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# Developing a Program for Planning the Material and Resources to Meet the Demand

George Martin Jose, Dr. Devi Prasad Varma, Jacob Kuriacose Department Of Mechanical Engineering, Mar Athanasius College of Engineering, Kothamangalam, Kerala, India – 686 666

Abstract: Production scheduling problems have been the subject of intense academic research for the last three decades. Scheduling is a key factor for manufacturing productivity. Effective production scheduling can improve on-line delivery, reduce inventory, cut lead time, and improve machine utilization. Super plastic forming manufacturing operations have a numerous product back logs because of the following problems as per the observations during this project study. As per the time study of the Manufacturing Operations, the Production Leader plans their activities for the upcoming week. But in reality the associates do not meet the targets due to various issues and concerns and this is mainly due to scheduling problem. And this has been repeating for the last 5 years. The objective of the study is to find out the major problems and to find remedies for minimizing the same.

*Index Terms*—production scheduling, cause and effect diagram, pareto diagram.

#### I. INTRODUCTION

Industry is an integrated power plant equipment manufacturer and one of the largest engineering and manufacturing companies in India in terms of turnover. We were established in 1989. We are engaged in the design, engineering, manufacture, construction, testing, commissioning and servicing of a wide range of products and services for the core sectors of the economy, viz. Power, Transmission, Industry, Transportation (Railway), Renewable Energy, Oil & Gas and Aerospace.

### Manufacturing Division

Industry diversified into engineering and manufacturing in the year 1991 with the production of fan blades. The versatile product is used the engines of aircrafts. To its high quality the production have been acknowledge as among the best in the world. The division is located adjacent to the marthaballi division.

#### **Experimental Details**

Fan blade is produced in manufacturing division of Industry. The finished product i.e fan blade is used in the engines of aircraft. Here the problem is associates are not able to meet targets plans set by Production Leader because of various reasons like machine, maintenance, unforeseen working conditions etc. The data for the study were collected from maintenance department of the company. And major problem were identified. Root causes for these defects were found out from cause and effect diagram and remedies were suggested.

### **II. RESULTS AND DATA COLLECTION**

Super plastic forming manufacturing operations have a numerous product back logs because of the following problems as per the observations during this project study. Associates are not able to meet targets plans set by Production Leader because of various reasons like machine maintenance, unforeseen working conditions etc. Blue Chip Projects are done only on the scrap products. In Blue chip projects, the production data is not captured in structured and methodological manner. Even though before each manufacturing operations they punch in the Batch card, while correlating the existing data does not match. As per the time study of the Manufacturing Operations, the Production Leader plans their activities for the upcoming week. But in reality the associates do not meet the targets due to various issues and concerns and this is mainly due to scheduling problem. And this has been repeating for the last 5 years.[1] Details of planning

Table 1 shows the details of actual planning and result

Γ	15	Water Jet - C - Scan												
			XWB		T1000		T900		T800		T700		T500	
		Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	
Da	y/ Shift													
Sat	N													
Sun	D													
	N													
Mon	D									24	24			
	Α					2	2				11			
	N					10	8							
Tue	D									24				
	A		1		6	10	6				10			
	N				6			10	10		5			
Wed	D				10				10	24				
	A		2		6			10		12	12			
	N		2	10	4						6			
Thu	D			10						-			<u> </u>	
	A									24	6	-		
-	N		4			L		10			1	-	<u> </u>	
Fri	D	II		10		L		<u> </u>		12		L	<u> </u>	
	A			I		L		<u> </u>		4		L	l	
C - 4	0						_							
281	Cammil	0		20	22	22	40	20	20	10	04	0		

Details	of	scrap	formed
		-	

Table 2 shows the details of scrap formed						
PRODUCT	NO.PRODUCED	BECAME				
		SCRAP				
T 500	20	9				
T 700	1590	103				
T 800	304	18				
T 900	114	8				
T 1000	464	21				
TXWB	58	4				



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## **III. CAUSES OF UNACHIEVEMENT OF TARGETS**

In order to identify the causes of un achievement of targets, cause and effective diagram was drawn and the main causes was categorized in to different categories as shown below.



Fig .1 represents cause and effect diagram

Pie chart was plotted based on the data collected, is shown in figures given below. It is found that these defects were responsible for about 80% of the problem and hence study was focused on these defects.



Fig.2 Pie chart represents the percentage of occurrence

Pareto chart was plotted based on the data collected, is shown in figure given below. It is found that these defects were the occurred due to Men, Machine, Material.



Fig.3 Pareto chart represents the scrap review

Current situation in the shop floor

The Manufacturing of Wide Chord Fan blades consist of 90 Manufacturing Operations. These Manufacturing operations are grouped into various cells as per the respective domain. The various Cells in the Production of Wide Chord Fan Blades are

- 3010 Diffusion Bonding
- 3013a Waterjet & HCF
- 3013b Forming
- 3008 X-Ray
- 3022 Taper Etch
- 3023 Outgas
- 3076 Polish
- 3093 Machining
- 3081 Inspection

These various cells consist of Production Leaders where they are given targets as per the production demand. They are required to plan their production activities for their cell every week. In each cell the various products are undergoes the various process of New Product introduction where they identify the best method to manufacture the product and also identifies the processing time. This processing time and the various features are approved by a process called First Article Inspection Report (FAIR). Once the product has been approved by FAIR these products production is managed and controlled by the Production Leader and Component Owner.

### **IV. PRESENT METHOD OF PLANNING**

In all the Cells will have their key manufacturing Operation. This Manufacturing Operation is identified and plan according to single machine scheduling. For Example, for the Cell - DB, the key Manufacturing Operation is Diffusion Bonding. As per the processing time, it is this manufacturing operation that takes a lot maximum time. Hence all the other Manufacturing operation where considered to provide on time feed for Diffusion bonding.



Table 3 represents the planning of water jet operation

Various targets for the shift are provided in an excel sheet as shown. This is replicated on big board in the shop Floor. If they are not able to meet the target on the particular day, they try to complete that task on some other day in the week, making sure they meet the target. If there are any issues and concerns, it is noted on the 3C chart which is on Key Performance Indicator (KPI) Board in the shop Floor.



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Material – Analysis of the material flow from the Supplier to the customer.



Fig.4 represents the 3c chart

### V. ISSUES AND CONCERNS IN THE CURRENT SITUATION

In the present condition, each cell in the production is scheduled using single machine scheduling. From the pi-chart above, its very clear that major issues and concerns in production is due to MAN, MACHINE, MATERIAL. Hence it was very evident that we need to include these issues into consideration while planning. We need to find a solution to scheduling by considering various factors that has happen. Hence we changed scheduling method from single machine to flow shop scheduling so that the production leaders will get a better view of the number production as input into their cells and plan accordingly. Also structurized the meeting agenda among the Production Leaders to resolve the issues in shop floor, so that everybody is aware of all the issues and concerns.

### VI. PROJECT ELEMENTS VISION STATEMENTS

The items below indicate how the project title and its sub elements have been derived and their strategic intent. The project solution will fall into the delivery of these 4 toolsets and all together will deliver the DREAM project.

## Dream (Data Rich Environment enables Active Management)

## Strap Line: Improving Credibility and Reliability through Consistently Achieving the Production Plan

Vision: "To deliver a dynamic and user friendly manufacturing data capture system that enables real time management control to drive a cross functional approach to production plan adherence "

### Wrap (Weekly Resource & Asset Planning)

Strap Line: Robust planning that meets our customers' needs, and guides our teams

Purpose – A module in DREAM which helps the Production Leader's to plan & analyze the production for the upcoming week. This production plan is analyzed with Man, Machine, and Material & FTG on shiftily basis. This analysis enables the PL to know various risks and issues for the plan.[2,3]

Man – Analysis of the Holiday Planner & Updates Fire Register.

Machine – Analysis of MTM planner + STH for the No. of products assigned in a shift.

FTG – Analysis of Fixtures, Tooling & Gauges planner.



Fig.5 represents the process flow chart of wrap

### Tab (Team Achievement Board)

## Strap Line: *Enabling accountability for how we contribute to the success of the business*

Purpose – A tool in DREAM which helps the System Admin / Admin user's to enter the production data and various concerns (if production plan isn't met) are updated on shiftily basis. At the end of shift, a shift meeting is hosted by the admin / System admin user's in each Department. In this meeting, the number of products processes are entered which is checked with the Plan. The user has to note the concerns if the production plan is not met. These concerns are then escalated to 3C charts under the respective KPI's.[6,7]



Fig.6 represents process flow chart of tab Part (Production Adherence Review Tool – D, W, M)

Strap Line: *Review the team's achievements and take action to achieve the production plan* 

Purpose: A tool in DREAM which helps the Admin user/PL to review the summary production updated by WRAP



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and TAB. The achievement made by the WRAP and TAB is analysed and necessary action is taken to obtain the plan.



Fig.7 represents process flow chart of part

Crib (Central Reports for Intelligent Business)

Strap Line: Information enabling intelligent business decisions to be taken based upon data

Purpose: A tool in DREAM which help to bind all the reports that can be accessed by all cell.

### VII. SCOPE

The scope of the project covers the following sub elements System

- Definition of system requirements
- Identification of pilot area and desired functionality
- Development of software solution on a future proof platform
- Compliance with RR IT requirements
- Identification of software / functionality limitations
- Creation of Programmers Guide
- Creation of user manuals

### VIII. CONCLUSION

Project at industry included an organizational study and a Project. During the project period a brief study of various cells, its functions and objectives were accomplished. Major problem faced was "un-achievement of target production plan" was observed and taken up as project. The major causes and root causes are identified. The solution for the causes was found out and a new tool was created.

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