

REFURBISHMENT SSD TESTERS BUILDING 1 ON PRODUCTION LINE AT NEW SITE

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ABSTRACT

This paper presents the result of a comprehensive refurbishment SSD Testers on production line at new site of Micron Memory Malaysia. The inadequate space in Solid State Drive (SSD) manufacturing line at first site to support new testers for additional New Incoming Product (NPI) is the core issue for this research. The best alternative is to loan temporary space to the other product assembly line to run new testers activities at second site which is the new Building 1. The findings depict an overall version of specific layout, testers' implementation lead time analysis and the impact latest testers quantity construct the balancing of capacity planning in operation. Based on this study able to capture on how the space has been utilized for allocated the SSD testers to support flourishing of upcoming demands.

1. Introduction

In the past few many years, a fourth business revolution has emerged and called Industry 4.0. Industry 4.0 takes the emphasis on virtual era from current many years to an entire new stage with the assist of interconnectivity through the Internet of Things (IoT), get entry to real-time facts, and the creation of cyber-bodily systems. This gives an extra comprehensive, interlinked, and holistic method to manufacturing. It connects bodily with virtual and lets in for higher collaboration and get entry to throughout departments, partners, vendors, product, and people. The revolution of industry 4.0 empowers commercial enterprise proprietors to manage and apprehend each issue in their operation and lets in them to leverage immediate facts to enhance productivity, enhance processes, and power growth. Many worldwide semiconductor industries compete to be the best in supplying cyber physical systems and one of them is company M [1][2].

Company M is a semiconductor company that offers the best industries broadest portfolio by developing and producing memory and storage technologies. It has steadily grown its presence in Malaysia to establish the Centre of Excellence for Solid State Drive (SSD) Assembly and Test. SSD or solid-state hard drive is a type of storage device used by computers. This non-volatile storage medium stores persistent data in solid-state flash

memory. SSD replaces the computer's traditional hard disk drives (HDDs) and perform the same basic functions as hard drives. However, SSDs are significantly faster than HDDs. With SSDs, the device's operating system boots faster, programs load faster, and files save faster. Solid State Drive technologies is developed successfully and contribute to be one of main profits for company M. Company M really concerns about the quality of the products are producing every day until has ability to create the ideal machines to ensure defects on finished products are close to zero. The company understands the importance of providing quality and excellent demand to manage workloads to avoid any profits losses [1] [3]. On middle of 2021, this company setup a new goal for having SSDs mass production by accepting high customers' demand. The aim is to add new incoming products (NPI) and bring a bulk of new testers to support the demand. However, the space to run new testers in SSD manufacturing line already maximize and inadequate in first site. After going through a lot of engineering discussion and analysis, the engineering team has unanimously agreed to find a temporary space at the new site of company M which is Building 1. Eventually, level 3 was selected to allocate all new testers. Level 3 in Building 1 technically belongs to another product manufacturing area which is Component Assembly and Test (CAT) yet there is still a cold shell space that can perfectly fix all new SSD testers to support upcoming products.

1.1 Problem Statement

The inadequate space for running new testers in SSD manufacturing line at first site has made the engineering team decided to move this tester to new site which is Building 1 in level 3. However, refurbishment activity is needed in level 3 since the space for new testers is shared with Component Assembly and Test (CAT) production line.

1.2 The objective of this project:

- i. To optimize the specific layout for the tester's activities for SSD manufacturing line.

1.3 The scope of this project:

- i. To oversee the installation of testers A and testers B that can be installed in Building 1 Level 3 according to schedule plan.
- ii. To balance out quantity of both testers for capacity planning in production by comparing previous capacity plan and the capacity new plan.

2. Materials and Methods

In this parts discussed overview of data collection process and method of SSD refurbishment manufacturing line. This project must be done by steps and follow the process flow to achieve stated objectives. In order to gain the project objectives, it is must to divide duties based on individual skills. This procedure is needed to ensure everything is on track as per scheduled. Also, it can ensure this project team is effective to monitor the appropriate execution in testers' setup.

2.1 Observation on project to gain understanding on SSD manufacturing line.

a. SSD Flow Process

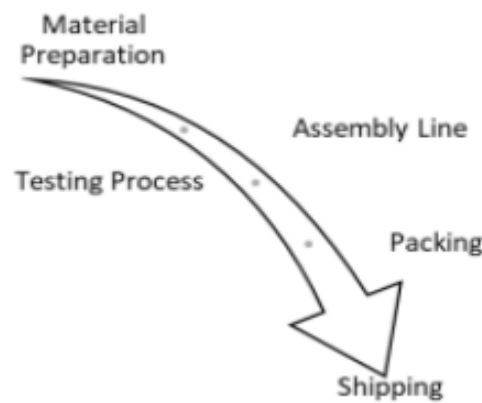


Figure 1 shows SSD Testers flow process in manufacturing line

b. SSD Tester Types

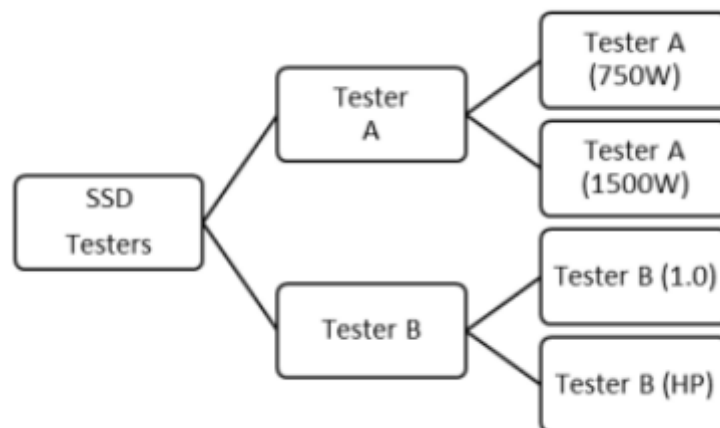


Figure 2 shows SSD tester's types

2.2 Method of data collection about project

a. Weekly project meeting on every Tuesday at 10am

The weekly project meeting on every Tuesday at 10am is held via zoom platform. The goal of this meeting is to update and discuss on testers activities status from each engineering site (Quality, Test and Process) and Finance team. The meeting also helps to keep the project moving forward based on schedule. Moreover, it allows to determine and remind all members which chores should be completed

soon, set new tasks as well as task to be remove and examine the status of current tasks and the amount of time left.

- Tool purchase types and flows in Company M

In order to get and track the testers, it is a must to understand how the flows in every tools purchase and types of purchase. In micron, there are two types of tool purchases.

i. New purchase

- Monthly purchase
- Weekly purchase

ii. Hardbook / Urgent purchase

This purchases have different process and procedure need to fulfil to get approval from local and global procurement site and Vice President. Figure below show flow process of standard new tool purchase in Company M.

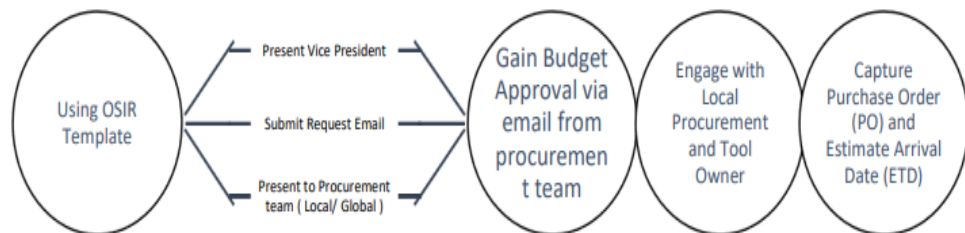


Figure 3 shows the flow of standard tool purchase in SSD testers' types.

- Testers' readiness activities process flow

After the purchased tools on-board in warehouse, those testers will be track in the readiness file. Below shows general flow of testers activities of testers that need to be capture in every stage.

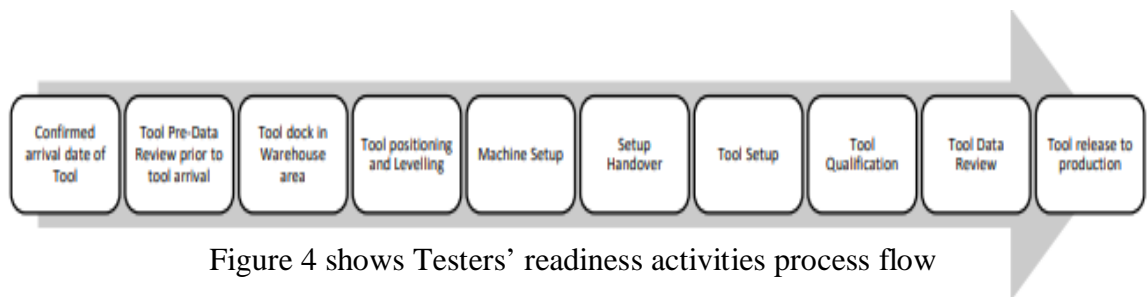


Figure 4 shows Testers' readiness activities process flow

b. Project monitoring software

Project monitoring software includes several useful features that help to manage project effectively from start to completion. This make organizing each project activity, assigning it to team members and following up on it easily.

- Monitoring activities testers activities using excel files.

There are two file that use to track and capture testers activities as

per planned in scheduled.

i. Testers and parts purchased order tracking file.

This file works as to track the testers and small parts status by tracking arrival dates, receive dates, lead time of shipment, requestor name, tool owner name, vendor shipment location and arrival site. There are a lot of communication and complex discussion needed to gain data from procurement team, tool owners and warehouse site.

ii. Tester's readiness activities file

This file works to track testers' activities in production line. Once the testers docked in Micron warehouse the file will starts to track all activities happen. Tool owners will be the one who report on the testers' activities time to time.

- Project design layout software by using Autodesk software:

AutoCAD AutoCAD is a computer aided program that created by Autodesk business. It enables to create and edit digital 2D and 3D designs faster and more readily than using hands. The data also can be readily download and keep in the cloud. This allowing the software can access from any location and any time easily. In this project the software is using to frame the level 3 production layouts also capture quantity and utilize space need to the testers.

- Tester forecast planning and capacity analysis by using Capacity Planning Software:

Capacity planning software is a programmable technology that assists manufactures in determining actual production capacity require and support to meet the changing loading demand for every product. In terms of capacity planning, the capacity will be calculating as maximum amount of work can be perform period by considering a lot of possibility and constraints in manufacturing line. The effective capacity is when the maximum quantity of work can do in given time.

2.3 Refurbishment of SSD Testers Building 1 Level 3 Flow Process

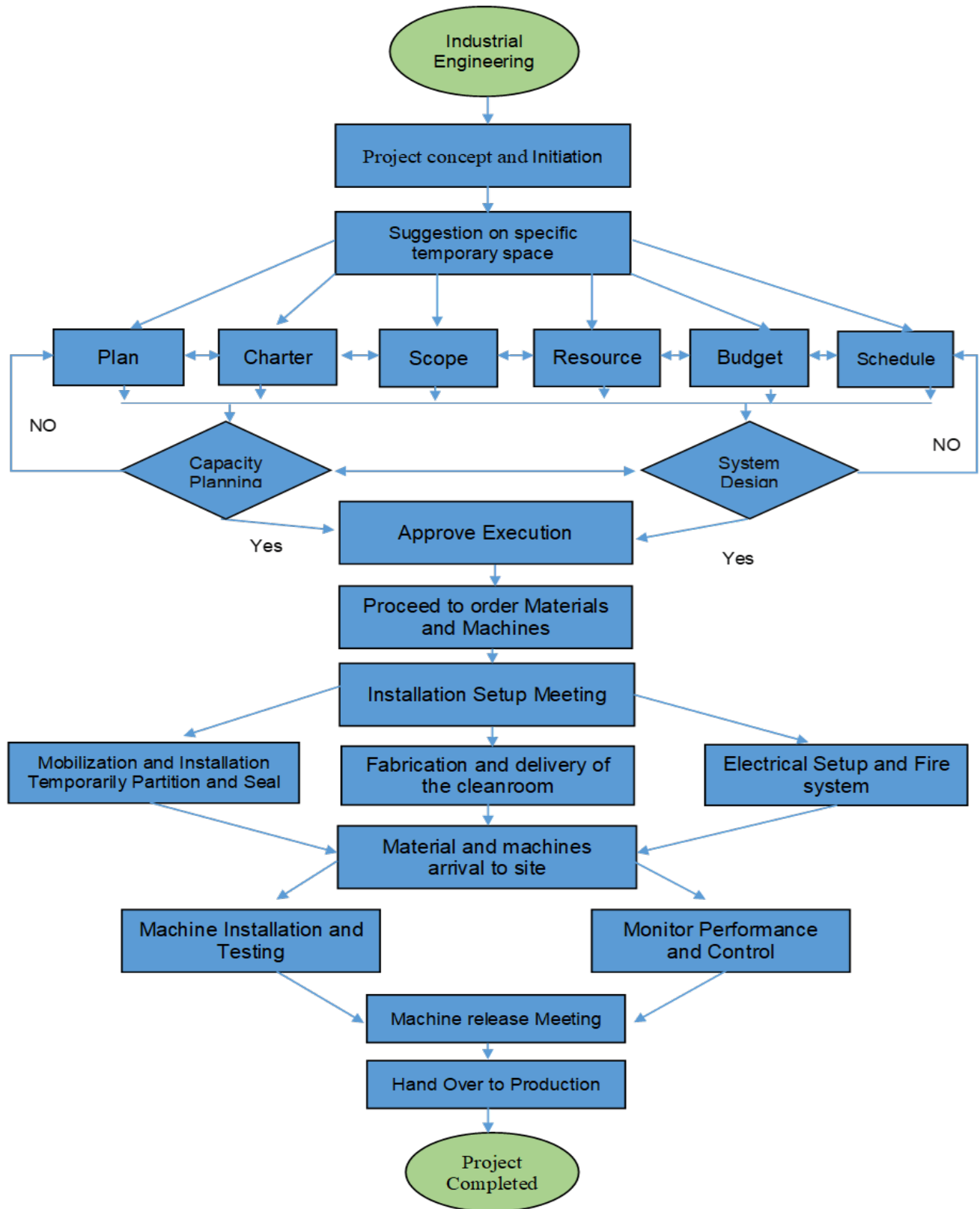


Figure 5 shows refurbishment SSD Testers Building 1 Level 3 flow process

3. Results and Discussion

3.1. Next objective is to reduce lead time these testers activities by 10% as compared to current activities before release to production. At this phase, the lead time is captured to compare previous testers and latest activities. Based on objective stated the reduction can be captured based on formula below:

Step 1: Average of lead time Testers A and Testers B

$$A = \frac{1}{n} \sum_{i=1}^n (ai)$$

A = Arithmetic mean (Average)

n = number of value (week)

a = Data set value

Step 2: Convert week to days.

$$\text{Days} = \text{Total of Week} \times 7 \text{ days}$$

Step 3: Convert Days into percentage.

$$\text{Days in percentages (\%)} = \frac{\text{Actual Days}}{\text{Plan Days}} \times 100\%$$

Step 4: Using different method to get reduction in lead time.

$$\text{Days Reduction} = \text{Previous Day (100)\%} - \text{Latest Day (\%)}$$

Notes : Plan lead Time = 4.3 Weeks = 31 days =100%

Below is Table 1 that shows the data after using formula stated to capture the reduction:

Table 1: Average Actual Lead Time in Week Testers A and Testers B

TESTER	PREVIOUS	LATEST (NEW)
A	6	4.5
B	8	7.1

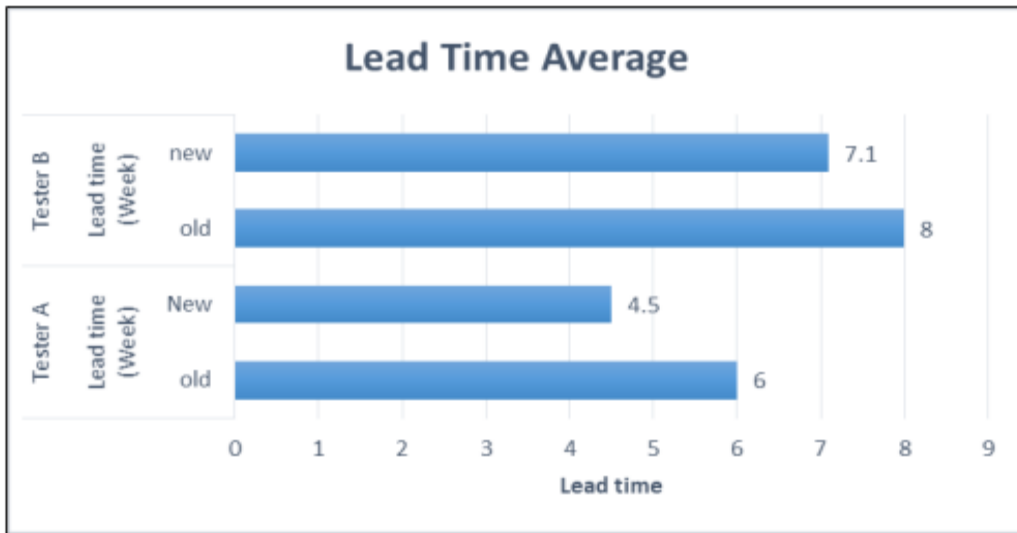


Figure 6 shows Average Actual Lead Time Previous VS Latest Tester A and B

Table 2: Reduction of Lead Time Testers A and Testers B

	PREVIOUS	LATEST (NEW)			
Tester	Total Count	Percentage	Total Count	Percentage	Reduction
A	42	135%	33	106%	29%
B	56	181%	50	161%	19%

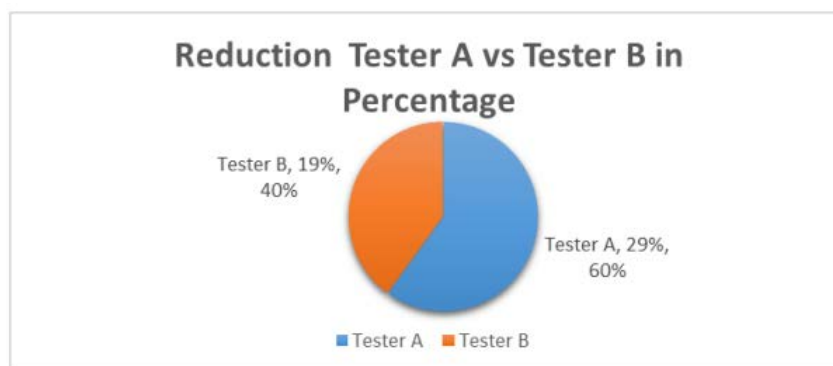


Figure 7 Reduction of Lead Time Testers A and Testers B

Based on this result, both testers are having reduction lead time compared to previous data. Based on Table 2, Tester A is having 29% of reduction meanwhile Tester B is 19%. There a few main factors can be highlighted on this study that effected towards previous and latest lead time.

- a. Type of testers
- b. Production line setup activities
- c. Engineering qualification and discussion

These three factors influence latency between the initiation and completion of SSD Testers process. The shorter period of completion is better for the testers. So, the testers can be release at production line and run the line.

3.2. Capacity planning helps production and planners decide which demand among a portfolio of products are options to prioritize and when. By having a balance capacity in these testers, planners will have best strategies to plan weekly loading demand for production. Previously, the plan is to insert the quantity of Tester A is 42 while Tester B is 99. However, this total created imbalance capacity plan. The best analysis is made to provide balance capacity to the testers' workstation based on space required.

By using capacity plan formula:

$$\text{Output per week} = \text{Capacity per tool (CPT)}$$

$$CPT = \frac{\text{Total Per Week}}{\text{Effective Process Time (EPT)} + \text{Handling Time}} \times \text{Load Size} \times \text{Tool Utilization (\%)} \times \text{Yield (\%)}$$

$$\text{Total Time Per Week} = 24 \text{ Hrs} \times 7 \text{ Days} = 168$$

$$EPT = \text{Test tim}$$

$$\text{Load Size} = \text{No.testes slots} \times \text{Tool primitive}$$

$$\text{Yield} = \frac{(\text{100 \%} - \text{First Past Yield}) + 100\%}{100\%}$$

The result shows as per tabled in Table 3 below:

Table 3: Result of Capacity Plan of Tester A and Tester B

WORKSTATION	PREVIOUS		LATEST	
Tester	Total Count	Capacity	Total Count	Capacity
A	42	243278	64	370709
B	56	464707	50	391031

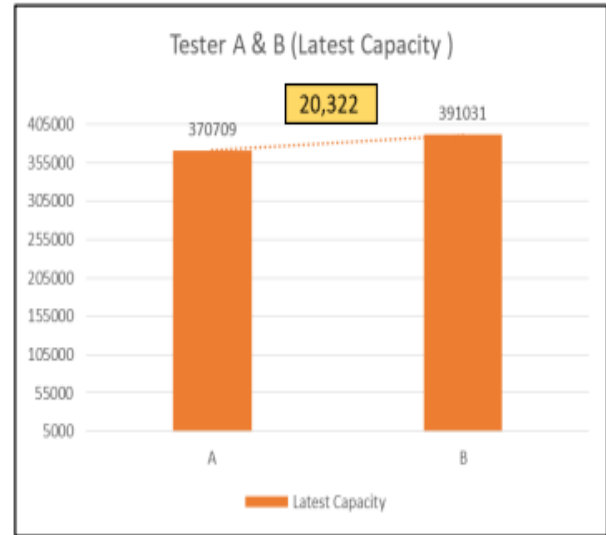
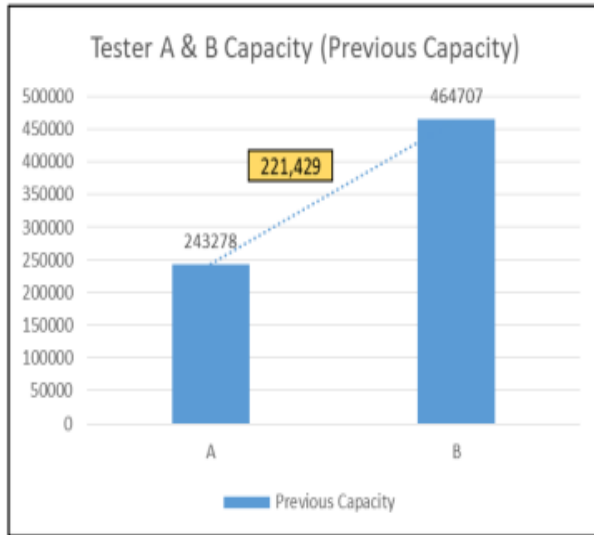


Figure 8 shows two graphs of previous Capacity Latest Capacity Testers A and Tester B

Based on this analysis, the latest capacity of both testers is almost balance. It can be capture by comparing at Figure 8. There are reasons the latest plan is planning to not reach equivalent. One of them due to customer request on specific product that need Testers B more than Testers A and next is the temporary space required to run at SSD Testers can supports around 145 and below quantity of testers. Generally, balance out the capacity for both testers are important to avoid bottleneck in production line. The impact will point a congestion in production system flow if workloads arrive to only one tester instead other. This can have a significant impact on the flow of SSD Testers line and sharply increase the time and expense of production. Line balancing is manufacturing engineering function in which whole collection of production line task are divide into equal portions. Well-balanced production line improve productivity.

4. Conclusion

There are methods to perform engineering layout design linked with lead time of testers' activities and capacity planning calculations under precision is described in this paper. The findings depict an overall version of specific layout, testers' implementation lead time analysis and the impact latest testers' quantity construct the balancing of capacity planning in operation. Manufacturing line balancing study based on capacity check from industrial engineering team also tends to employ thought and ingenuity to change conditions in production long term game plan. Manufacturing flexibility is the key to effective resource management. So, it is important to keep concerns and predict each issue happen in every part of SSD manufacturing activity to avoid worst scenarios. Based on this study researcher able to capture on how the space has been utilized for allocated the SSD testers to support flourishing of upcoming demands with the best plan loading plan for production.

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