

**Indian Institute Of Technology
Madras**

BDM Capstone Project

**ANALYSIS OF DRAGLINE PERFORMANCE TO
IMPROVE COAL PRODUCTION**

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Organization Background

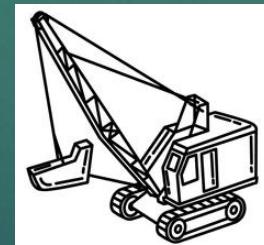


Main objective of company is to produce coal in compliance with social upliftment, sustainable development along with safe environment upgradation. It is an ISO 9001:2015, ISO 14001:2015 certified company. This company has surface (open-cast pit) type mine, mainly its products are subbituminous coal also known as non-cooking coal whose 86% coal is dispatched to power sectors for electric generation and remaining transported for other purposes. XYZ mining uses state of art mining technology for coal and overburden removal. It is located in Madhya Pradesh which constitutes 8% of the total coal resources in India, and 13% of coal production comes from Madhya Pradesh itself. Main HEMM equipment's for the production in this company are draglines, shovels, dumpers, surface miners, Drillers and many other Auxiliary Equipment Under the growing coal demand, Company is currently adapting advanced mining technologies along with its continuous research and development.

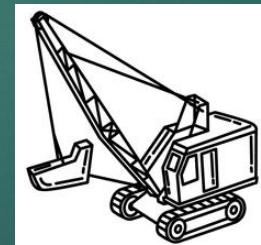
NOTE - Due to some privacy reasons I can't mention company's name so instead I used XYZ mining company

Business Problem

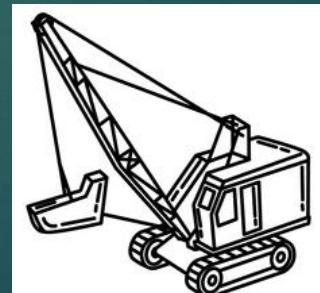
- 1) Many times, machines are unavailable so tracking which factor is mostly affecting its unavailability to achieve maximum utilization in terms of time usage.
- 2) Production maximization.



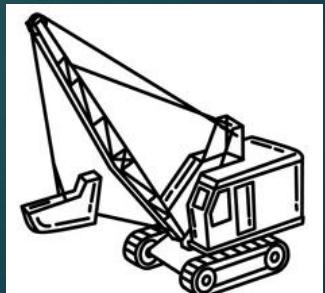
Ram
(8 Cum)



Shyam
(8 Cum)

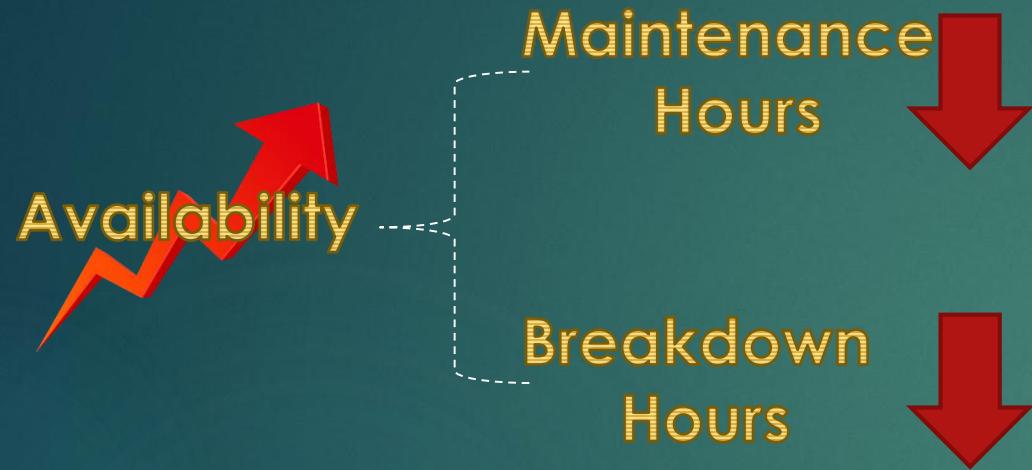


Gaurav
(19 Cum)

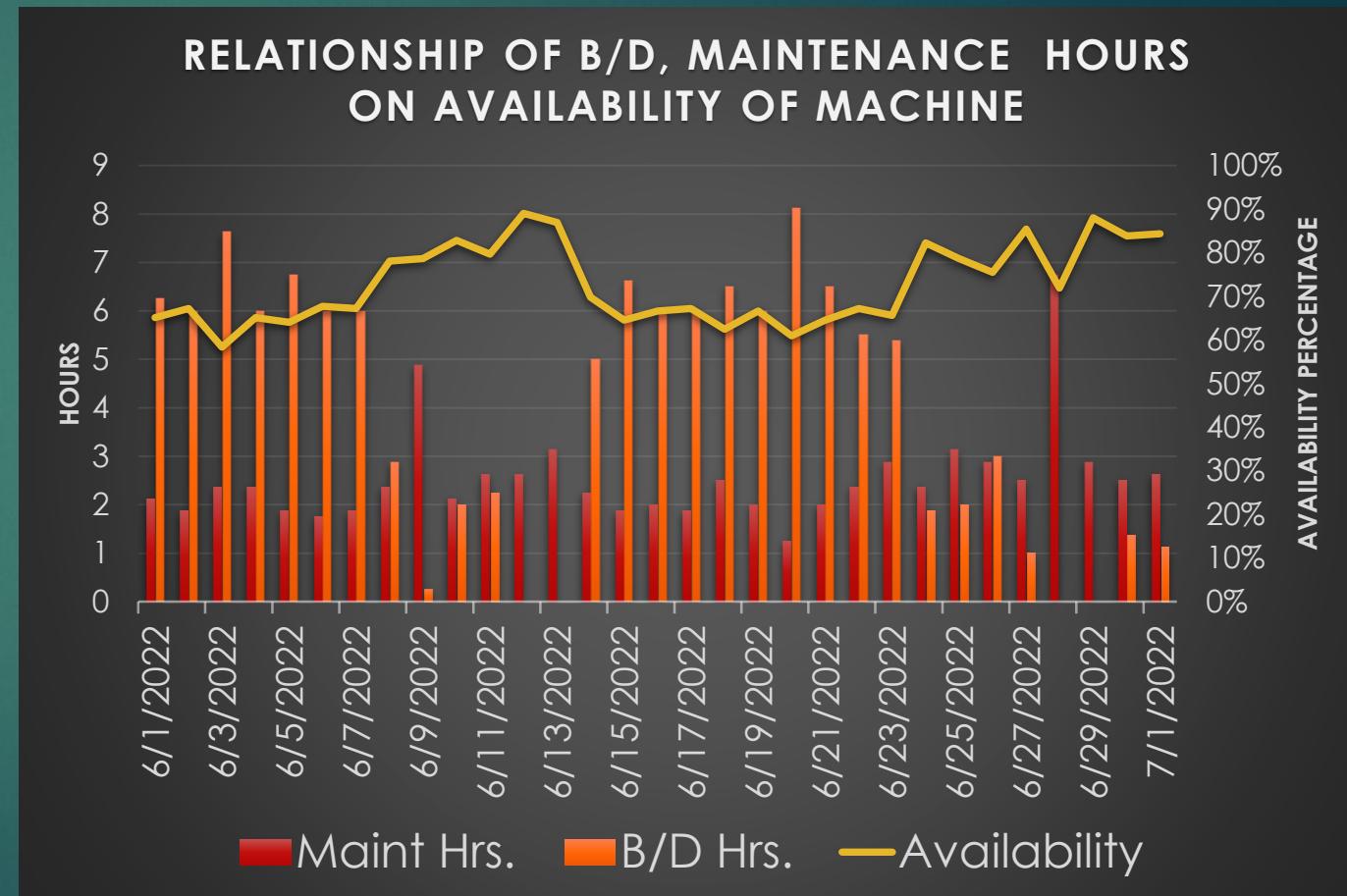


Saurav
(19 Cum)

Availability Maximization

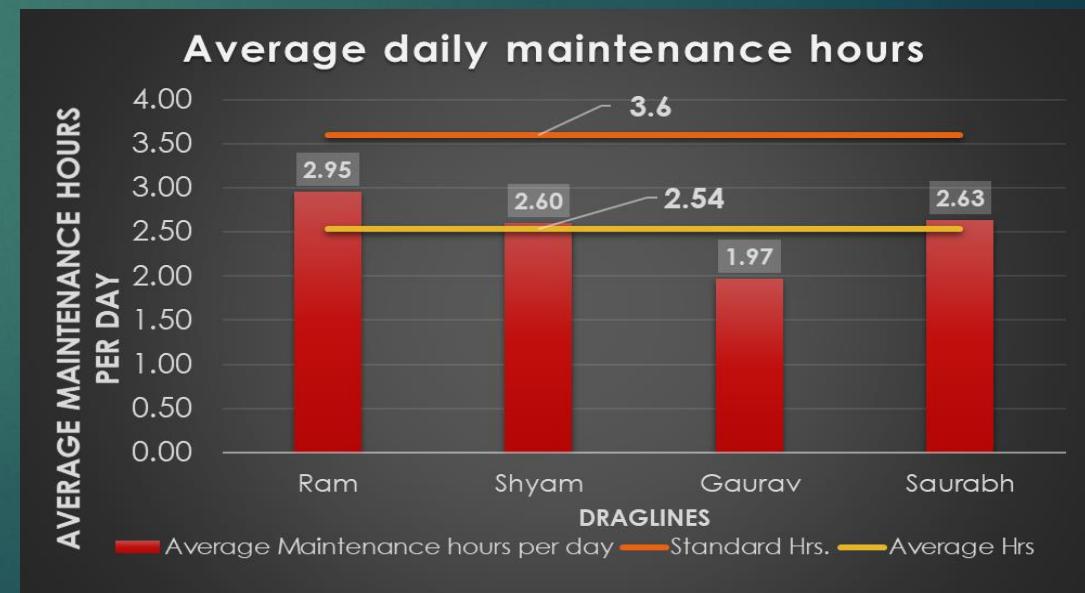
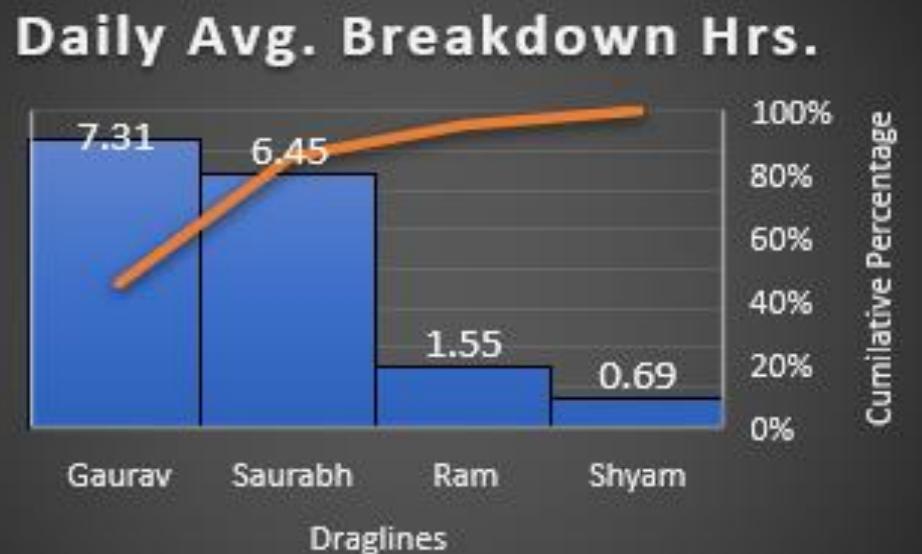


Availability of machinery can be represented by the total number of hours the machinery is free from any event of maintenance or breakdown. It represents the period for which the machine is available for work.



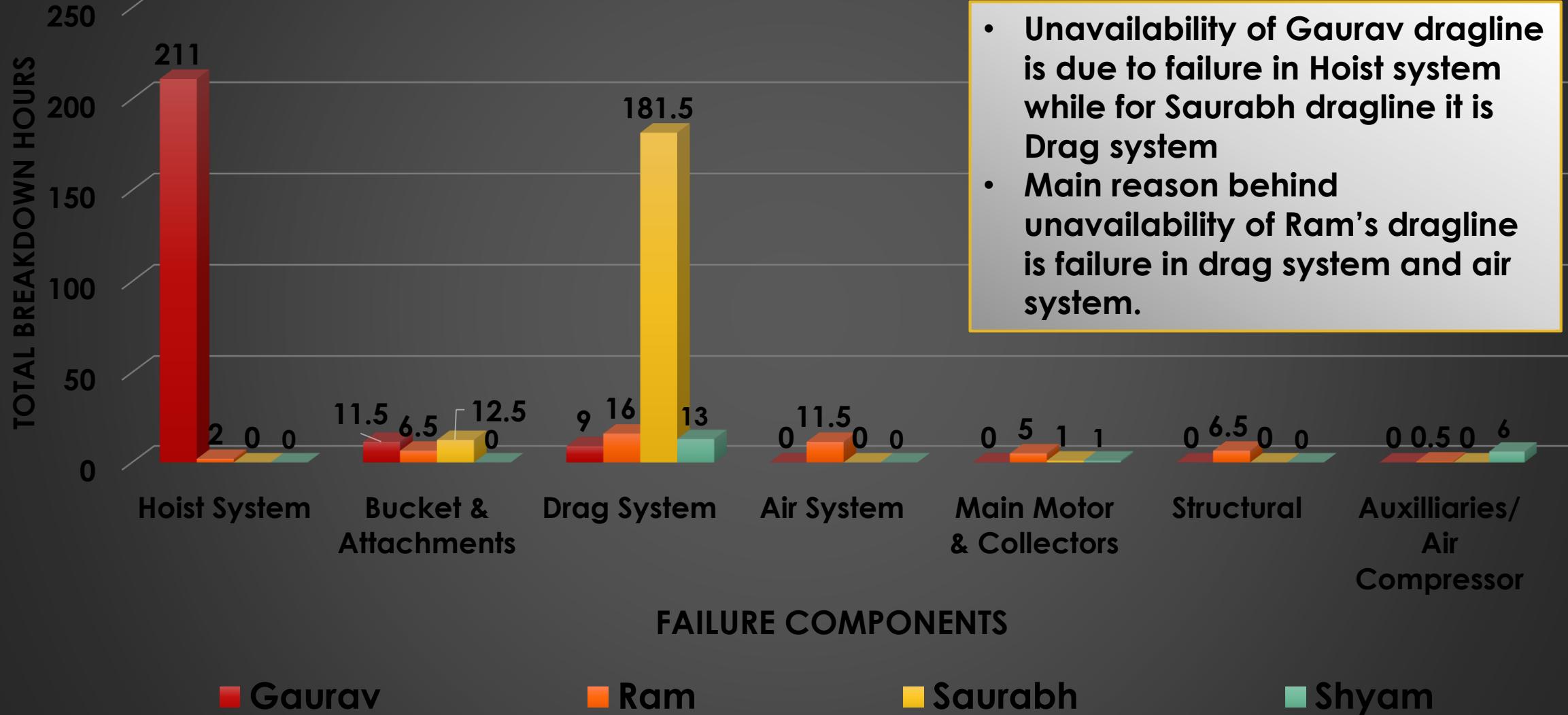


- Main factor for unavailability of draglines is high breakdown hours since maintenance hours less than standard mark line.
- Shyam is performing well in terms of availability



Analysis of breakdown hours

Breakdown Hrs. Component Wise



Conditional Monitoring Report

Summary of Condition monitoring report is enclosed which depicts condition of various assemblies and system of draglines and corrective action required to be taken on a time scale, from the report it may be inferred that following dragline wise corrective actions are required which can help in maintenance and spare parts management also:

| S.No. | System/Assembly | Ram | Shyam | Garam | Saurabh |
|-------|---|--------|--------|--------|---------|
| 1 | MG. Set | Red | Yellow | Yellow | Yellow |
| 2 | Exciter Set | Red | Yellow | Yellow | Yellow |
| 3 | Drag System | Yellow | Orange | Red | Red |
| 4 | Hoist System | Yellow | Orange | Red | Red |
| 5 | Swing System | Orange | Red | Red | Yellow |
| 6 | Walk System | Orange | Orange | Red | Yellow |
| 7 | Structural | Red | Yellow | Red | Grey |
| 8 | Pneumatic | Grey | Grey | Grey | Grey |
| 9 | Lubrication | Yellow | Orange | Yellow | Yellow |
| 10 | Ventilation | Grey | Grey | Yellow | Yellow |
| 11 | Air Conditioners | Grey | Grey | Grey | Yellow |
| 12 | Electrical control & Protection | Grey | Grey | Yellow | Red |
| 13 | Gauge, Anunciator etc. | Grey | Grey | Yellow | Grey |
| 14 | Bucket and Accessories | Orange | Orange | Grey | Grey |
| 15 | Safety, Protection, lighting, cables etc. | Red | Red | Yellow | Grey |

| | OK |
|--------|--|
| Yellow | Corrective action within week |
| Green | Corrective action in a convenient time |
| Orange | Corrective action within month |
| Red | Immediate corrective action |

a. Ram dragline: Exciter set, M G Set, Structural, Safety/ Protection cables require immediate corrective action.

b. Shyam dragline: M G Set, Swing system, and Safety Protection cables require immediate corrective action.

c. Gaurav dragline: Drag system, Hoist system, Swing system. Walk system and Structural faults need immediate corrective action.

d. Saurabh dragline: Drag system, Hoist system, Electrical controls & protection and Structural faults require immediate corrective action.

Production Maximization



Cycle time

Utilization and Capacity utilization of draglines

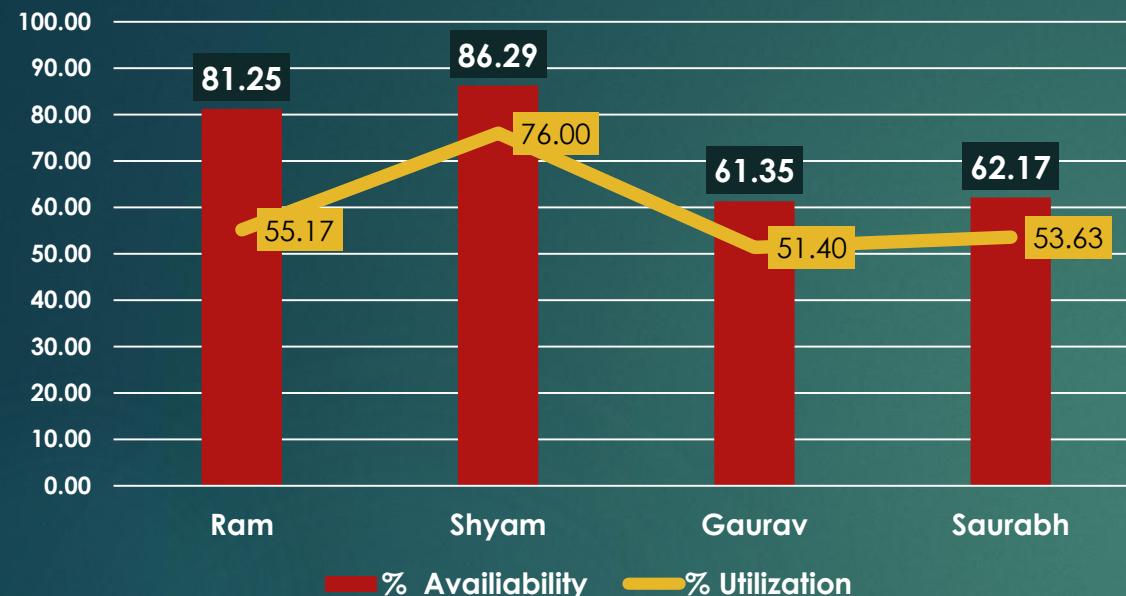
Utilization of machine – Utilization signifies the use of available hours for actual working in the field. A machine may be available but still may not be working in all the available hours due to inordinate idling conditions. Thus, utilization represents a loss in available hours.

Capacity utilization – Capacity utilization of dragline is the capacity of one bucket capable to dugout coal and overburden out of its maximum capacity to handle.

Cycle Time – Time taken by machine to complete one cycle from loading till unloading is called Cycle time. By decrease in cycle time we can increase production(increase count of number of buckets).

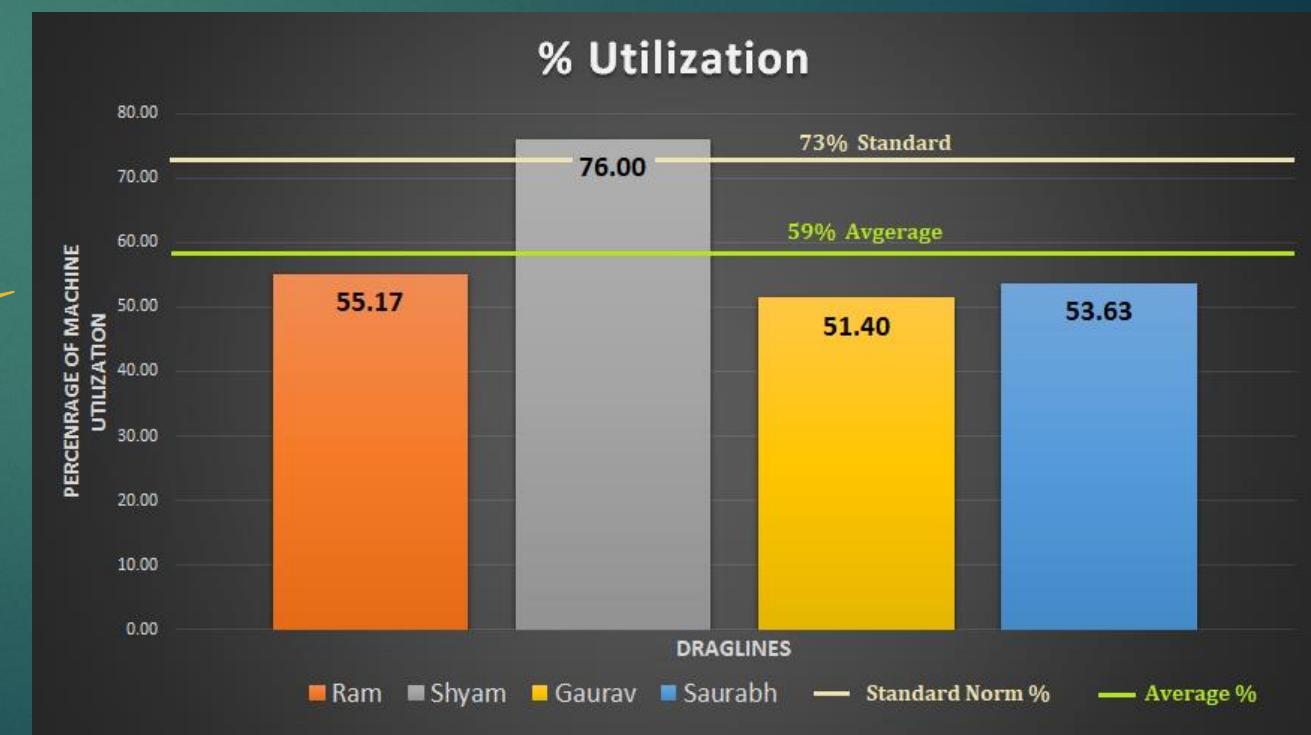
Utilization of machine

Availability and Utilization of draglines



- Standard availability 85% and utilization 73%
- All Draglines are less utilized except Shyam's.
- Average utilization of draglines are 59%

Reason behind **lower utilization** of machine is **idling**.

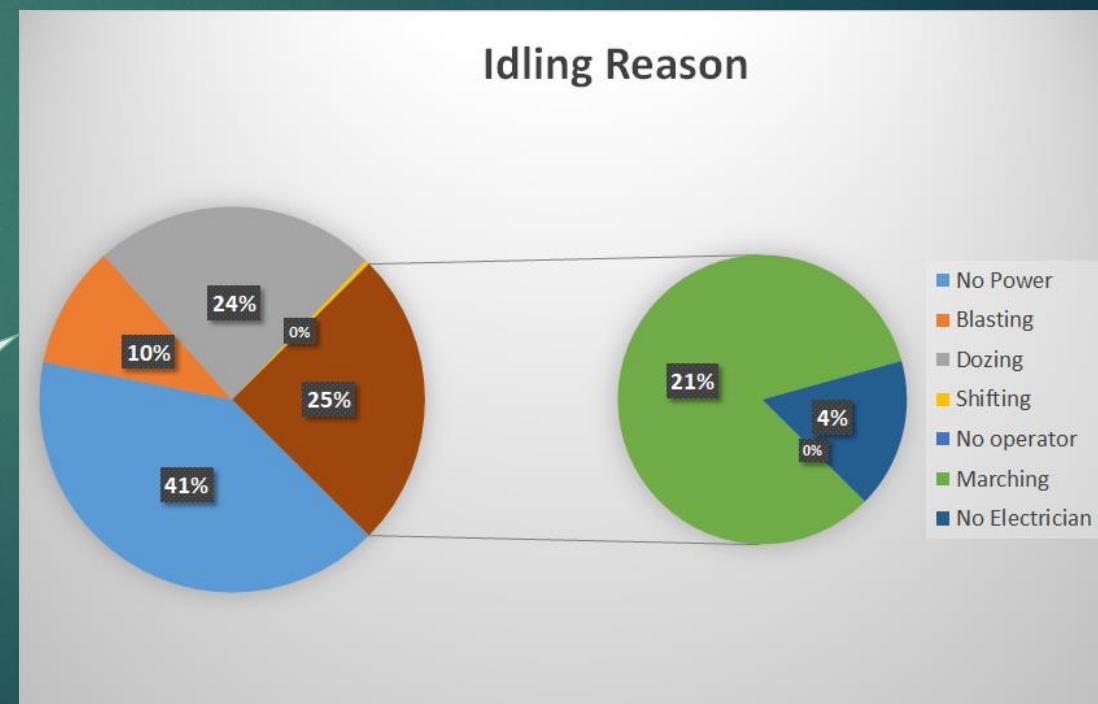


Idling of Draglines



Reason

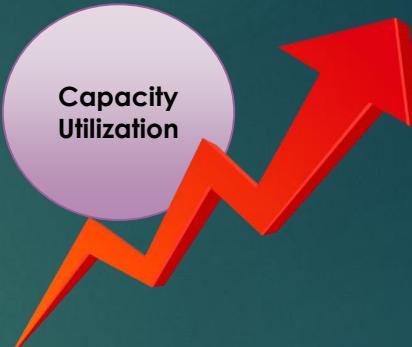
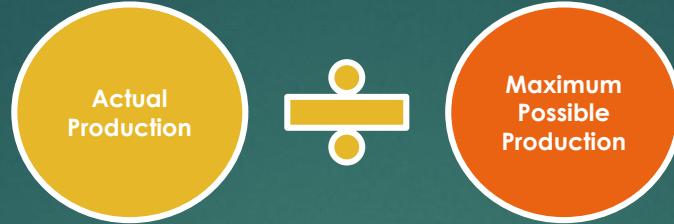
- (1) **Ram's Dragline** –Marching, No Power, Blasting, Dozing.
- (2) **Gaurav's Dragline** –No Power, Blasting, Dozing.
- (3) **Saurabh's Dragline** –No Power, Blasting, Dozing.



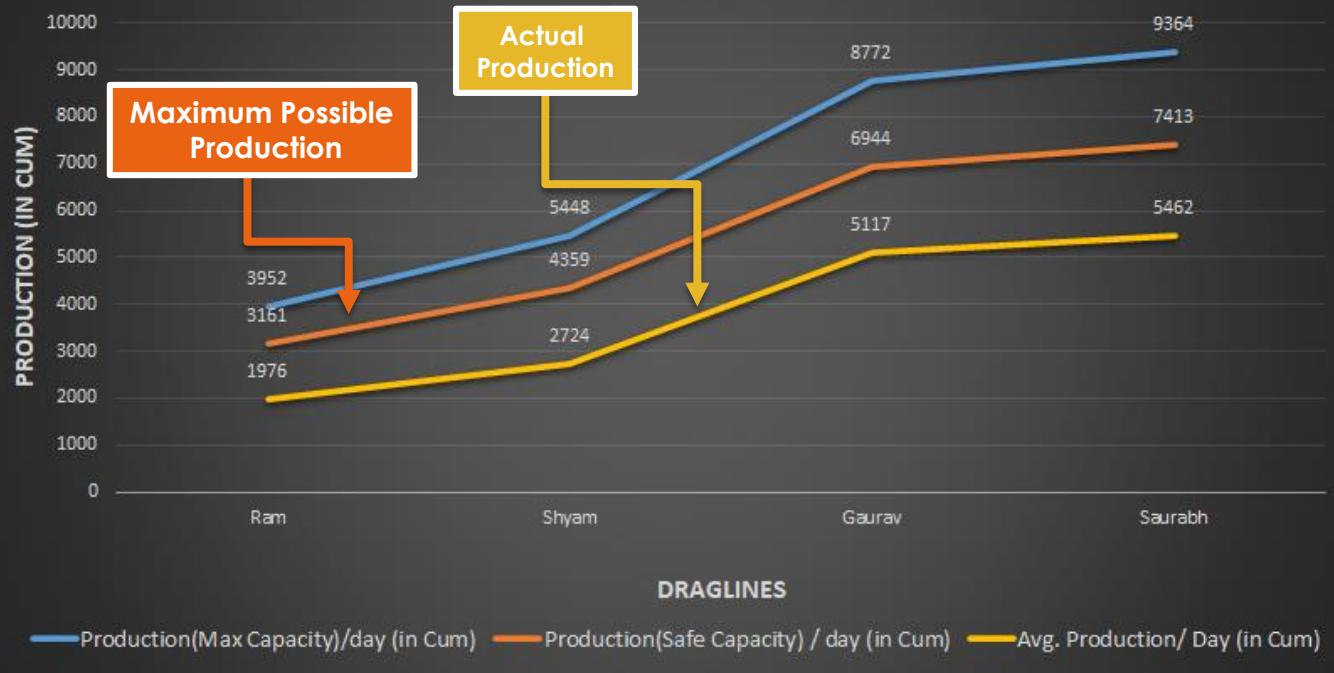
- Major reason for the idling of draglines is **No Power, Dozing, Marching, Blasting and No electrician**.
- There is scope for reducing the idle time on account of No Power, Blasting, No electrician and optimizing of idling due to Dozing



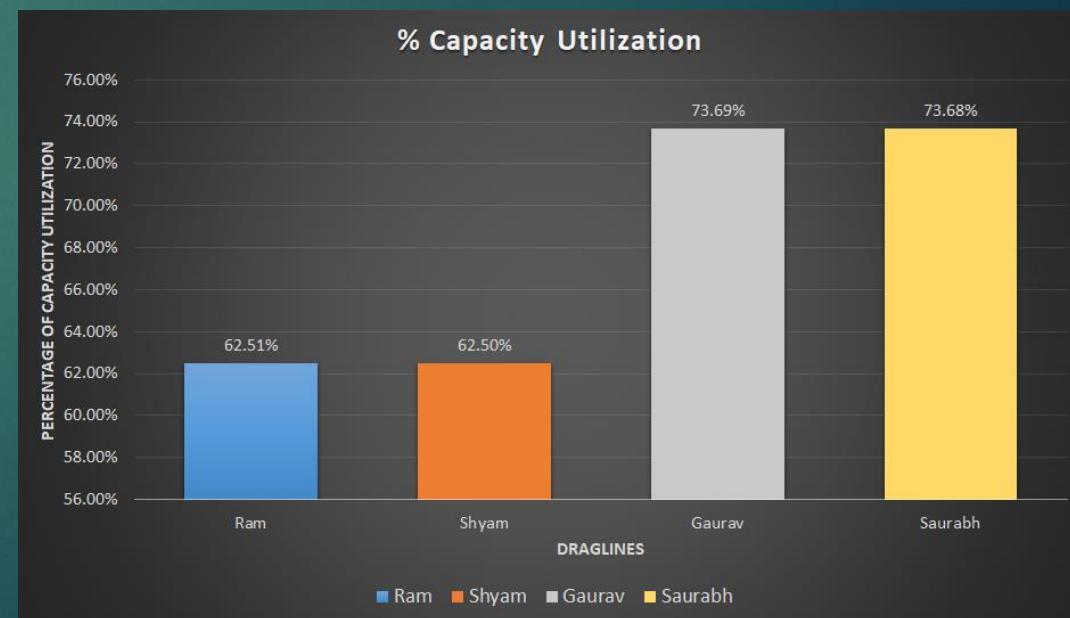
Capacity utilization of draglines



PRODUCTION BASED ON CAPACITY OF DRAGLINES



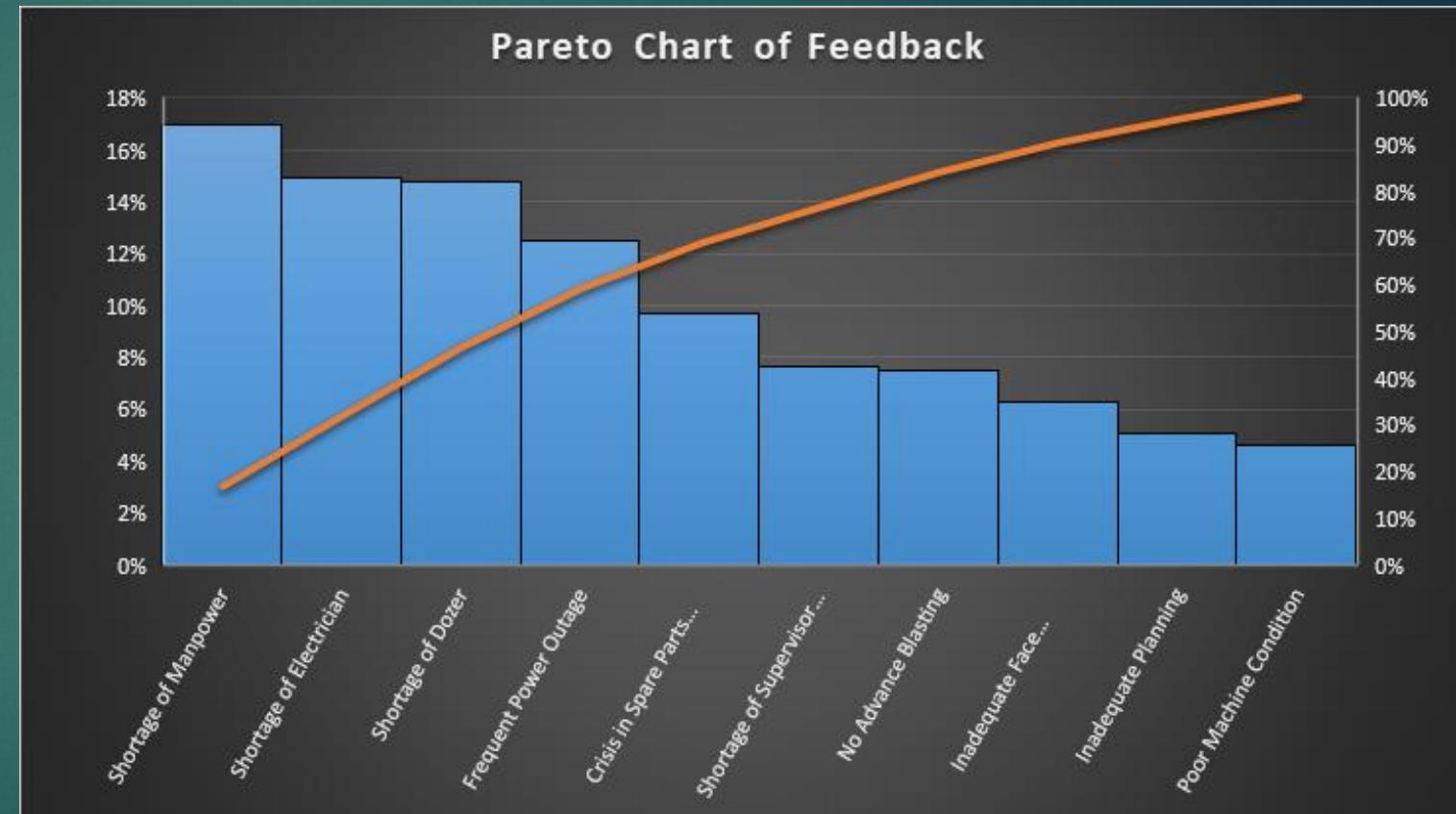
Capacity utilization of dragline is the capacity of one bucket capable to dugout coal and overburden out of its maximum possible capacity.



Analysing feedback form for lower capacity utilization through draglines

In order to find out the major constraints which affects performance of Draglines in the coal mines, a feedback survey was done which was filled by the manpower engaged in operation and maintenance department of the dragline.

Through feedback analysis we can see **shortage of manpower** (17%), **shortage of electrician** (15%), **shortage of dozer** (15%), **frequent power outage** (13%), **crisis in spare parts** (10%) are main reason which are impacting performance of draglines.



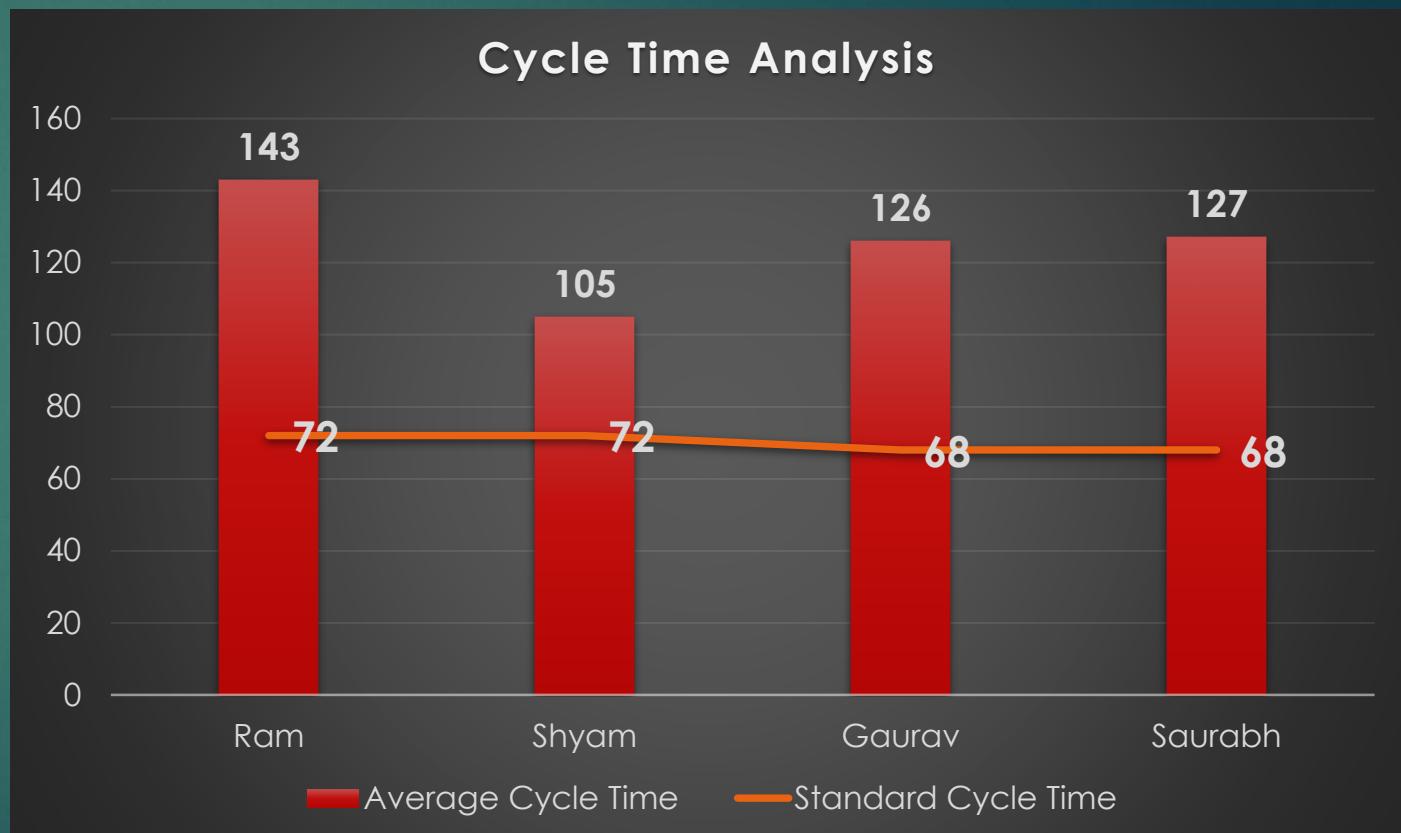
Jointly all these factors decreases dragline performance which lowers production.

Cycle
Time

Production

Cycle Time

Time taken by machine to complete one cycle from loading till unloading is called Cycle time. By decrease in cycle time we can increase production or we can say increase in count of number of buckets.



All draglines are lagging behind its standard cycle time.

Interpretation of Results and Recommendation

Availability Of draglines can be maximized by fixing Drag and Hoist system since Maintenance hours are tune of less than the standard hours.

Manpower requirement: In order to improve the performance of draglines shortages of manpower must be filled up at the earliest.

Advance Blasting and face condition: Appropriate face preparation with adequate advanced blasting is required to be made available for productive deployment of draglines. Action for advance blasting should be implemented to the tune of high depth so that time losses due to frequent blasting and marching could be minimized, for this proper advance action plan (for at least 30 days) for drilling and blasting should be made and accordingly the plan should be implemented in co-ordination with dragline section.

Separate Feeder Switch for each Dragline: Major reason for idling of Ram, Gaurav and Shyam draglines were No Power condition. It is suggested that separate feeder switch for each dragline must be ensured for smooth operation of Draglines in the mines

Dedicated dozer for Each Dragline: Presently there are only 2 nos. of Dozers deployed the Dragline section. In case of any exigency Dozer has to be marched to respective Dragline which is resulting in Idling of other draglines due to shortage of dozers this pattern can also be seen in idling report.



Thank You
For your attention

Any Questions?