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An Experimental Investigation of Capacity Utilization in Manufacturing Industry

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Abstract: *In the modern day competitive world, every organization demands an effective utilization of capacity. Capacity Utilization means the maximum amount of output that can be produced in the short run of time. A lot of planning is necessary for the proper management of capacity. Capacity planning is one side of a coin and capacity management is the other. The capacity plans needs to be executed flawlessly, with unpleasant surprises avoided. A managerial problem is to match the capacity with the plans. Companies whether labour or machine intensive have a CI trend that remains fairly constant in that particular sector. For example a company will have a monthly cumulative CI trend that could be compared with any other company trend within the same market. The present paper makes an attempt to study the most important parameter of the organization i.e capacity utilization of a company.*

I. Introduction

For most companies, production assets are finite—utilization is a key measure and is a major determinant of product costs. Yet with those established and even expected constraints, not all companies perform a mid-range (between 3 to12 months) rough-cut capacity plan. This process is important for five key reasons:

- Understand the unconstrained production requirements
- Understand available capacity
- Resolve any capacity exceptions
- Create a constrained, feasible Master Production Schedule
- Understand the total supply chain outlook

Most companies today auto-tune capacity measurement methods to their individual needs which are fine on a small scale but on a larger global scale, where comparison and standards mean everything, a larger widely accepted method is required. The smaller companies often end up benchmarking incoherent capacity planning methods and this leads to a wastage of resources. With all the methods there are several pros and cons and we have tried to eliminate and determine the best way to go about planning capacity.

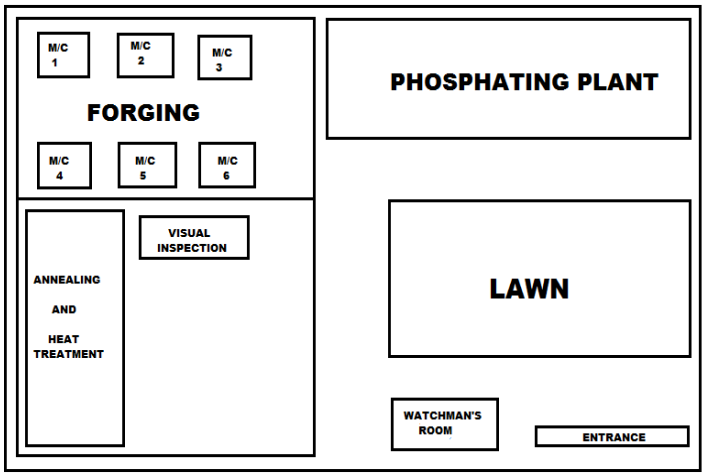
Under current economic conditions, severe global competition and postponement of new equipment purchases are causing business executives to be sensitive about all aspects of manufacturing operational costs. In this context Overall Equipment Effectiveness (OEE) has become a hot topic among many manufacturers. It provides a simple way to "keep score" of manufacturing performance, and lean manufacturing initiatives. In simple Words, "Overall Equipment Effectiveness shows the effectiveness of a machine compared to the ideal machine as a percentage."

II. Capacity Utilization

The investigation on optimization on capacity utilization was carried out at Cold Forging organization situated in Bangalore. **The Organization had** started its journey in a humble way in 1990. The two decades long experience focuses its vision about the future of Indian automotive and engineering industry and its dedicated efforts in pursuing the objective of achieving higher degree of perfection.

Manufactured as original equipment for supply to O.E.M, spares and export markets the range of Megamiles products have a wide spectra of application in heavy, medium and light carriage vehicles, passenger cars, jeeps, tractors, two wheelers and Engineering applications.

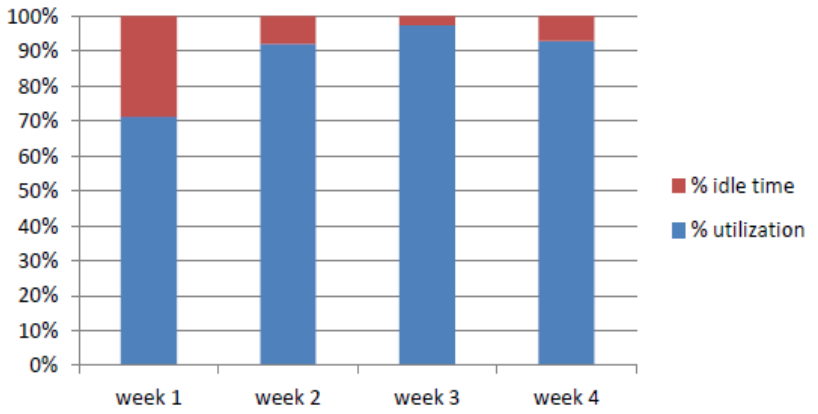
Plant layout:



III. Machine Data & Utilization Charts

Month: February
Operation: Annealing
Machine: MCPL/FU/09

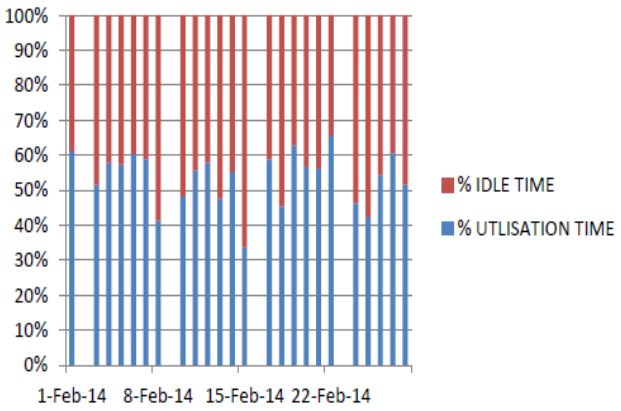
week	working time	idle time	total time	%utlization	%idle
week 1	9060	1020	10080	89.88095238	10.1190476
week 2	7080	3000	10080	70.23809524	29.7619048
week 3	9240	840	10080	91.66666667	8.33333333
week 4	9240	840	10080	91.66666667	8.33333333



Special purpose Phosphate Line

Date	Machine W.T	Machine I.T	Total Time	%Utilization	% Idle Time
01-Feb-14	881	559	1440	61.18055556	38.8194444
02-Feb-14	SUNDAY HOLIDAY				
03-Feb-14	743	697	1440	51.59722222	48.4027778
04-Feb-14	835	605	1440	57.98611111	42.0138889
05-Feb-14	826	614	1440	57.36111111	42.6388889
06-Feb-14	869	571	1440	60.34722222	39.6527778
07-Feb-14	848	592	1440	58.88888889	41.1111111
08-Feb-14	596	844	1440	41.38888889	58.6111111
09-Feb-14	SUNDAY HOLIDAY				
10-Feb-14	695	745	1440	48.26388889	51.7361111
11-Feb-14	802	638	1440	55.69444444	44.3055556
12-Feb-14	834	606	1440	57.91666667	42.0833333
13-Feb-14	686	754	1440	47.63888889	52.3611111
14-Feb-14	797	643	1440	55.34722222	44.6527778
15-Feb-14	486	954	1440	33.75	66.25
16-Feb-14	SUNDAY HOLIDAY				
17-Feb-14	847	593	1440	58.81944444	41.1805556
18-Feb-14	654	786	1440	45.41666667	54.5833333
19-Feb-14	904	536	1440	62.77777778	37.2222222
20-Feb-14	816	624	1440	56.66666667	43.3333333
21-Feb-14	811	629	1440	56.31944444	43.6805556
22-Feb-14	945	495	1440	65.625	34.375
23-Feb-14	SUNDAY HOLIDAY				
24-Feb-14	666	774	1440	46.25	53.75
25-Feb-14	611	829	1440	42.43055556	57.5694444
26-Feb-14	780	660	1440	54.16666667	45.8333333
27-Feb-14	872	568	1440	60.55555556	39.4444444
28-Feb-14	743	697	1440	51.59722222	48.4027778

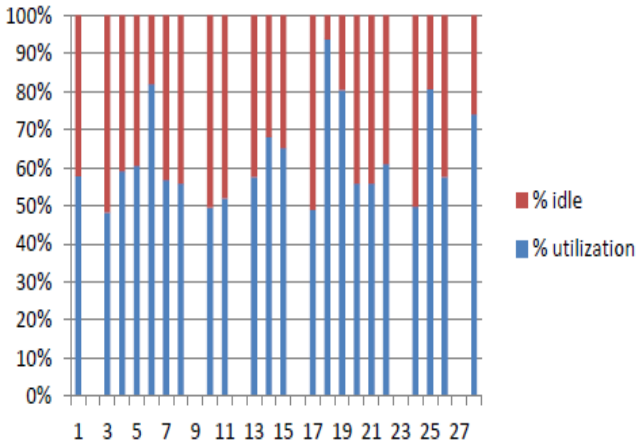
week	Machine W.T	Machine I.T	total time
week 1	5002	5078	10080
week 2	4410	5670	10080
week 3	4518	5562	10080
week 4	4617	5463	10080



Forging Section
Machine Name: KOMATSU 250 TN

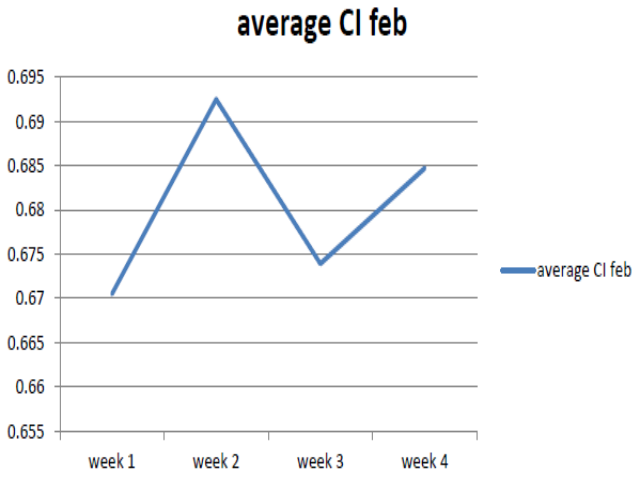
Date	Total Time	Working time	Idle time	% utilization	% Idle time
1	1440	995	725	69.09722222	50.347222
2	HOLIDAY				
3	1440	920	990	63.88888889	68.75
4	1440	910	630	63.19444444	43.75
	1440	935	610	64.93055556	42.361111
6	1440	1180	260	81.94444444	18.055556
7	1440	930	710	64.58333333	49.305556
8	1440	915	725	63.54166667	50.347222
9	HOLIDAY				
10	1440	970	990	67.36111111	68.75
11	1440	1070	990	74.30555556	68.75
12	No work				
13	1440	945	695	65.625	48.263889
14	1440	1115	525	77.43055556	36.458333
15	1440	1165	625	80.90277778	43.402778
16	HOLIDAY				
17	1440	950	990	65.97222222	68.75
18	1440	1110	75	77.08333333	5.2083333
19	1440	1065	260	73.95833333	18.055556
20	1440	915	725	63.54166667	50.347222
21	1440	915	725	63.54166667	50.347222
22	1440	975	625	67.70833333	43.402778
23	HOLIDAY				
24	1440	965	975	67.01388889	67.708333
25	1440	1080	260	75	18.055556
26	1440	985	725	68.40277778	50.347222
27	HOLIDAY				
28	1440	1065	375	73.95833333	26.041667

week	Total Time	Working time	Idle time
week 1	10080	5870	3925
week 2	10080	5015	3925
week 3	10080	6120	3400
week 4	10080	5070	2960



Cumulative charts

machines/week	week 1	week 2	week 3	week 4	average machine CI
MCPL/FU/09	0.7337	0.8793	0.9056	0.8417	0.840075
phosphating line	0.4403	0.4167	0.4522	0.4291	0.434575
Komatsu 250TN	0.6344	0.5332	0.6562	0.5518	0.5939
Average C.I	0.6704875	0.692475	0.6738875	0.6846875	



IV. Results & Suggestions

Month: Febraury
Operation: Annealing
Machine: MCPL/FU/09

Week	C.I	Remarks
week 1	0.7337	**Less Load run/No power Cut**
week 2	0.8793	
week 3	0.9056	
week 4	0.8417	

Inference:

The results indicate in the first week, there was low utilization, mainly due to power cuts, which is peculiar in that month. The results also revealed that there was labour rotation in the shop floor which created some problems, due to which no operators were available at the workstations. As the weeks progressed a very high level of CI was reached and good level of utilization was seen. Where ever the CI value is more, it is advisable to study the plant conditions from the Log Book and try to implement the same situation for achieving good CI results.

Suggestion

i. Installing of an Automated Generator to account for the power cuts which are very common in the area.
ii. Better labour optimization by reducing labour idle time by using optimization techniques
iii. It is also suggested to study analyze the Plant Location and Layout problems scientifically, which eliminates non value added activities in the process and improves Capacity Utilization.

Special purpose Phosphate Line

Month	C.I	Remark
01-02-2014	0.52090278	
02-02-2014		Sunday holiday
03-02-2014	0.50798611	**Machine maintenace-liquid change**
04-02-2014	0.51083333	
05-02-2014	0.52013889	
06-02-2014	0.53611111	
07-02-2014	0.48659722	
08-02-2014	0.41527778	**Phosphating line service disruption-repair**
09-02-2014		Sunday holiday
10-02-2014	0.47361111	
11-02-2014	0.48472222	**High working liquid temperature**
12-02-2014	0.56215278	
13-02-2014	0.51392361	**less load/unplanned stops**
14-02-2014	0.46736111	
15-02-2014	0.45770833	**Worker absent/Power Disruption**
16-02-2014		Sunday holiday
17-02-2014	0.56701389	
18-02-2014	0.49618056	**Early end/late start**
19-02-2014	0.53402778	
20-02-2014	0.53854167	**Power Disruption**
21-02-2014	0.57222222	
22-02-2014	0.53090278	
23-02-2014		Sunday holiday
24-02-2014	0.51006944	
25-02-2014	0.44895833	**raw material shortage**
26-02-2014	0.47743056	**Early end/late start**
27-02-2014	0.57951389	
28-02-2014	0.45694444	**Early end/late start**

Inference:-

i. Machine maintenance liquid change resulting in about 40% downtime.
ii. Power disruptions.
iii. Frequent line disruptions.

Suggestion

i. Install a parallel phosphating plant to double the current capacity
ii. Clubbing the labour of phosphating and annealing plant since both the annealing plant and the phospahting plant has a lot of labour idle time the same worker can take care of two parallel operations on both the plants

Machine Name: KOMATSU 250 TN

Date	Capacity index	Remarks
1	0.746527778	machine running ok
2		
3	0.741319444	machine running ok
4	0.720486111	power cut
	0.703125	no load for three hours
6	0.807291667	machine running ok
7	0.722222222	machine running ok
8	0.723958333	machine running ok
9		
10	0.756944444	machine running ok
11	0.751736111	machine running ok
12		maintanance
13	0.710069444	no load for six hours
14	0.789930556	machine running ok
15	0.8125	machine running ok
16		
17	0.736111111	machine running ok
18	0.786458333	machine running ok
19	0.763888889	machine running ok
20	0.727430556	time delay due to setting change
21	0.767361111	machine running ok
22	0.793402778	machine running ok
23		
24	0.743055556	machine running ok
25	0.784722222	machine running ok
26	0.753472222	machine running ok
27		
28	0.788194444	machine running ok

Inference

i. No load.
ii. Power cut
iii. Settings change(30% downtime)

Suggestion

i. Increasing the capacity of phosphating plant
ii. Make flexible labour timings,reduce time delay in labour shifts to make up for time lost due to power cuts
iii. Installation of a generator to make up for power cuts

Impact on Capacitive Index (CI)

Installing of generators is a long term solution .It basically improves machine working time thus the labour time and therefore the capacitive index. However the management has wait until the initial investment is returned and a net profit is registered

V. Scope For Future Work

i. Detailed study of automization and installing it in the current factory.
ii. Detailed study for 3-4 months records and cost analysis
iii. We would like to see one of the advanced planning tools to be used in the future so that a plant knows its efficiency before it is even built.This would not only increase productivityand profit, it would also reduce redundant waste and stabilize the global economy.

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