‘A study of Techno-Managerial factors influencing Productivity of tailings Dewatering Plants (associated with Tata Steel) in India’

Synopsis of the Research Proposal Submitted for the Ph.D. Programme (Part-Time) in Management
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1. INTRODUCTION

In any organisation, People are the greatest asset as they possess Skill, Knowledge & Experience, which implements processes systems in place & thus, enhances Productivity and, efficiency, creating Economic value to the Organisation.

Dewatering is a necessity in the mineral process industry since it improves Productivity and efficiency, reduces transportation costs, returning back generated water in the process for re-use and gets a material that is easier to handle in a wide range of processes driving environmental sustainability.

To keep dewatering applications in line with other related processes in this industry they need to be continuously developed as the dewatering process does not create any effluent discharge and is proven as eco-friendly technology word wide. In fact, this plant will reduce the pollution risks in the existing system.

The washing process adopted by Tata Steel requires the coal to be crushed and washed in a heavy dense media cyclone, whereas mineral Fines (- 0.5 mm) are washed by Froth Flotation Process. This process generates high ash mineral fines called Tailings which is a reject product and has to be disposed.

The tailings are discharged into tailing ponds where they are allowed to settle. Tailings pond occupy huge space and water loss including evaporation losses are very high & other problems of the system: -

(i) Pollution — there is always the risk of ponds overflowing and coal fines polluting the local area & the river.

(ii) Excavation — In the process of evacuation and recovery of coal from the ponds, equipment are used to dig out tailings from the ponds which is then transported to the disposal area. This process of evacuation has some risk of accidents & as well extra labour and expenses.

(iii) Capacity — the existing number of ponds will not be able to handle the enhanced capacity in future.

World over new technologies have been developed to dewater tailings and recover water for recirculation in the washery for re-use.

So, Tata Steel also proposed & build thro' Naresh Kumar & Co. Pvt. Ltd. (NKCPL) a modern centralized "On Line" tailings dewatering facility (first time in India in the year 2010) which receives tailings slurry from the existing two washeries to dewater the tailings, using combination of Screens & Filter Presses which removes solids in the form of Cakes for disposal (which also generates extra revenue) and recover

water, which Pumped back to the washery. These have the following proposed benefits over the earlier system:

(i) No requirement of tailings pond occupying huge land area. Tata Steel may be required to maintain only an emergency tailings pond.

(ii) Almost 100 % recovery of solids (tailings) from the slurry.

(iii) Very clean water recovered which again re-circulated to the Washery for re-use.

(iv) Water recovered from the system considerably reduces the quantum of make-up water required by Tata Steel for its washing purposes.

(v) The dewatered tailings available for sale immediately on processing rather than it having to wait for the tailings to dry out after evacuation from the pond.

1.1. DEWATERING PROCESS DESCRIPTIONS

- Filter Presses used for dewatering of tailings.
- The tailings slurry received from washeries into a Slurry buffer tank.
- The filter press utilises a batch process where the Slurry is pumped under pressure by membrane pumps into the chambers of the press formed by the recess plates until the cake is formed.
- This further followed by squeezing and compressed air blowing for moisture reduction prior to cake discharge.
- The clear filtrate collected in storage tanks and the water pumped back to Washeries for re-use.

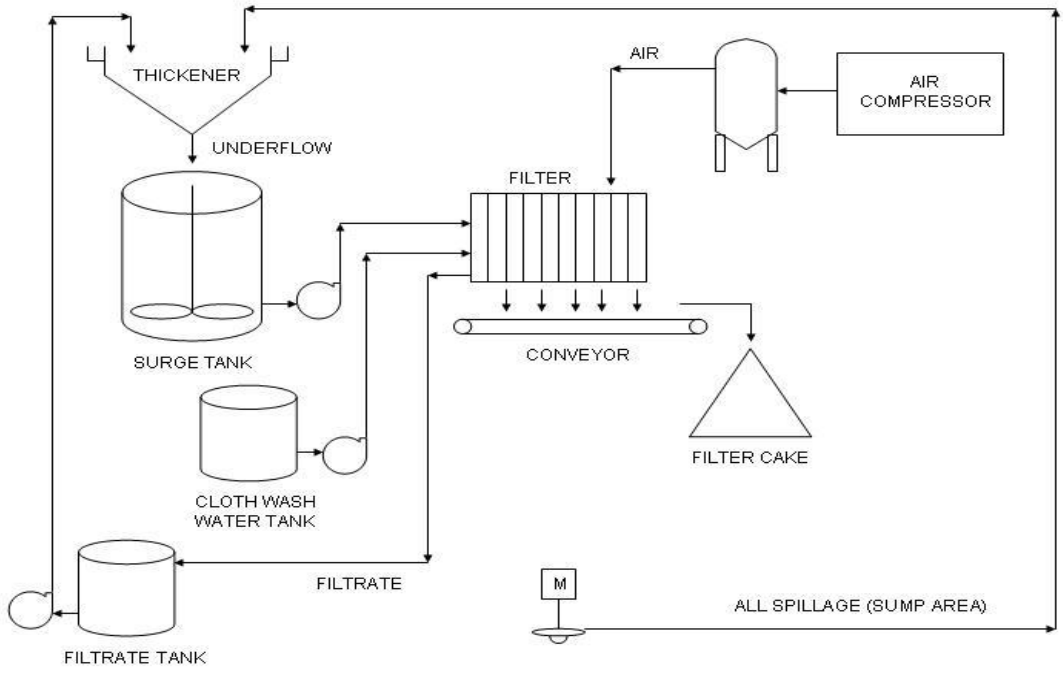

Fig. 1.1

So, Plant performance & Productivity enhancement of Tailing Dewatering Plant is a crucial need of the hour and, this Productivity depends on many human & working Techno-Managerial factors.

Thus, the present study encompasses Productivity enhancement of Tailings Dewatering Plants considering different Techno-Managerial factors.

The main Technological factors considered are as follows

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

The main Management factors considered are as follows:

- Leadership
- Management of change
- Teamwork
- Motivation
- Training and Skill development

2. 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.

3. REVIEW OF LITERATURE

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.

3.1 Standard operating Procedures (SOP)

A standard operating procedure (SOP) is a set of step-by-step instructions compiled by an organization to help workers carry out routine operations. SOPs aim to achieve efficiency, quality output, and uniformity of performance, while reducing miscommunication and failure to comply with industry regulations.

According to the U.S Environmental Protection Agency (EPA, p. 1), SOP avoids variations regardless of the operator and time of operation; provides individuals with the information to perform a job properly; facilitates consistency in quality of an end-result; addresses safety concerns; and minimizes chances for miscommunication, even if there are temporary or permanent personnel changes.

de Treville et al. (p.232) also described that SOP ensures that all workers are performing tasks in the same way, which is a necessary condition to obtain consistent output; and asserted that if a workforce cannot operate the parlor consistently, then the whole operation will fail.

According to **Biologic Technological Applications** (EBTE) Consultants, SOP standardizes activities of a specific procedure; speeds up the integration of an individual into the organization during an initial phase of an employment; improves transparency within the organization; serves as a valuable structure for internal communication; shares best practices within the organization; and provides valuable background information for management policy development and change.

Levinthal & March (as cited in de Treville et al, p.231) asserted that SOP has the ability to facilitate the transfer of knowledge that leads to variability reduction and organizational effectiveness.

According to Edelson & Bennett (as cited in Treville et al, p.232), the domains of a typical SOP include purpose of operation, equipment and materials required, and the operations required for the process.

The best practice to develop SOP calls for active involvement of workers. Highly successful managers actively engage their teams and it is human nature that people support what they help create and managers who write SOP without input from workers run the risk of upsetting them while those who enlist the talents of their workers increase buy-in (Stup R., p. 6).

Adler, Imai, MacDuffie and Monden, (as cited in Treville et al, p.234), claimed that companies that test, refine, and implement workers' creative suggestions are likely to end up with higher quality SOP; they have the advantage to foster teamwork; and the motivational implications of SOP use are moderated by workers' ability to participate in the process. For continuous organizational improvement, established procedures need a continuous enhancement; and thus, requiring creative and novel ideas appropriate to the task from those individuals using those procedures (Treville et al, p. 233).

Apparently, SOP is not one-size-fits-all. Specific SOP should exist for every single task that addresses some essential elements. According to Edelson & Bennett (as cited in Treville et al, p.232), the domains of a typical SOP include purpose of operation, equipment and materials required, and the operations required for the process.

The process of developing an effective SOP is critical to its successful implementation and the process should be inclusive which considers the input of everyone (8). The best practice to develop SOP calls for active involvement of workers. Highly successful managers actively engage their teams and it is human nature that people support what they help create and managers who write SOP without input from workers run the risk of upsetting them while those who enlist the talents of their workers increase buy-in (Stup R., p. 6).

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Apparently, the convincing reason to involve workforce is that individuals who participate in the process are positive to generate ideas, accept the SOP, and feel a sense of ownership in it, which is not the case when workers feel that management is imposing an SOP without regard to their input.

One of the earliest known models for managing SOP development is Plan-Do-Check-Act cycle i.e. first, you plan; next do what you planned; then check what and how you did and how things went; and finally, act on what you learned

Once SOP is developed, the next critical stage is adherence to it. The expectation is that everyone should adhere to the established SOP. However, according to Imai, Edelson & Bennett (as cited in Treville et al, P.236), adhering to SOP does not happen automatically and ensuring workers adherence to SOP is one of the primary jobs of management and requires discipline and management intervention.

3.2 Safety initiatives

Safety initiatives refer to a situation or an employee's condition to not just simply work in a standard safety environment but are also contributing ideas and are proactive in increasing the standard of safety in their work environment (Zacharatos, 2002.).

Risk is understood and managed as a result of the models used to explain how accidents happen. (Many of these models are described in the Encyclopedia of Occupational Health and Safety, edited by J.M. Stellman, International Labor Office, Geneva.) The Domino Theory developed in 1931 suggests that one event leads to another, then to another and so on, culminating in an accident. It found that 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 plays an essential role since it influences employee motivation. Employees are concerned with a comfortable physical work environment that will ultimately provide extra optimistic level of motivation. Lack of favorable working conditions, amongst other things, can affect badly on the employee's mental and physical well-being. According to Arnolds and Feldman (2001) factors such as working hours, temperature, ventilation, noise, hygiene, lighting, and resources are all part of working conditions. Negative performance will be provoked by poor working conditions since employees job demand mentally and physically tranquility (Irons and Buskist, 2008).

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

In 1991, Reason developed the Resident Pathogens and Risk Management Model. His theory indicates that residual risks are not reducible by purely technological counter-measures. Workers contribute to accidents in high-risk technologies through slips - where actions do not go as planned - and through mistakes, which are deficiencies or failures of judgment. The accumulation of human errors leads to active and latent failures of organizational systems. Reason argues the need to appreciate the presence of residual risks and develop strategies to contain it. This challenges managers to over-ride their assumptions that systems are "safe" and to look for underlying weaknesses in business systems.

3.3 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

3.4 Plant layout or Orientation

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. 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.

3.5 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.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.

Hemsworth Martinez-Lorente Clavel et al. (2006) stated that Standardization of materials is one important purchasing department decision.

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).

3.6 Leadership

Leadership is about influencing people to do things the right way. To achieve that you need people to follow and to have them trust you. And if you want them to trust you and do things for you and the organization, they need to be motivated. Theories imply that leader and followers raise one another to higher levels of morality and motivation. Motivation is purely and simply a leadership behavior. It stems from wanting to do what is right for people as well as for the organization. Leadership and motivation are active processes in management (Rukhman, 2010).

As per the Contingency management theory, developed by Fred Fiedler, this theory's primary focus is that no one management approach works for every organization. Fiedler suggested a leader's traits were directly related to how effectively they lead their team. He asserts there are leadership traits that apply to every kind of situation and that a leader must be flexible to adapt to a changing environment. As per the Principles of administrative management theory, Henri Fayol, a senior executive and mining engineer, developed this theory in the 19th century when he examined an organization through the perspective of the managers and situations they might encounter. Fayol believed 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. He suggested that the principles should not be rigid but that it should be left up to the manager to determine how they use them to manage efficiently and effectively.

As per the, Bureaucratic management theory, developed by Max Weber, bureaucratic management theory focuses on structuring organizations in a hierarchy so there are clear rules of governance. His principles for creating this system include a chain of command, clear division of labor, separation of personal and organizational assets of the owner, strict and consistent rules and regulations, meticulous record-keeping and documentation and the selection and promotion of employees based on their

performance and qualifications. This theory has played a key role in establishing standards and procedures that are at the core of most organizations today.

As per Tata Business Excellence model, 2010 reference manual, senior leaders should serve as role models through their ethical behaviour and their personal involvement in planning, communicating, coaching the workforce, developing future leaders, reviewing organisational performance, and recognising members of your workforce. As role models, they can reinforce ethics, values, and expectations while building leadership, commitment, and initiative throughout the organisation.

3.7 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.

This Foundational Concept provides brief overviews of four theories of change. These are: (1) the Concerns-based Adoption Model (CBAM), (2) Improvement Science, (3) Kotter's Model of Change, and (4) Lewin's Three-stage Change Model.
The McKinsey 7-S Model identifies seven components of an organization that must work together for effective change management: Structure, Strategy, Staff, Style, Systems, Shared Values, and Skills. In both research and practice, we find that transformations stand the best chance of success when they focus on four key actions to change mind-sets and behavior: fostering understanding and conviction, reinforcing changes through formal mechanisms, developing talent and skills, and role modeling. Harvard professor and change management expert John Kotter created a theory called Kotter's change management theory, which focused primarily on the people involved in a change process and their psychology.

3.8 Teamwork

Cohen et al. [23] defined agent teamwork as *"a set of agents having a shared objective and a shared mental state"*, whereas Salas et al. [85] characterizes human teams as *"a distinguishable set of two or more people who interact dynamically,*

interdependently, and adaptively towards a common and valued goal/objective/mission".

A team is a group of people working together to achieve the same objectives. Katzenbach and Smith state in their report The Discipline of Teams (1993) that 'the essence of a team is common commitment. Without it, groups perform as individuals; with it, they become a powerful unit of collective performance.' The literature consistently highlights 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 enough to adapt to cooperative working environments where goals are achieved through collaboration and social interdependence rather than individualised, competitive goals (Luca & Tarricone, 2001).

Key attributes for successful teamwork Key Attributes Descriptors Commitment to team success and shared goals • participants understand their purpose and share their goals – the combination achieves mission (Francis & Young, 1979) • members must share a strong common goal (Kets De Vries, 1999) • groups provide each member of the team with prestige and recognition (Scarnati, 2001) • successful teams are motivated to succeed (Bradley & Frederic, 1997) • there is strong team commitment to succeed (Critchley & Casey, 1986) • members have strong shared values and beliefs (Kets De Vries, 1999) • engaged in and satisfied with their work (Wageman, 1997) • creation of a team atmosphere that is informal, relaxed, comfortable and non-judgemental (Harris & Harris, 1996) • promote group cohesion (Bradley & Frederic, 1997) • people enjoy regular interaction with individuals who have similar interests and goals (Scarnati, 2001). Interdependence • one cannot succeed unless the other members of the group succeed (Smith, 1996) • together the group can deliver more than the individuals who compromise it could do in isolation (Francis & Young, 1979) • team members must work together effectively to produce successful systems (Bradley & Frederic, 1997) • team members interact to help each other accomplish the task and promote one another's success (Smith, 1996) • team members build on the capabilities of their fellows – the combinations energised through synergy (Francis & Young, 1979) • team members must take an interest in both the group and each individuals achievement (Harris & Harris, 1996) • team members must never be fully self-directed or completely independent (Johnson, Heimann, & O'Neill, 2000) • teams are often empowered to accomplish tasks not available to individuals (Scarnati, 2001) • Individuals experience a wide range of new ideas and skills when interacting with team members (Scarnati, 2001) • team members learn together so that they can

subsequently perform better as individuals (Smith, 1996) HERDSA 2002 ✯✯ PAGE 643 Key Attributes Descriptors Interpersonal skills • people must care for each other (Critchley & Casey, 1986) • members must protect and support each other (Kets De Vries, 1999) • feelings cab be expressed freely; (Critchley & Casey, 1986) • members must be respectful and supportive of one another, and realistic in mutual expectations (Harris & Harris, 1996) • there is a high level of trust (Critchley & Casey, 1986) • members respect and trust each other (Kets De Vries, 1999) • foster trust, confidence and commitment within the group (Harris & Harris, 1996) Open communication and positive feedback • give and accept feedback in an non-defensive manner (Harris & Harris, 1996) • ideal team should be highly diversified in the talents and knowledge each member contributes, while maintaining open, non-threatening communication (Bradley & Frederic, 1997) • value effective listening and communications that serves group needs (Harris & Harris, 1996) • engage in open dialogue and communication (Kets De Vries, 1999) • cultivate a team spirit of constructive criticism and authentic non-evaluative feedback (Harris & Harris, 1996) • team members must be open and truthful (Critchley & Casey, 1986) • enable members to express group feelings (Harris & Harris, 1996) • listen to all ideas and feelings; (Critchley & Casey, 1986) • face up to conflict and work through it (Critchley & Casey, 1986) Appropriate team composition • successful teams are a product of appropriate team composition (Bradley & Frederic, 1997) • clarify member roles, relationships assignments and responsibilities (Harris & Harris, 1996) • discuss differences in what each member has to contribute to the work (Wageman, 1997). Commitment to team processes, leadership & accountability • tolerate of ambiguity, uncertainty and seeming lack of structure (Harris & Harris, 1996) • instil approaches that are goal-directed, divide labour fairly among members and synchronize efforts (Harris & Harris, 1996) • accept individual accountability/personal responsibility; (Smith, 1996) • team members are accountable for their share of the work (Smith, 1996) • members subscribe to distributed leadership (Kets De Vries, 1999) • decisions are made by consensus (Critchley & Casey, 1986) • effective leadership is needed (Bradley & Frederic, 1997) • encourage group participants, consensus and decisions (Harris & Harris, 1996) • experiment with new ways to work more effectively; (Wageman, 1997) • seek best practice from other teams and other parts of the organizations; (Wageman, 1997) • be open to change, innovation and creative, joint problem solving (Harris & Harris, 1996) • take action to solve problems without waiting for direction (Wageman, 1997) • monitor the team's progress (Johnson, Heimann, & O'Neill, 2000) • perform post-project analyses to find out what worked and what didn't (Johnson, Heimann, & O'Neill, 2000)

3.9 Motivation

Research on workplace performance and motivation has been started since the late 1920s and early 1930s with the study of Elton Mayo at the Western Electric Hawthorne plant and Maslow's need hierarchy theory. The ingredients of motivation lie within all and the internalized drive toward the dominant thought of the moment (Rabby 2001).

Panagiotakopoulos (2013) concluded that factors affecting staff motivation at a period where the financial rewards are kept to the least leads to stimulate employee performance. So, management personnel's responsibility to motivate their employees to work as per the expectation to enhance the organization's performance.

Similarly Dysvik and Kuvaas (2010) concluded 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.

As per Kuo (2013) 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.

Barney and Steven Elias (2010) found that with extrinsic motivation there exist a significant interaction between job stress, flex time, and country of residence.

Leaders know that at the heart of every productive and successful business lies a thriving organizational culture and hardworking people collaborate passionately to produce great results (Gignac and Palmer 2011).

3.10 Training and Skill development

As Frederick Taylor proposed in his scientific management theory, we can boost employee productivity by observing work processes and then creating policies recommending best practices. Invest in training for our employees to help them be more effective in their respective roles. We will generally find such training boosts their productivity and improves overall on-the-job performance. Human relations theory can impact productivity as well, since the attention you give team members and the interest you pay in their performances can increase their productivity.

Enhancing productivity performance is an essential driver of the UK monetary performance and long haul sustainable intensity (HM Treasury, 2006). As needs are, the UK government has built up a system for enhancing productivity, which concentrates on five key drivers: improving competition, promoting enterprise, supporting science and innovation, raising UK skills, and encouraging investment (Budget Report, 2005). Government reports give the feeling that skills hold the way to productivity change, a view, which is upheld by its organizations. For instance, the Sector Skills Development Agency (SSDA) Strategic Plan 2005/08 (SSDA, 2005, p. 9) expressed obviously that expanding support levels in preparing (which is one of the basic skills markers received by the administration) by 5 % points could build productivity by 4 % – boosting GDP by £40 billion.

Horner (1982) found 10 main factors affecting construction productivity are: quality, labour force management, the Saurav Dixit, Satya N Mandal, Anil Sawhney, Subhav Singh http://www.iaeme.com/IJCIET/index.asp 652 editor@iaeme.com motivation of labour force, the degree of mechanization, continuity of work, the complexity of work, skilled workforce, quality of managerial staff, a method of construction and weather conditions olomolaiya et al (1998).

India is one of the most youthful countries on the planet with over 54% of the aggregate populace beneath 25 years old. India's workforce is the second biggest on the planet after China's. While China's statistic profit is relied upon to begin decreasing by 2015, India will keep on enjoying it till 2040. In any case, India's formally gifted workforce is around 2% - which is drearily low contrasted with China (47%), Japan (80%) or South Korea (96%).To use our statistic profit all the more considerably and seriously, the Government propelled the "Ability India" battle alongside "Make in India". In this concise, we take a gander at the Skill Development biological system in India - the requirement for Skill Development, activities are taken by the Government and plans presented for aptitude government by the present government. Skill development is basic for accomplishing quicker, sustainable and comprehensive development on the one hand and for giving not too bad business openings to the developing youthful populace on the other.

3.11 Research work that was done on the topic, so far

Although, no such specific research work is available considering Technological & Managerial working factors for Tailing Dewatering Plant Productivity enhancement, however related researches on Human behavioural factors related with other areas are available, which guides the methodology & also ascertain the gaps, importance and, need for this research.

This study carried out in major Dewatering Plants in India, which is an economy where not any research on Dewatering Plants Productivity enhancement based

on Techno-Managerial factors has been carried out.

The Organization where the case study carried out is associated with Tata Steel & run by M/S Naresh Kumar & Co. Ltd on Build, Own and Operate (BOO) basis.

The population comprises a total of 216 employees. The sample of the study comprises a total of 205 respondents from various departments of the organization which include Human Resources, Operation & Maintenance, Logistics, Internal & External Consultants, Tata Steel relevant professionals and other stake holders, As per the local community is concerned, many employees belongs from the same & their responses are well taken.

4. 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. The studies mentioned in the literature survey have identified number of techno-managerial factors responsible for the enhancement of Productivity of manufacturing or different processing units.
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? Possibility also exists that these factors may not impact the Dewatering Plants in the same way as they do in case of other Manufacturing or Processing units. There are several factors that affect Productivity of Dewatering Plants. These factors, are broadly classified under two major heads

Importantly, Capacity utilisation of Dewatering Plants are very erratic (~ <35%) and, Plant Key Performance Indicator (KPI's) compliances are not sustainable. The dewatering process does not create any effluent discharge and is proven as eco-friendly technology worldwide.

In fact, this reduces the pollution risks in the existing system. So, Productivity of the system is an important concern as this will be going to be mandatory for the entire Mineral beneficiation businesses in the time to come. From review of literature, the research gaps have been identified as no such study has been done on Productivity improvement considering working factors of Dewatering Plants. 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 because of the familiarity of the place and cheaper means of getting good and needed information at a time and at the lowest cost.

5. Objectives and Limitations of the Study

The objectives were as follows:

i) To identify and prioritize 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 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.

The following limitations of the research study are envisaged:

I. The study does not cover entire technology of the Plant.

II. The research study is limited to Techno-Managerial working factors only.

III. The study covers Dewatering Plants related with Tata Steel in India only

6. HYPOTHESIS

The study had the following hypotheses to test;

- 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); there is no significant relationship between Technological factors and Plant Productivity of Dewatering Plant

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

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

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

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

7. Research Methodology

A sample of this study is 205 no's of Dewatering Plant employees drawn from 216 no's employees.

The sample size was determined using the Slovin's formula (Tejero, 2011),

n = N / (1 + Ne^2)
Where:
n = Number of samples,
N = Total population and
e = Error tolerance (level).

The error of tolerance is 5%.
Using Slovin's formula, the need for sample size is 140 approximately.

In the first phase of this study the pilot survey was carried out among 15 respondents with two primary purposes:

a. To identify major understandings of questionnaire & its relevance with the topic factors and impacts on Productivity of Dewatering Plants.Discussion & clarification done on the understanding of questionnaire.

b. To clarify the selected factors meanings & contents and, also identify further factors that has been suggested by the respondents and are important for inclusion in the list of factors in the main survey. Discussion & clarification done of both Technological & Management factors. As with any questionnaire survey the selection of sample is of prime importance.

Data analysis Framework		
Step-1	Identification of Factors influencing Plant Productivity	Statistical Tools or Method Used
1a	Basis Feedback from research supervisor, Tata Steel chief & Heads, Other Industrial experts & EX-Colleagues	

1b	Feedback from External consultants	
1c	Literature Review	

Step-2	Measuring Impact of Technological and Management Factors on Productivity	Statistical Tools or Method Used
2a	Identification of Productivity KPI- Activation & Recharges	Frequency tables, bar and column diagrams, pie charts, descriptive statistics, and cross-tabulations. Exploratory (graphical) analysis and reliability tests (such as Cronbach's alpha value and correlation) . Cronbach's alpha and KMO were used as a scale to measure reliability and Validity of data collected respectively.

Step-3	Identification of key working factors which has impact on productivity	Multivariate Analysis (MANOVA) was used to measure overall Impact on Productivity. Also ANOVA test was used to measure impact of individual factors on Productivity

8. Significance of the Study

- 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'.

9. Bibliography

Books and, Reference Manuals:

1. Steers, R., & Porter, L. (1983a). Motivation & Work Behaviour (3 ed.). New York: McGraw-Hill Book Company.
2. Steers, R., & Porter, L. (1983b). Motivation and Work Behaviour (Third ed.). New York: McGraw-Hill Book Company.
3. David,J.Sumanth .Productivity Engineering and Management, TATA McGraw Hill, New Delhi (1990).
4. Adam,E.E Jr and R.J.Ebert, Production and Operations Management, Prentice Hall Englewood Cliff N.J (1978).
5. Riggs J.L, Production system , Planning Analysis and Control, John Wiley and sons , New Delhi.
6. Introduction to work-study (Third Revised Edition) International Labour Office (ILO), Geneva.
7. Stellmam,J.,M., Encyclopedia of Occupational Health & Safety, International Labour office(ILO), Geneva.
8. Permanent innovation by Langdown Morris
9. Reference manual: TATA Business Excellence model, 2010.

Journal Articles

1. (Rencken, G,K.,1992.Performance studies of the tubular Filter Presses).
2. (Bickert,G.,2012.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).
3. (Verma,S. and Klima,M.S.,2010.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).
4. (Stella,Opu,2008.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)
5. Ghose,M.K.,2000.Design of cost effective coal washery Effluent Treatment Plant for clean environment.
6. Prasad,L.,Safvi,S.M.M.,2000.Some aspects of Coal flotation at Washeries of Tata Steel.
7. Malikova,Petra., Thomas, Jan.,2015.Innovation in dewatering process of Flotation tailings by study of particle interaction in Colloidal environment.
8. Naveen,B., Ramesh Babu,T.,2013.Productivity Improvement in Manufacturing Industry using Industrial Engineering tools.
9. Mishra,DeviPrasad.,Sugla,Mamtesh.,Singha, Prasun.,2013.Productivity Improvement in unground Coal Mines-A Case study.
10. K. Treffry-Goatley and C.A. Buckley, South African Patent No.86/1834, Dewatering Slurries (1987) assigned to the Water Research Commission, Pretoria, and Republic of South Africa**.**
11. Behra,P.P., NIT, 2010. Study of Filter Press applications.
12. Rencken,G.K.,1992.Performance studies of the tubular Filter Presses
13. Bickert,G.,2012.Mechanical Dewatering of Tailings-an update with case studies
14. Verma,S. and Klima,M.S.,2010.Evaluation of a Pilot-scale, Plate- and-Frame Filter Press for Dewatering thickener underflow slurries from Bituminous Coal-cleaning Plants
15. Arnold Barbara, J.,2010.Fine Coal and Refuse Dewatering
16. Terblanche,A.N. and Esterhuizen,J.J.,2010.Dewatering technology used at Mayfube Colliery.
17. Katzenbach,Jon.R and Douglas,K.Smith,1993.The disciplines of Teams, Harvard Business review
18.

Websites

http://www.iaeme.com