

Productivity Improvement of a Laboratory Equipment Manufacturing Company through Production and Operation Management

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ABSTRACT

The Small Scale Industrial sector plays a significant role in the industrial development of any country. Especially in India It has emerged as powerful tool in providing relatively larger employment next to agriculture. Global Markets are continuously changing and demanding product of high quality and low cost. In India, the survival and growth of small scale industry largely depends on its ability to innovate, improve operational efficiency and increase productivity. The importance of the Small Scale Industrial Sector is well recognized world over for its significant contribution in various fields like socioeconomic objectives, thereby creating a higher growth of employment, promotion of exports, output and encouraging youngsters to take up entrepreneurship. To maintain business arena in Small Scale Industries it is of most important to win hearts of customer by delivering products according to the requirement of the customer, quality, time and cost of the product of service. To achieve this Small Scale Industries should have sustainable production with continuous improvement. The Aim of this project is to minimize the inventory, optimize the rate of production and maintenance scheduling for the Tech-Ed Equipment Company. Using the concepts of ERP, inventory classification scheduling, Likert scale to minimize the company's problems in the area of purchase, production and service. The main purpose of this project is to bring lean concepts in small scale industries in India, where industries are working on very old and obsolete techniques of manufacturing and there is no any working culture available and even they are not thinking to develop it.

KEYWORDS – Small Scale Industries, ERP, Scheduling, Inventory Classification, Linkert Scale

1. INTRODUCTION

Production and operation technique has a great importance with Indian small scale Industries. In India Small and medium Scale industries (SME) play a very important role in Indian Economy. The problem is most of SME'S are working on very old and obsolete techniques of manufacturing. There is no any working culture available and even they are not thinking to develop it. Indian small scale Industries are using top to bottom (management to workers) approach for information flow thereby not asking for any suggestions and ideas from workers (bottom). The Entrepreneurs are using the bottom work force physically but not intellectually. Thus they are not able to capitalize the hidden talent and innovative ideas or suggestions which they are identifying while ground reality working. They are just imposing their orders over them regarding production and production quality. In small scale industries there is less importance for training. To enhance the working skills or motivation of the work force lean

Manufacturing technique is essential and helps in making a habit in the industry to learn and teach. Similarly, there is no focus on data collection in industry but with lean concepts they have started compilation of data in reference to rejection rate. There is missing a feeling of responsibility in small scale industries because there is no housekeeping, no management information system and no store management and there is no production planning and control system. Lean Manufacturing is one the initiatives that helps in focusing on the cost reduction by eliminating wastes (nonvalue added activities). [3]Research at Lean Enterprise Research Centre (LERC) U.K. indicated that for a typical manufacturing company the ratio of activity could be broken down as, Value added activity – 5%, non-value added activity (waste) – 60% and necessary non value added activity – 35%. This implies that up to 60% of the activity

at a typical manufacturing company could potentially be eliminated. All Lean manufacturing tools are not possible to implement in small scale industry because of limitation in resources like finance, technology, marketing, infrastructure, work force, project planning, managerial etc. So as an industrial engineer it was my motivation to implement some of the lean techniques in small scale industry to increase the productivity.

2. LITERATURE REVIEW

- Chakraborty et al (2011), studied the critical problems facing by small scale industries while selling their product. SSE (Small Scale Enterprise) is not having huge financial backup and therefore they are depending upon the revenue eared after selling their product. The product sales can only be increased by reducing the cost of the product.
- Upadhye et al (2010), studied the importance of small and medium scale industries in Indian context. Medium size manufacturing industry plays an important role in Indian economy. Their contribution to the economic development of the nation is indeed significant. But the productivity level of these industries is quite low as compared to other country.
- Palaniappan (2010), described the performance and benefits of small scale manufacturing industry in India. Small scale industries form an important sector constituting 40% of the total output to the privet sector and much more significant is the employment generation capacity of small scale sector.
- Chauhan et al (2010), shows the problem to sustain in global market for an organization. Lean manufacturing is hymn of survival and success of any organization. The goal of lean manufacturing is to minimize all types of waste so cost of the product can be reduced.
- Hudli and Inamdar (2010), described the development of key areas which could be used to assess the adoption and implementation of lean manufacturing practice also presented some of the key areas developed to evaluate and reduce the most optimal project so as to enhance their production efficiency.
- Anand h. Mishrikoti and V.S. Puranik describes According to the industrial point of view lean manufacturing is an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer and internal variability.
- Adam and O'Doherty, used case studies to study ERP implementations in small and medium enterprises in Ireland.
- Effective Preventive Maintenance Scheduling, Hasnida Ab-Samat, Livendran Nair Jeikumar, here they talks about how Maintenance is an important system in operation. In an era where industries are focusing on 24hours operation to maximize production, machines are pushed to its absolute limits to cope with this demand. As utilization increases, the rate at which the machine parts get worn out increases thus the frequency of failure increases rapidly. To combat this problem and ensure that machines continue to operate at its optimum, maintenance work is carried out.

3. PROBLEM STATEMENT

When I got a chance to do project in Tech-Ed Equipment Company, I started to study the entire plant assembly process and by carrying out time-motion study collected data of each process thereby helped in identifying value added and semi value added activities. After data collection and with inputs from the manager, these where the departments where major problems that Tech- Ed company was facing listed below :-

1. Purchase :

- Improper Material Management, Storage of material, inventory control
- Improper Follow ups and tracking of sub-contractor's PO's, inspection of the input raw materials and trading items.

2. Production :

- Unable to achieve production target, and execution of production as per planning.

3. Service :

- Improper maintenance of service complaints, service quotations, attending service complaints and billing (Both Warranty and non-warranty cases)
- Unable to get customer feedback / maintaining of feedback letter or service completion letter.

4. PROCESS FLOW DIAGRAM

This diagram provides brief information which is related to process of the manufacturing of FM Lab Equipment and it also categorizes the flow of process. Process flow diagram for a general equipment production is shown in figure 1

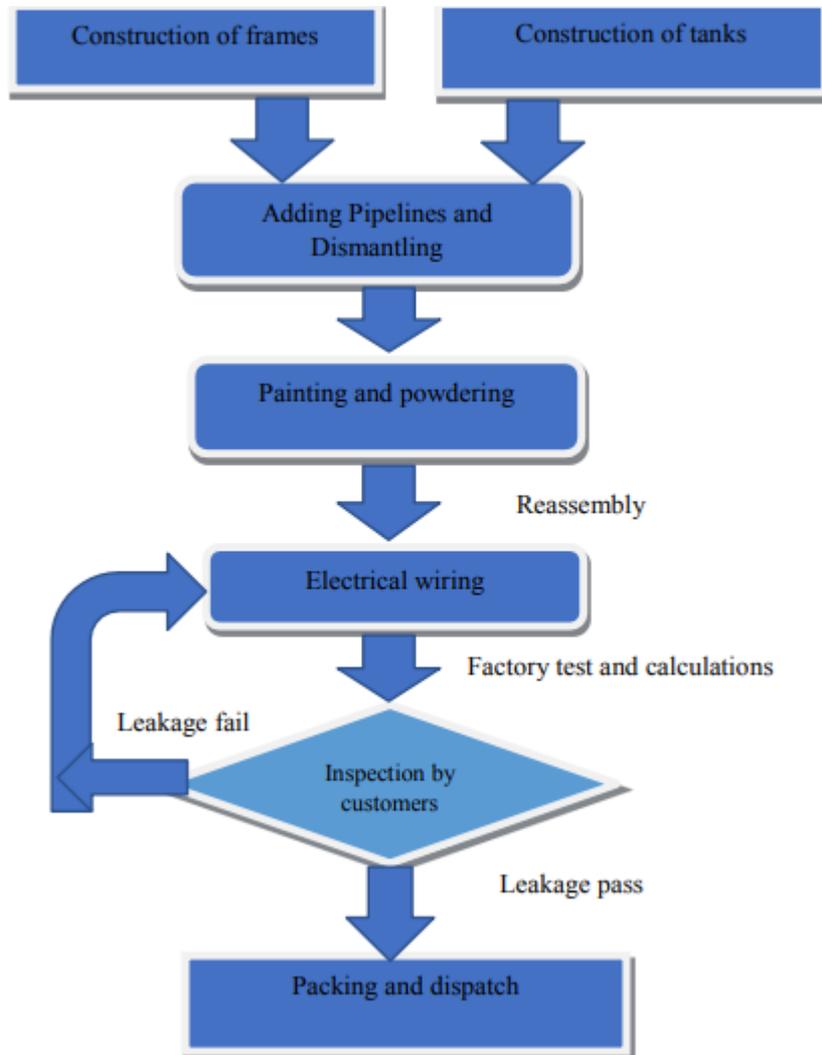


Figure 1 Process flow diagram for FM lab Equipment

5. METHODOLOGY

5.1 ERP

Enterprise resource planning (ERP) is business process management software that helps an organization to achieve a system of integrated applications to manage the business and automate many back office operations related to technology, services and human resources. ERP software is majorly used in large scale industries for strategic needs, thereby they are using more ERP functionality than small scale industries. Large companies customize ERP software according to their requirement and uses incremental implementation approach by phasing in the system. By using ERP large scale industries achieve greater benefits in financial areas.

As Tech-Ed is facing problems in purchase department like material management, improper follow up of purchase order, ERP was the ideal solution to solve the problems and also improves the overall productivity of the organization. So I discussed with the manager of Tech-Ed about the insights of ERP software and he was keen on knowing the benefits. So when I was looking for ERP vendors, I came to know about Roadmap IT solutions (P) Ltd. This company had prior work experience related to lab equipment manufacturing company thereby explaining our requirement was easy. Upon discussion we found that Sky Finch software from Roadmap IT solution was suitable for our requirement. Sky Finch was more motivated towards tactical considerations which was more important for small scale companies and it uses radical implementation approach such as implementing the entire system or several major modules at the

same time and thereby benefiting in manufacturing (purchase, production) and logistics. Now Tech-Ed and road map solution (ERP vendor) are involved in discussion about the user interface and cost of the software.



Figure 2 process flow of ERP

5.2 INVENTORY CLASSIFICATION

Inventory classification techniques helps to solve the issue of inventory control, storage of materials and shortage of materials. So my first step is to make an account of all the items in the inventory and thereby making a significant impact on overall inventory cost and effective space utilization. The method of inventory classification that I have choose and implemented is ABC classification. ABC analysis is a term used to define an inventory categorization technique often used in material management. The ABC Classification helps in identifying items that will have a significant impact on overall inventory cost, while also providing a mechanism for identifying different categories of stock that will require different policy settings and inventory control. Thereby it is best practice for Tech-Ed Company to group their inventory into three categories (A, B, and C). ‘A Classification’ items are very important for an organization→ ‘B Classification’ items are important, but of course less important than ‘A’ items→ ‘C Classification’ items are marginally important, but of course less important than ‘A’ and ‘B’ items→ Generally ‘A Classification’ items are of high demand, these are fast moving and generally lower value items that targets the largest percentage of target service levels and customer satisfaction rates. ‘B Classification’ are typically midrange in inventory value and order frequency. ‘C Classification’ items are very low order frequency and high inventory value. These items are generally stocked with very low quantities or not at all due to the high carrying costs associated with the stock levels. According to ABC analysis, I have classified the inventory in Tech-Ed equipment Company.

5.3 CAUSE AND EFFECT DIAGRAM

It is one of the important quality control tool this mainly finds the possible causes for a problem. It is also used for doing brainstorming; it gives ideas to solve the problem. This is also called Ishikawa Diagram or fishbone diagram.

5.4 PARETO CHART

A Pareto chart is a bar graph. The lengths of the bars represent cost or frequency (money or time), and it is arranged in such a way that shorter bars will be seen in right side and longest bars on left hand side.

5.5 SCHEDULING USING STANDARD TIME

Scheduling is the method of arranging, controlling and optimizing work and workloads in a manufacturing process. Scheduling is generally used to allocate resources like Scheduling is the process of arranging, controlling and optimizing work and workloads in a production process or manufacturing process. Scheduling is used to allocate resources like plant and machinery, human resources, plan production processes and purchase materials. It is an important tool for manufacturing and engineering, because it can have a major impact on the productivity of a process. Generally In manufacturing, the purpose of scheduling is to minimize the production time and costs. Thereby telling a

production facility when to make, with which staff, and on which equipment. Production scheduling main objective is to maximize the efficiency and effectiveness of the operation and reduce costs. Below I Have Prepared Scheduling Of Production Process For Employee. Like this scheduling is done for each employee and thereby helping in increasing the production rate and effective utilization of employees. Standard time is the time required by an average skilled operator, working at a normal pace, to perform a specified task using a prescribed method. It includes appropriate allowances to allow the person to recover from fatigue and, where necessary, an additional allowance to cover contingent elements which may occur but have not been observed. $\text{Standard time} = \text{normal time} + \text{allowance}$ Where; $\text{normal time} = \text{average time} * \text{rating factor}$.

5.6 LINKERT SCALE

The Likert Scale is a rating scale that’s often used when surveying the customers regarding their experiences about the product or brand – from the service. To understand the overall effectiveness of your product and service. It’s one of the most popular technique used on customers by the company to know the customer’s perspective about the service by collecting audience feedback. The Likert scale is a series of questions that asks the customers to select a rating on a scale that ranges from one extreme to another, such as “strongly agree” to “strongly disagree.” Unlike binary “yes or no” questions, the Likert scale gives you deeper insight into what your customers are thinking and how they feel. So I have set a series of questions to know the customer’s feedback regarding Tech-Ed Equipment Company’s service capability

6. DATA ANALYSIS

6.1 CAUSE AND EFFECT DIAGRAM

The Fishbone diagram or Cause and Effect diagram gives all possible causes that are responsible for defective product. By asking questions to different level of employees, possible causes that are responsible for defective products are listed. Possible causes that are responsible for defective products is shown below in figure 3

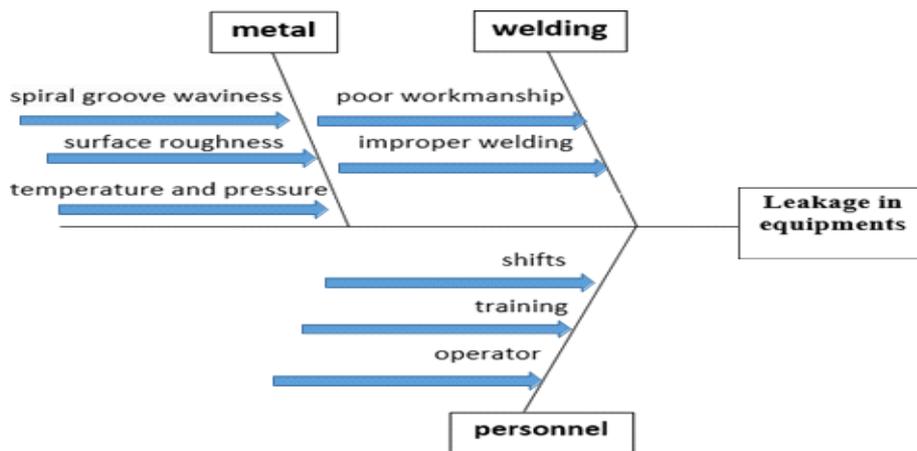


Figure 3: Cause and Effect diagram of leakage in equipment

6.2 PARETO CHART

The purpose of the Pareto chart is to highlight the most important among a (typically large) set of factors. Pareto chart for rejected equipment due to leakage is shown in figure 4 Based on pareto analysis few major losses was identified.

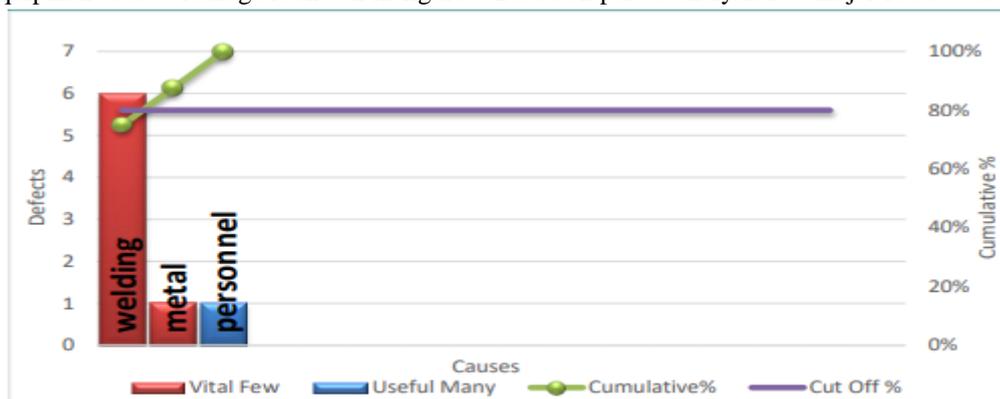


Figure 4 rejections of equipment due to leakage

6.3 CLASSIFICATION OF INVENTORY

Table 1: classification implemented in FM inventory

A Category Items	B Category Items	C Category Items
Gauges	Rotometer	Speed Indicator
Starter	Venture Clamp	Viers Model
Manometer	Orrifice Clamp	Notch Model
Pipe Fitting	Spring Balance	
Tubes		
Electrical Wire		
Pezo Meter		
MS Sheets		



Figure 5 inventory room before classification



Figure 6 inventory room after classification

By classifying the inventory into ABC analysis, it was found that there was

- Better Control of High-Priority Inventory
- More Efficient Cycle Counts than previous
- Requires Substantial Resources
- Supplier negotiation can be done
- Inventory optimization- Depending on the demand fluctuations the inventory is stocked to cater to high demand items and also carrying low stock for undesirable items.
- Strategic Pricing- Purchasing more goods from a single supplier will reduce carrying costs and complexity costs associated with them.
- Better Resource Allocation- if class A item is no longer desired by the customers or has fairly lower demand, the item needs to be moved to a lower classification B or C.
- Boosts overall Efficiency
- Helps in identifying critical items

6.3 PREPARED SCHEDULING OF PRODUCTION PROCESS FOR OPERATORS

Calculations

Standard Time = Normal time + Allowances

Normal time = average time *rating factor

Rating factor =

Normal time= 225 * = 215 mins

Standard time = 215+12% allowance

= 240.8 minutes = 4 hours

Table 2: scheduled timings for employee

TASKS	START DATE	FRAME AND TANK	PIPELINE	DISMANTLE	PAINTING AND POWDERING	REASSEMBLY	ELECTRICAL WIRING	FACTORY TESTING AND CALCULATION
PRODUCTION 1	02-04-2018	9AM-1 PM, 2/4/18	1.45PM- 2.45	2.45-3.15 PM	3-4 DAYS	9-10AM, 9/4/18	10-11 AM	11-12 PM
PRODUCTION 2	03-04-2018	9AM-1 PM, 3/4/18	1.45PM- 2.45	2.45-3.15 PM	3-4 DAYS	12-1PM, 9/4/18	1-2 PM	2-3 PM
PRODUCTION 3	04-04-2018	9AM-1 PM, 4/4/18	1.45PM- 2.45	2.45-3.15 PM	3-4 DAYS	3-4 PM , 9/4/18	4-5 PM	5- 6 PM
PRODUCTION 4	05-04-2018	9AM-1 PM, 5/4/18	1.45PM- 2.45	2.45-3.15 PM	3-4 DAYS	9-10AM, 10/4/18	10-11 AM	11-12 PM
PRODUCTION 5	06-04-2018	9AM-1 PM, 6/4/18	1.45PM- 2.45	2.45-3.15 PM	3-4 DAYS	12-1PM, 10/4/18	1-2 PM	2-3 PM
PRODUCTION 6	07-04-2018	9AM-1 PM, 7/4/18	1.45PM- 2.45	2.45-3.15 PM	3-4 DAYS	3-4 PM , 10/4/18	4-5 PM	5- 6 PM

By Implementing Planned Scheduling with Standard Time Calculation, These Are the benefits that was found:-

- Motivation of workers “to-do” the work was increased
- Communication between the employees of different department was found to be increased
- Helped in keeping costs under control
- Preparation for unexpected events (power cuts, machine breakdown) was better

6.5 DESIGNED LIKERT SCALE FORMAT

Tech ED service review

We appreciate your business and value as a customer. To help us continue our high quality of service, we invite you to leave us your feedback

* Required

How was the service experience *

- very satisfied
- satisfied
- neutral
- Dissatisfied
- very Dissatisfied

Your name

Your answer

Name of the Institution

Your answer

Service attended by

Your answer

Service attended on

Your answer

Any comments?

Your answer

SUBMIT

Figure 7 Designed Likert scale

Responses can be seen through a pie chart

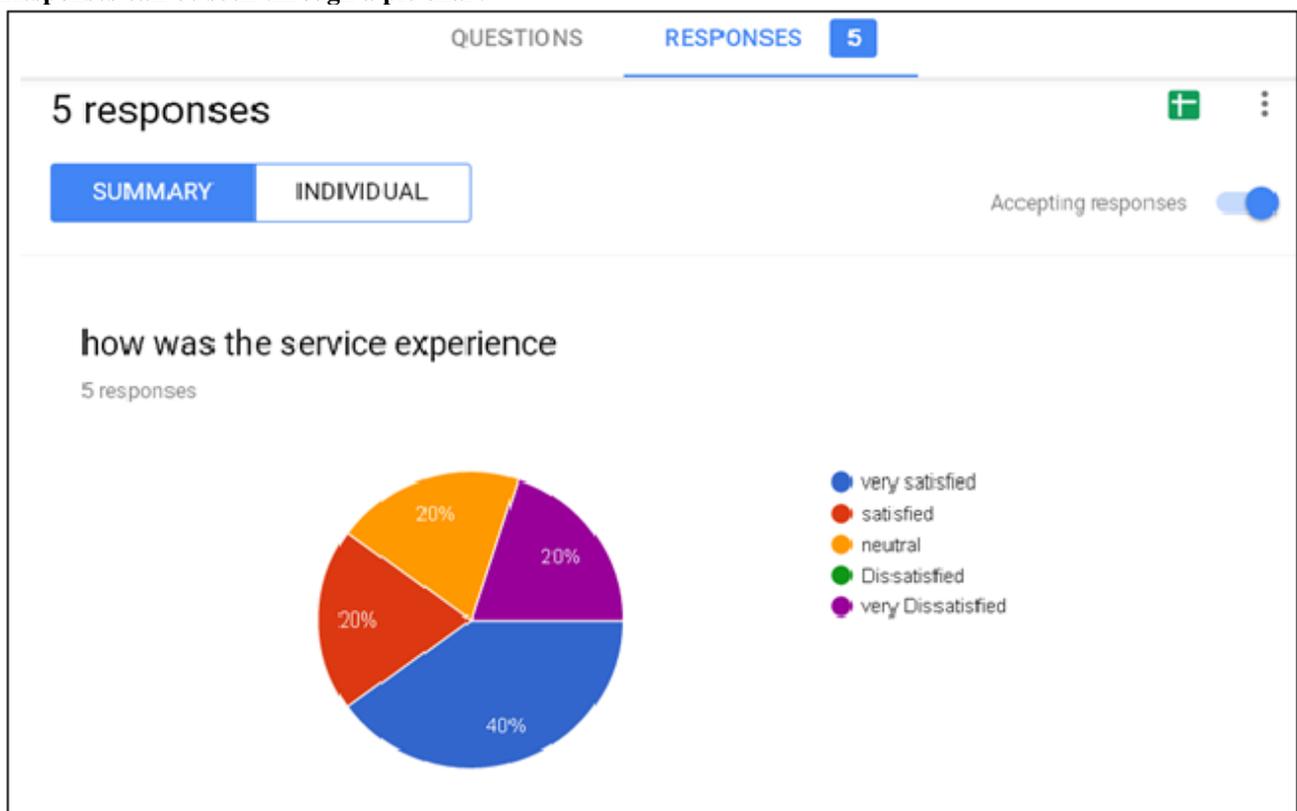


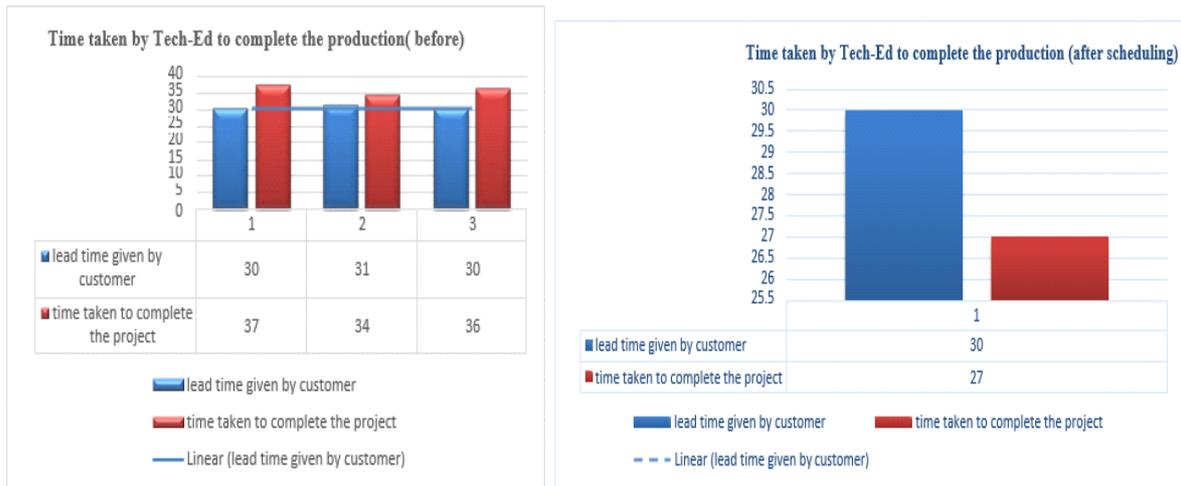
Figure 8 - Response Sheet

Based on the response we can always draw the conclusion of how good is the service level of Tech Ed Company. If there is any scope of improvement in service can be always rectified by using this method the traditional way to report on a Likert scale is to sum the values of each selected option and create a score for each respondent. This score is then used to represent a specific trait — satisfied or dissatisfied, in this example — particularly when used for service. In these cases the scores can be used to create a chart of the distribution of opinion across the population. For further analysis, you can cross tabulate the score mean with contributing factors.

7. RESULTS AND DISCUSSIONS

1. Successfully convinced about the importance of ERP and their advantages to the company. Now Tech-Ed and road map solution (ERP vendor) are involved in discussion about the user interface and cost of the software

2. With the help of Cause and Effect diagram and Pareto chart, it was identified that the method of welding was the prime cause for leakage that resulted in rejection and rework. To minimize the time spent on rework and rejection , instead of Arc welding Mig welding was implemented
3. Successfully achieved the production target for the order from Customer Name: Bajaj Inst. of Tech - Wardha well within the due date. By scheduling the workloads equally with the available workforce as shown in graph 1
4. Helped them to achieve production target and execution of production as per planning even though some of the production engineers and technicians were involved in service hours



Graph 1: production graph before and after scheduling

8. CONCLUSION

By working as a supervisor in Tech-Ed Equipment Company, gave me the exposure of the problems faced in small scale industries. The main objective of this project is to minimize the inventory, optimize the rate of production and maintenance scheduling for the Tech-Ed Equipment Company. Thus using of various tools like, inventory classification, scheduling, ERP, Likert scale etc. Helped in solving the problems, thus by implementing the production and operational techniques it helped Tech-Ed equipment company (Bangalore) in improving quality, productivity and efficiency of the organization. This paper shows how operational techniques and lean principles can be implemented in small scale industries. The implementation leads to improvement of productivity of Tech-Ed Company in many small things such as reduction in wastage; reduce unnecessary motion and worker's effort, cleanliness and proper arrangement of inventory in organization.

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