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"A Study of Operation Management adopted in Textile Mills with reference to MIDC Butibori, Nagpur."

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Abstract: *Scheduling of operations is essential for all firms as it helps them maximize customer satisfaction, minimize service delays, hence enables firms to allocate their production capacity to meet their customer requirements on time. An attempt will be made to study how the Sequencing of job is important for proper scheduling of job, in minimizing the processing time of job, in maximize Operations efficiency and in reducing the processing cost of the firm over a period of time. Operation managers at Textile Mills, can use Johnson's rule and develop a job sequence that minimize the total time span required in completing the job sequence, with which they can determine the sequence in which n jobs could be processed using n machines in order to minimize the total elapsed time. Also, he can use Dispatch rule in scheduling production activities for determining the sequence of jobs, the average flow time, average lateness and average number of jobs at the work centre for the rules viz., Earliest due date; First come first serve, Longest process time, Shortest process time and Slack time remaining.*

Keywords: *Slack time, Due date, Flow time, Idle time, Elapsed Time*

I. Introduction

Scheduling of operations is essential for all firms as it helps them maximize customer satisfaction and minimize service delays. Proper scheduling enables firms allocate their production capacity to meet their customer requirements on time. If a firm schedules too much capacity, the facilities may remain idle, resulting in wastage of resources. Likewise, scheduling low capacity may result in incomplete jobs at the specified time, resulting in poor service to customers.

OBJECTIVES

1. To maximize total elapse time or total operation time. And to determine Total elapse time and idle time on each machine.
2. To determine the average delay in earliest due date; First in first serves, longest process time, shortest process time and Slack time remaining.Textile Mill Processes The Process involves following jobs:

Speed Frame – To prepare uniform and even roving containing parallel fibers of equal unit weight per unit length.

Ring Frame – To produce the required count no. yarn from roving with appropriate twist and strength.

Winding Packing – To pack the yarn of winding in appropriate shape in HDPE bags to send in market for sale.

Weaving-At various stages of production in weaving preparatory the norms for operating parameters such as speeds, breakage rates, etc. are given. For operations and operating parameters. In high speed winding and autoconer winding, production levels are determined on the basis of number of operations a winder can perform in a shift. In loomshed, for different widths and types of looms, norms for actual loom speeds are tabulated. The norms for cause-wise loom efficiency, losses, interference loss vs. operations per weaver hour and achievable loom efficiency for plain looms and looms with various attachments are given. Finally, hard waste levels for various count groups, inspection standards (for defects) for cotton and polyester blended fabrics are listed.

Dispatching

Dispatching is the final act of releasing job orders to the worker to go ahead with the production process. In this activity, an operations manager releases job orders in accordance with the planned sequence. Then the manager controls the production processes to ensure the effective implementation of the schedule in

order to achieve the objectives specified in the master production schedule. Both manufacturing and service firms use the following dispatching rules (also called priority rules) in scheduling their production activities:

Earliest due date

Firms that follow this rule prioritize their jobs according to their earliest due date. Firm lists the earliest due dates of all the jobs and dispatching is done in such a way that the one with the earliest due date is dispatched first, the next earliest job second, and so on.

Longest processing time

Jobs that have the longest processing time are loaded first onto the work center in this method. These types of jobs are given priority because they are considered more valuable to organizations.

Shortest processing time

Some firms prioritize their work centers' jobs on the basis of the shortest processing time of jobs. Under this rule, the job which has the shortest processing time is given the highest priority. Firms use this rule when they want to maximize the number of completed jobs and keep a lower number of jobs in waiting.

First in, first serve

Firms that use this rule, process their jobs in the order of their arrival. Jobs are not prioritized according to their relative importance because all jobs are treated as equally important. This rule is used by organizations that lay emphasis on providing fair customer service.

Slack time remaining (STR)

In this method, the operations manager calculated the slack time of each job, i.e. the difference between the time remaining in the due date and the processing time required. Jobs with the shortest slack time are dispatched first.

Johnson's Job Sequencing Rules

When jobs are processed in a single stage of production, they can be simply scheduled one after the other. If two or more stages of production are required, firms should ensure that the jobs are sequenced in a way that idle time is minimized. Operations managers can use Johnson's rules
and develop a job sequence that minimizes the total time span required in completing the given jobs.
Source: Brucker. P. Scheduling Algorithms. Berlim: Spring Verlag, 2001.

Statement of Hypothesis

The Statement of Hypothesis is "By using the Scheduling techniques like "Johnson's Job Sequencing Rules" and "Dispatch rule", in Textile Mills, we can minimize the operation time and can determine the average delay in various operational activities."

Data Collection methods

Source of data --The data used in the project is Primary Data. The data is collected using a questionnaire. The workers of the mill were asked questions regarding the processing time of each job and the sequence of job they followed for producing the finished product.

SecondaryData--Mills Operations like Weaving, Chemical Processing, Engineering, Manpower Complement

- Computations Involved in the Measurement and Analysis of Productivity.
- Information from annual reports of the company.

Research Design

In the absence of adequate and relevant secondary data. Primary had to collect. This was accomplished through the formulation of a schedule of questions and data was collected by meeting the respondents personally.

Types of Research	:	Exploratory
Type of Question	:	Open/Closed End
Research Technique	:	Survey Method
Contact Method	:	Personal Interview

Sampling Plan

Sample Size	:	60 Mills workers/Employee

Sample unit : Different departmental employees
Sampling Procedure : Simple Random Sampling

Constraints Faced by Textile Mills

1. Absence of proper feedback from transporters regarding any delay.
2. Breakdown of vehicle is another delaying cause.
3. Rules and regulations of different states call for proper and perfect documentation which sometime leads to complicities.
4. Thefts and accidents are certain unavoidable constraints.
5. Transporters strikes against government disrupt the regular flow of supply.
6. Natural Calamities.
7. Absence of proper packaging facilities at warehouses.
8. High cost for maintaining sub-contractor.

Analysis and Interpretation (Operation Scheduling)

Tool: Johnson's Rule for 4 Machines and 5 jobs

As per the data recorded from Textile Mill has to complete 5 jobs on 4 machines Processing Time (PT) required for each job is shown in table below. Our objective is to determine Total elapse time and idle time on each machine.

Machine \JOB	**I**	**II**	**III**	**IV**	**V**
M_1	**3**	**4**	**3**	**5**	**6**
M_2	**5**	**7**	**5**	**7**	**7**
M_3	**2**	**4**	**4**	**5**	**3**
M_4	**7**	**9**	**5**	**8**	**6**

Calculation

- We have to combine the data into two machines A i.e. ($M_1 + M_2 + M_3$) and B i.e. ($M_2 + M_3 + M_4$)
- After this the data would be as follows,

Machine\JOB	**I**	**II**	**III**	**IV**	**V**
A	10	15	12	17	16
B	14	20	14	20	16

- Identify the least PT, in case of tie select either of PT.
- Place the smallest PT of A at the beginning of the sequence and for B at the end of the sequence. (To find the optimum sequence of jobs).
- Repeat the procedure.
- After doing this we get the optimum sequence as follows,

I	**III**	**II**	**V**	**IV**

- **Total elapse time** = Last job time out of Last Machine i.e. 4 – Start Time = 41 – 0= 41.

JOBS\ Machine	**M_1**	**M_2**	**M_3**	**M_4**
J1	0 – 3	3 - 8	8 - 10	10 - 17
J2	3 – 6	6 - 11	11 - 15	15 - 20
J3	6 – 10	10 - 17	17 - 21	21 - 30
J4	10 – 16	16 - 23	23 - 26	26 - 32
J5	16 – 21	21 - 28	28 - 33	33 - 41

- **Idle time on Machine I** = Time out of last job in the optimum Sequence of Machine II – time in of the last Job in the optimum sequence of Mach

  = 41 – 21 = 20.

- **Idle time on Machine II** = Time out of first job on Machine I in the Optimum sequence + (Time in of last job in Optimum sequence on Machine II – Time Out of last but one in optimum sequence on Machine

= 3 + (6 – 8) + (10 – 11) + (16 – 17) + (21 – 23) + (41 – 28) = 10

- **Idle time on Machine III** = Time out of first job on Machine II in the Optimum sequence + (Time in of last job in Optimum sequence on Machine III – Time Out of last but one in optimum sequence on Machine III)

= 8 + (11 – 10) + (17 – 15) + (23 – 21) + (28 – 26) + (41 – 33) = 23

- **Idle time on Machine IV** = Time out of first job on Machine IV in the Optimum sequence + (Time in of last job in Optimum sequence on

Machine III – Time Out of last but one in optimum sequence on Machine III)

= 10 + (15– 17) + (21 – 20) + (26 – 30) + (33 – 32) = 6.

Dispatch Rule--Processing time (including setup time) and Due dates for five jobs viz. A B C D and E waiting to be processed are recorded at a work centre of Nanded Textile Mills are tabulated as shown below:

Job	Processing time	Due date
A	**12**	**15**
B	**6**	**24**
C	**14**	**20**
D	**3**	**8**
E	**7**	**6**

We can determine the average delay in:

1. Earliest due date. 2.First come first serves 3.Longest process time.
1. Shortest process time. 5.Slack time remaining.

Calculation

1. Earliest due date (EDD) – Can be calculated by arranging the jobs according to the due dates in increasing order.

Jobs	Processing Time (PT) (hours)	Due Date (DD) (hours)	Flow Time (FT)	Delay (FT-DD)
E	**7**	**6**	**(Start time + PT) 0+7 = 7**	**1**
D	**3**	**8**	**(Preceding FT + Succeeding PT) 7+3=10**	**2**
A	**12**	**15**	**10+12 = 22**	**7**
C	**14**	**20**	**22+14 = 36**	**16**
B	**16**	**24**	**36+16 = 52**	**28**

2.First in first serves (FIFS) – Can be calculated by arranging the jobs in the order in which they occur.

12	**6**	**14**	**3**	**7**

$$\text{Average Delay} = \frac{1 + 2 \pm 7 + 16 + 28}{5} = 10.8 \text{ days}$$

Note: In the calculation of Delay; negative quantity is taken as 0.

$$\text{Average Delay} = \frac{0 + 0 + 12 + 27 + 36}{5} = 15 \text{ Days}$$

3.Longest process time (LPT) – Can be calculated by arranging the jobs according to the processing time in decreasing order.

C	**A**	**E**	**B**	**D**

14	**12**	**7**	**6**	**3**

Jobs	PT (Hrs)	DD (Hrs)	Flow time	Delay (FT-DD)
A	**12**	**15**	**0+12 = 12**	**0**
B	**6**	**24**	**12+6 = 18**	**0**
C	**14**	**20**	**18+14= 32**	**12**
E	**7**	**6**	**35+7 = 42**	**36**

OBS	PT (Hrs)	DD (Hrs)	Flow time	Delay (FT-DD)
C	14	24	14	0
A	12	20	26	6
E	7	15	33	18
B	6	8	39	31
D	3	6	42	36

$$\text{Average Delay} = \frac{0 + 6 + 18 + 31 + 36}{5} = 7 \text{ hours} .$$

4. Shortest process time (SPT) – Can be calculated by arranging the jobs according to the processing time in increasing order.

JOBS	PT (Hrs)	DD (Hrs)	Flow time	Delay (FT-DD)
D	3	6	3	0
B	6	8	9	1
E	7	15	16	1
A	12	20	28	8
C	14	24	22	0

$$\text{Average Delay} = \frac{0 + 1 + 1 + 8 + 0}{5} = 2.8 \text{ hours} .$$

5. Slack time remaining (STR) – Can be calculated as: Hence, the optimum job sequence is

JOBS	PT (Hrs)	DD (Hrs)	S.T.(DD-PT)
A	12	15	15-12=3
B	6	24	24-6=18
C	14	20	20-14=6
D	3	8	8-3=5
E	7	6	6-7=0

$$\text{Average Delay} = \frac{1 + 4 + 14 + 16 + 18}{5} = 10.6 \text{ Days}$$

Position of order today to the previous year

Analysis	Views
More (Increased)	60%
Decreased (Less)	15%
Stagnant (Constant)	20%
No Response	5%
Total	100%

JOBS	PT (Hrs)	DD (Hrs)	Flow time	Delay (FT–DD)
E	**7**	**6**	**0+7 = 7**	**1**
A	**12**	**15**	**7+12 = 19**	**4**
D	**3**	**8**	**19+3 = 22**	**14**
C	**14**	**20**	**22+14 = 36**	**16**
B	**6**	**24**	**36+6 = 42**	**18**

From the above Bar Graph out of 60 respondents (Employees of a Textile Mills) of various department

- 36 respondents said that the position of order as compared to previous year has increased.
- 9 respondents said that the position of order as compared to previous year has decreased.
- 12 respondents said that the position or offers as compared to previous year has stagnant.
- 3 respondents gave no response.

II. Conclusion And Recommendations

1. Sequencing of job is important for:

- Proper scheduling of job.
- Minimizing the processing time of job.
- Maximize operations efficiency.
- Reduce the processing cost of the firm over a period of time.

1. When jobs are processed in a single stage of production, they can be simply scheduled one after the other. If two or more stages of production are required, firms should ensure that the jobs are sequenced in a way that idle time is minimized. Operations managers can use Johnson's rules and develop a job sequence that minimizes the total time span required in completing the given jobs.
2. To provide proper scheduling to enables firms for allocation of their production capacity; so that they can meet their customer requirements on time by providing firm a job sequence that minimized total span required for the completion of the job and by providing schedule for the processing of job using n number of machines so that the total operation time can be minimized. Henceforth, firm can provide best service to the customers through efficient use of the firm's resources and can maximize customer satisfaction and minimize service delays.
3. Operation managers of Textile mill can use Dispatch rule in scheduling production activities in sequence. By knowing the processing time (including setup time) and Due dates for 5 jobs waiting to be processed.
Using the dispatching rule operation manager of mill release job orders in accordance with the planned process. He found out the average delay in

i. Earliest due date (EDD) = 108 Days.
ii. First in first serves (FIFS) = 15 Days.
iii. Longest process time (LPT) = 7 Hours
iv. Shortest process time (SPT) = 2.8 Hours
v. Slack time remaining (STR) = 10.6 Days.

Appendix

Questionnaire [1]

1) How many jobs were performed by your firm?
2) How many processes were involved in each job?
3) How many machines were required for processing of job?
4) What order you are processing a job?
5) How many jobs you have to perform for finished products?
6) Expected Processing Time (PT) for each job?

Questionnaire [2]

1. Do you think or agree that Textile Mills domestic market share has been increased?

A. Yes
B. No.

2. If yes, what is the most important reason for increased domestic share?

A. Quality
B. Timely delivery
C. Customer awareness

D. Longest presence

3. What is the position or order today to the previous year?
A. Increased
B. Decreased
C. Stagnant
D. No response

4. Do you feel that the order placement will show any change in the upcoming year?
1. More
2. Less
3. Constant
4. No response

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