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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. In India, small-scale industrial sector has emerged as a relatively larger employment provider after agriculture. The importance of the small-scale industrial sector is well recognized world over for its significant contribution in various fields like socio-economic objectives, thereby creating a higher growth of employment, promotion of exports, output and encouraging youngsters to take up entrepreneurship. The survival and growth of small-scale industry largely depend on its ability to innovate, improve operational efficiency and increase productivity. The prime objective of this study is to minimize the inventory, optimize the rate of production, and maintenance scheduling of a small-scale laboratory equipment fabricating company. Industrial engineering tools such as ERP, inventory classification, scheduling and Likert scale were used to minimize the company's problems in the area of purchase, production and service.

Keywords: *ERP, inventory classification, Likert scale, scheduling, small-scale industries*

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INTRODUCTION

After data collection and with inputs from the manager, these were the departments where major problems that Tech-Ed Company was facing:

A. 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. [1-2]

B. Production:

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

C. Service:

- Improper maintenance of service complaints, service quotations, attending service complaints and billing (both warranty and non-warranty cases) [3].
- Unable to get customer feedback/maintaining of feedback letter or service completion letter.

PROCESS FLOW DIAGRAM

This diagram provides brief information which is related to the process of the manufacturing of FM lab equipment and it also categorizes the flow of process [4]. Process flow diagram for a general equipment production is shown in Figure 1.

METHODOLOGY

ERP

Enterprise resource planning (ERP) is a 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. By using ERP, large-scale industries achieve greater benefits in financial areas.[5]

Inventory Classification

Inventory classification techniques help to solve the issue of inventory control, storage of materials and shortage of materials. Therefore, the first step is to make an account of all the items in the inventory and thereby making a significant impact on overall inventory cost-effective space utilization. Thereby it is the 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.

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.

Pareto Chart

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

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.

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.

Standard time =normal time +allowance

where normal time = average time × rating factor.

Likert 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 techniques used on customers by the company to know the customer's perspective about the service by collecting audience feedback.

DATA ANALYSIS

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 levels of employees, possible causes that are responsible for defective products are listed**.** Possible causes that are responsible for defective products are shown in Figure 2-3.

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 were identified.

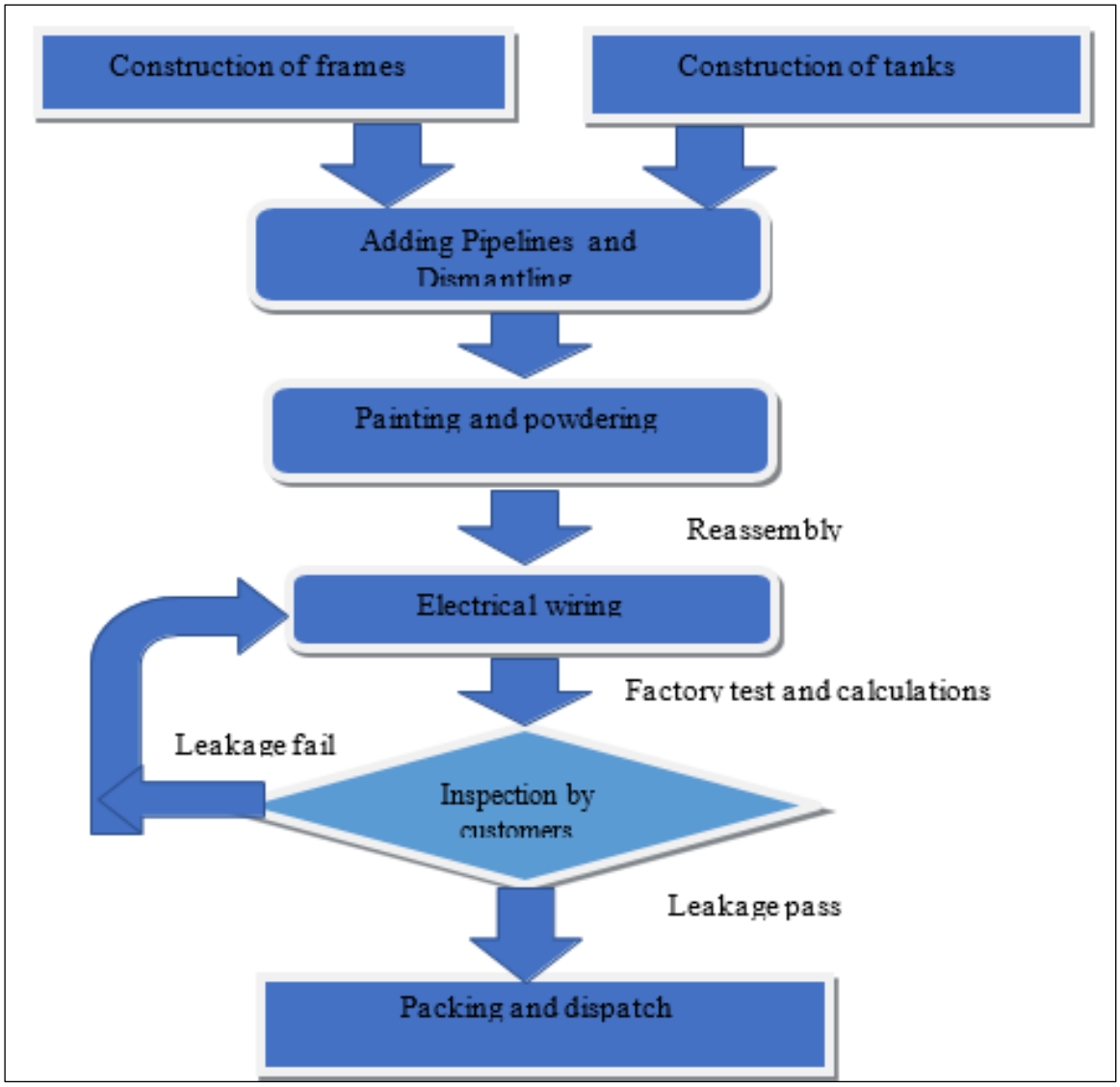


Fig. 1. *Process flow diagram for FM lab equipment.*

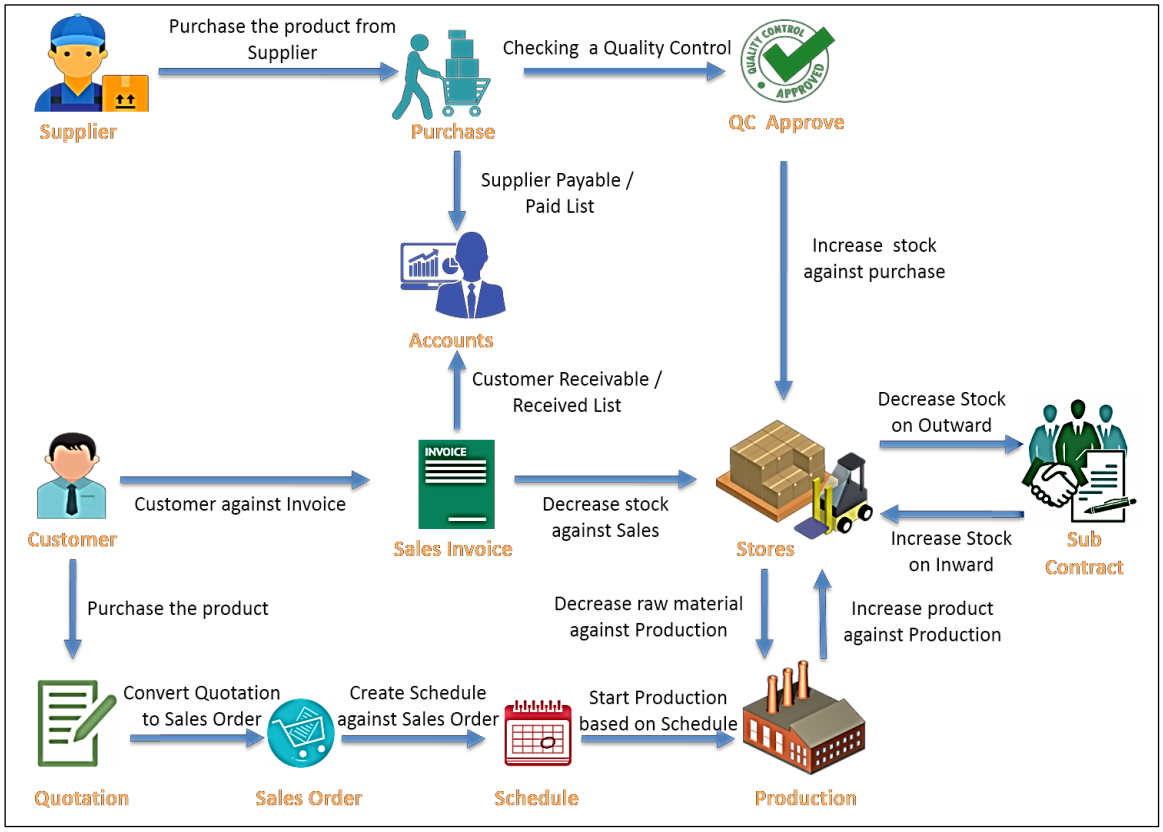


Fig. 2. *Process flow of ERP.*

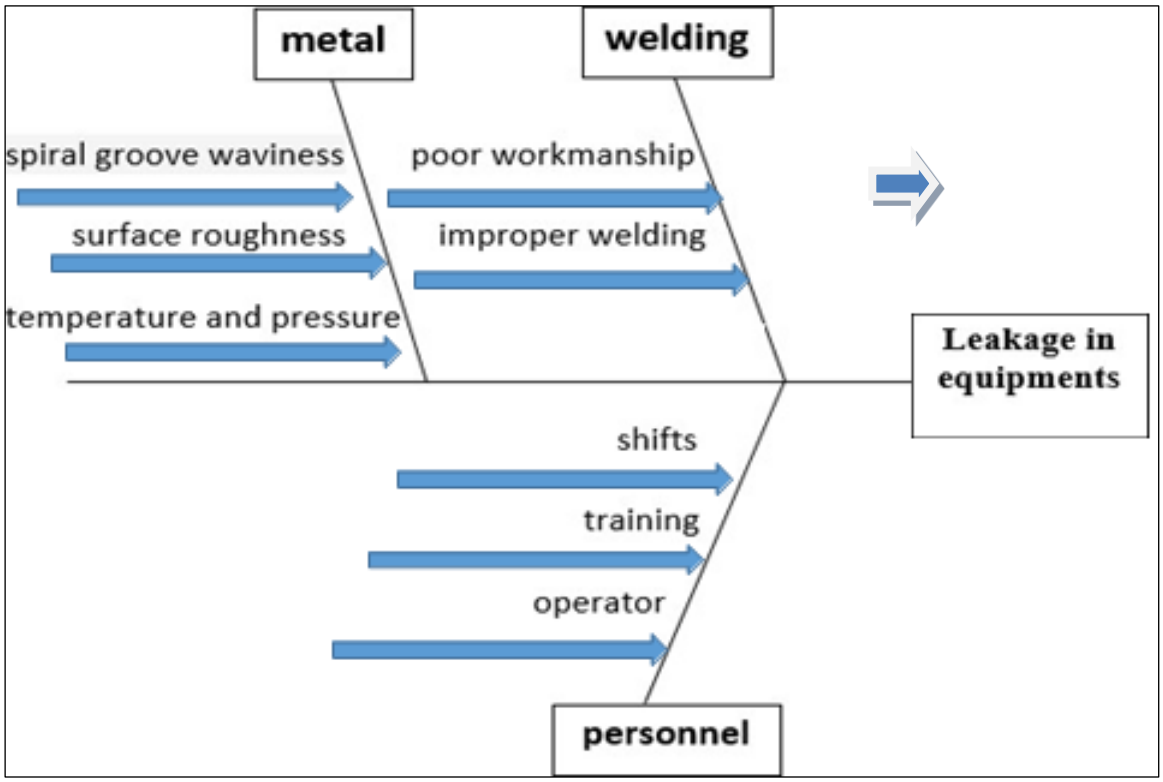


Fig. 3. *Cause and effect diagram of leakage in equipment.*

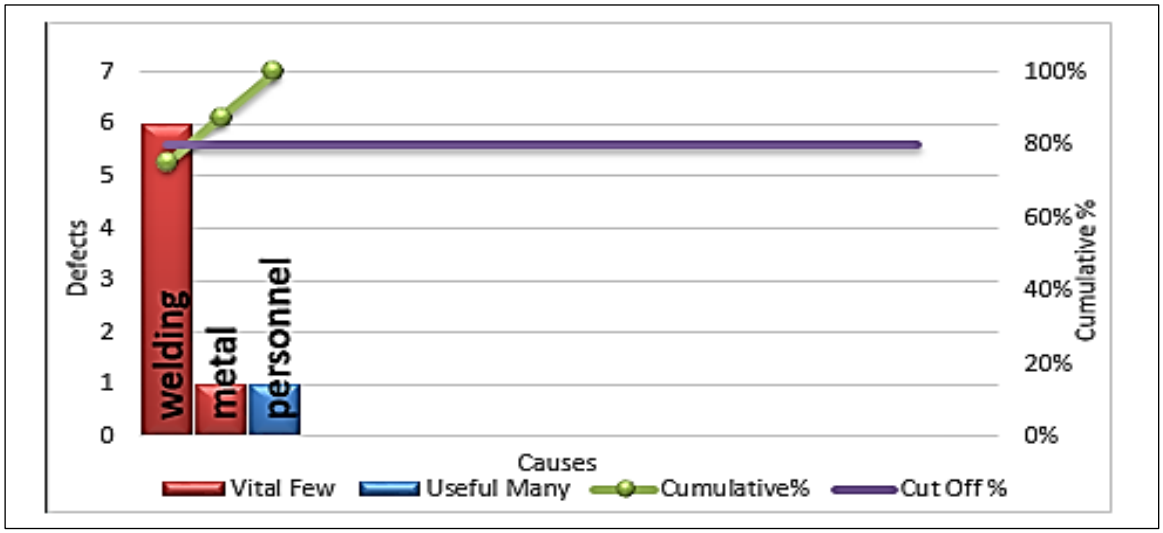


Fig. 4. *Rejections of equipment due to leakage.*

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		

Classification of Inventory

By classifying the inventory into ABC analysis in Table 1, 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;
- strategic pricing;
- better resource allocation; and
- boosts overall efficiency.

Prepared Scheduling of Production Process for Operators

Calculations

Standard Time = Normal time + Allowances, Normal time = Average time × Rating factor

Rating factor = $\frac{Observed\ performance}{Normal\ perormance}$,

Normal time = $225 \times \frac{0.86}{0.9}$ = 215 min

Standard time = 215 + 12% allowance = 240.8 min = 4 hours

By implementing planned scheduling with standard time calculation, these are the benefits that were found:

- Motivation of workers "to-do" the work was increased, and communication between the employees of different department was found to be increased.
- Helped in keeping costs under control, and preparation for unexpected events (power cuts, machine breakdown).

Designed Likert Scale Format

Based on the response, we can always draw the conclusion of how good the service level of Tech-Ed Company is. If

there is any scope of improvement in service, it 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. Responses can be seen through a pie chart. Figure 5.

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 Institute of Technology, Wardha, well within the due date, by scheduling the workloads equally with the available workforce as shown in Graph 1 and Table 2.

[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.

[5] Successfully implemented inventory classification in Tech-Ed Company, thereby focusing on inventory control, maintaining optimum inventory levels and determining order/replenishment schedules and quantities, thus trying to balance inventory all the time and maintain optimum levels to avoid excess inventory or lower inventory, which can cause damage to the business.

[6] Helped Tech-Ed Equipment Company in getting customer feedback/maintaining of feedback letter.

[7] Briefed the workers with the insight and importance of motion and time study.

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

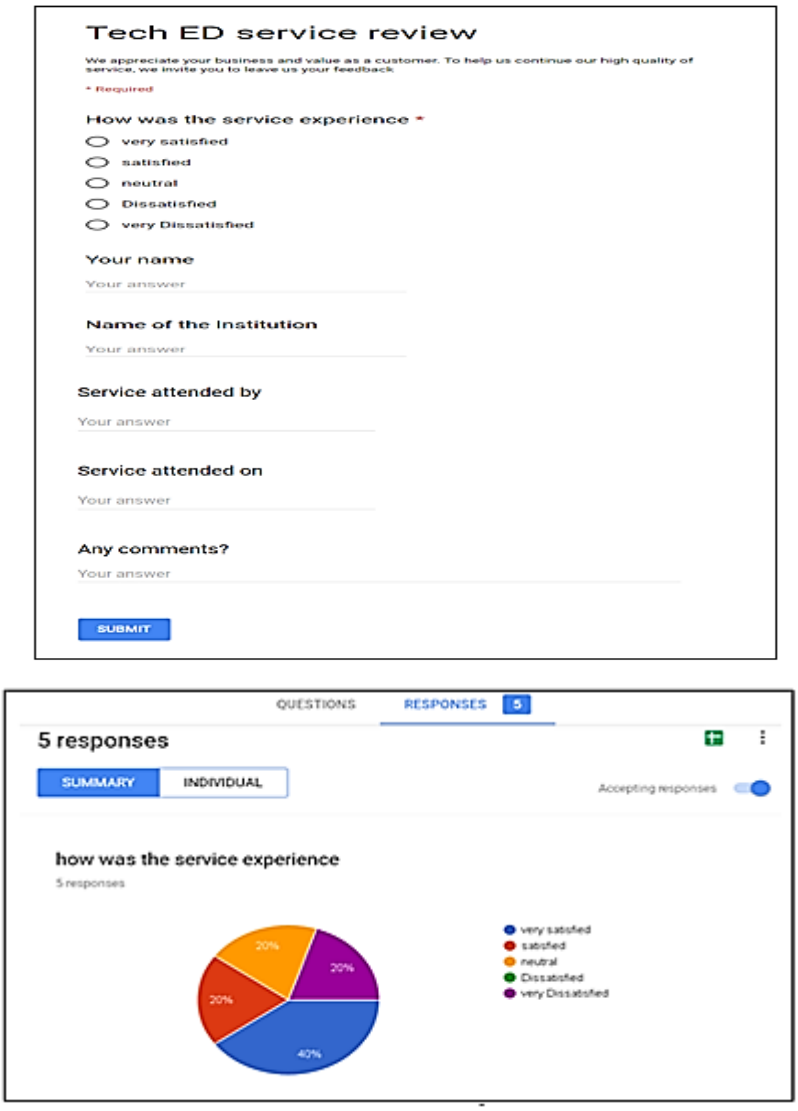
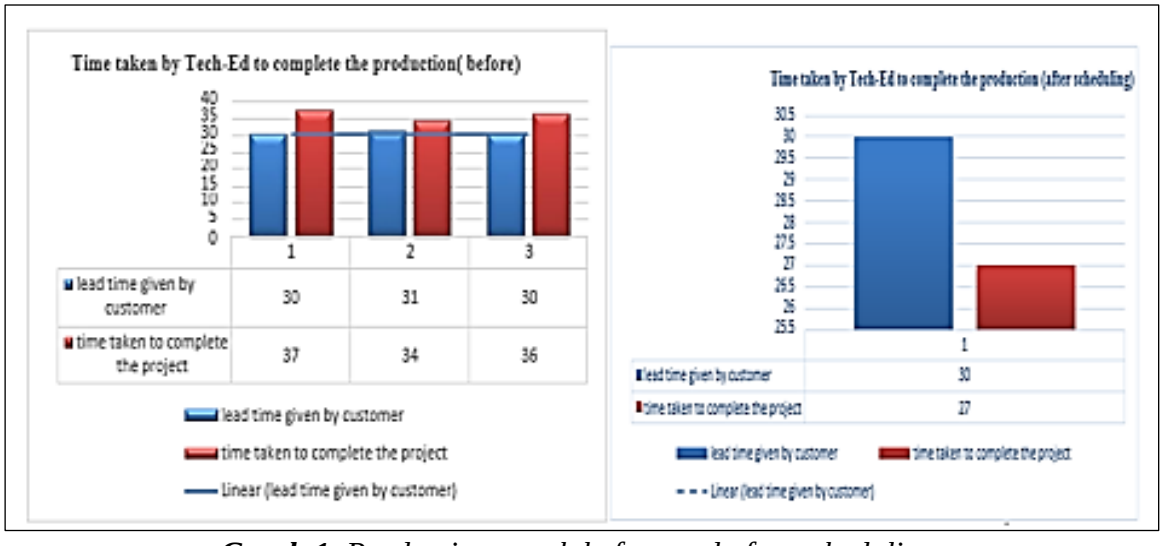


Fig. 5. *Designed Likert scale and response sheet.*



Graph 1. *Production graph before and after scheduling.*

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, by using various tools like inventory classification, scheduling, ERP, Likert scale, etc. This 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.

REFERENCES

[1] Chauhan G, Singh TP, Sharma SK. Measuring the status of lean manufacturing using AHP. *Int J Emerg Technol*. 2010; 1(2): 115–120p.

[2] Miller G, Pawloski J, Standridge C. A case study of lean, sustainable manufacturing. *J Ind Eng Manag*. 2010; 3(1): 11–32p.

[3] Sethi G, Pal P. *Energy Efficiency in Small Scale Industries – An Indian Perspective*. New Delhi: Tata Energy Research Institute; 2007.

[4] Chakraborty A, Deb SK, Bhattacharya R. Internal obstacles to quality for small scale enterprises. *Int J Excl Manag Res*. 2011; 1(1): 1–9p.

[5] Upadhye N, Deshmukh SG, Gard S. Lean manufacturing system for medium size manufacturing enterprise: an Indian case. *Int J Manag Sci Eng Manag*. 2010; 5(5): 362–375p.

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