INCREASING COAL PRODUCTION THROUGH DRAGLINES

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Executive Summary

I went to the company XYZ, where I talked with employees about business problems we discussed earlier and explained to them how I could help them with the issues.

Problems are listed below –

Problem 1- Many times, machines are unavailable, so tracking which factor mainly affects its unavailability.

Problem 2 - Growth in production, improving machine utilization as well as capacity utilization of draglines.

Problem 3- Analysing which system and assemblies of draglines cause breakdown at regular intervals so that corrective actions can be taken within a time scale, which can help in spare parts ordering.

They showed me the data which they collected from 4 draglines named as RAM, SHYAM, GAURAV, and SAURABH all these draglines are old aged. I found a few things they did not collect, like a Feedback survey with field employees for lower capacity utilization of draglines since feedbacks are essential in terms of improvement. So, I suggested them to take one day feedback with various levels of employees who are related to dragline in terms of factors that could affect machine availability, capacity, etc.

They agreed with my opinion. Then after I collected the data which they had at that time and rest, I told them that again I would come to discuss it with you.

Also, we talked about a few standard guidelines and norms which every dragline had to follow up for sustaining productivity.

NOTE – I have shown the company name as XYZ due to some privacy reasons.

Proof of originality of the Data

Metadata

Metadata given by the company is in excel sheet format which consists of 8 sheets –

Sheet (1-4) – These sheets consists of 1 month (31 days) machine-wise working hours, maintenance hours, idle hours breakdown hours, and productions (in Cum).

Here machine means Dragline which are named as RAM, SHYAM, GAURAV and SAURABH.

Sheet 5- In this sheet dragline-wise sum of the distribution of breakdown hours is mentioned which can be used to detect which compartment of the dragline has a major issue.

Sheet 6- In this sheet dragline-wise sum of the distribution of Idle hours is mentioned which can be used to analyse the idling of the dragline.

Sheet (7,8)- These sheets consist of dragline-wise cycle time reports along with operation time which can be used to find cycle time efficiency.

LINK for Excel Sheet: - https://docs.google.com/spreadsheets/d/15SwcoNql5XaYDwtA3cqw5uX0YO5OrTKU/edit?usp=sharing&ouid=114655607241996977764&rtpof=true&sd=true

Descriptive Statistics

Dragline	Average hrs per day/equipment				% Avail	% Utilizn
	Wkg. Hrs	Maint. Hrs	Idle Hrs	B/D Hrs		
Ram	13.24	2.95	6.26	1.55	81.25	55.17
Shyam	18.24	2.60	2.47	0.69	86.29	76.00
Gaurav	12.34	1.97	2.39	7.31	61.35	51.40
Saurabh	12.87	2.63	2.05	6.45	62.17	53.63
Average per day	14.17	2.54	3.29	4.00	72.76	59.05
Standard Norm	17.52	3.60	2.88	0.00	85.00	73.00

- From the above table it is evident that among all draglines, working hours of Ram, Saurabh and Ram is lower than standard norms, while the Idling of Ram is 6.26 hrs/day which is more than standard norms.
- On an average, machine was non-productive to the tune of 4.0 hours/day due to machine breakdown whereas time spent for maintenance of the machine was to the tune of 2.54 hours in a day.
- This table also reveals that the Availability and Utilization of draglines in the company are lagging behind their respective Standard Norms.

Dragline	Production (Predicted) / day (in Cum)	Avg. Production / Day (nos. of buckets)		Avg. Production/ Day (in Cum)
		Solid	R.H.	
Ram	3,161	384	11	1,976

Shyam	4,359	544	1	3,814
Gaurav	6,944	325	40	5,482
Saurabh	7,413	216	174	6,633
Average per day	21,877	1,469	226	17,905

The average production/ day of all draglines during the study period is 17,905 Cum which is less than the predicted production i.e. 21,877 Cum.

Dragline	% Capacity Utilization	% Utilization
Ram	62.50%	55.17%
Shyam	87.50%	76.00%
Gaurav	78.95%	51.40%
Saurabh	89.47%	53.63%
Average per day	81.84%	59.05%
Standard Nord	100%	73%

From the above table, it is evident that among all draglines, no one has 100% capacity utilization, here aging of machines can be a factor but in terms of percentage utilization of draglines in the field, only Shyam is performing well.

Detailed Explanation of Analysis Process/Method

Problem 1- Many times, machines are unavailable, so tracking which factor mainly affects its unavailability.

In view of problem statements (1) there are 4 draglines in the mine Named RAM,SHYAM,GAURAV and SAURABH there working hours, idle hours, breakdown hours, maintenance hours and total shift hours is covered in sheet 1-4 from those sheets I have calculated average working hours (a), idle hours (b), breakdown hours (c), maintenance hours (d) and total shift hours (e).

$$\%\ availibility = \frac{\text{Total shift hours(e) - Breakdown hours (c)-Maintenance hours (d)}}{\text{Total shift hours(e)}} \times 100\ \%$$

Using above formula, I have calculated % availability of each draglines which is tabulated above under descriptive statistics where all draglines are found less than the standard norm which is 85% then to finding reason of unavailability of machines I analysed B/D report and Idle report of machines by drawing pie chart along sum of hrs.

Dragline	Average hrs per day/equipment				% Avail
	Wkg. Hrs	Maint. Hrs	Idle Hrs	B/D Hrs	
Ram	13.24	2.95	6.26	1.55	81.25
Shyam	18.24	2.60	2.47	0.69	86.29
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Saurabh	12.87	2.63	2.05	6.45	62.17
Average per day	14.17	2.54	3.29	4.00	72.76
Standard Norm	17.52	3.60	2.88	0.00	85.00

Problem 2 - Growth in production, improving machine utilization as well as capacity utilization of draglines.

For improving production machine utilization and capacity utilization of machines should be higher than standard norm.

Now for finding percentage utilization, I used average working hours (a) of each dragline then divided it with total shift hours of each dragline whose formula is mention below

$$\% \text{ utilization} = \frac{\text{Working hours (a)}}{\text{Total shift hours(e)}} \times 100\ \%$$

Then after second factor which affects production is capacity utilization that can be calculated by dividing average production of each dragline to maximum production of each dragline.

$$\text{Percentage of Capacity Utilization} = \frac{\text{Maximum Production (in Cum)}}{\text{Average Production (in Cum)}} \times 100$$

Dragline	% Capacity Utilization	% Utilization
Ram	62.50%	55.17%
Shyam	87.50%	76.00%
Gaurav	78.95%	51.40%
Saurabh	89.47%	53.63%

Average per day	81.84%	59.05%
Standard Nord	100%	73%

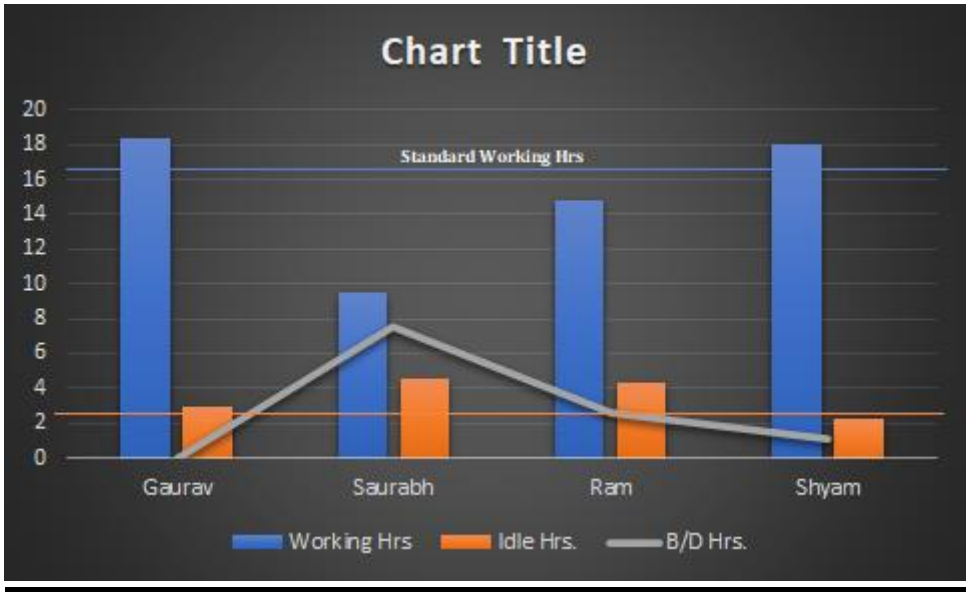
Problem 3- Analysing which system and assemblies of draglines cause breakdown at regular intervals so that corrective actions can be taken within a time scale, which can help in spare parts ordering.

To tackle problem statement 3, I analysing breakdown hours of each machine to understand which factor causes breakdown machine of mostly. Then used condition monitoring checks which is maintained by maintenance engineers

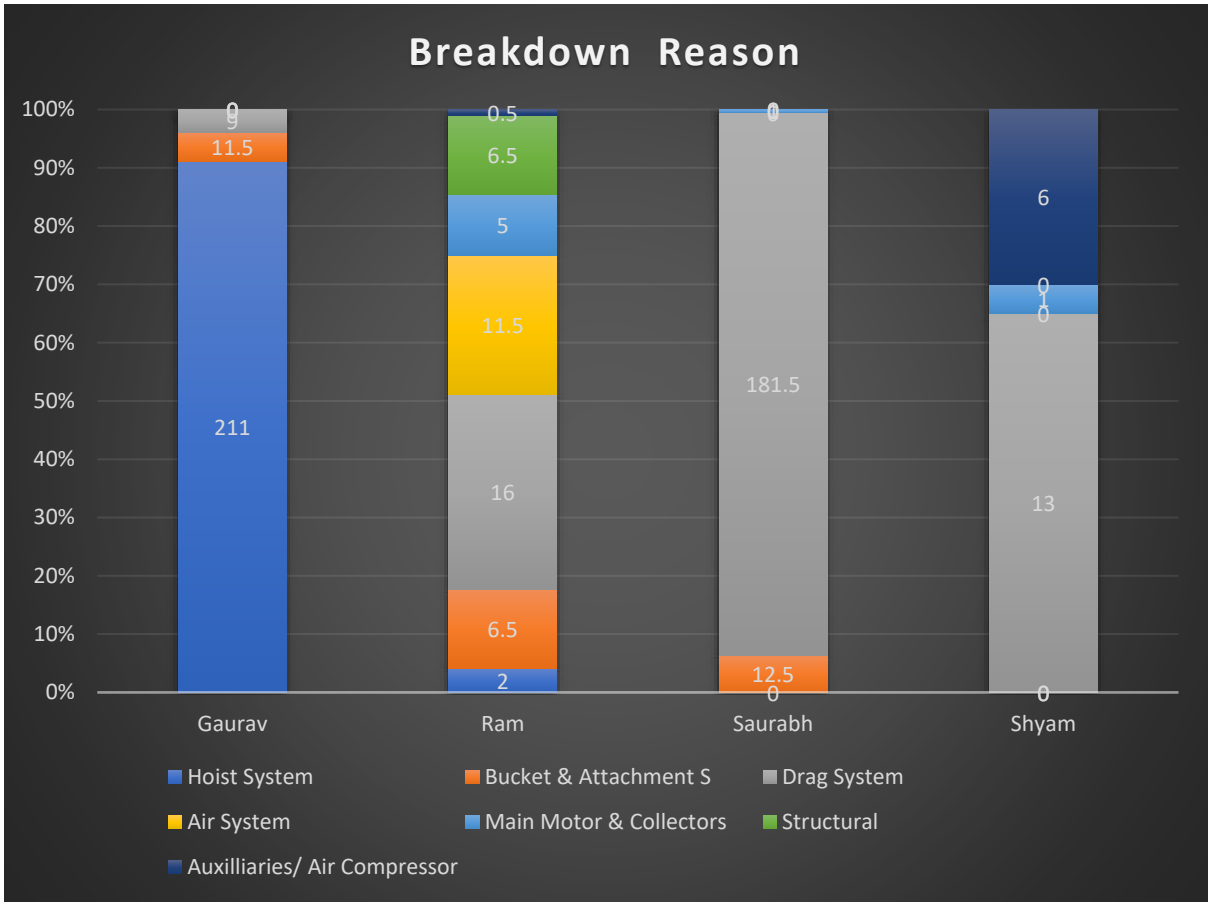
which constitute machine system and its assemblies condition checks at regular interval if any major system cause breakdown of draglines regularly then it can be used for fixing major issues.

After plotting the graph for breakdown hours for different reasons then I inferred the condition monitoring report in excel.

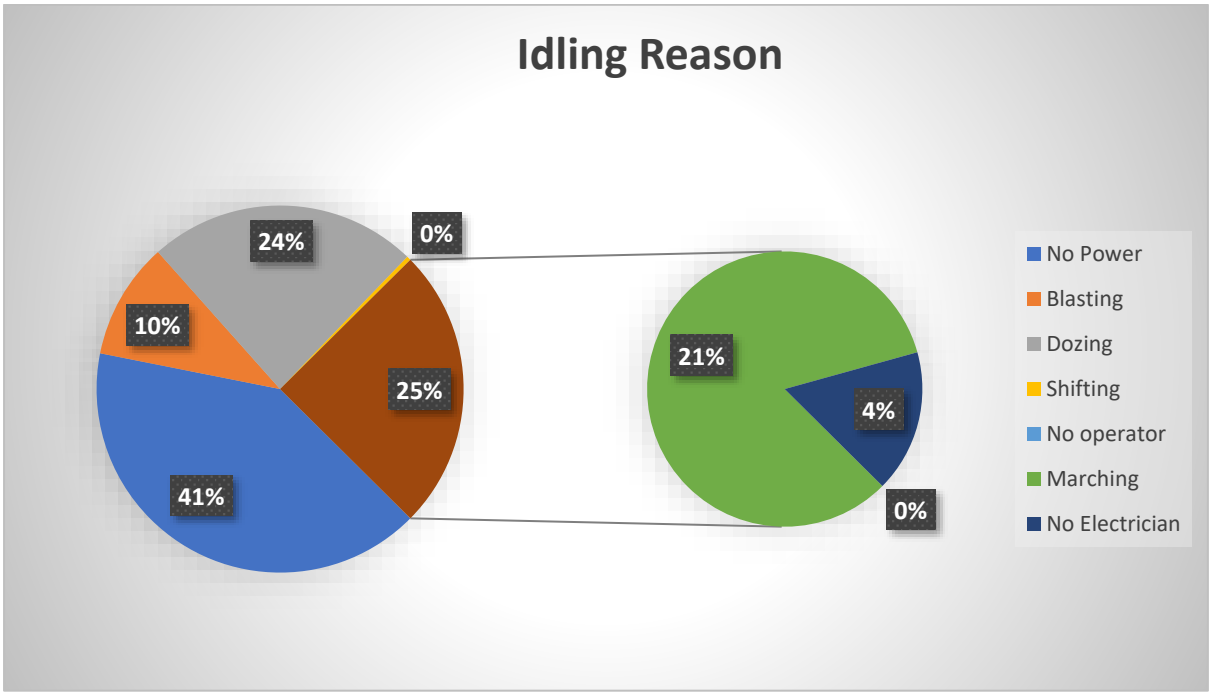
Results and Findings



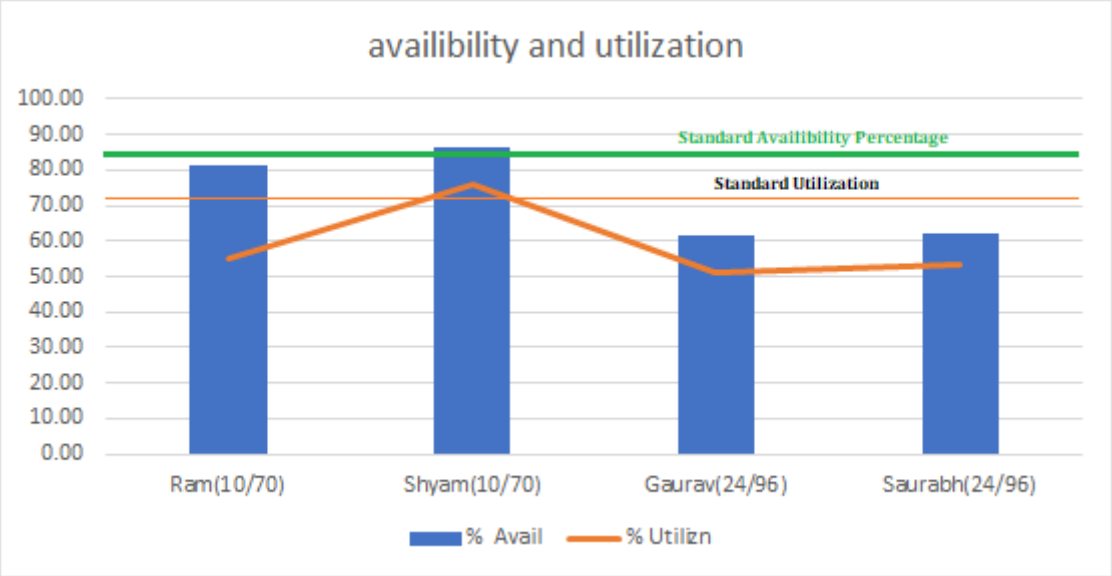
From the above graph it is evident that among all draglines, the working hours of Saurabh and Ram is lower than standard norms while Idling of Saurabh and Ram is 4.5 hrs/day and 4.3 hrs/day respectively which is more than the Standard norm.



It can be inferred from the above graph that the major reason for the breakdown of Draglines is faults in Drag system, hoist system, air system, bucket accessories. structural and main motor & ring collectors.



From the above chart, 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 because dozing is too important for cleaning dragline pathway to work.



From this graph, it can be inferred that machines are available to use but they are not utilized completely which means machines are underutilization

Main reason of all this could be dozing along with faults in Drag system, hoist system, air system and bucket accessories.