, driving sustainable Productivity is the major challenge before Organizations and as well before the society too.

The economic development is happening globally due to present competitive scenario. This also increases the demand of minerals product resulting in increased production of mining minerals. Thus at end more tailings getting generated. This also causing more problem of tailing handlings, environment, mining etc. If this tailings will be not handled judiciously then always there will be a tendency of overflow to rivers & polluting the water. So, for further recovery of these Tailings as an industrial by-product for further miscellaneous uses having some Economical value addition too along with to address the Environmental sustainability, installation of Tailings Dewatering Plant is the key initiatives in line with any mineral beneficiation processes, and thus, optimisations of Plant Productivity of dewatering Plants are the need of the hour.

There are various factors which influences the Productivity as per the Technological and Managerial point of view. This thesis describes the importance of some key Technological and Managerial factors in optimization of Productivity of Dewatering Plants. Here considering the case of key Dewatering Plants in India associated with

Tata Steel, perceptions of experienced personnel associated with Dewatering Plants have been analysed to study the influence of both factors. The analysis was done based on different demographical experiences of respondents. This thesis discusses findings of significance levels of both technological as well managerial factors based on different demographical parameters and suggests how this could be strategically used in any organizations particularly in dewatering plants.

Productivity also refers to an overall measure of efficiency as it's also a kind of ability to transform all inputs into desired service or products or deliverables etc.

Towards achieving the target objectives in any effective way, one has to utilize the input resources in a much optimized way, whether in terms of quality as well as in terms of quantity. So the outcome in the form of product or services will always will be at the rate of an optimized cost. The losses should be at a minimal level and moreover there is no wastages. Here the input may be in the form of materials, labor, and machine utilization, energy inputs etc. In an organization, productivity ratio is very wide and based on the inputs viz. labor, machine, Energy, complete system & finally the total plant or complete unit Productivity may be evaluated.

As a concept, Productivity have some objective. It can be measured as an objective concept, ideally against some universal standard. As such, organizations can monitor productivity for strategic reasons such as corporate planning, organization improvement, or comparison to competitors.

In case of any Project whether green field or brownfield, there also Productivity concept is most vital. Project Manager has to make strategy & use different Project Management tools, software's to monitor the utilization of all kinds of resources in an effective and, optimized way to ensure Project cost versus the Project budget.

Different people or area wise productivity can be viewed as differently viz. In Economics it being called as partial or total Productivity, in accounts, it regarded as financial ratio or budgetary variances, in the eyes of behavioral Scientists as labor utilization (Man-days), and Engineers understands productivity as Capacity utilization, Production per Man-hour, Manpower efficiency.

Productivity is the multiplier effect of efficiency and effectiveness. Productivity can be expressed in different forms like partial factor productivity, multifactor productivity, and total productivity.

Some organizations following the philosophy of TPM (Total Productive Maintenance to address & improve the Efficiency as well as ultimately Productivity of the organization at different levels & different areas, also facilitating and driving sustainable manufacturing, OEE is gaining increasing interest as a key measure of considerable relevance and represents as:

OEE = Availability x Performance Rate x Quality Production Rate

Productivity related factors

Several factors have linkages with Productivity. Moreover, since, every individuals are the part of the system or Plant or organisational unit. So each ones performance is vital as each individual's contribution or performance together towards the organisational goals or objectives, results into Plant or organisational Productivity. These factors are regarded by Management experts as:

(a) Controllable internal factors and, (b) Uncontrollable external factors

Thus, based on the literature reviews, finally the following are the factors which are affecting Productivity:

Job hours, job nature i.e. Human and Machine or Equipment Safety, Competencies of Employees, Job Security, Social security & welfare, Employees skill trainings, Salary packages & perks, Freedom at work to perform, leadership quality, Employees motivation, Opportunities of Career development, Rewards and recognitions, Performance incentives, Organisational working culture, Behaviour of peers & bosses, work locations, Management hierarchy & approach, Human resource policies, Technology used at work, Business strength, weakness and threat environment, Speed and agility, Customer centricity etc.

Finally, key working factors, which are more practical oriented have been identified from Literature reviews, going through reference manual of Tata Business Excellence model, focus group interview and discussions with Tata steel Chief, Head & Senior Manger level personnel, interaction with Plant officers and Supervisors, External Consultants & Technology supplier experts and, considering the dewatering Plants overall operational scenario.

Thus, Following factors were identified for further study in details, which influences the Productivity of Dewatering Plant:-

A. Technological Factors:

Standard operating Procedures (SOP), Safety initiatives, Technological learning's or Innovation Management, Plant layout or Orientation, Materials Management.

B. Managerial Factors:

Leadership, Management of change, Teamwork, Motivation, Training & skill Development.

1.2. Motivation for the Study

In mining and mineral industry, huge volumes of mine waste tailings are generated in ore beneficiation process in India and around the World. To address the Environmental sustainability, installation of Tailings Dewatering Plant and optimisation of its Productivity are the current needs of the hour.

So, the main thought behind this study is how to enhance the Productivity of Dewatering Plants by providing a comprehensive understanding of key Techno-Managerial factors and, thus to contribute in the body of knowledge. The study would contribute significantly to understand how all factors contribute & impacts on Dewatering Plant Productivity and what are the key statements of each factors validating their impacts.

1.3. Relevance of the Topic

Very relevant topic and, challenging & interesting one for research work as because:

a. The topic synergy has useful linkages with my current profession as in the process will be able to freeze strategy & action plans for the Productivity improvement and, cost optimization considering significant Technological & Managerial factors.

b. Gap analysis in the process could be evaluated to modify operating practices & other modification activities, if any.

c. Research learning's could be taken care & implemented in the upcoming Dewatering Projects to address sustainable Productivity.

d. New dimensions in the field Dewatering Plants could be explored.

1.4. Scope of the Study

Here the study is done in major Dewatering Plants in India associated with Tata Steel. Earlier this type of study was not carried out related with Productivity enhancement of Dewatering Plant considering Technological and Managerial factors.

Further, these tailing dewatering Plants are installed by another company on BOO (Build own & operate) basis of agreement between Tata Steel and M/S Naresh Kumar & Co. Ltd.

Here a total of 250 employees comprises as the Population and, out of them, 205 is the no's of persons taken as sample. This 205 no's of sample taken from each sections of the plant. Someone are from Human resources, some from store & logistics, some are from electrical, mechanical & operation departments. Some person, who are closely related with the dewatering Plants also included from Internal & External Consultants, some Tata Steel relevant professionals and other

stake holders also taken in the sample.

As per the local community is concerned, many employees belongs from the same nearby localities & their responses are well taken.

1.5 Outline of the study & the thesis:

Here in this thesis outline five major chapters are there. The first chapter introduces the basic concepts of evaluation of tailings Dewatering Plant and Plant Productivity. The challenges in analysing degree of significance level of key Techno-Managerial factors brought out in this chapter.

In the second chapter, all relevant literatures, manuals, books etc. taken into study is presented. So far, this literatures review also facilitates of identifying gaps in the research work undertaken and, also guides about the research framework.

The third chapter addresses the methodology of the research work adopted for the study. From the different literature reviews & thesis's, we got an idea of research questions and, basic research questions developed in connection with the development of objectives and different hypotheses of the study. The sampling plan also discussed here. About the pilot study conducted of the research design is also explained to ascertain its robustness.

In the fourth chapter, the analytical job viz. data analysis done being presented with the help of statistical tools and measures explained and the hypotheses testing also set out here in this chapter along with the various interpretations.

In the fifth and final chapter, explained the data analysis results and their interpretation, contributions, limitations and further future scope of research, conclusions etc.

1.6 Summary

The basic idea of this research outlined here in the chapter, which is to study the Key Techno-Managerial factors influencing Productivity of Tailings Dewatering Plant, to analyze facilitating Techno-Managerial factors & their degree of influence for the improvement of Productivity, to identify measures based on influence of Key Techno-Managerial factors for the enhancement of Productivity of Tailing Dewatering Plant.

In starting, along with an introduction, motivation for this study explained. Finally, the scope of this study and a detailed outline of the thesis also discussed.

CHAPTER 2

REVIEW OF PUBLISHED LITERATURE

2.1 Introduction

To get a research framework & foundation on the research topic, relevant literature review is a must. It also provides the amount of research work done so far on the topic in the body of knowledge. Here in this chapter, all kinds of relevant literatures, manuals & books being studied keeping back of the mind all research questions, which are as follows:

(i) What are the key factors in relevance of Managerial aspects inflencing the Productivity of Dewatering Plant?

(ii) What are the main Technological factors, which influences the Productivity of Dewatering Plant?

(iii) How much these factors impact on Productivity of Dewatering Plant?

Since in the late 1920s and early 1930s, some research work on motivation linking to enhance productivity initiated taking help of the studies of Elton mayo, Maslow's and western electric Hawthorne plant.

During that period, studies done based on considering mainly Human behavioural factors, but studies based on Plant related key working factors which having significant impact on Plant productivity are very rarely available.

Learnings & knowledge captured from al kinds of research work done in earlier times, serves as the foundation of my study and research work.

Here various factors both Technological and Managerial, which influences Productivity of Dewatering Plant presented.

2.2 Literature reviewed with citation on the Topic

Although many different literatures being referred to derive the key Technological & Management factors, but The Tata Business Excellence model, reference manual, 2010 serves as the base.

2.2.1 Technological Factors that Influence Productivity of Dewatering Plant:

Those working factors which needs technological interventions or having any technical interfaces are generally considered as technological factors.

2.2.1 A) Standard operating Procedures (SOP)

At shop-floor, it being a normal practice to fabricate step by step work instructions of activities to perform any particular job, which is termed as standard operating procedure (SOP).
This SOP in the process helps, down the floor workers to carry out routine or any job or operations safely & satisfactorily.
Here, through SOP the objective is to achieve efficiency, effectiveness, quality output, and performance consistency and uniformity. This also ensures miscommunication and failure to comply activities as per the industry standards & regulations.

SOP also helps to ensure that according to de Treville et al. (p.232), in the same way & processes, every workers are performing the tasks, which is a desirable state, ensuring to get consistent output.

According to consultants of **Biologic Technological Applications** (EBTE), SOP also helps any newly inducted person in the organisation by creating transparency. SOP acts to create valuable structure to improve internal communication. Through SOP, best practices can be shared across the organization, which in the process provides background valuable information's for the development of management policy and desirable changes.

SOP have the capability, as per Levinthal & March (as cited in de Treville et al, p.231), for the improvement of organizational effectiveness, best practise & knowledge sharing facilitation is very crucial. This actually reduces the variability.

SOP domain as per Edelson & Bennett (as cited in Treville et al, p.232), includes all kinds of process related equipments and, resources.
In case of any SOP development, the best practice calls for positive and, active involvement of shop floor workers. The high performing & successful managers actively involve & engage all team members for any SOP development.

Managers and team leaders, who write SOP without taking input from shop floor workers run the risk of upsetting them (Stup R., p. 6).

The main reason of involving workforce is that individuals who participate in the processes are positive to generate ideas, feel a sense of ownership about the SOP, and accept the SOP, which is not the case when workers feel and get a sense that management is imposing any SOP without regard to their input.

As per Adler, Imai, MacDuffie and Monden, (as cited in Treville et al, p.234), states that wherever, organisations implement workers' creative & valuable suggestions are more likely ends up with higher quality of SOP's; they usually foster teamwork.

To address, continuous improvement in the organisation, established procedures need amendment & continuous enrichment; which requires novelty & creativity i.e. new ideas from those individuals using those procedures in line with their job (Treville et al, p. 233)

For managing SOP development, PDCA(Plan-Do-Check-Act)cycle is one of the earliest known model i.e. first, plan; next do what planned; then check what and how things went; and finally, act on what learned in the whole process.
When SOP is developed then the next critical stage is adherence to it i.e. everyone should follow and adhere to the established SOP.
However, adherence to SOP does not happen automatically and one of the primary jobs of management is discipline of ensuring workers adherence to the same, according to Imai, Edelson & Bennett (as cited in Treville et al, P.236),.

2.2.1. b) Safety initiatives

Safety initiatives is generally an employee's condition or situation to work in a standard safety environment but in parallel also to contribute ideas or suggestions and are proactive in enhancing the safety standard in their work environment (Zacharatos, 2002.).

Under safety, risk is understood and managed as a result of the models used to explain how accidents happen. Many of these models are stated in the Encyclopedia of Occupational Health and Safety, edited by J.M. Stellman, International Labor Office, Geneva.).

As per, the Domino Theory developed in 1931, which states that one event leads to another, then to another and so on, culminating in the form of an accident. Finally, concluded that unsafe acts and unsafe conditions are the base i.e. 88 percent of accidents are caused by unsafe acts of people, 10 percent by unsafe actions and 2 percent by acts of God

Work environment also plays a crucial role since it influences & creates employee motivation. All employees are concerned with a comfortable physical working environment, which will ultimately provide extra optimistic level of motivation. Amongst other things, unfavourable working conditions can affect badly on the employee's physical and mental well-being.

Factors such as working hours and at site or workplace noise, dust, temperature, ventilation, hygiene, lighting, and resources are all part of working conditions as per Arnolds and Feldman (2001).

Since employees job demand mentally and physically tranquillity, so negative attitude along with poor performance will provoke poor working conditions as per Irons and Buskist, 2008.

Furthermore, when employees have feelings that management does not appreciate or acknowledge their work done or efforts, they may use poor working conditions as an excuse to get back at management (Whittaker, 2008).

Reason in 1991, developed the risk Management model and, the resident Pathogens and, his theory states that some residual risks will always exist and are not reducible by purely technological counter-measures.

Employees contribute to accidents in high-risk technologies domain through slips, trips also, where planned actions do not go as and through mistakes, which are deficiencies or failures of judgment and the accumulation of human errors, which leads to latent and active failures of organizational systems. Reason also argues the presence of residual risks needs to be also appreciated and to contain it strategies need to be developed. Line managers to over-ride their assumptions that systems are "safe" and to look for this inherent weaknesses in business systems to address this challenges.

2.2.1. c) Technological learning's or Innovation Management

Innovation management involves the process of managing an organization's innovation procedure, starting at the initial stage of ideation, to its final stage of successful implementation. It encompasses the decisions, activities and practices of devising and implementing an innovation strategy. Three theories of technology and innovation; the product-process concept, the meta-learning concept, and the concept of technological interdependence, are used to relate technology and innovation to strategic management.

The four types of innovation viz. sustaining or incremental innovation, Breakthrough innovation, Disruptive innovation, Basic research.

Technological advances, customer behavior changes, intensified competition and the changing business environment are some of the factors that are creating the need for innovations in the organizations (Goffin & Mitchell, 2010).

According to Tidd, Bessant and Pavitt (2008), innovation can be related to the organizations' ability to recognize the market opportunities and establish commercial relationships that make them economically viable. It is related to the development of

new products, new processes or to the creation of new ways to work on established and mature markets

2.2.1. d) Plant layout or Orientation

A plant layout study is an engineering study used to analyze different physical configurations for a manufacturing plant.
The principle of minimum travel (from suppliers, to the airport, to customers, etc.)Viz. The principle of sequence, Effective use of available space, the principle of usage, the principle of safety, Maximum visibility. The principle of flexibility, the principle of minimum investment, Maximum accessibility, Overall integration of factors.

A good layout is one that integrates men, materials, machines and supporting activities and others in a way that the best compromise is obtained. No layout can satisfy each and every principle of a good layout.
A good placement of facilities contributes to the overall efficiency of operations and can reduce up to 50% the total operating expenses (Tompkins et al., 1996).

Amine Drira, (2007) defines in his review, different types of facility layout problems and has discussed various problem formulation methods.
The authors also discussed different facility problem solving techniques with more emphasis on dynamic facility layout problems. He has derived a rough tree structure to present an idea of different considerations while developing a plant layout.

Robin S. Liggett (2000) reviewed about techniques that are used to optimize single objective functions and evaluated various variety of space allocation problems and uses of different algorithm to solve these space allocation problems with detailed review of facility problems/space allocation problem.

2.2.1. e) Materials Management or Planning

Materials management is the process of planning and controlling material flows. It

includes planning and procuring materials, supplier evaluation and selection, purchasing, expenditure, shipping, receipt processes for materials (including quality control), warehousing and inventory, and materials distribution.

Integrated decision making provides opportunities for efficiency improvements compared to sequential decision making (Darvish and Coelho, 2018, Farahani et al., 2015).

It is a management philosophy that extends traditional intra-enterprise activities by embracing an inter-enterprise scope, bringing trading partners together with the common goal of optimization and efficiency (Harwick, 1997).

Kasim Anumba Dainty et al. (2005) described a key factor adversely affecting project performance is the improper handling and management of materials on site. This paper reports on the early stages of research, which is developing a new ICT-based approach to managing materials on fast-track schemes. They concluded that, it is clearly important to manage all materials from the design stage to the construction stage. Poor handling of construction materials affects the overall performance of construction projects in terms of time, budget (cost), quality and productivity. The wastage of materials should also be minimised during construction in order to avoid loss of profit for construction companies. There is a need to develop new approaches to materials management in fast-track construction projects in order to improve the efficacy of the production process. (17)

Hemsworth Martinez-Lorente Clavel et al. (2006) stated that Standardization of materials is one important purchasing department decision. The primary objective of this study is to examine empirically the impact of standardization of materials and purchasing procedures on purchasing and business performance. Kasim et al. (2007) stated that Materials management is made problematic by materials shortages, delays in supply, price fluctuations, damage and wastage, and lack of storage space

Ngwu Okolie Ezeokonkwo et al. (2015) identified the key areas where material management is deficient so that improvement could be made in order to increase productivity. Effective

SCM rests on the twin pillars of trust and communication (Grieco, 1989).

Working cooperatively with suppliers, savvy procurement professionals move beyond mere cost reduction into the domain of real manufacturing efficiency, utilizing concepts and techniques such as value analysis, materials standardization and early supplier involvement (Porter, 1994).

2.2.2 Managerial Factors that Influence Productivity of Dewatering Plant

Those working factors which are purely Management driven i.e. Managers needs to display as a role model in their daily activities viz.

2.2.2. a) Leadership of the organization

Leadership is about guiding & influencing people to do the right things in an optimised way. This could be achieved with trust of the people on the leader so that they follow the leader religiously.
And if the leader want the people to trust and do things for him & the organization, they need to be motivated. As per the theories it implied that followers and leaders raise one another to higher levels of motivation and morality.

Motivation is purely and simply a leadership behaviour and, stems from wanting to do what is right for people as well as for the organization. Motivation and leadership both are active processes in management (Rukhman, 2010).

As per Fred Fiedler and his the Contingency management theory, no one management approach works for every organization and he suggested a leader's traits were directly related to how effectively they lead their team.
He also asserts that a leader must be flexible to adapt to a changing environment as there are leadership traits that apply to every kind of situation.

Henri Fayol, a senior executive and mining engineer, developed one theory in the 19th century. As per Henri Fayol and his Principles of administrative management theory, an organization through the perspective of the managers and situations they might encounter. As per his belief, leaders had mainly five functions—to forecast & plan, command, coordinate and control. He also outlined how leaders should interact & organize communication with their teams. He also advised that his principles is not so rigid and it is left up to the managers to determine how they use them to manage efficiently and effectively.

His principles outlined as:

- Equity which refers that in an environment of kindness, everyone's self-esteem & dignity should be respected by each one & vice versa.

- Initiative which implies as level of freedom whereas employees understands their accountability & responsibilities without any force or order.

- Scalar chain which implies the communication processes from top to bottom level of management. .

- Remuneration or Salary packages & perks, which refers to the assertion of incentives based on performance levels. This usually addresses bonding between the management & its people.

- Organization should have standing orders that clarify rules regulations along with a reward system.
- All the team members should have shared responsibilities with accountability based on their key strengths & skill from overall action of management. This will ensure effective and efficient participation from all.

- Keeping the organizational interest as priority as it will bring rewards for each individuals, everyone should work as team with harmony.

- Centralization refers that at the top level, have the power or authority. This will ensure smooth running of the organization.

- Stability of tenure implies that employees must have some job security, which will facilitates them to be efficient.

As per Tata Business Excellence model, 2010 reference manual, senior leaders must be a role model for their workforce. They should have ethical values & strong commitments.

2.2.2. b) Management of change

Change management is a systematic approach to dealing with the transition or transformation of an organization's goals, processes or technologies.

The purpose of change management is to implement strategies for effecting change, controlling change and helping people to adapt to change. It provides a safe and systematic approach to managing changes in the organization.
Management of change have great linkages with some theories viz. Kotter's model, adoption model & science of improvement and Lewin's model.

In any organization, for effective change management, the main seven components viz. Structure, Strategy, Staff, Style, Systems, Shared Values, and Skills should have very strong coordination & they have to work together as per McKinsey 7-S Model.

Actually, in practical field any kind of transformations or change done with clear understanding, much conviction, developing new skills & talents, role modelling as leader, yields in the form of great success.

Management guru & Harvard professor John Kotter also developed a theory on management of change, which also validates that in case of any change the success depends mainly People, the greatest asset of any organization.

In case of any change processes, the psychology of the people involved or participated is the greatest factor for the success.

2.2.2. c) Teamwork

When people work together towards a common goal or target that could be personal or organisational then it termed as teamwork.
It is the collaborative effort of a group or team to achieve a common goal or to complete a task in the most effective and efficient way. The theory behind teamwork is human relations theory, whereas by encouraging interpersonal relationships and creating a collaborative transparent environment.
We should have to give more power to our team members in making decisions. This means allowing or giving them more control within their roles so that they can exhibit greater contribution towards organisational goals, objectives and strategical targets.

Cohen et al. [23] stated agent teamwork as "a set of agents or groups having a shared objective or goal and a shared mental state",

Whereas Salas et al. [85] characterizes & defined human teams as "a distinguishable set of two or more people who interact interdependently, dynamically and adaptively towards a common and valued goal/target/objective/mission".

A team is a group of people working together to achieve the same strategical objectives. In their report Katzenbach and Smith state in The Discipline of Teams (1993) that 'the main essence of a team is common target or commitment. Without this, any groups perform as individuals and, with it, they become a powerful unit of collective performance.'

Consistently, the literature highlights & stressed upon that one of the essential elements of a team is its focus toward a common goal and a clear purpose (Fisher, Hunter, & Macrosson, 1997; Johnson & Johnson, 1995, 1999; Parker, 1990; Harris & Harris, 1996).

Team members must be flexible & transparent enough to adapt to cooperative working environments where goals are achieved through collaboration, consistent efforts and social interdependence rather than individualised, competitive goals (Luca & Tarricone, 2001).

Team members should have commitment to team success and shared goals and understand their purpose. The combination of all these achieves mission (Francis & Young, 1979).

Team members must share a strong common goal (Kets De Vries, 1999). The Groups provide each member of the team with prestige and recognition (Scarnati, 2001). Successful teams are more motivated to succeed (Bradley & Frederic, 1997).

To achieve any success, in a team, determined commitment needs to be displayed by all team members (Critchley & Casey, 1986).

In a team, among themselves, strong belief on the team capability to achieve success should exists (Kets De Vries, 1999).

In a team, all members' goals should be connected with each other & members should have more frequent communication & interactions towards the team goal (Scarnati, 2001).

In a team, group success depends upon each one of the members success (Smith, 1996).

In any team, the major attributes are commitment, confidence along with trust, among the members (Harris & Harris, 1996). In team, communication is very important component (Kets De Vries, 1999).

In teams, criticism also to be encouraged for further improvement (Harris & Harris, 1996).

In team, integrity & honesty at all stages by the team members is a significant part (Critchley & Casey, 1986).

In a team, optimized no's of member needs to be selected (Bradley & Frederic, 1997).

In a team, members must accept individual accountability/personal responsibility (Smith, 1996).

In team, accountability of success and failures lies on each team members (Smith, 1996).

In team, new ways to be experimented to work more effectively (Wageman, 1997).

In team, all members must seek for best practices from other teams and other parts of the organizations; (Wageman, 1997).

In team, all members have to be open to change, innovation and creative, joint problem solving (Harris & Harris, 1996).

In team, members must take action to solve problems without waiting for direction (Wageman, 1997).

In team, progress needs to be monitored and post-project analysis also to be done to find out what went well or what needs improvement (Johnson, Heimann, & O'Neill, 2000)

2.2.2. d) Motivation

Research on workplace performance and motivation has been started since the late 1920s and early 1930s. The study of Elton Mayo at the Western Electric Hawthorne plant and Maslow's need hierarchy theory was the starting point.

The ingredients of motivation lie within everyone and the internalized drive toward the dominant thought of the moment (Rabby 2001).

Motivation directly links to individual performance that gain to organization performance and also as a catalyser for all individual employees working for an

organization to enhance their working performance or to complete task in much better way than they usually do.

Any organization runs because of people working for it, and each person contributes toward achieving the ultimate goal of an organization.

It being concluded that factors affecting staff motivation at a period where the financial rewards are kept to the least leads to stimulate employee performance (Panagiotakopoulos, 2013).

So, management personnel's responsibility to motivate their employees to work as per the expectation to enhance the organization's performance.

It being also concluded by Dysvik and Kuvaas (2010) that intrinsic motivation was the strongest predictor of turnover intention and relationship between mastery-approach goals and turnover intention was only positive for employees, low in intrinsic motivation. The only thing organization needs to do is to give employees with ample resources and platform to do.

A successful organization must combine the strengths and motivations of internal employees and respond to external changes and demands promptly to show the organization's value as per Kuo (2013).

In this paper, we have taken various techniques of motivation from existing literature, and managed to make flow of motivation from young-age employees to old-age employees. From organization perspective managers need to understand the flow of motivation, it helps them to create a culture where employees always get motivated to do better.

It was found by Barney and Steven Elias (2010) that with extrinsic motivation there exist a significant interaction between job stresses, flex time, and country of residence. Leaders know that at the heart of every successful and productive business lies a thriving organizational culture and hardworking people collaborate passionately to produce great results (Gignac and Palmer 2011).

Various frameworks are used by the researchers in the body of literature, based on theory of motivation, with only few dimensions of motivation.

2.2.2. e) Training and Skill development

In any organisation, it is the people, who is responsible for any improvement, system implementation or for any change management. Many new initiatives could be thought off, but ultimately the human resource force will be accountable for successful implementation of that initiatives. Thus, People are the greatest asset for that organisation and moreover, Productivity of the organisation greatly dependent upon the capability & skill of the associated Human resource force or the people of the organisation.

For upgrading the capability of people of the organisation, training & skill development is very essential. So, skill development & training is greatly linked up with improvement & boosting up of Plant Productivity.

It was also proposed & validated by Frederick Taylor also. As per his scientific theory of management, sharing of the best practices is among employees and across the organisation will help to upgrade the skill levels of the people. Training matrices could be designed with respect to the work activities associated with the People. Organisational policies may also be modified in support of the same to improve the skill level of the employees.

It is also important for the management to select the right person & for his desired right training. So skill matrices of all individuals should be correctly mapped based on his or her present skill set and based on the job activities of each individuals, the skill set desirable to improve his or her on job performance, which in turn will contribute in Plant Productivity improvement. So investment in training & skill development of employees never be a wastage, it will be a worthwhile investment. Organisational leader's also have an attention over all employees, who are undergoing training so human relation theory also validates that due to this attention employees who had undergone to improve their skill, also remain serious on their individual performances and, thus Plant Productivity will automatically get improved.

In our country the population of youth generations are very high & that is our advantage for high growth in all the sectors. In India around 54% of the population is below the age of 25 yrs. This ensures easy availability of young workforce for growth in all the sectors of Industries. For our country this is an edge in comparison of other countries across the

world. Now, the need of the hour is suitable training for their skill development as per their capability, interest & the type of job requirement. Although, the Government propelled the "Make in India" initiative and also requirement for Skill Development activities too as for comprehensive & sustainable growth, skill development is the basic for young populace.

2.3 Research Gap

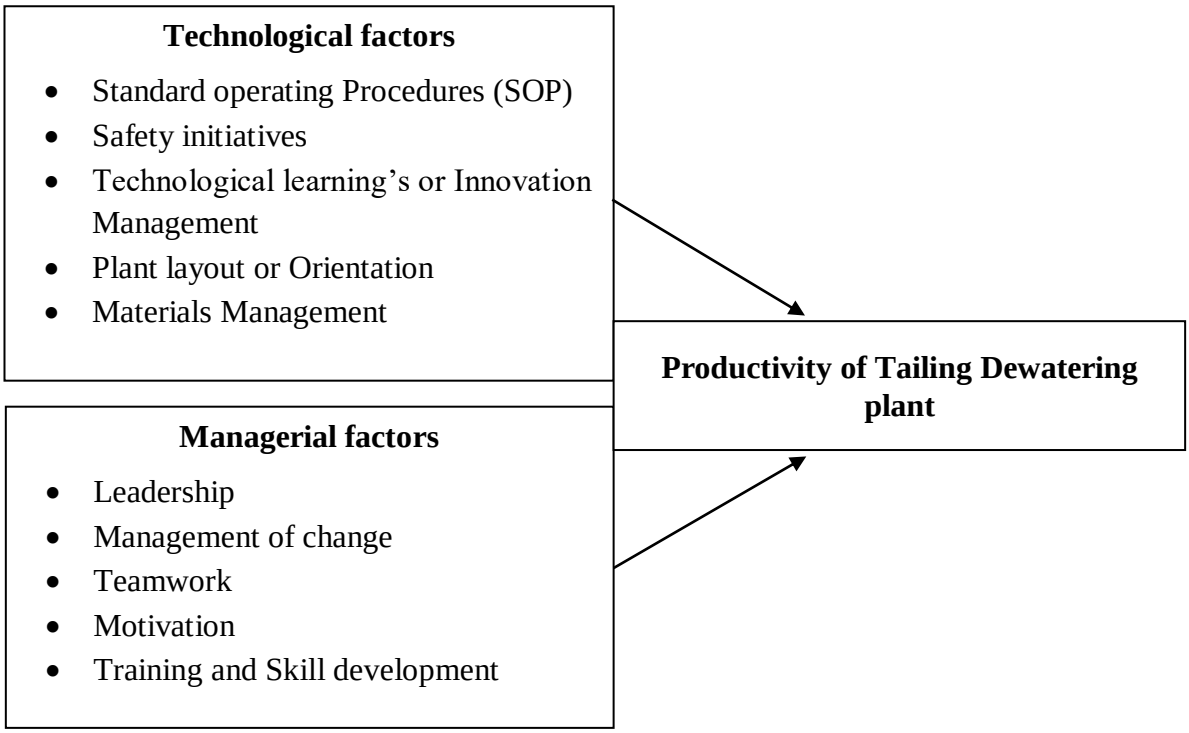
From the various literature reviews, we have seen that based on human behavioural factors & motivation for Productivity enhancement, studies have done. But literature surrounding motivational theory based on Plant related key working factors and, their significance level, which measures impact of motivation on Plant productivity merely visible.

2.4 Conceptual framework

Conceptual framework is a summary of variables, which could be fabricated in a logical manner with the help of literature reviews & focus group discussions and interviews (Sekaran, 2012).

Here, in this study, we discussed with Tata Steel seniors & other executives and, Industry experts connected with dewatering Plants and mineral processing.

Here in this study, independent variables which includes Technological and Management



Factors while dependent variable is Productivity of Dewatering Plant. As per the literatures review & the studied theories also supports this conceptual frameworks.

Higher the motivational impact level of these working factors, higher the Plant productivity. This linkages also explained in chapter 4 after analysis using statistical tools too.

2.5 Summary

Finally, here literature reviews on Technological and Management factors for enhancement of Plant Productivity is presented. This may be of theoretical type or some are empirical also.

From this reviews, we came across various researched theories and their explanations too. These theories somewhat related partially or fully, but have given an idea and further provided guidance for research.

Study on Productivity enhancement provides a wider range of scope & knowledge, going through many literatures and manuals widens the thought processes. Research on Productivity enhancement of dewatering Plants connected with Tata Steel Dewatering Plants in India as a novelty in case studies.

CHAPTER THREE

RESEARCH METHODOLGY

3.1 Introduction

Here, in this chapter to conduct the study, the methodology adopted are presented, Which is focused on research design, sampling technique, methods of data collection & analysis, research procedures, population.

Since here the purpose of the study is of association between the variables so, descriptive design taken for this research study, which also maximizes the reliability of the collected evidences with minimum bias.

Here the problem of the statement remains absolutely clear. Here specific hypothesis and detailed information needed to find the impact of Technological & Managerial factors and their significances on Productivity of Dewatering Plant.

3.2 Research Question

Basically in any quantitative study, research questions and research objectives should be closely linked. The research questions are :

i) What are the key Techno-Managerial factors influencing Productivity of Tailings Dewatering Plant?
ii) Which factors are more significant & their justification?
iii) How much is their degree of influence for the improvement of Productivity?
iv) What are the identified measures needs to be taken for the enhancement of Productivity of Tailing Dewatering Plant based on the evolved significant factors?

3.3 Statement of the Problem

Productivity & Efficiency is the prime for any Growth. This growth may be anywhere in any sector or in any manufacturing/Processing units/areas etc. As an Environment sustainable Project, Dewatering Plants are the current need of the hour. In any mineral beneficiation system, Tailings dewatering unit should be viewed as an integral part, to address the processing of generated mineral tailings in the process.

Hence, Productivity of Tailings Dewatering Plant is an important concern ensuring zero discharge and extending the reach towards driving sustainable Productivity. Here in the studies, thro' the literature survey number of techno-managerial factors responsible for the enhancement of Productivity of manufacturing or different processing units have identified but it is not clear whether these factors are also significant for Dewatering Plants also and how they are impacting? Moreover as a pin point, which factor is more significant and in what way? There may be a possibility that these factors may or may not impact on Dewatering Plants Productivity as of the same case as of any processing or manufacturing Plants.

Multiple factors may effect on Productivity in which some factors are connected with labour Productivity for its increase or decrease.

Others also viz.

Payment system & individual rewards/recognition systems and the effectiveness of Human resource department in hiring, training, communication with employees on any issues e.g. Remunerations and other incentives, Speed and agility, Customer centricity etc.

Finally, at last following factors are finalized for study:-

a) Technological Factors:

Identified from Literature reviews, going through reference manual of Tata Business Excellence model, focus group interview and discussions with Tata steel Chief, Head & Senior Manager level personnel, interaction with Plant officers and Supervisors, External Consultants & Technology supplier experts and, considering the dewatering Plants overall operational scenario.

These factors are purely shop floor driven, needs technological interventions based on different job activities viz.

- Standard operating Procedures (SOP),
- Safety initiatives,
- Technological learning's or Innovation Management,
- Plant layout or Orientation,
- Materials Management.

b) **Managerial Factors** :

Identified from Literature reviews, going through reference manual of Tata Business Excellence model, focus group interview and discussions with Tata steel Chief, Head & Senior Manager level personnel, interaction with Plant officers and Supervisors, External Consultants & Technology supplier experts and, considering the dewatering Plants overall operational scenario.

These factors are purely Managerial driven i.e. Managers needs to display as a role model in their key activities.

- Leadership
- Management of change
- Teamwork
- Motivation
- Training & skill development

The study was conducted in key Tailing Dewatering Plants in India associated with Tata Steel viz. West Bokaro-Ghato (Jharkhand), Jharia at Jamadoba (Jharkhand) and, Sukhinda (Orissa).

These are being selected due to:

i. Very close working relationships, ii. Familiarity of the place, iii. Similarity in Manpower competency & skill set, iv. Cheaper means of getting good and needed information at a time and at the lowest cost, v. Good support from everyone.

3.4 The Study Objectives

The objectives are as follows:

i) To identify and prioritize key factors(Technological and managerial), influencing Productivity of Tailings Dewatering Plant ,
ii) To analyze facilitating Techno-Managerial factors & their degree of influence for the improvement of Productivity of Tailing Dewatering Plant,
iii) To identify measures based on influence of Key Techno-Managerial factors for the enhancement of Productivity of Tailing Dewatering Plant.

3.5 Model & theories adopted in the study:

3.5.1 **Bureaucratic theory of management:**

This was developed by Max Weber & this theory has played a key role in establishing procedures & standards and which are the core for most of the organisations in present times.

3.5.2 Hygiene Theory:

This is one of the content theories of motivation which attempts to explain the factors that motivate individuals through their satisfying needs, desires and the aims which they pursue to satisfy their desires.

3.5.3 Contingency theory of management:

This was developed by Fred Fiedler and primarily focuses on leadership traits that apply to every kind of situation and that a leader must be flexible to adapt to a changing environment.

3.5.4 Administrative management theory :

Henri Fayol, a senior executive and mining engineer, developed this theory in the 19th century. As per him leaders had five main functions—to forecast, plan, coordinate, command and control-and he developed principles that outlined how leaders should organize and interact with their teams.

3.5.5 Kotter's Model of Change:

Which focused primarily on the people's psychology & their involvement in change processes.

3.5.6 McKinsey model of 7S :

Here seven components of an organization that must work together for effective change management identified viz.: Structure, Strategy, Staff, Style, Systems, Shared Values, and Skills.

3.5.9 Entropy Model:

As per this model, an accident theory which identifies risks & ties Safety and Productivity together by providing a balanced, comprehensive approach to hazard

control. E.g. in the 1980s, Perceptions of motivational factors and risk of each individuals became the central theme of accident causation.

3.5.10 Homeostatic model of risk & accident:

This model applies particularly to traffic accidents introduced the notion of a target level of risk. Any organisation or firm can develop strategies to reduce the level of risk of workers, who are willing to take.

3.5.11 Model theory of Hale and Glendon :

As per this model theory, the conceptual understanding of risk was further expanded to include residual risks. Planning for unforeseen circumstances and residual risks finally evaluated.

3.5.12 Risk Management & Resident Pathogens Model theory:

Reason developed the theory in 1991, which indicates that purely technological counter-measures will not be able to reduce residual risks. The total accumulation of human errors ultimately leads to active and latent failures of organizational systems.

3.5.13 Theories of innovation & technology:

As per this model theory, the concept of technological interdependence, the product-process concept & the meta-learning concept are used to relate technology and innovation to strategic management.

3.6 A Determination of constraints and moderating variables (if any)

Here independent variables are Technological and Managerial factors, which are considered for study, while dependent variable is Productivity of Tailing Dewatering Plant.

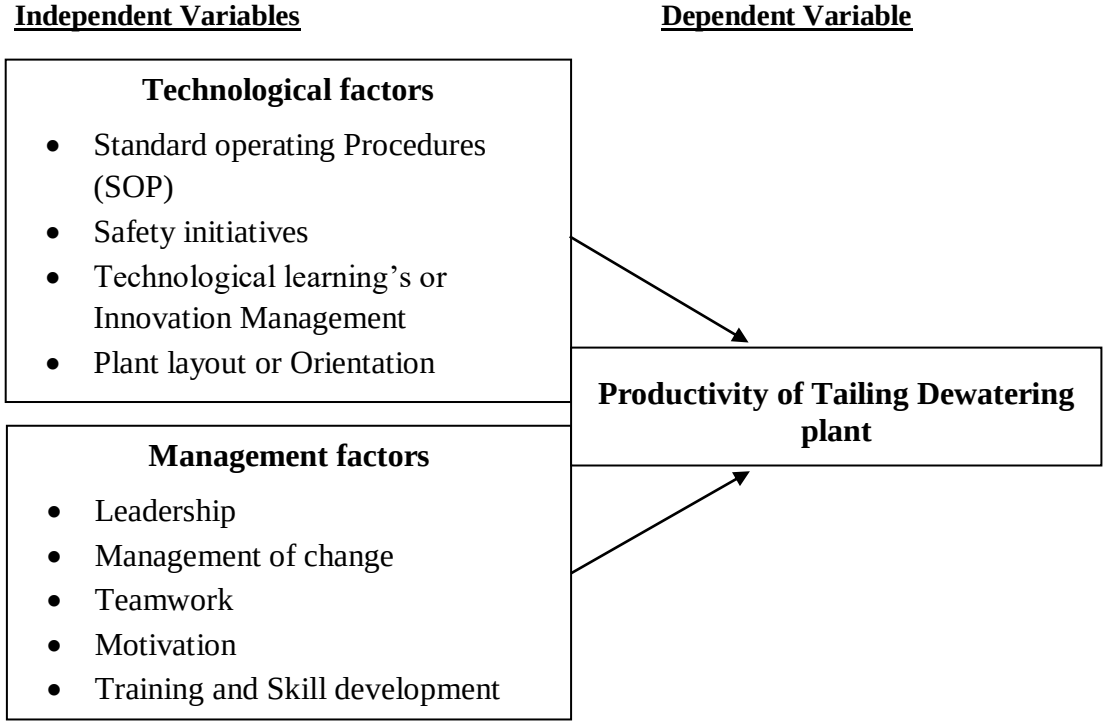


Figure 3.1.0: Conceptual Framework for factors influencing Productivity of Tailing Dewatering Plant.

3.7 B Formulation of Hypothesis :

Hypotheses formulation in research, is very instrumental which guides researcher into making relevant observation.

The study had the following hypotheses to test;

- To find out if technological factors influence Plant Productivity of Dewatering Plant

Null hypothesis (Ho); there is no significant relationship between technological factors and Plant Productivity of Dewatering Plant.

Alternative hypothesis (H1); there is significant relationship between technological factors and Plant Productivity of Dewatering Plant

- To find out if Managerial factors influence Plant Productivity of Dewatering Plant.

Null hypothesis (Ho); there is no significant relationship between managerial factors and Plant Productivity of Dewatering Plant.

Alternative hypothesis (Ha); there is significant relationship between managerial factors and Plant Productivity of Dewatering Plant.

3.8 Research Design

In a research design, to find out the solution more efficiently, how the researcher after Review of literatures, puts together all combinations of components & techniques of Research in a logical manner. Here the answer is how to conduct research with a Particular methodology to find answer of the research questions.

Since this study mainly concerned with certain variables are associated with a provision for protection against bias and also maximize reliability. So, the chosen research design for this study should be descriptive.

3.10 Population

Here, the respondents details fabricated in the below table 3.1, of 205 no's of sample size. Here 216 no's of total Population, based on the minimum Education criteria of High School, which was the actual status-co at the time of data collection.
Respondents are categorized broadly into three main categories based on the different locations of Dewatering Plants (Ghato, Sukhinda, Jamadoba) in India as presented in the table below:

Table 3.1

Respondents details as per the locations of Dewatering Plant			
		Frequency	Percent
Valid	Ghato	95	46.4
	Sukhinda	32	15.6
	Jamadoba	73	35.6
	Other External Consultants	05	2.4
	Total	205	100.0

From Table 3.1, it is evident that respondents of Ghato and Jamadoba Plant respondents are the major Population than Sukhinda Plant. However, some consultants & technology suppliers also contributed as others.

The unit of the study is the total Population on which the data collection being done (Cooper and Schindler, 2011).

As per Bryman and Bell (2011) 'sample is to be selected from the population, which is the universe of units'.

From all three dewatering Plants of different departments and working at different categories, all workmen along with the consultants are the Population here in this study.

3.7.1 Sample Frame

From the Population of all cases or items, sample is drawn (Sullivan 2001). In this study, the sample frame includes employees of all departments or sections of Dewatering Plants.

Population Distribution

No	Department	Population	Sample size
1	Human Resource & Administration	6	6
2	Store and Procurement	5	5
3	Safety	7	7
4	Production	88	83
5	Maintenance (Electrical & Mechanical)	32	30
6	Transportation	67	63
7	Finance& Accounts	6	6
8	Other external Consultants	5	5
TOTAL		216	205

Table 3.2

3.7.3 Sampling Technique

Here in this study, the technique of stratified random sampling is used in the selection of sample elements from the sampling frame. The population further segregated into several mutually exclusive sub populations, or strata. This include fundamentals from each of the segments, which is referred to as stratified random sampling.

Stratified random sampling has three main benefits, it: increases a sample's statistical efficiency, provides adequate data for analyzing the various sub populations and enables different research methods and procedures to be used in different strata (Cooper and Schindler, 2001).

The study population was segmented on the basis of various departments of Tailings dewatering Plants and comprised: Human Resources & administration, Procurement, Operations, accountancy, stores, Maintenance department. This ensured presentation across the various departments. Proportionate stratified sampling approach was used.

3.7.4 Sample Size

It is the sample, which is mainly concerned for purposes of drawing conclusions about the universe or population (Kothari, 2004).

From the results of the sample, generalizations can be done about the whole population. Here, the sample of this study is 205 no's of Dewatering Plant employees drawn from 216 no's employees as population.

As per the Slovin's formula, a sample size usually determined as per the following (Tejero, 2011) :

n = N / (1 + Ne^2)

Where:

N = Total population in no's,
n = Samples quantity in no's
e = Error tolerance (level).

The error of tolerance is 5%.

Using this formula, 140 no's is the calculated need for minimum sample size. Sample size drawn is as 205 no's.

3.8 Data Collection method:

Here, in this study, mainly Primary data being collected as secondary data's are unavailable. This Primary data's are collected through questionnaires, which is prepared based on literature reviews, manuals, books, journals and inputs from industry & experts were prepared.

3.8.1 Primary data:

Here in this study, first time, fresh data collected in the form of Primary data.
This data can be expressed as first information collected through various methods such as observation and, using the questionnaire in Likert (or summated) scale and then tabulated and classified using Excel.

Taking help from the colleagues distributed the questionnaire to all the respondents; the questionnaires having only closed ended questions. The respondents were given time of two to three days to respond to questionnaires and submit unit wise representatives.

Closed ended questionnaire was used as because it allows all respondents to express their views independently and they reduce bias and subjectivity. The questionnaire was administered to the respondents of each units respectively. Based on their doubt & clarifications, different chances were given to the respondents to fulfil up questionnaire.

3.8.2 Secondary data

Secondary data are those which have already undergone through statistical processes and collected by someone other researchers else (Kothari 2004).
Here in this study, no such concrete data related to dewatering units was available to the researcher, however relevant data's from different journals & websites also studied.

3.11 Pilot Study

Under a pilot survey, data or information's collected from different respondents as a small-scale research survey.

This serves as a guide for the larger survey. It is useful in fine-tuning research objectives and questionnaire. Also the pilot study helps in locating any areas, where the main research is out of the topic domain or research could fail and wherever proposed methods or instruments are inappropriate. The results of the pilot study would help greatly in refining the instrument of final study.

Here, the pilot survey is carried out among 15 respondents with following purposes & actions:

a. For knowing, major understandings of questionnaire of the Techno-managerial factors relevance of the topic factors and, having impacts on Productivity of Dewatering Plants.

Discussion & clarifications made on the doubt raised to understand the questionnaires and accordingly fine tuning done in the questionnaires in line with topic factors.

b. To clarify the selected factors meanings & contents. Discussion & clarification done of both Technological & Managerial factors

3.12 Data analysis tools

Framework of data analysis		
Step-1	To know, factors influencing Plant Productivity	Statistical Tools or Method Used
1a	On the basis of feedback from Tata Steel chief & Heads and other executives. Other Industrial experts & EX-Colleagues	Interview & observations
1b	Feedback from External consultants	
1c	Literature Reviews	

Step-2	Measuring Impact of Technological and Managerial Factors on Productivity of dewatering Plant	Method & Statistical tools used
2a		Frequency tables, mean, percentage, pie charts, descriptive statistics, bar and column diagrams and cross-tabulations. Graphical analysis, test for reliability (Cronbach's alpha, KMO value and correlation).

Step-3	key working factors identification having impact on productivity	ANOVA

Table 3.10

3.13 Summary

In this chapter, analysis of research questions being done through research methodology has presented.

In this study, total population was of 216 no's of person from all three Dewatering Plants at Ghato, Sukhinda & Jamadoba and the sample size taken as 205 no's of respondents. The study totally relies on the collected primary data & descriptive analysis and correlation test was done for analysis.

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

Here, the collected data through the questionnaires further analyzed & its finding and results mainly dealt.

In line with the research objectives, the questionnaires were prepared. Data collected from the respondents based on this questionnaires. Now these data's are further analyzed using statistical tools and many charts viz. bar and pie, tables viz. frequency distribution, graphs, percentages, means etc. generated and presented for further their results are interpreted. Demographical details of the respondents also analyzed and their interpretation presented here in this chapter.

4.2 Scales Assessment

The primary data was collected based on the prepared questionnaires in line with the research objectives in Likert-type (or summated) scale. Here the approach is to analyze each items of the questionnaires between the respondents to see how well it discriminates, either favorable or unfavorable attitude of the respondents.

Here, in the likert scale, the respondents are asked to respond to each of the statements of the questionnaires in terms of five degrees between very less important to very highly important.

4.3 Data analysis

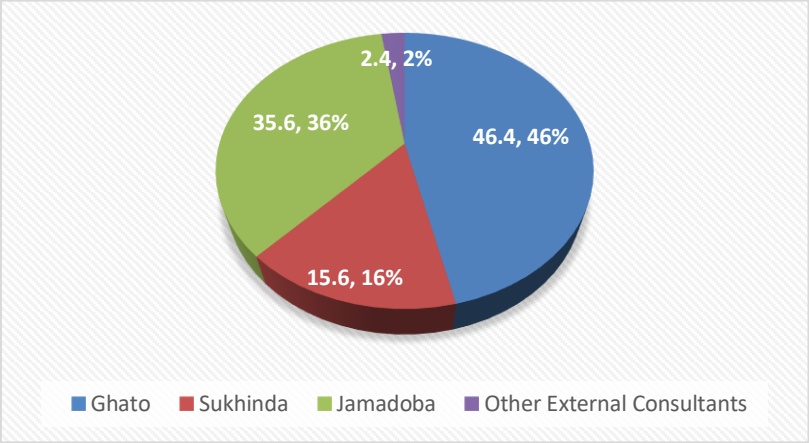
Respondents are categorized broadly into three main categories based on the different locations of Dewatering Plants (Ghato, Sukhinda, Jamadoba) in India as:

Table 4.3 Respondents as per locations of the Dewatering Pant

Details of respondents as per the locations of Dewatering Plant			
		Frequency	Percent
Valid	Ghato	95	46.4
	Sukhinda	32	15.6
	Jamadoba	73	35.6
	Other External Consultants	05	2.4
	Total	205	100.0

Source: Field data, 2019

Fig.4.3 Respondents as per locations of the Dewatering Pant



Interpretation:

From Figure 4.3, it is evident that respondents of Ghato (46%) and Jamadoba (36%) Plant are the major Population than Sukhinda (16%) Plant. However, some consultants & technology suppliers also contributed as others (2%).

4.4 Demographic details

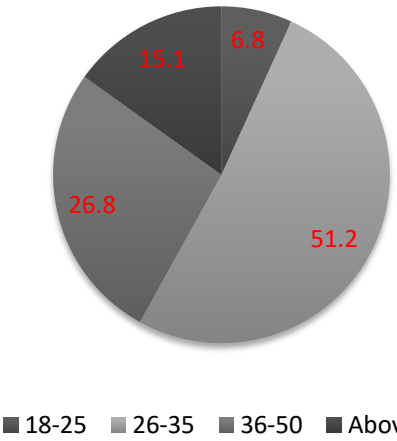
The demographic information's are:

4.4.1 Age wise Distribution of the respondents

Personal information's		**Number**	**%**
Age	18-25	14	6.8
	26-35	105	51.2
	36-50	55	26.8
	Above 50	31	15.1

Source: Field data, 2019

Fig.4.4.1 Age wise respondents



Interpretation:

From the above Pie chart 4.4.1; the respondents (51.2%) are young (of 26 to 35 years of age), well matured and experienced.

Respondents (26.8%) are of (36-50) years, (15.1%) are of greater than 50 years and, (6.8%) are of (18-25) years.

4.4.2 Respondents Gender

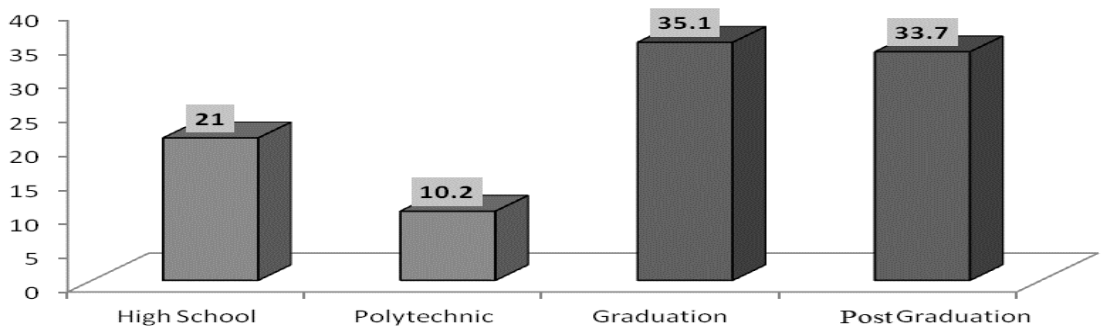
The findings reveal that 100 % of respondents are male.

4.4.3 Distribution of respondent's as per their Educational status.

Educational Status	High School	43	21.0
	Polytechnic	21	10.2
	Graduation	72	35.1
	Post-Graduation	69	33.7

Source: Field data, 2019

Figure4.4.3 Qualification-wise respondents



Interpretation:

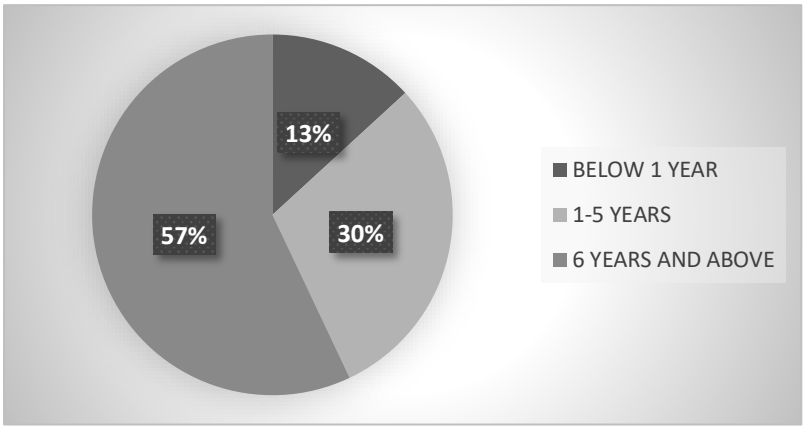
From the figure 4.4.3, well qualified respondents of Graduate level (35.1%) and Post graduate (33.7%) too. Other respondent's viz. Polytechnic diploma (10.2%) and High school (21%) as per the minimum qualification required for them.

4.4.4 Respondents demography based on their working experiences (in years)

No. of year served	Less than 1 year	27	13.2
	More than 1 up to 5 years	61	29.8
	More than 6 years	117	57.1

Source: Field data, 2019

Figure4.4.4 Working experiences -wise respondents



Interpretation:

From the figure 4.4.4, it is evident that the majority of respondents have very rich service experiences viz. 57% have more than 6 years and above, 30% have 1 to 5 years

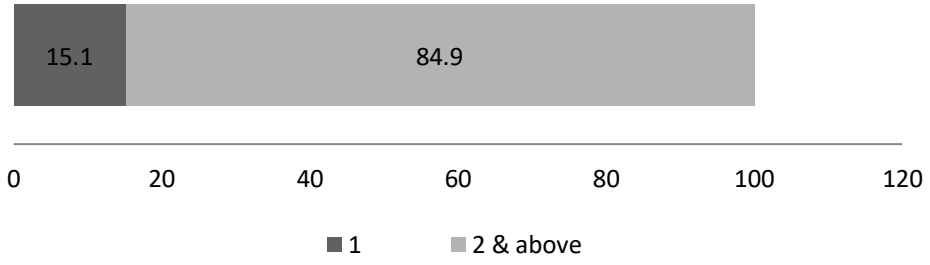
of experiences and, 13% have below 1 yr. of experience. This also shows that the responses are more practical.

4.4.5 Distribution based on association with no's of Plant in their Career

No. of Plants you have been associated in your Career	1	31	15.1
	2 & above	174	84.9

Source: Field data, 2019

Figure4.4.5 Association with no's of Plant in their Career -wise respondents



Interpretation:

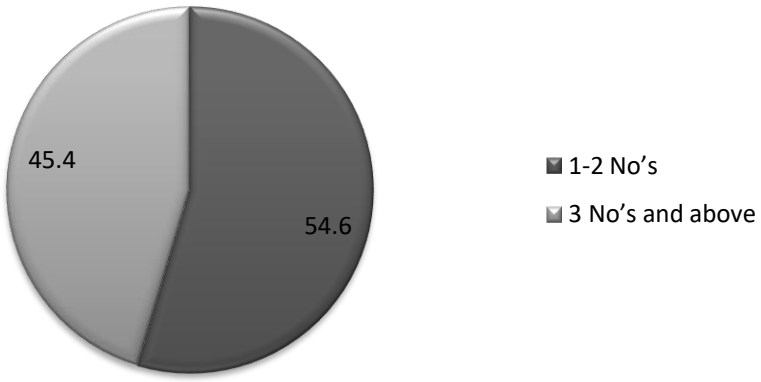
From the figure 4.4.5, it is evident that the majority of have very rich varieties of service experiences viz. 84.9% have associated with more than 2 and above no's of Plant and remaining have at least of one plant experience. Thus, respondents are well experienced and, their responses are full of practicality.

4.4.6 Respondents demography as per their experiences in no's of Dewatering Plants

Experience in No. of Dewatering Plants served	1-2 No's	112	54.6
	3 No's and above	93	45.4

Source: Field data, 2019

Figure4.4.6 Experiences in no's of Dewatering Plants



Interpretation:

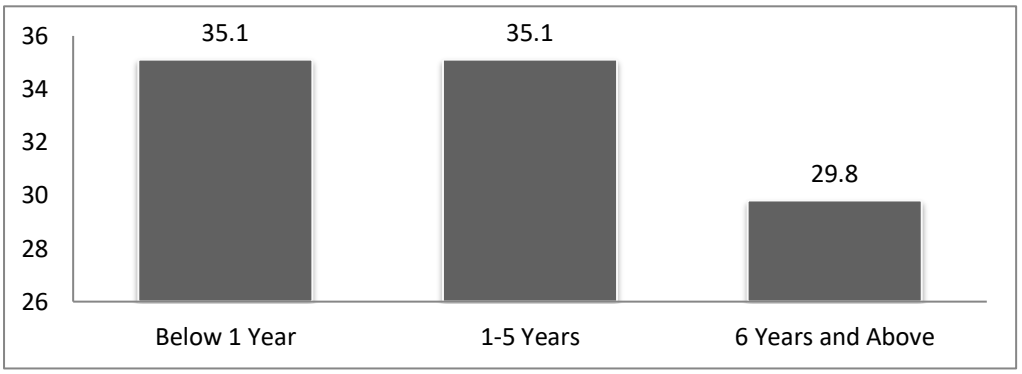
From the figure 4.4.6, it is evident that the majority of respondents have very rich core Dewatering plants experiences as almost 54.6% are associated with more than 3 no's of Dewatering Plants and 45.4% associated with only 1-2 no's. So their responses are very much ethical & true.

4.4.7 Respondents demography as per their experiences in working in Dewatering Plant

Experience in Dewatering Plant	Less than 1 year	72	35.1
	More than1 up to 5 years	72	35.1
	More than 6 years	61	29.8

Source: Field data, 2019

Figure 4.4.7 Experiences in working in Dewatering Plant



Interpretation:

From the figure 4.4.7, it is evident that the respondents having core Dewatering Plants experiences also exists in a distributive way i.e. around 35.1% have experience of both below 1 year as well 1 to 5 years too. Moreover, around 29.8% respondents have more than 6 years and above experience of core Dewatering Plants. This signifies more practicality of the study.

4.5 Reliability and Validity

Here, to determine whether the collected data's are valid & reliable, Cronbach alpha and KMO test was done. Based on their values obtained the relevant validity and reliability are measured.

4.5.1 Reliability Test

Reliability test needs to be done to determine the degree to which the instrument can measures consistently (Ojo, 2003).

The value of Cronbach's alpha helped researcher to know if data collected were reliable or not. If the value of Cronbach's alpha exceeds 0.5, data collected are reliable (Sekeran, 2013). After analyzing data collected on SPSS v.20 the result of Cronbach's alpha was as follow:

Reliability Statistics

Table 4.5.1: Reliability Statistics

Reliability Statistics	
Cronbach's Alpha	**No of Items**
0.962	**205**

4.5.2 Validity Test

KMO test being done to check the validity as whether the study uses the correct and accurate instruments. The data collected are valid & meaningful, if the value of KMO more than 0.6 (Crano, 2009).

Here, using SPSS v.20 the data analyzed & its value as:

Table 4.5.2 KMO Test

Kaiser-Meyer-Olkin value		**0.882**
	Sig.	**.000**

Source: Field data, 2019

Interpretation:

In the Table 4.5.2 above, it shows that the value of KMO was 0.882 which suggested that the sample was adequate for exploratory factor analysis as suggested by Crano, 2009 who argued that KMO should be either 0.6 or above.

From the findings of the study, value of KMO was 0.882 which imply that data collected were valid. On the other hand, Bartlett test in this study yield p-value = 0.000 which signify that the variables are correlated highly enough to provide a reasonable basis for factor analysis as suggested by Crano, 2009 that the value for Bartlett test should be significance value of less than .05 as describe above in Figure 4.5.2 above.

4.6. Importance of Technological and Managerial factors in influencing

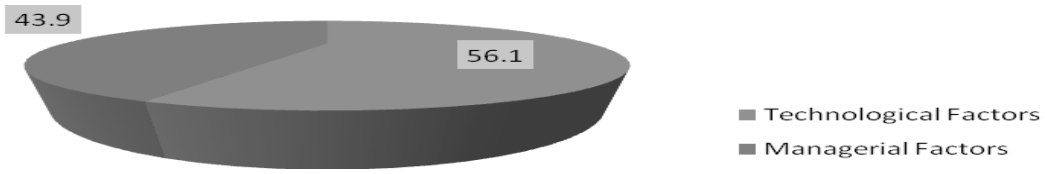
Analysis of the influence of Technological and Managerial Factors

Table 4.6. No. of Respondents of both factor

Factor	Numbers of respondents	Percentage
Technological Factors	115	56.1
Managerial Factors	90	43.9
Total	205 no's	100.0

Source: Field data collected, 2019

Fig 4.6. No. of Respondents of both factor



Interpretation:

It is evident from the figure 4.6 above that both factors are significant, but Technological factors(56.1%) are more significant than Management factors(43.9%) as per the overall respondent's view.

4.6.1 Analysis of Technological and Managerial Factors based on respondent's age groups:

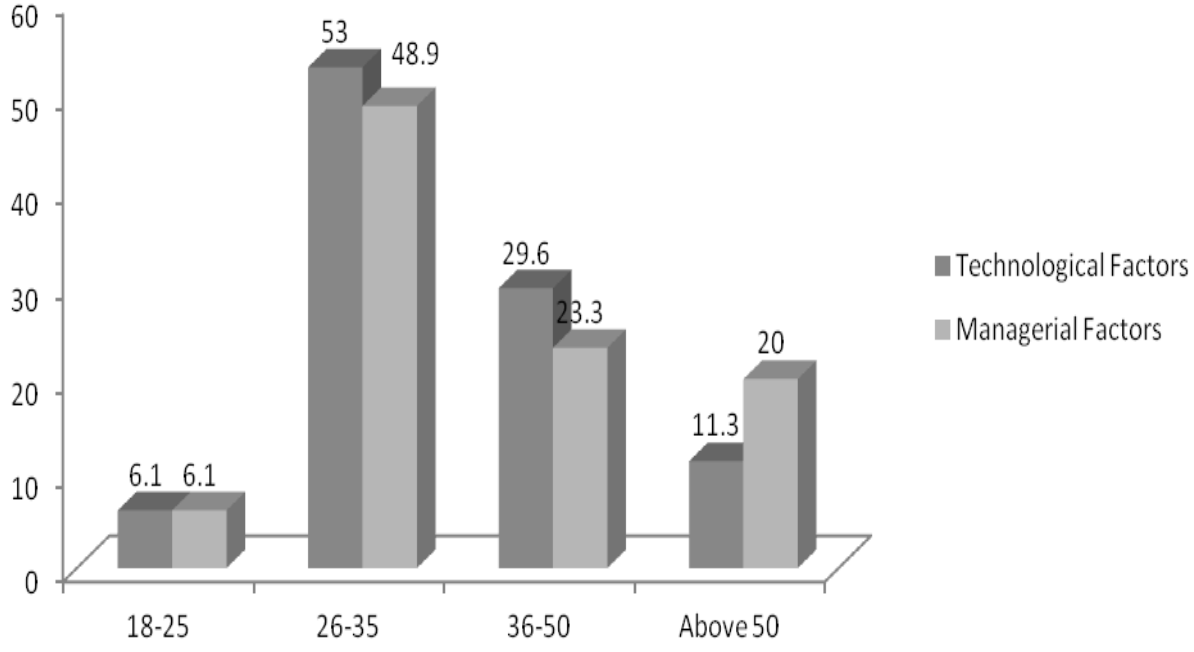


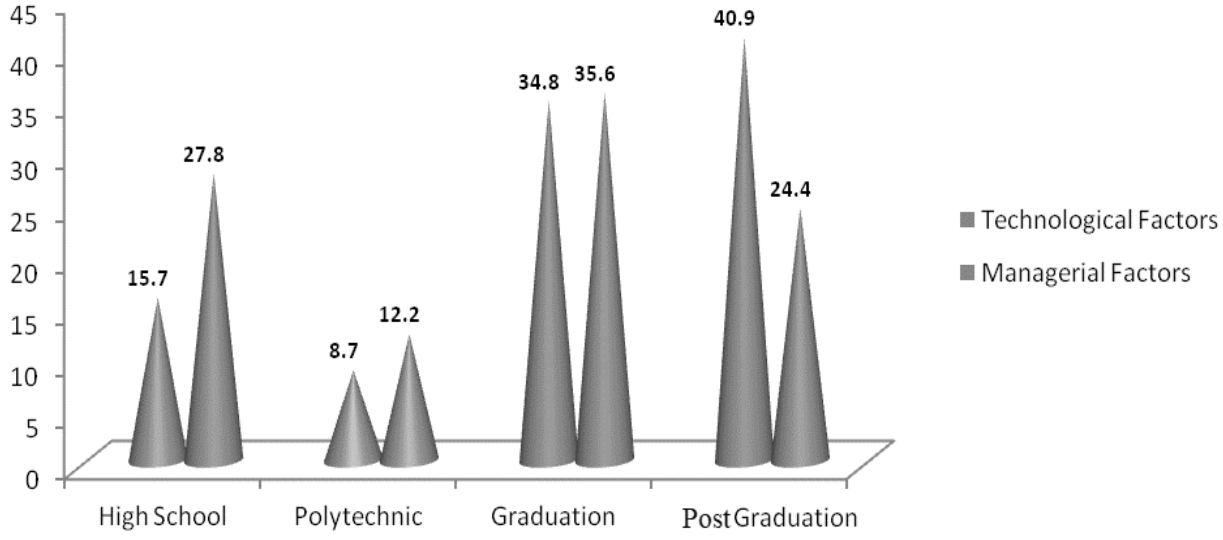
Figure 4.6.1 Age-wise Analysis of Technological and Managerial Factors

Interpretation:

Here as per the above figure, the respondents having of age group (18-25) years prefers both Technological and Management factors equally, but the respondents of age group(26-35) years and (36-50) years prefers Technological factors as more significant than Managerial factors. Most importantly, again the respondents of higher ages of above 50 years, prefers Management factors as more significant over Technological factors.

4.6.2 Analysis of Technological and Managerial factor based on respondents Educational status:

Figure 4.6.2 Technological and Managerial factor based on respondents Educational status:

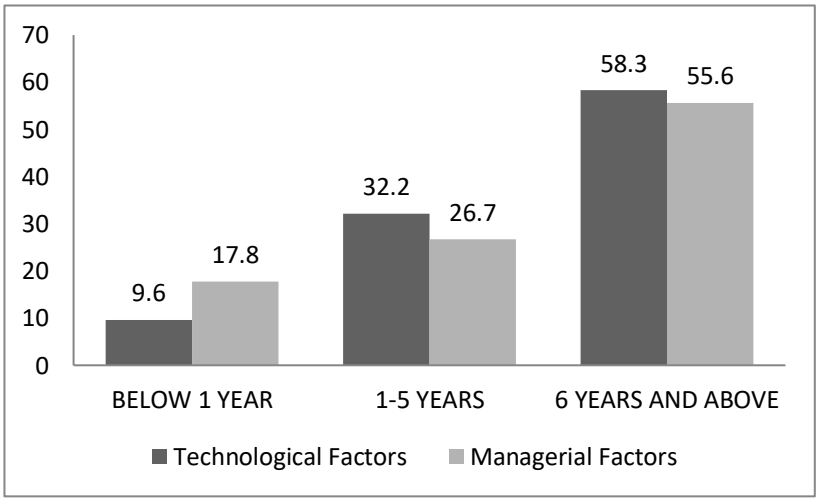


Interpretation:

Qualification-wise importance of Technological and Managerial Factors From the figure 4.6.2, it is evident that with the rise in respondents qualification, the Management factors dominates the Technological factors i.e. Management factors are more significant for highly qualified respondents.

4.6.3 Significance level of Technological and Managerial factors as per the respondents Working experiences

Figure 4.6.3 Technological and Managerial factors as per the respondents working experiences

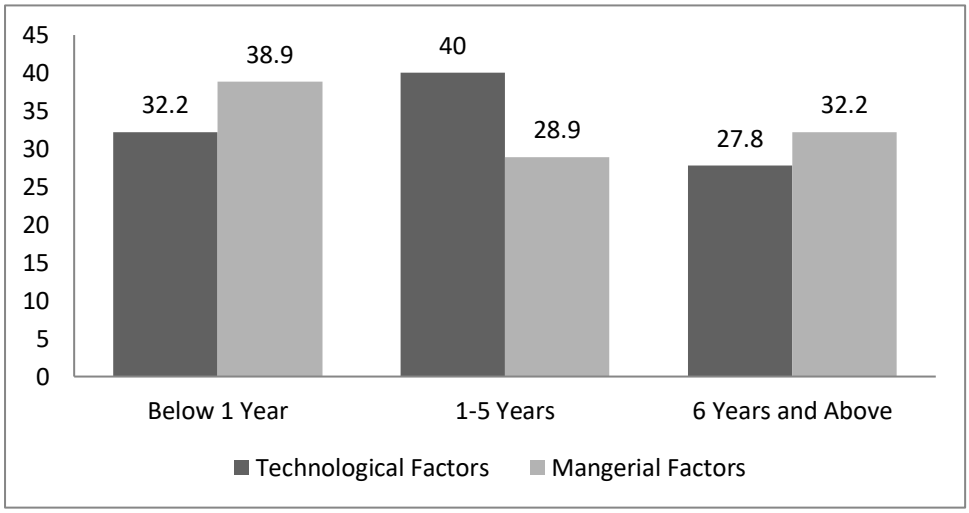


Interpretation:

Here as per the above figure, although both the factors are significant as per the different experience levels of respondents but with low experience (below 1 year) - Management factors are more significant and with the increase in experiences; Technological factors marginally dominates the Managerial factors and influences on Plant Productivity more significantly

4.6.4 Significance level of Technological and Managerial factors as per the respondents Experience in working in Dewatering Plants.

Figure 4.6.4 Technological and Managerial factors as per the respondents Experience in working in Dewatering Plants

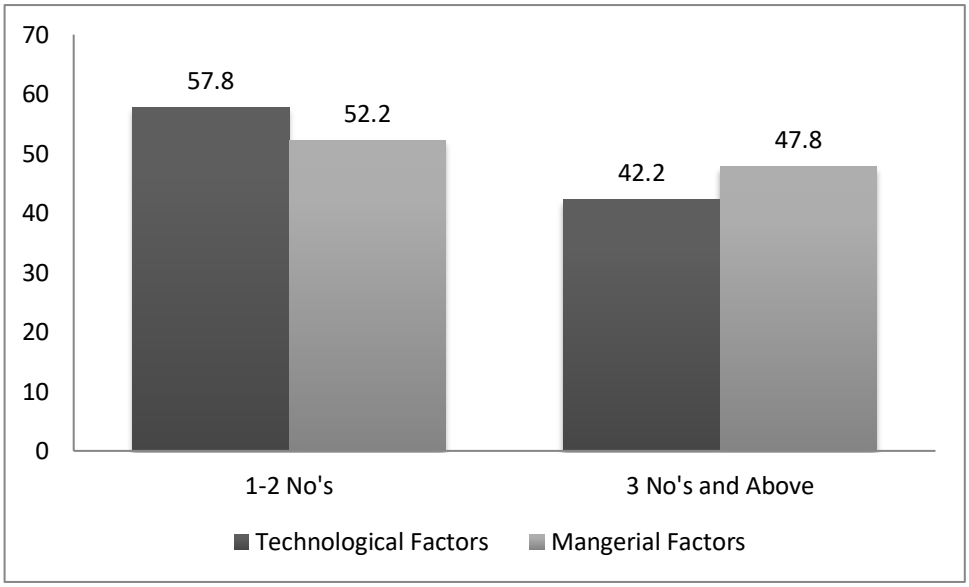


Interpretation:

Here as per the above figure, although both the factors are significant as per the respondents core experiences in Dewatering Plants but at low level of experience i.e. (below 1 year) – Managerial factors are more significant and with the increase in experiences (1-5 years) - Technological factors chosen as more significant one and again at high experiences - (6 years and above); Managerial factors influences on Plant Productivity more significantly than Technological factors.

4.6.5 Significance level of Technological and Managerial factors as per the respondents Experience in no's of Dewatering Plants.

Figure 4.6.5 Technological and Managerial factors as per the respondents Experience in no's of Dewatering Plants



Interpretation:

Here as per the above figure, although both the factors are significant as per the numbers of dewatering plants association levels of respondents but with low association (1-2 no's) - Technological factors are more significant and with the increase in no.'s of dewatering plants association (3 no's and above); Managerial factors influences on Plant Productivity more significantly than Technological factors.

4.6 Analysis of Technological Factors: -

The main Technological factors considered are as follows

- Standard operating Procedure (SOP),
- Safety initiatives,
- Technological learning's or Innovation Management,
- Plant layout or Orientation,
- Materials Management.

Technological Factors

Table 4.6 Technological Factors Statistical analysis

Technological Factors	Mean
Standard Operating Practices	3.98
Safety Initiatives	4.26
Technological Learning's or Innovation Management	4.06
Plant Layout or Orientation	4.11
Materials Management	4.24

Technological Factors	Very less Important		Less Important		Important		Very important		Very high important	
	F	%	F	%	F	%	F	%	F	%
Standard Operating Practices	5	2.0	9	4.4	32	15.6	72	35.1	88	42.9
Safety Initiatives	0	0	4	2.0	21	10.2	78	38.0	102	49.8
Technological Learning's or Innovation Management	0	0	5	2.4	22	10.7	52	25.4	126	61.5
Plant Layout or Orientation	6	2.9	18	8.8	49	23.9	45	22.0	88	42.9
Materials Management	2	1.0	16	7.8	36	17.6	59	28.8	92	44.9

Interpretation:

From the table 4.6, based on percentage and mean, it is evident that the degree of importance of five Technological factors are different & out of them Safety Initiatives (87.8%) (Mean 4.26) is the Key Technological factor having the greatest degree of influential importance on Plant Productivity of Dewatering Plant.

4.6.1 Analysis of the components of each Technological factors :

4.6.1.1 Standard Operating Procedures (SOP)

Table 4.6.1.1 SOP

Technological Factors	**Mean**
SOP helps to carry out the recurring operations correctly, safely & always in the same manner.	4.37
People have to take active participation, while making SOP's.	4.06
All SOP'S should be readily available.	4.26
People should use to refer SOP's frequently.	3.97
People should give feedback to modify SOP'S as a continuous improvement process as per the technological advancements.	3.98

Components	Very less Important		Less Important		Important		Very important		Very high important	
	F	%	F	%	F	%	F	%	F	%
SOP helps to carry out the recurring operations correctly, safely & always in the same manner.	0	0	0	0	15	13.0	27	23.5	73	63.5
People have to take active participation, while making SOP's.	0	0	7	6.1	8	7.0	61	53.0	39	33.9
All SOP'S should be readily available.	3	2.6	2	1.7	22	19.1	24	20.9	64	55.7
People should used to refer SOP's frequently.	2	1.7	6	5.2	17	14.8	52	45.2	38	33.0
People should give feedback to modify SOP'S as a continuous improvement process as per the technological advancements.	0	0	0	0	33	28.7	47	40.9	35	30.4

Table 4.6.1.1.a

Reliability test		
Cronbach's Alpha	Based on Standardized Items Cronbach's Alpha	N of Items
.810	.809	5

KMO	
Kaiser-Meyer-Olkin(KMO) value	.720

Interpretation:

From the figure 4.6.1.1, it being concluded that as a Technological factor, Standard Operating Practices(SOP) is important influencing on Plant Productivity of Dewatering Plant as "SOP helps to carry out the recurring operations correctly, safely & always in the same manner". The degree of importance of this component statement of SOP is highest (87%) (Mean 4.37) in comparison of other components.

Further corresponding value of Cronbach's Alpha is 0.810 (>0.5) implies data are reliable, value of KMO is 0.720 (>0.6) means data collected are valid.

4.6.1.2 Safety Initiatives

Table 4.6.1.2

Technological Factors	**Mean**
Management should seriously concerned on Safety issues.	4.58
There should exist Safety committee to investigate accident/incident report.	4.17
Safety supervisor regularly organizes safety awareness initiatives & conduct meetings	4.19
There should exists an onsite Emergency Preparedness Plan	4.30
Without Safety Personal protective Equipment's (PPE's), nobody should allowed at site.	4.56

Components	Very less Important		Less Important		Important		Very important		Very high important	
	F	%	F	%	F	%	F	%	F	%
Management should seriously concerned on Safety issues.	0	0	0	0	4	3.5	29	25.2	82	71.3
There should exist Safety committee to investigate accident/incident report.	0	0	0	0	18	15.7	54	47.0	43	37.4
Safety supervisor regularly organizes safety awareness initiatives & conduct meetings	0	0	2	1.7	17	14.8	45	39.1	51	44.3
There should exists an onsite Emergency Preparedness Plan	0	0	5	4.3	14	12.2	30	26.1	66	57.4
Without Safety Personal protective Equipments (PPE's), nobody should allowed at site.	0	0	0	0	7	6.1	24	20.9	84	73.0

Safety Initiatives

Table 4.6.1.2.a

Reliability test		
Value of Cronbach's Alpha	Based on Standardized Items Cronbach's Alpha	N of Items
.689	.687	6

KMO	
Kaiser-Meyer-Olkin (KMO) Value	.736

Interpretation:

From the figure 4.6.1.2, it being concluded that as a Technological factor, Safety Initiatives are important influencing on Plant Productivity of Dewatering Plant as "Management should seriously concerned on Safety issues". The degree of importance of this component statement of Safety Initiative is highest (96.5 %) (Mean 4.58) in comparison of other components.

Further corresponding value of Cronbach's Alpha is 0.689 (>0.5) implies data are reliable, value of KMO is 0.736 (>0.6) means data collected are valid.

4.6.1.3 Technological Learning's or Innovation Management

Table 4.6.1.3

Technological Factors	**Mean**
There should be involvement of higher level in Problem solving as a competitive advantage in organization	4.08
There should exist Culture of understanding Problems or reasons for improvements.	3.88
There should be an environment of continuous learning to deal with environmental challenges	3.99
There should exists respect for individual initiative & Personal growth	3.91
There should be an environment of tolerance for mistakes & allowing room for failure.	3.76

Components	Very less Important		Less Important		Important		Very important		Very high important	
	F	%	F	%	F	%	F	%	F	%
There should be involvement of higher level in Problem solving as a competitive advantage in organization	0	0	0	0	21	18.3	42	36.5	52	45.2
There should exist Culture of understanding Problems or reasons for improvements.	0	0	1	0.9	10	8.7	77	67.0	27	23.5
There should be an environment of continuous learning to deal with environmental challenges	0	0	2	1.7	36	31.3	46	40.0	31	27.0
There should exists respect for individual initiative & Personal growth	0	0	2	1.7	29	25.2	53	46.1	31	27.0
There should be an environment of tolerance for mistakes & allowing room for failure.	0	0	5	4.3	28	24.3	43	37.4	39	33.9

Technological Learning

Reliability test		
Cronbach's Alpha value	Based on Standardized Items value Cronbach's Alpha	N of Items
.807	.815	6

KMO	
Kaiser-Meyer-Olkin(KMO) Value	.843

Table 4.6.1.3.a

Interpretation:

From the figure 4.6.1.3, it being concluded that as a Technological factor, Technological Learning's or Innovation Management is important influencing on Plant Productivity of Dewatering Plant as "Culture of understanding Problems or reasons for improvements". The degree of importance of this component statement of Technological Learning's or Innovation Management is highest (90.5%) (Mean 4.08) in comparison of other components.

Further corresponding value of Cronbach's Alpha is 0.807 (>0.5) implies data are reliable, value of KMO is 0.843 (>0.6) means data collected are valid.

4.6.1.4 Plant layout Orientation

Table 4.6.1.4

Technological Factors	**Mean**
It is important to keep in mind managerial policies & plans before deciding the Plant layout.	4.06
Layout selected greatly influences the general arrangement of Equipment's, Pipe line & others in & out of the work flow.	4.18
Layout greatly addresses hard to access areas & ease of maintenance.	4.14
Layout of Plant & Equipment's influences safety of the workmen.	4.25
Layout addresses Ergonomics as reduces stress, strain & fatigue.	4.14

Components	Very less Important		Less Important		Important		Very important		Very high important	
	F	%	F	%	F	%	F	%	F	%
It is important to keep in mind managerial policies & plans before deciding the Plant layout.	6	5.2	6	5.2	33	28.7	41	35.7	29	25.2
Layout selected greatly influences the general arrangement of Equipment's, Pipe line & others in & out of the work flow.	0	0	3	2.6	15	13.0	64	55.7	33	28.7
Layout greatly addresses hard to access areas & ease of maintenance.	0	0	2	1.7	30	26.1	45	39.1	38	33.0
Layout of Plant & Equipment's influences safety of the workmen.	0	0	5	4.3	15	13.0	59	51.3	36	31.3
Layout addresses Ergonomics as reduces stress, strain & fatigue.	0	0	2	1.7	24	20.9	38	33.0	51	44.3

Plant layout orientation

Table 4.6.1.4.a

Reliability test		
Cronbach's Alpha value	Based on Standardized Items Cronbach's Alpha value	N of Items
.806	.807	6

KMO	
Kaiser-Meyer-Olkin(KMO) Value	.848

Interpretation:

From the figure 4.6.1.4, it being concluded that as a Technological factor, Plant layout Orientation is important influencing on Plant Productivity of Dewatering Plant as "Layout selected greatly influences the general arrangement of Equipment's, Pipe line & others in & out of the work flow". The degree of importance of this component statement of Plant layout Orientation (84.4%) (Mean 4.25) in comparison of other components.

Further corresponding value of Cronbach's Alpha is 0.806 (>0.5) implies data are reliable, value of KMO is 0.848 (>0.6) means data collected are valid.

4.6.1.5 Materials Management

Table 4.6.1.5

Technological Factors	**Mean**
Design & inadequate details in drawings affects materials management	3.95
Poor Planning & quality of materials affects material management	3.99
Inefficient workforce is linked with material management	3.92
Wastages during handling & transportation impacts material management	3.90
Storage facility for safety is important for material management	4.24

Components	Very less Important		Less Important		Important		Very important		Very high important	
	F	%	F	%	F	%	F	%	F	%
Design & inadequate details in drawings affects materials management	0	0	2	1.7	17	14.8	70	60.9	26	22.6
Poor Planning & quality of materials affects material management	0	0	4	3.5	27	23.5	34	29.6	50	43.5
Inefficient workforce is linked with material management	0	0	4	3.5	23	20.0	58	50.4	30	26.1
Wastages during handling & transportation impacts material management	2	1.7	6	5.2	24	20.9	50	43.5	33	28.7
Storage facility for safety is important for material management	0	0.0	0	0.0	16	13.9	51	44.3	48	41.7

Materials management

Table 4.6.1.5.a

Reliability test		
Cronbach's Alpha value	Based on Standardized Items Cronbach's Alpha	N of Items
.729	.727	5

KMO	
Kaiser-Meyer-Olkin(KMO) Value	.732

Interpretation:

From the figure 4.6.1.5, it being concluded that as a Technological factor - Materials Management is important influencing on Plant Productivity of Dewatering Plant as "Storage facility for safety is important for material management". The degree of importance of this component statement of Materials Management is highest (86%) (Mean 4.24) in comparison of other components.

Further corresponding value of Cronbach's Alpha is 0.729 (>0.5) implies data are reliable, value of KMO is 0.732 (>0.6) means data collected are valid.

4.7 Analysis of Management Factors: -

The main Management factors considered are as follows:

- Leadership
- Management of change
- Teamwork
- Motivation
- Training & skill development

4.8 Analysis of Management Factors

Table 4.8

Technological Factors	**Mean**
Leadership	4.00
Management of Change	4.15
Teamwork	4.07
Motivation	3.80
Training & Skill development	3.97

Management Factors	Very less Important		Less Important		Important		Very important		Very high important	
	F	%	F	%	F	%	F	%	F	%
Leadership	7	1.6	20	4.4	108	24.0	154	34.2	161	35.8
Management of Change	6	1.3	17	3.8	93	20.7	168	37.3	166	36.9
Teamwork	15	3.3	24	5.3	85	18.9	150	33.3	176	39.1
Motivation	22	4.9	27	6.0	133	29.6	143	31.8	125	27.8
Training & Skill development	37	8.2	12	2.7	105	23.3	161	35.8	135	30.0

Interpretation:

From the figure 4.8, based on percentage and mean, it is evident that the degree of importance of five Managerial factors are different & out of them Management of Change (74.2%) (Mean 4.15) is the Key Managerial factor having the greatest degree of influential importance on Plant Productivity of Dewatering Plant.

4.8.1 Analysis of the components of each Management factors :

4.8.1.1 Leadership

Table 4.8.1.1

Technological Factors	**Mean**
Role of Leadership is vital to guide & sustain any organization.	4.26
People should aware about the Vision, Values & performance expectations of the organization.	3.84
People should aware about the Organizational Leadership system.	3.70
In organization Legal & Ethical behaviours should be Promoted.	4.11
Leaders should be role model & committed.	4.07

Components	Very less Important		Less Important		Important		Very important		Very high important	
	F	%	F	%	F	%	F	%	F	%
Role of Leadership is vital to guide & sustain any organization.	1	1.1	0	0	14	15.6	26	28.9	49	54.4
People should aware about the Vision, Values & performance expectations of the organization.	0	0	7	7.8	29	32.2	29	32.2	25	27.8
People should aware about the Organizational Leadership system.	2	2.2	8	8.9	24	26.7	39	43.3	17	18.9
In organization Legal & Ethical behaviours should be Promoted.	3	3.3	3	3.3	19	21.1	26	28.9	39	43.3
Leaders should be role model & committed.	1	1.1	2	2.2	22	24.4	34	37.8	31	34.4

Leadership

Table 4.8.1.1.a

Reliability test		
Cronbach's Alpha value	Based on Standardized Items Cronbach's Alpha	N of Items
.678	.673	5

KMO	
Kaiser-Meyer-Olkin(KMO) Value	.725

Interpretation:

From the figure 4.8.1.1, it being concluded that as a Management factor --Leadership is important influencing on Plant Productivity of Dewatering Plant as "Role of Leadership is vital to guide & sustain any organization." The degree of importance of this component statement of Leadership is highest (83.3%) (Mean 4.26) in comparison of other components.

Further corresponding value of Cronbach's Alpha is 0.678 (>0.5) implies data are reliable, value of KMO is 0.725 (>0.6) means data collected are valid.

4.8.1.2 Management of change

Table 4.8.1.2

Technological Factors	**Mean**
In organization active execution support should be provided from the higher Management	4.07
People should have meaningful relationships with their boss & peers.	4.09
People must open to participate in meetings & open dialogue session conducted by their seniors.	3.98
People should clear about their responsibility & job accountability	4.18
In organization Reward & recognition forum should exist.	4.00

Components	Very less Important		Less Important		Important		Very important		Very high important	
	F	%	F	%	F	%	F	%	F	%
In organization active execution support should be provided from the higher Management	0	0	3	3.3	18	20.0	39	43.3	30	33.3
People should have meaningful relationships with their boss & peers.	0	0	0	0	18	20.0	39	43.3	33	36.7
People must open to participate in meetings & open dialogue session conducted by their seniors.	3	3.3	0	0	32	35.6	21	23.3	34	37.8
People should clear about their responsibility & job accountability	3	3.3	9	10.0	6	6.7	27	30.0	45	50.0
In organization Reward & recognition forum should exist.	0	0	5	5.6	19	21.1	42	46.7	24	26.7

Management of change

Table 4.8.1.2.a

Reliability test		
Value of Cronbach's Alpha	Based on Standardized Items Cronbach's Alpha	N of Items
.781	.782	5

KMO		
Kaiser-Meyer-Olkin(KMO) Value		.799
Bartlett's Test of Sphericity	Approx. Chi-Square	256.378
	df	10
	Sig.	.000

Interpretation:

From the figure 4.8.1.2, it being concluded that as a Management factor -- Management of change is important influencing on Plant Productivity of Dewatering Plant as "People should have meaningful relationships with their boss & peers". The degree of importance of this component statement of Management of change is highest (80%) (Mean 4.07) in comparison of other components.

Further corresponding value of Cronbach's Alpha is 0.781 (>0.5) implies data are reliable, value of KMO is 0.799 (>0.6) means data collected are valid.

4.8.1.3 Team work

Table 4.8.1.3

Technological Factors	**Mean**
People should have a better understanding & trust with their boss & peers.	3.99
Everyone in team should clear about their Goals	4.19
Listening & respect should valued at all levels in the organization.	4.03
There should be a collective responsibility for any success or failure	4.09
Regular meetings to be held to address any issue.	4.15

Components	Very less Important		Less Important		Important		Very important		Very high important	
	F	%	F	%	F	%	F	%	F	%
People should have a better understanding & trust with their boss & peers.	0	0	6	6.7	19	21.1	31	34.4	34	37.8
Everyone in team should clear about their Goals	0	0	8	8.9	20	22.2	27	30.0	35	38.9
Listening & respect should valued at all levels in the organization.	6	6.7	4	4.4	14	15.6	34	37.8	32	35.6
There should be a collective responsibility for any success or failure	3	3.3	6	6.7	10	11.1	29	32.2	42	46.7
Regular meetings to be held to address any issue.	6	6.7	0	0	22	24.4	29	32.2	33	36.7

TEAMWORK

Table 4.8.1.3.a

Reliability Test		
Cronbach's Alpha Value	Based on Standardized Items Cronbach's Alpha	N of Items
.841	.841	5

KMO	
Kaiser-Meyer-Olkin(KMO) Value	.817

Interpretation:

From the figure 4.8.1.3, it being concluded that as a Management factor -- Team Work is important influencing on Plant Productivity of Dewatering Plant as "There should be a collective responsibility for any success or failure". The degree of importance of this component statement of Team Work is highest (80%) (Mean 4.19) in comparison of other components.

Further corresponding value of Cronbach's Alpha is 0.841 (>0.5) implies data are reliable, value of KMO is 0.817 (<0.6) means data collected are valid.

4.8.1.4 Motivation

Table 4.8.1.3

Technological Factors	**Mean**
There should exist appreciation & recognition atmosphere.	3.80
Fixed salaries, Bonuses/Incentives are good	3.92
Good working Environment should exists	3.97
There medical support & accommodation should made available	3.87
Promotion & Growth opportunities should exists	3.80

Components	Very less Important		Less Important		Important		Very important		Very high important	
	F	%	F	%	F	%	F	%	F	%
There should exist appreciation & recognition atmosphere.	2	2.2	9	10.0	33	36.7	33	36.7	13	14.4
Fixed salaries, Bonuses/Incentives are good	3	3.3	7	7.8	27	30.0	31	34.4	22	24.4
Good working Environment should exists	2	2.2	5	5.6	21	23.3	24	26.7	38	42.2
There medical support & accommodation should made available	6	6.7	3	3.3	28	31.1	27	30.0	26	28.9
Promotion & Growth opportunities should exists	9	10.0	3	3.3	24	26.7	28	31.1	26	28.9

MOTIVATION

Table 4.8.1.3.a

Reliability test		
Cronbach's Alpha Value	Based on Standardized Items Cronbach's Alpha	N of Items
.795	.794	5

KMO	
Kaiser-Meyer-Olkin(KMO) Value	.744

Interpretation:

From the figure 4.8.1.4, it being concluded that as a Management factor – Motivation is important influencing on Plant Productivity of Dewatering Plant as "Good working Environment should exists". The degree of importance of this component statement of Motivation is highest (68.9%) (Mean 3.97) in comparison of other components.

Further corresponding value of Cronbach's Alpha is 0.795 (>0.5) implies data are reliable, value of KMO is 0.744 (>0.6) means data collected are valid.

4.8.1.5 Training & Skill development

Table 4.8.1.5

Technological Factors	**Mean**
Top Management should advocates learning to Employees.	3.87
People have to attend training Programs, aligned with the business objectives.	4.07
People enjoy training programs as it upgraded them as technological advances.	3.91
Training allows to find solution to certain problems & hence perform duties better.	3.99
People must give positive feedback after training program to make it better & more beneficial for the organization.	3.93

Components	Very less Important		Less Important		Important		Very important		Very high important	
	F	%	F	%	F	%	F	%	F	%
Top Management should advocates learning to Employees.	5	5.6	6	6.7	23	25.6	28	31.1	28	31.1
People have to attend training Programs, aligned with the business objectives.	8	8.9	0	0	20	22.2	31	34.4	31	34.4
People enjoy training programs as it upgraded them as technological advances.	8	8.9	2	2.2	21	23.3	33	36.7	26	28.9
Training allows to find solution to certain problems & hence perform duties better.	8	8.9	3	3.3	16	17.8	43	47.8	20	22.2
People must give positive feedback after training program to make it better & more beneficial for the organization.	8	8.9	1	1.1	25	27.8	26	28.9	30	33.3

TRAINING & SKILL DEVELOPMENT

Table 4.8.1.5.a

Reliability test		
Cronbach's Alpha Value	Based on Standardized Items Cronbach's Alpha	N of Items
.875	.875	5

KMO	
Kaiser-Meyer-Olkin(KMO) Value	.842

Interpretation:

From the figure 4.8.1.5, it being concluded that as a Management factor - Training & Skill development is important influencing on Plant Productivity of Dewatering Plant as "Training allows finding solution to certain problems & hence performing duties better". The degree of importance of this component statement of Training & Skill development is highest (70%) (Mean 4.07) in comparison of other components.

Further corresponding value of Cronbach's Alpha is 0.875 (>0.5) implies data are reliable, value of KMO is 0.842 (>0.6) means data collected are valid.

4.9 Hypothesis Testing

Here, the following hypotheses needs to be tested:

- To find out if Technological factors(Viz. Standard operating Practices, Safety initiatives, Technological learning's or Innovation Management, Plant layout or Orientation, Materials Management) influence Plant Productivity of Dewatering Plant

  Null hypothesis (Ho): Between Technological factors and Plant Productivity of Dewatering Plant there is no such significant relationship exists.

  Alternative hypothesis (H1): Between Technological factors and Plant Productivity of Dewatering Plant there is significant relationship exists.

- To find out if Managerial factors (Viz. Leadership, Management of change, Teamwork, Motivation, Training & skill development) influence Plant Productivity of Dewatering Plant.

  Null hypothesis (Ho): Between Managerial factors and Plant Productivity of Dewatering Plant there is no such significant relationship exists.

  Alternative hypothesis (Ha): Between Managerial factors and Plant Productivity of Dewatering Plant there is significant relationship exists.

4.9.1 Correlation

Table 4.9.1 below, between the variables, the relationship was investigated.

Between Technological factors and Plant Productivity performance (r=1.000**, N=205) exists strong correlation.

Between Management factors and Plant Productivity (r=1.000 **, N=205), also significant relationship exists.

4.9.1 Correlation

Table 4.9.1

Different Parameters		Technological Factors	Management Factor	Plant Productivity
Technological Factors	Correlation	1		
	N	205		
Managerial Factor	Correlation	1.000*	1	
	Sig. (2-Tailed)	0.000		
	N	205	205	
Plant Productivity	Correlation	1.000**	1.000*	1
	Sig. (2-Tailed)	0.000	0.001	
	N	205	205	205
** Correlation at the 0.01 level (2-tailed) is significant				

4.9.2 Regression analysis

To test the hypotheses, here considered some assumptions:

i. First assumption: In the modal summary, determination Coefficient should explain the variables (Independent) above 50%.

ii. Second assumption: The P Value of significance in the ANOVA and coefficient regression should be P < 0.000-0.05 at 5% level of significant and 95% confident level,

iii. Third assumption: The value of predictions or independent variables should be P ≤ 0.000 - 0.05 at 5% level of significant and 95% confident level,

After analysing dependent variables and independent variables on SPSS v.20, the two assumptions were tested so as to know if the hypotheses hold or not.

First, variables were tested so as to check if coefficient of determination in the modal summary would explain the independent variables above 50%.

After testing them on SPSS v.20 the results were presented on the table 4.9.3 below. The result shows that dependent variable "Plant productivity" is explained well by independent variables "Technological factors, Managerial factors" to a greater extent as demonstrated by R Square of 53.9% which is high percent since it exceeds 50%. Therefore, the first assumption hold which also means hypothesis of this study are positively correlated since coefficient of determination in the modal summary explained the independent variables above 50%.

4.9.3 Summary (Model)

Table 4.9.3

Summary [b]									
Model	R	R square	R Square adjusted	Estimate Std. Error	Statistics (Change)				
					Change R Square	Change F	df1	df2	Change Sig. F
1	0.694[a]	0.539	0.345	1.5281	0.412	19.621	2	205	.000

a. Independent Variable :- Technological Factors, Managerial Factor
b. Dependent Variable :- Plant Productivity

In table 4.9.4 below shows:

Significant value (P value) is 0.000 which is less than 0.05; so the model applied in this study significantly & statistically predicts the outcome variable of relationship between dependent variable "Plant Productivity" which is explained well by independent variables "Technological factors and, Managerial factors" to a greater extent.

Further, this also validates the hypothesis of this study are positively correlated; as at 5% level of significant and 95% confident level, the significant value (P value) in the ANOVA and coefficient regression lie between value of P < 0.000-0.05.

4.9.4 ANOVA

Table 4.9.4

ANOVA[a]						
Model		Squares sum	Df	Square mean	F	Sig.
1	Regression	218.57	1	218.57	18.623	0.000[b]
	Residual	192.12	113	1.910		
	Total	410.69	114			

Independent Variable: - Technological Factors, Managerial Factor

Dependent Variable: - Plant Productivity

From coefficient table below, the equation of regression ($Y = \beta O + \beta 1X_1 + \beta 2X2 + \alpha$) as; Y= 12.291 +-0. 593 X1 + 0.319 X2

Where, Y = Plant Productivity, X1= Technological Factors, X2 = Managerial Factor

As per the below, coefficient table implies significant relationship exists between Plant Productivity with Technological factors as it shows value 0.00 ; which is between 0.000 – 0.05 Also, significant relationship exists between Plant Productivity with Managerial factors as it shows value 0.001 ; which is between P≤ 0.00– 0.05.

4.9.5 Coefficients

Table 4.9.5

Model		Coefficients Unstandardized		Coefficients Standardized	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	12.291	1.216		5.567	0.00
	Technological Factors	0.593	0.129	0.316	3.392	.000
	Managerial Factor	0.319	0.062	0.219	1.492	.001

Dependent Variable: - Plant Productivity

4.9.6. Discussion on findings

- It is evident that both factors are significant, but Technological factors are more significant than Management factors as per the overall respondent's view.
- It is evident that the respondents having of age group (18-25) years prefers both Technological and Managerial factors equally, but the respondents of age group (26-35) years and (36-50) years prefers Technological factors as more significant than Managerial factors. Most importantly, respondents of higher ages of above 50 years, prefers Managerial factors as more significant over Technological factors.
- Qualification-wise importance of Technological and Managerial Factors, the Management factors dominates the Technological factors i.e. Management factors are more significant for highly qualified respondents.
- It is evident that although both the factors are significant as per the different experience levels of respondents but with low experience (below 1 year) - Management factors are more significant and with the increase in experiences (1-5 years) - Technological factors chosen as more significant one and again at high experiences - (6 years and above); Management factors influences on Plant Productivity more significantly than Technological factors.

- Out of all Technological factors based on respondents percentages and corresponding mean “Safety Initiatives” emerges as the Key Technological factor having the greatest degree of influential importance on Plant Productivity of Dewatering Plant and, the most important component statement behind this Technological factor is ‘Management should seriously concerned on Safety issues’. (Ref : Table no 4.6 & 4.6.1.2)

- Out of all Management factors based on respondents percentages and corresponding mean -------- “Management of Change” emerges as the Key Management factor having the greatest degree of influential importance on Plant Productivity of Dewatering Plant and, the most important component statement behind this Management factor is ‘People should have meaningful relationships with their boss & peers’.(Ref : Table no 4.8 & 4.8.1.2)

4.9.6 Summary

This Chapter has presented the data that was obtained from the field study. Descriptive statistics was used to represent the data and consequently, bar graphs and pie charts as well as frequency tables have been used to present the data. The chapter has also shown the results of the correlation analysis & discussion of the findings.

CHAPTER FIVE

RESULTS, DISCUSSIONS & CONCLUSION

5.1. Introduction

Here in this chapter, basically all the findings and results are discussed. Here, findings of the studied factors - Technological and Managerial, which influences Plant Productivity, a case of major dewatering Plants associated with Tata Steel's mineral beneficiation units in India are dealt.

Based on the questionnaires prepared in line with the studies specific objectives, the data's are captured and further analyzed. Now, whatever are the findings and results obtained, that needs to be addressed in this chapter.

5.2. Results & Discussions

This study have main purposes as:

i. Primarily, to identify the Key Techno-Managerial factors influencing Productivity of Tailings Dewatering Plant,
ii. To analyze facilitating Techno-Managerial factors & their degree of influence for the improvement of Productivity,
iii. To identify measures based on influence of Key Techno-Managerial factors for the enhancement of Productivity of Tailing Dewatering Plant.

This research questions are:

i. What are the key Techno-Managerial factors influencing Productivity of Tailings Dewatering Plant?
ii. Which factors are more significant & their justification?
iii. How much is their degree of influence for the improvement of Productivity?
iv. What are the identified measures based on influence of Key Techno-Managerial factors for the enhancement of Productivity of Tailing Dewatering Plant?

Descriptive research design chosen for this study and the populations are the workmen of all three dewatering Plants along with the related other stake holders too. Here in the study, the total population was of 216 employees from various

functions of the units. Using questionnaires, data's collected from different respondents of 205 no's; which is the sample size.

Now these data's are analyzed using statistical tools through software of SPSS and presented in the form of percentage, frequency, mean, charts and finally interpreted.

5.2.1 Findings summary

- It is evident that both factors are significant, but Technological factors are more significant than Management factors as per the overall respondent's view.

- It is evident that the respondents having of age group (18-25) years prefers both Technological and Management factors equally, but the respondents of age group (26-35) years and (36-50) years prefers Technological factors as more significant than Managerial factors. Most importantly, respondents of higher ages of above 50 years, prefers Management factors as more significant over Technological factors.

- Qualification-wise importance of Technological and Managerial Factors, the Management factors dominates the Technological factors i.e. Management factors are more significant for highly qualified respondents.

- It is evident that although both the factors are significant as per the different experience levels of respondents but with low experience (below 1 year) - Management factors are more significant and with the increase in experiences (1-5 years) - Technological factors chosen as more significant one and again at high experiences - (6 years and above); Management factors influences on Plant Productivity more significantly than Technological factors.

- Out of all Technological factors ------- "Safety Initiatives" emerges as the Key Technological factor having the greatest degree of influential importance on Plant Productivity of Dewatering Plant and, the most important component statement behind this Technological factor is 'Management should seriously concerned on Safety issues'

- Out of all Management factors -------- "Management of Change" emerges as the Key Management factor having the greatest degree of influential importance on Plant Productivity of Dewatering Plant and, the most important component statement behind this Management factor is 'People should have meaningful relationships with their boss & peers'.

5.3 Implications of the study

This study is mainly focuses on Productivity improvement of major Dewatering Plants associated with Tata Steel ore washeries in India. The research findings have some aspects of implications, which are as follows:

5.3.1 Theoretical Implications:

- From this research work, the some of the identified working factors of motivation emerges out to address the Productivity improvement of Tata Steel Tailing Dewatering Plants and were under low focus by researchers before.

- Various statistical tools used to validate the linkages between working factors of motivation on Plant productivity.

5.3.2 Practical Implications:

- From this study, Management team & other concerns of the organisation as per their organisational strategy towards their goal may devise more impactful employee engagement Programmes.

- Managers and organization must give due considerations & formulate shop floor initiatives related with these working factors of motivation, emerges out from the study.

- For other industries this research findings can be used as a guide to fabricate their future strategy & action plans for their productivity improvement & business sustainability.

Social Implications:

- This study refers to the importance of Technological and Managerial factors in context of shop floor management, which is directly impacting on Plant's motivational atmosphere as well on plant productivity.

- As this study is closely related with mineral (Coal) processing dewatering units but its findings can be taken as a guide for other sectoral or other kinds of mineral processing units.

- The findings would guide in the development of administrative strategies in line with the organisational mission & vision.

- Prospectively, it would serve as a guide for future reference to students of higher learning Institutions / Universities who wish to research on the same topic.

5.4 Major recommendations

- Out of all Technological factors, since "Safety Initiatives" emerges as the Key Technological factor having the greatest degree of influential importance on Plant Productivity of Dewatering Plant and, the most important component statement behind this Technological factor is 'Management should seriously concerned on Safety issues'.

  So Management must focus & periodically review all kinds of safety activities & initiatives of the organisation. Safety calendar should be made in which time bound safety campaigns, safety talk competitions, mock drills should be organised. Tool box meetings & job wise hazard and risk analysis needs to be done. Based on Learnings from past incidents, desired CAPA (corrective and preventive actions) should be implemented. The ultimate purpose should be more awareness about Safety culture in the plant working atmosphere to reduce the unsafe acts and unsafe conditions in the organisation, which in turn will enhance the Plant Productivity.

- Out of all Managerial factors, since "Management of Change" emerges as the Key Managerial factor having the greatest degree of influential importance on Plant Productivity of Dewatering Plant and, the most important component statement behind this Managerial factor is 'People should have meaningful relationships with their boss & peers'.

  So for any change, implementation of any new idea or initiatives, system or processes - Management should be very flexible, transparent in communication about the change Plan, scope, training plan(if any) & establishing new benchmarks etc. Management should create such an atmosphere, so that everyone feels in the organisation be the part of the change. This will lead to continuous improvement, which in turn enhance the Plant Productivity.

5.5 Limitations of this Study

- Here, considering only three dewatering units of Tata Steel in India the study has been done.

- The study is limited to some of the key Technological and Managerial factors only.

- This study is done for tailing dewatering Plant in-line with ore beneficiation processes only. Any other businesses are not included.

5.6 Scope for future research

- This study validates key working factors (Technological and Managerial) of motivations for Productivity improvement at shop floor level however further study can be done at other levels in the organisations.

- There are many other Technological and Managerial factors viz. Strategic Planning, Customer focus, Process Management, Management by fact, Speed & agility, societal responsibility etc. which are also very crucial factors for further study.

- The study was done in Tata Steel ore beneficiation related tailing dewatering Plants India, the study imply that the other researcher must conduct the study in difference region in India or abroad. Also the study involves quantitative method so other must conduct in other method.

5.7 Research Contributions

- This research work validates the relationship between Technological and Managerial working factors of motivation with Plant Productivity enhancement, which will serve as a guideline for any organisations Senior Management team & other Human resource concerns in devising their employee engagement or motivational strategy for enhancement of their organisational Productivity of each resources.

- There are some key working factors emerges out from this study which have significant impact on productivity, which must be focussed in the daily management shop floor activities & reviews and, further accordingly initiatives could be formulated in the organisation.

- Research findings can be used by other industries too in designing and developing their long term strategy & policy which will result in sustainable business with improved Productivity.

- This study reiterates the importance of Technological and Managerial factors, which uplift the motivation levels of the People, which are the greatest asset of any organisation; here the case of dewatering units. Since their performance level greatly enhance the organisational Productivity level and, this is also not limited to any specific sectors or geography. So findings related to dewatering units can be used for other Processing sectors and Industries too.

- The findings would provide a guide in developing suitable & effective managerial policies through' some short and long term strategies in line of organizational goals & objectives.

- This study can provide a clear framework for future research or Policy making too.

- This research also highlights the importance of considering demographical variables, when developing work & job responsibility planning and recruitment planning etc.

5.8 Conclusion

Plant Productivity is a very significant conceptual term which have a very close relationship with many factors consists of behavioral related and as well as working related motivational factors. Further these factors are either in the form of Technological or Managerial in nature as they emerge from within the organization. These factors determines the level of motivation among employees, creating a hygiene safe working conditions and also crucial to know the employee's satisfaction levels.

Employee's motivation level is very vital for employee performance but it's also crucial to know the significant factors to the organizational management team so that they can put focused emphasis considering the same. Finally the organizations will get benefited in terms of improved performance & thus Productivity.
Human resource department also facilitates top management for formulation of short & long term strategy.

Bibliography

1. Motivation & Work Behaviour (3 ed.) , Steers, R., & Porter, L. (1983a)
2. Motivation and Work Behaviour (Third ed.), Steers, R., & Porter, L. (1983b).
3. Performance studies of the tubular Filter Presses, Rencken, G,K.,1992
4. Mechanical Dewatering of Tailings-an update with case studies reviews the current state with challenges & opportunities of Dewatering technologies & different methods, also discusses operational experiences of South African Filter Presses, Bickert,G.,2012
5. Evaluation of a Pilot-scale, Plate-and-Frame Filter Press for Dewatering thickener underflow slurries from Bituminous Coal-cleaning Plants to evaluate the effects of filter time,air drying time, and air-blow pressure on filtrate flow,filtrate solids content,final cake moisture,and filter press unit capacity, Verma,S. and Klima,M.S.,2010
6. Motivation and Work Performance: Complexities in Achieving Good Performance Outcomes; A Study Focusing on Motivation Measures and Improving Workers Performance in Kitgum District Local Government, Stella,Opu,2008.
7. Design of cost effective coal washery Effluen Treatment Plant for clean environment, Ghose,M.K.,2000
8. Some aspects of Coal flotation at Washeries of Tata Steel, Prasad,L.,Safvi,S.M.M.,2000
9. Innovation in dewatering process of Flotation tailings by study of particle interaction in Colloidal environment, Malikova,Petra., Thomas, Jan.,2015
10. Productivity Improvement in Manufacturing Industry using Industrial Engineering tools. Mishra,Devi Prasad,Sugla,Mamtesh,Singha, Prasun,2013.Productivity Improvement in unground Coal Mines-A Case study, Naveen,B., Ramesh Babu,T.,2013
11. Dewatering Slurries (1987) assigned to the Water Research Commission, Pretoria, and Republic of South Africa, K. Treffry-Goatley and C.A. Buckley, South African Patent No.86/1834
12. Study of Filter Press applications, Behra,P.P., NIT, 2010
13. Performance studies of the tubular Filter Presses, Rencken,G.K.,1992
14. Mechanical Dewatering of Tailings-an update with case studies, Bickert,G.,2012
15. Evaluation of a Pilot-scale, Plate- and-Frame Filter Press for Dewatering thickener underflow slurries from Bituminous Coal-cleaning Plants, Verma,S.and Klima,M.S.,2010
16. Coal and Refuse Dewatering, Arnold Barbara, J.,2010
17. Dewatering technology used at Mayfube Colliery, Terblanche,A.N. and Esterhuizen,J.J.,2010
18. Productivity Engineering and Management, TATA McGraw Hill, New Delhi, David,J.Sumanth 1990
19. Production and Operations Management, Prentice Hall Englewood Cliff N.J, Adam,E.E Jr and

R.J.Ebert 1978.

20. Production system , Planning Analysis and Control, John Wiley and sons , New Delhi, Riggs J.L Abadi, F. E., Jalilvand, M. R., Sharif, M., Salimi, G. A., & Khanzadeh, S. A. (2011). A Study of Influential Factors on Employees‟ Motivation for Participating in the In-Service Training Courses Based on Modified Expectancy Theory. International Business and Management, 2 (1), 157-169.

Anderson, A.E. (2004). What's absent in absence management. Employee Benefits Journal 29 (1): 25-30.

Annamalai, T., Abdullah, A. G. K., & Alasidiyeen, N. J., (2010).The Mediating Effects of Perceived Organizational Support on the Relationships between Organizational Justice, Trust and Performance Appraisal in Malaysian Secondary Schools. European Journal of Social Sciences, 13 (4), 623-632.

Arnolds, C.A., & Feldman, C. (2001). The challenge of motivating top management: A need satisfaction perspective [Electronic version]. Journal of Industrial Psychology, vol. 27(1): 39-42.

Bagraim, J,Cunningham p, Potgieter T, Viedge C. (2007). Organizational behaviour: A contemporary South A frican perspective. Pretoria: Van schaik

Beugré, C, D., & Offodile, O. F., (2001). Managing for organizational effectiveness in sub-Saharan Africa: a culture-fit model. The International Journal of Human Resource Management, 12 (4), 535-550.

Chiang, C.F., & Jang, S.C. (2008). An expectancy theory model for hotel employee motivation. International Journal of Hospitality Management, 27: 313-322.

Cooper, D. R. & Schindler, P. S. (2011). Business Research Methods, 11th ed., USA: McGraw-Hill Irwin International Edition.

Daft R. L., (2009). Organization Theory and Design. Cengage Learning, Inc.

Deming, W. E. (1990). Sample design in Business Research. New York: John wile& Son

Döckel, A., Basson, J. & Coetzee, M. (2006).The effect of retention factors on organizational commitment: an investigation of high technology employees. SA Journal of Human Resource Management, 4(2):20-28.

Donald, G. G., & Jon, L. P. (2008). Self-esteem and self-efficacy within the organizational context: An empirical examination. Group & Organization Management, 23(1), 48-70.

Elliot, A., & Zahn, I. (2008). Motivation. In: N. Salkind (Ed.), Encyclopedia of educational psychology. (pp. 687-693). Thousand Oaks, CA: SAGE Publications, Inc.

Fisher, D. M. (2012). Facet personality and surface-level diversity as team mental model antecedents: Implications for implicit coordination. Journal of Applied Psychology, 97(4), 825-841.

Gautam, M.; Mandal, K., & Dalal, R.S. (2006). Job satisfaction of faculty members of veterinary sciences: an analysis. Livestock Research for Rural Development 18 (7).

George, J.M., & Jones, G.R. (2002). Organizational behavior. (3rd Ed.). New Jersey: Prentice Hall.

Grant, A. M., Fried, Y., & Juillerat, T. (2010). Work matters: Job design in classic and contemporary perspectives. Forthcoming in S. Zedeck (Ed.), APA handbook of industrial and organizational psychology. Washington, DC: American Psychological Association.

Guay, F. (2010). Intrinsic, identified, and controlled types of motivation for school subjects in young elementary school children. British Journal of Educational Psychology, 80(4), 711–735.

Gurland, S. T., & Lam, C. F. (2008). Self-determined work motivation predicts job outcomes, but what predicts self-determined work motivation? Journal of world. (pp. 11611162). Thousand Oaks, CA: SAGE Publications, Inc.

Herzberg, F., Mausner, B. & Snyderman, B. (1959). The motivation to work, New

York: John

Human Resource Management Society, (2012). SHRM 2012-2013 Human Capital Benchmarking Report.State, Nigeria. Library Philosophy and Practice, 1-16.

Hunjra, AI, Chani, MI, Aslam, S, Azam, M & Rehman, KU (2010), 'Factors effecting job satisfaction of employees in Pakistani banking sector', African Journal of BusinessManagement, vol 4, no. 10, pp. 2157-2163.

Hussin A. B. (2011). The relationship between job satisfaction and job satisfaction and job performance. Centre for graduate studies; Open University Malaysia.

Iqbal, A. (2010). An empirical assessment of demographic factors, organizational ranks and organisational commitment.International Journal of Business andManagement,5(3):16-27.

Irons, J., & Buskist, W. (2008). Operant Conditioning. In S. Davis, & W. Buskist (Ed.), 21st Century psychology: a reference handbook. (pp. 1-329-1-340). Thousand Oaks, CA: SAGE Publications, Inc.

Jackson, S.L. (2011). Research methods and statistics: a critical thinking approach. 4thEdition.Cengage Learning.

Jun, M., Cai, S., & Shin, H. (2006). TQM practice in maquiladora: antecedents of employee satisfaction and loyalty. Journal of Operations Management, 24, 791-812.

Kabir, .M. (2011), Factors affecting employee job satisfaction of pharmaceutical sector, Australian Journal of Business and Management Reserch, Vol. 1 No. 9, pp: 113-123.

Kalimullah, K. U (2010). The Relationship between Rewards and Employee Motivation in Commercial Banks of Pakistan. Research Journal of International Studies, 14, 37-52.

Kamalian, A. R. (2010) Survey of Relationship between Organizational Justice and Empowerment (A Case Study). European Journal of Economics, Finance and Administrative Sciences, 24, 165-171.

Key, J. (2002). Research design in occupational education. Oklahoma: Oklahoma State University.

Kidder, L. H., & Judd, C. M. (2006). Research methods in social relations (5th Ed.). New York:

Kothari, C. R. (2004). Research Methodology: Methods and Techniques (2nd Ed.). New Delhi: New Age International limited.

Krejcie, R. V. (2010). Determining Sample Size for Research Activities. University of Minnesota. Duluth. Publications.

Ladebo, O.J., Awotunde, J.M. & Abdul Salaam-Saghir, P. (2008). Coworkers‟ and supervisor interactional justice: correlates of extension personnel's job satisfaction, distress, and aggressive behavior. Institute of Behavioral &Applied Management, 9(2):206-225.

Lai, H-H (2011), 'The influence of compensation system design on employee satisfaction', African Journal of Business Management, vol 5, no. 26, pp. 1078-10723.

Latham, G. P., & Locke, E. A. (2007). New developments in and directions for goal-setting research. European Psychologist, 12(4), 290-300.

Lewis, P., Sauders, M., & Thornhill, A. (2003). Research Methods for Business students, Third Edition. London: Prentice Hall.

Lunenburg, F. & Ornstein, A. (2008). Educational administration: Concepts and practices. 5th Edition. Belmont CA: Thomson Wadsworth.

Luthans, F. (1995). Organisational behaviour. (7th ed.). McGraw-Hill, Inc.

Mani, V., (2010). Development of Employee Satisfaction Index Scorecard. European Journal

Mathis, R.L. & Jackson, J.H. (2008). Human resource management. 12th Edition. Singerpore: Thomson Learning Academic.

Matthew, J., Grawhich, & Barber, L. K., (2009). Are you Focusing both Employees and Organizational Outcomes.Organizational Health Initiative at Saint Louis University(ohi.slu@edu), 1-5.

Mudor, H. & Tooksoon, P. (2011). "Conceptual Framework on the Relationship between Human Resource Management Practices, Job Satisfaction and Turnover", Journal of Economics & Behavioral Studies. Vol. 2(2): pp. 41 – 49.

Muhammad R. A & Wajidi. F.A (2013) Factors influencing jog satisfaction in public health sector of Pakistan. Double Blind Peer Reviewed International Research Journal Publisher: Global Journals Inc. (USA).

Obasan. K. (2011) Impact of Job Satisfaction on Absenteeism: A Correlative Study. European Journal of Humanities and Social Sciences. ISSN 2220-9425 Volume 1, No. 1 of Social Sciences, 15 (1), 129-139.

Oluseyi, S., & Ayo, H. T., (2009). Influence of Work Motivation, Leadership Effectiveness and time Management on Employees' Performance in some Selected Industries in Ibadan, Oyo State, Nigeria. European journal of Economics, Finance and Administrative Sciences, 16, 7-17.

Pocock, B (2006) The labour market ate my babies: work, children and a sustainable future. Sydney : Federation Press.

Ran, B. (2009). Motivation. In C. Wankel (Ed.), Encyclopedia of business in today"s Research in Personality, 42(4), 1109-1115.

Rukhmani, K., Ramesh, M., & Jayakrishnan, J., (2010). Effect of Leadership Styles on Organizational Effectiveness. European Journal of Social Sciences, 15 (3), 365-369.

Salman, R., Gerhart, B., & Minette, K. A., (2010). The Importance of Pay in employee Motivation: Discrepancies between What People say and what they do. Human Resource Management, 43 (4), 381-394.

Santrock, J. (2009). (4th ed.) Educational Psychology. New York, NY: Mc Grawhill

Sheldon, K. M., & Filak, V. (2008). Manipulating autonomy, competence, and relatedness support in a game-learning context: New evidence that all three needs matter. British Journal of Social Psychology, 47, 267-283

Sisk, D. (2009). Achievement motivation. In B. Kerr (Ed.), Encyclopedia of giftedness, creativity, and talent. (pp. 13-16). Thousand Oaks, CA: SAGE Publications, Inc.

Sullivan, (2009). In L. Sullivan (Ed), The SAGE glossary of the social and behavioral sciences. (p. 378). Thousand Oaks, CA: SAGE Publications, Inc.

Swarnalatha, C, & Sureshkrishna, G (2013). Role of employee engagement in building job satisfaction among employees of automotive industries in India.International Journal of Human Resource Management and Research, 3 (1).

Tella, A. (2007). Work Motivation, Job Satisfaction and Organizational commitment of Library Personel in Academic and Research Libraries in Oyo State, Nigeria. Library Philosophy and Practice, 1-16.

Turkyilmaz, A. Z., Akman, G., Ozkan, C., & Pastuszak, Z., (2011). Empirical study of Public sector Employee Loyalty and Satisfaction. Industrial Management and Data Systems, 111 (5), 675-696.

Van-Wyk, R. & Adonisi, M (2008). The role of entrepreneurial characteristics in predicting job satisfaction. South African Journal of Economic & Management Sciences, 11(4):391-405.

Vlosky, P. & Aguilar, X. (2009). A model of employee satisfaction: Gender differences in cooperative extension. Journal of Extension, 47(2):1-15.

Wentzel, K.R., & Wigfield, A. (2009) Handbook of Motivation at School. Routledge, New York.

Westover, L.A. (2010). Enhancing long-term worker productivity and performance: The connection of key work domains to job satisfaction and organizational commitment. International Journal of Productivity and Performance Management, 59(4):372-387

Whittaker, C. (2008). Hotel operator motives in UK sale and leaseback/management-back transactions. International Journal of Hospitality Management, 27 (4): 641-648.

Yaseen. A. (2013) Effect of compensation factors on employee satisfaction: International Journal of Human Resource Stusies. ISSN 2162-3058 2013, Vol. 3, No.1

Yazdani, B. O., Yaghoubi, N. M., & Giri, E. S., (2011). Factors affecting the Empowerment of Employees. European Journal of Social Sciences, 20 (2), 267-2

Appendix -1

Dear Respondent,

This questionnaire is prepared regarding a research activity related to Ph.D. program at ICFAI University, Jharkhand, based on your experience to enhance productivity of Dewatering plant.

I shall be highly grateful if you could spare a few minutes to complete the questionnaire. There is no right or wrong answer to the question. Answer given by you will be kept confidential and used for academic purpose only.

Part-1

1) Rank the factors with respect to its importance to enhance the Productivity of Dewatering Plant on a five (5) point scale (i.e. 1= Very less important, 2= Less important, 3= Important, 4= Very important, 5= Very highly important.

a. Leadership ( ) b. Management of Change ( ) c. Teamwork ( ) d. Motivation ( )

e. Training & skill development ( ) f. Standard operating Procedures ( )

g. Safety initiatives ( ) h. Technological learning's or Innovation Management ( )

i. Plant Layout or Orientation ( ) j. Materials Management ( )

Part -2

How much technological and Management factors are important in influencing Plant Productivity of Tailings Dewatering Plant?

Share	Technological Factors	Managerial Factors	Total
%			100

Ref:

Technological Factors: Standard operating Procedures (SOP),Safety initiatives, Technological learning's or Innovation Management, Plant layout or Orientation, Materials Management.

Management Factors: Leadership, Management of change, Teamwork, Motivation, Training & skill development

Part -3: On a five point scale (i.e. 1= Very less important, 2= Less important, 3= Important, 4= Very important, 5= Very highly important, please indicate how strongly you feel important to the following statements based on your experience of Dewatering Plant.

Leadership

Factors	Views					
		1	2	3	4	5
Role of Leadership is vital to guide & sustain any organization.						
People should aware about the Vision, Values & performance expectations of the organization.						
People should aware about the Organizational Leadership system.						
In organization Legal & Ethical behaviours should be Promoted.						
Leaders should be role model & committed.						

Management of change

Factors	Views					
		1	2	3	4	5
In organization active execution support should be provided from the higher Management						
People should have meaningful relationships with their boss & peers.						
People must open to participate in meetings & open dialogue session conducted by their seniors.						
People should clear about their responsibility & job accountability						
In organization Reward & recognition forum should exist.						

Teamwork

Factors	Views					
		1	2	3	4	5
People should have a better understanding & trust with their boss & peers.						
Everyone in team should clear about their Goals						
Listening & respect should valued at all levels in the organization.						
There should be a collective responsibility for any success or failure						
Regular meetings to be held to address any issue.						

Motivation

Factors	Views					
		1	2	3	4	5
There should exist appreciation & recognition atmosphere.						
Fixed salaries, Bonuses/Incentives are good						
Good working Environment should exists						
There medical support & accommodation should made available						
Promotion & Growth opportunities should exists						

Training & skill development

Factors	Views					
		1	2	3	4	5
Top Management should advocates learning to Employees.						

People have to attend training Programs, aligned with the business objectives.						
People enjoy training programs as it upgraded them as technological advances.						
Training allows to find solution to certain problems & hence perform duties better.						
People must give positive feedback after training program to make it better & more beneficial for the organization.						

Standard operating Procedures (SOP)

Factors	Views					
		1	2	3	4	5
SOP helps to carry out the recurring operations correctly, safely & always in the same manner.						
People have to take active participation, while making SOP's.						
All SOP'S should be readily available.						
People should used to refer SOP's frequently.						
People should give feedback to modify SOP'S as a continuous improvement process as per the technological advancements.						

Safety initiatives

Factors	Views					
		1	2	3	4	5
Management must seriously concerned on Safety issues						
There should exists Safety committee to investigate accident/incident report.						

Safety supervisor regularly organizes safety awareness initiatives & conduct meetings						
There should exists an onsite Emergency Preparedness Plan						
Without Safety - Personal protective Equipments (PPE's), nobody should be allowed at site.						
There must exist pre start-up safety review & also safety audits at regular intervals at site.						

Technological Learning's or Innovation Management

Factors	Views					
		1	2	3	4	5
There should be involvement of higher level in Problem solving as a competitive advantage in organization						
There should exists Culture of understanding Problems or reasons for improvements.						
There should be an environment of continuous learning to deal with environmental challenges						
There should exists respect for individual initiative & Personal growth						
There should be an environment of tolerance for mistakes & allowing room for failure.						
There should exist culture of sharing best practices or modifications across the organization.						

Plant layout orientation

Factors	Views					
		1	2	3	4	5
It is important to keep in mind managerial policies & plans before deciding the Plant layout.						
Layout selected greatly influences the general arrangement of Equipments, Pipe						

line & others in & out of the work flow.						
Layout greatly addresses hard to access areas & ease of maintenance.						
Layout of Plant & Equipments influences safety of the workmen.						
Layout addresses Ergonomics as reduces stress, strain & fatigue.						
Layout reduces Equipment erection & impacts on overall Project Cost.						

Materials Management

Factors	Views					
		1	2	3	4	5
Design & inadequate details in drawings affects materials management						
Poor Planning & quality of materials affects material management						
Inefficient workforce is linked with material management						
Wastages during handling & transportation impacts material management						
Storage facility for safety is important for material management						

Part-4

Personal information's

Please supply the following details about yourself:-

- Age:
  a) 18-25 [ ] b) 26-35 [ ] c) 36-50 [ ] d) > 50 [ ]
- Gender: Male [ ] b) Female [ ]
- Last grade of Education, you completed:-
  a) High School [ ] b) Polytechnic [ ] c) Graduation [ ] d) Others_____
- No. of year served:
  a) Below 1 year[ ] b) 1-5 years[ ] c) 6 years and above [ ]
- How many Plants you have been associated in your Career:
  a) 1 [ ] b) 2 and above [ ]
- Experience in Plant works:
  a) 1-5 years[ ] b) 6 years and above [ ]
- Experience in Dewatering Plant:
  a) Below 1 year[ ] b) 1-5 years[ ] c) 6 years and above [ ]
- Experience in No. of Dewatering Plants served:
  a) 1-2 No's [ ] b) 3 No's and above [ ]
- Which Dewatering Plant you are associated with recently
  a) Ghato[ ] b) Sukhinda[ ] c) Jamadoba [ ] d) Others, if any specify……

Thanks for your responses

Appendix -2

		Journal Articles						
SN	**Name of the Author/ Co-Author/s)**	**Topic**	**Journal name**	**Impact Factor, if any**	**ISSN No.**	**Page Nos /Vol/Issue No.**	**Month/ Year**	**Indexing (Scopus/UGC-Care/ ABDC/Others)**
1	**George Francis Osta**	Evaluation of Overall Equipment Effectiveness (OEE), its shortcomings & challenges in a Steel Service Centre Processing high end Steel involving Slitting Process.	The IUJ Journal of Management		2347-5080	38-43	May-16	UGC
2	**George Francis Osta** **&** **Dr. Hari Haran**	Study of Interrelationship of Techno- Managerial issues in installation of Dewatering Plant integrated with Mineral beneficiation facility in India.	'GROWTH' - Journal of Management Training Institute, SAIL, Ranchi		2249-6394	53-56	October - December;2018(Delayed) Vol.46, Edition 3.	
3	**George Francis Osta**	Influence of Technological and Managerial factors with	Punjab Institute of Management & Technology,		2278-7925	one to five		UGC Care listed

	Dr. Hari Haran Dr.Mahua Banerjee	respect to Demography on Productivity of Dewatering Plants	Journal of research					Journ al