

INTERNSHIP REPORT
WESTERN DIGITAL (THAILAND) Co., Ltd.



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INDUSTRIAL ENGINEERING PROGRAM
FACULTY OF INDUSTRIAL TECHNOLOGY
UNIVERSITAS ATMA JAYA YOGYAKARTA
YOGYAKARTA
2017

APPROVAL

The internship report which is written based on the internship at Western Digital (Thailand) Co., Ltd. during the period at April 19, 2017 to August 18, 2017 by:

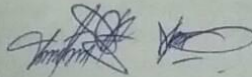
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Yogyakarta, 13th November, 2017

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To whom it may concern,

Dear Sir/Madam,

This is to certify that Ms. Eleonora Maria Pribadi, a student from Atma Jaya University Yogyakarta has completed the Cooperative & Work-Integrated Education in HDD Industrial Engineering department at Western Digital in Thailand.

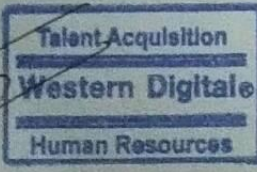
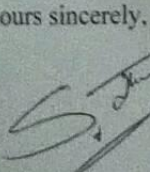
For duration of working weeks from April 19, 2017 to August 18, 2017
She completed the following project:

- 1. HDD Cleanroom B4L3 Phase 1 Flow and Capacity Improvement.
- 2. Back End Kanban Trolley and L-Cart Controlling.

During the working period, she has also improved upon different skills and knowledge that are recognized in the program of International Cooperative Education.

Presently, he has passed successfully all the project of Cooperative & Work-Integrated Education program.

Yours sincerely,



(Mr. Theerasak Sa-nguanmanasak)
Asia-University Relations & Recruitment Manager,
Western Digital (Thailand) Company Limited.

PREFACE

This internship report is made as one of the requirements to complete bachelor degree program. The internship program was done in Western Digital,Co.Ltd, Thailand on April 2017 until August 2018. The objective of this internship is to give practical knowledge in work field and connect between academics lesson and practical action.

On this opportunity, I would like to give my gratitude to :

1. God The Almighty
2. My parents, who fully support me
3. Mr. Yuparach Chaoyong, my supervisor from Western Digital,Co,Ltd who help me a lot during the internship
4. Mr. The Jin Ai, as my faculty supervisor who advise me during the report arrangement.

Last but not least, I realized that this report is far from the perfection. Therefore, I would be glad to receive the criticism and suggestion.

Yogyakarta, 10th November 2017

Author

(Eleonora Maria Pribadi)

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CHAPTER 1

INTRODUCTION

This chapter explains about the internship program in Department of Industrial Engineering, Universitas Atma Jaya Yogyakarta. This part explains about the background of internship and the objective of internship. Besides that, this chapter mentions the place and the schedule of the internship.

1.1. Background of Internship

Department of Industrial Engineering, University of Atma Jaya Yogyakarta (PSTI UAJY) defines the internship as a simulator that enables the students not only to apply the Industrial Engineering knowledge into real-world industry but also to train the student how to be a professional of Industrial Engineer. For this purpose, during the internship the students are requested to work in the host company for a period of one month.

The students should keep in their mind, that the paradigm of internship is that the students are expected to experience the application of Industrial Engineering knowledge in practice in which it can be obtained if during their internship the students do some activities to enhance their understanding in term of planning, designing, improving, implementing and problem solving. Therefore during the internship periods the students are requested to:

- a. Doing all the tasks that have been assigned by the host company
- b. Following all of relevant working procedures of the host company
- c. Capturing the big picture of the enterprise system in the host company and observing its characteristics

Since Industrial Engineer is dealing with the integrated system of some elements which are Man, Machine, Material, Methods, Money, Energy, Environment and Information, therefore during the internship the students should relate all of their activities in term of system perspective. Based on the explanation above, it is clearly seen that internship is not only gathering the data.

According to the Curriculum Document of PSTI UAJY, internship is an academic course in which the students should register for the course for 2 credits. Then, in order to fulfill the academic requirement of internship, the students are required to

submit an internship report. The performance of the student itself is evaluated both by on-site supervisor and by faculty supervisor.

1.2. Objective of Internship

The aims of the internship are:

- a. Practice discipline
- b. Improve the interaction between student and his/her ordinate or workmate
- c. Practice adaptability in the working atmosphere
- d. Observe the daily work in the host company
- e. Enhance the Industrial Engineering knowledge in practice by seeing the practical work in the host company
- f. Enhance the knowledge of enterprise system

1.3. Internship Location and Schedule

The internship was located at:

Western Digital (Thailand) Co., Ltd.
140 Moo 2, Bangpa-In Industrial Estate,
Udomsorayuth Road, Klongjig
Bangpa-In, Ayutthaya 13160 Thailand

The internship started from April 19th, 2017 and finished at August 18th, 2017 (4 months). Operation planning department selected as the place to do the internship. Internship schedule was started by the orientation of the process layout of the hard disk drive manufacturing at Western Digital. Followed by the finding the problem that need to be solved in project by the authors. Author started the projects after the introduction of the current situation for 2 weeks. Author conducted observation to know the problem for Weeks. Hence, author was discussing the solution that might be given to the improvement with mentor. The proposal of the improvement was analyzed using several methods to know the best solution. Lastly author presented the best solution that can be implemented to the HR Staff of Western Digital.

CHAPTER 2

COMPANY BACKGROUND

This chapter will explain about the company background, organized structure, and the management system in the company.

2.1. Company Profile

Western Digital, Co., Ltd is an American Company which one of the largest computer hard disk drive manufacturers in the world. At the beginning, western digital produced the chips as their main product. However in the early 1980s, western digital enter the data storage industry.

On April 23, 1970, Western Digital was founded by Alvin B. Phillips with name General Digital. The company also was supported with Emerson Electric, one of the American Multinational Company. Later on July 1971, General Digital changed their name to Western Digital and launch their first product, WD14024A UART (Universal Asynchronous Receiver Transmitter). In the 1975, Western Digital growth to the largest independent calculator chip maker in the world. On the 1976, Emerson withdrew the investment from WDC because of the financial crisis that was rooted from the world oil crisis.

On 1983, Western Digital making controller WD1003 for IBM. WD1003 is the basis of ATA interface and the product make the corporate growth. The company later acquired several hardware companies, such as graphics cards, core logic chipsets, SCSI controller chips for disk and tape, and networking. In 1988 WD also bought one of the PC hardware maker, Tandon and release their new products, ATA and XT attachment drives.

In 1990s the market for hard disk controller boards started to decrease because PC industry moved to ATA and SCSI disks. The WD Caviar, a disk using embedded servo and computerized diagnostic systems, boomed in this time, so WD decided to sell its other divisions.

In 1999 all HDD manufacturing was moved to Malaysia and the first drives for home entertainment users became available.

One year later in 2000 the first external drive was released, and in 2004 WD entered the mobile hard drive market. In 2006 the external drives WD Passport and My Book were released. In 2010 the first 2.5" notebook drive with 750GB

was released and one year later WD launched the first mobile hard drive with a capacity of 1 TB.



Figure 1.1. Western Digital in the World

Refer the Figure 2.1. today Western Digital has over 100.000 employees worldwide at locations in the US, Brazil, Malaysia, Thailand, Philippines, Singapore, Japan and China. Also Western Digital already acquired another leading computer data company, such as Hitachi, and SanDisk.

Western Digital Thailand

On 2001, Western Digital was acquired Fujitsu Thailand that was located in Pathumthani Province, Thailand. On February 7, 2002 the first customer hard drives were shipped.

In August 2003, Magnetic Head Operations were acquired and in the following years WD became one of the largest manufacturers of hard drives in Thailand. The company was growth rapidly, and was reached as one of the company with largest number of employers in Thailand with over then 27.000 employees. Until today over 750 million hard drives were shipped to customers all over the world, for example Dell, Lenovo, Microsoft or Samsung.

To serve the hard disk drives demand from around the worlds, Western Digital build another plan in BangPa-In, Thailand that was located around 20minutes

from the first plan in Pathumthani. The second plans was built to produce 2.5” Hard Disk Drives, and to produce the Head Stack Assembly (HSA).

In October 2011, there is a big flood in Thailand. Western Digital Thailand was flooded in 2meter depth, after that the operation was stopped. The impact of that natural disaster is there are hard disk drive shortages all over the world, and the price of hard disk drives was increased.

Fortunately after 6months, the engineer team could restore the hard disk drives operation with several plans changes due the broken machines and building. Building 3 that would be allocate for the plan, was allocate for the offices and building 4 that would be allocate for the offices was allocate for the plans.

Currently, Western Digital Plants that located in Bang Pa-In Industrial Estate, Ayutthaya was produced over than 150.000 hard disk drives each day, with total space 82.000 square meters. Western Digital Plants plant in Bang Pa-In also served HGST Plants in Prachinburi Province, to do the testing process.

2.2. Organizational Structure

Executive Organization



Figure 2.2. Executive Organization 1

Western Digital is one of the leading international companies that based in USA. The organizational structure that Western Digital has was led from USA and also was chained with other company business in the world. Refer to figure 2.1, and 2.2 are the Executive Board Organization that was led Western Digital across the world. For Figure 2.1 is the executive board that was leading from the

management strategy and was led by Chief Executive Officer, then for figure 2.2 is the executive board and led by Chief Operating Officer.

Executive Organization



Figure 2.3. Executive Organization 2

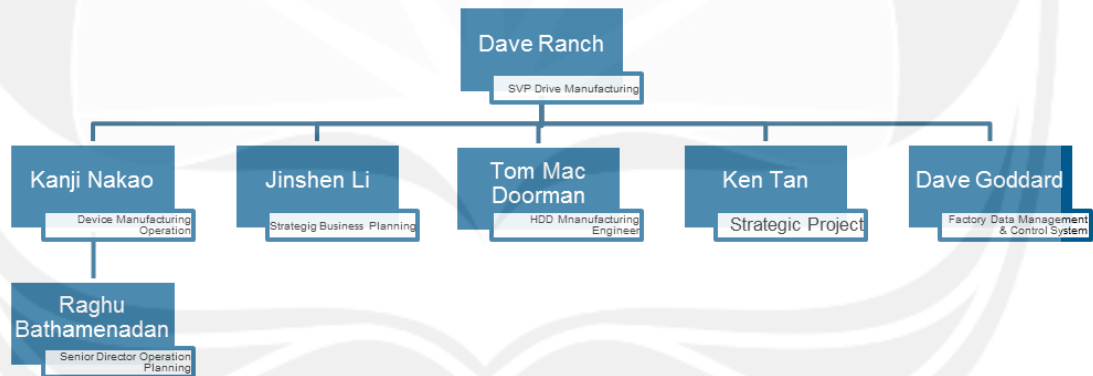


Figure 2.4. Director Organization for HDD Manufacturing

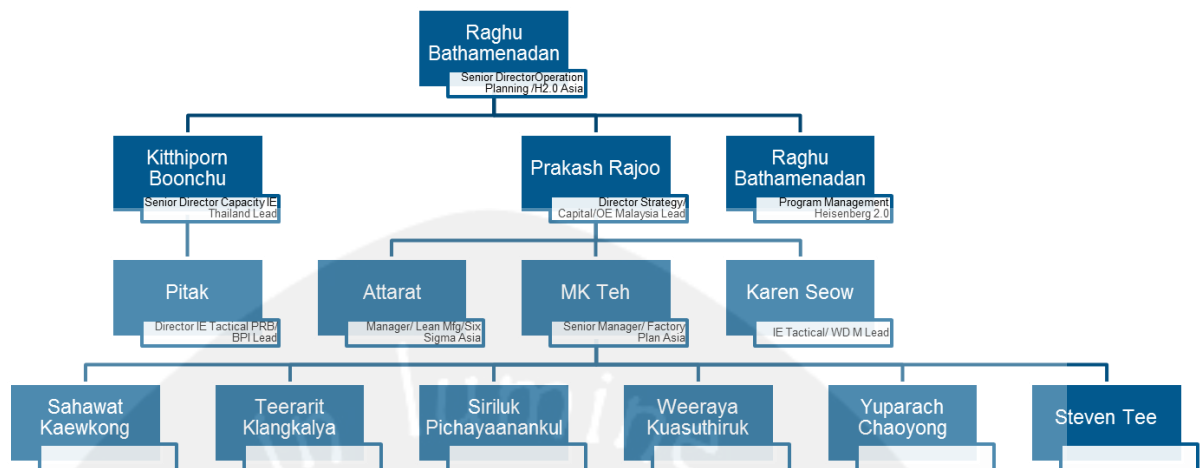


Figure 2.5. Organizational Structure Management HDD

Refer to Figure 2.5 author was placed under author's mentor, Yuparach Chaoyong in Thailand that is working under Senior Manager Mr. MK.Teh who has office in Kuala Lumpur. This structure were root from Director operation Planning for Asian, Mr. Ragu Bathamenadan that work under Mr. Kanji Nakao as Director of Device Manufacturing Operation (see figure 2.4). Mr. Kanji Nakao work under Mr. Dave Ranch as SVP - HDD Manufacturing and working directly under the COO.

2.3. Management of the Company

Vision:

To empower people to create, manage, experience and preserve digital content

Mission:

To sustainably delight customers with an unmatched experience, product breadth, quality and reliability

The WD Way is the way of the company implements knowledge of behavior and values to the employee. These are the WD Way

Integrity

1. Deals with people honestly, openly, and respectfully
2. Ensures words and actions are consistent
3. Admits mistakes
4. Influences to others to act with integrity when faced with ethical situations
5. Maintains confidentiality
6. Speaks up when faced with others' contrary opinions and ideas

7. Represents information and data accurately and completely

Passion

1. Demonstrates energy and commitment, even in the face of significant challenges
2. Shows commitment to colleagues and is actively engaged in organization "life"
3. Faces changes and challenges with resilience and a positive attitude
4. Takes personal responsibility to resolve issues and provide effective solutions
5. Commits to professional growth and development
6. Coaches and provides guidance to others
7. Committed to growth, welcoming and using coaching and feedback
8. Looks for and addresses the impact of process, policies, practices, actions and decisions on customers
9. Routinely plans for successful results, includes taking preventative action
10. Intensely focuses on achieving quality results

Innovation

1. Applies new ideas to improve products and processes to benefit the business
2. Demonstrates innovative and creative thinking
3. Uses critical thinking to solve problems
4. Influences others to implement new ideas to benefit the business
5. Identifies and removes barriers that impact achievement and excellence
6. Supports others' new ideas and innovative thinking
7. Is not afraid to take risks and try new things

Collaboration

1. Positively influences others when faced with change and challenge
2. Supports others without being asked
3. Seeks first to understand before being understood
4. Adapts interaction style to work effectively with others
5. Assesses the impact on others before taking action
6. Takes accountability for team results
7. Works to achieve win-win solutions and results with others
8. Actively looks for ways to build strong working partnerships with other functions, reducing silos

9. Works beyond job scope to support team goals
10. Proactively shares ideas to prevent and overcome problems and assure quality result



CHAPTER 3

COMPANY SYSTEM

3.1. Business Process of Department

Author was worked on HDD IE (Hard Disk Drive Industrial Engineer) Department. The main job in the IE Department is to make improvement towards the production lines. The member of IE Department usually working on projects with the other departments. Therefore the business process that was shown on Appendix 1 , was the business process of the improvement project.

The projects usually started by IE Departments that proposed the improvement ideas. After that following the data gathering of the current situation, IE Departments consulted with Facilities Planning and Facilities Engineer department that have more accurate data and current situation better than IE Department. Later the IE Departments needs to have approval of the projects from the Top Management, before they can start the projects. If the project was approved, the project still needs to be consulted with the other departments that will affect by the improvement.

After the projects got approval, then the purchasing department should make the purchasing order to buy the material or machine that support the improvement projects. To buy the new material, purchasing department will consult with both of external consultant, and the IE Department as the owner of the projects.

After buy the material, then the projects are ready to implement (project buy-off). When the project implementation, all of responsible party will coordinate the project buy-off, and do the inspection for the project. After finished the installation of the improvement, then the contractor need to provide the training for the employee, and labor to know how to use the machine or how the new process will going on. Then facilities engineer, that responsible with shop floor will handle over the improvement to the current process and the project was done.

3.2. Product

Western Digital as a digital storage manufacturer has many products. Refer the Figure 3.1 shows type of products from Western Digital.

There are 6 categories of product from Western Digital. These are *desktop, mobile, enterprise, audio visual storage, network-attached storage, and digital*

home. The most popular products are desktop and mobile hard drive. Desktop category consists of internal and external hard drive for PC (desktop). Mobile category consists of internal and external hard drive for laptop.



Figure 3.1. Western Digital Products

3.2.1. Desktop Product

There are two types of desktop products, internal and external desktop drives. The desktop drives was built from 3.5" Hard Disk Drives.

Refer the Figure 3.1. shows types of internal desktop drives with different purposes. Western Digital provides solutions of data storage for customer with colors. WD has segmented their storage lineup into easy to recognize colors that give customers the power to choose the right product for their needs. *WD Blue* for everyday used. *WD Green* for capacity used. *WD Black* for performance used. *WD Red* for network attached storage (NAS) used. And *WD Purple* for surveillance used. WD offers more than a one-size-fits-all storage solution.



Figure 3.2. Internal Desktop Drive

Refer the Figure 3.2 the example of external desktop drive for Windows and Mac. My book for Windows has capacity of 2TB – 4 TB. This product is optimized with USB 3.0 port to transfer data with a high speed than with USB 2.0 port. Western Digital plants a backup system inside the drive for data security.



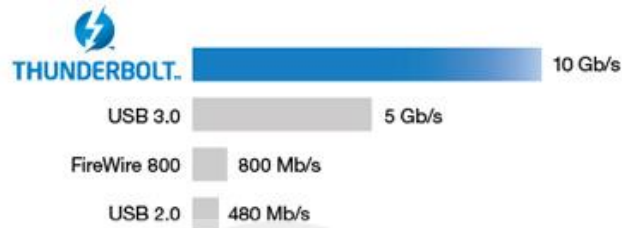
Figure 3.3. My book – External Desktop Drive for Windows

Refer the Figure 3.3 My Book Thunderbolt Duo is an example of external desktop drive for Mac. It has 4Tb – 8TB of capacity. This external drive is supported by *Thunderbolt* and *RAID* system. *Thunderbolt* is a performance system for hard drive to transfer data with a high speed.



Figure 3.4. My Book Thunderbolt Duo – External Desktop Drive for Mac

Refer the Figure 3.4. the comparison of the transfer speed can be seen at Figure 3.5. Whereas, RAID system is a system that enables user to select the drive between RAID and JBOD (Just a Bunch of Disk). When set to RAID 0 (striping), My Book Thunderbolt Duo offers the performance you need when designing or editing graphics-intensive media files. When set to RAID1 (mirroring), this drive provides double safe data protection by automatically generating a duplicate copy of your data. Set to JBOD (Just a Bunch of Disks) to use as two individual drives and select between HFS+J or FAT per disk. It is Ideal for running Windows OS on a Mac.



Stated transfer rates for Thunderbolt, FireWire, and USB 3.0 and USB 2.0 are based on published specifications from Intel, Apple and USB.org. Actual transfer rates will differ significantly based on system configuration. Performance testing by WD resulted in an average actual transfer rate for Thunderbolt of >250 MB/s on 6 TB systems and >225 MB/s on 4 TB systems.

Figure 3.5. Transfer Speed Comparison

3.2.2. Mobile Product

Mobile drive product or known as 2.5" drive. Mobile drive products are classified into internal and external drive. This product dedicates to provide storage location for laptop. External mobile drive products are already known as portable hard drive. It is compatible for Windows and Mac operation system.



Figure 3.6. My Passport Pro – Portable drive for Mac

Refer the Figure 3.6. is an example of external mobile drive for Mac operation system, My Passport Pro. It has 2TB – 4TB of capacity. This hard drive is supported by thunderbolt transfer feature.



Figure 3.7. My Passport Ultra – Portable Drive for Windows

Refer the Figure 3.7. is an example of mobile portable drive for Windows operating system, My Passport Ultra. It has 1TB – 2TB of capacity. It performs high speed data transfer using 3.0 USB port. It also has a feature for local or cloud data backup.



Figure 3.8. Internal Mobile Drive

Refer the Figure 3.8. is an example of internal mobile drive. Western Digital provides solutions of data storage for customer with colors. WD has segmented their storage lineup into easy to recognize colors that give customers the power to choose the right product for their needs. *WD Blue* is for everyday use. *WD Green* is for capacity. *WD Black* is for performance. *WD Red* for network attached storage (NAS). WD offers more than a one-size-fits-all storage solution. The new innovation of internal mobile drive is WD Black. This is a combination between Solid State Drive (SSD) and HDD. Customer can have the speed from SSD and also the capacity from HDD in their notebook.

3.2.3. Enterprise Product

Refer the Figure 3.9 is none of the enterprise products, WD Sentinel DS6100. Enterprise product is storage solution for business. This product is suitable to store a huge number of data for an enterprise. Enterprise hard drive uses up to four 3.5-inch data center class WD Se hard drives and integrated data protection with either RAID or Windows Storage Spaces. This product has 8TB – 16TB of capacity.



Figure 3.9. WD Sentinel DS6100 – Enterprise Product

3.2.4.AV Storage Product



Figure 3.10. My Passport AV-TV

Refer the Figure 3.10. is one of AV storage product, My Passport AV-TV. AV storage product is built to record TV program and watch it whenever you want. Created with an AV-grade drive inside, My Passport AV-TV delivers high-quality recording and crystal-clear playback of all your favorite programs making it the perfect drive for your recordable TV. My Passport AV-TV is designed to withstand the high demands of always-on, video streaming environments, giving you 24x7 reliability.

3.2.5.Network Attached System (NAS) Product

Refer the Figure 3.11. is a product of consumer series, My Cloud Mirror. It has 4TB – 8TB of capacity. NAS product is the answer from Western Digital to follow the new storage technology using network, as known as cloud computing. Cloud computing enables users to store and access the data whenever and wherever they are, using internet service. There are two types of NAS product; Consumer series and Expert series. Consumer series product is for personal usage. Save everything in one safe place at home and access it from anywhere using computers, tablets and Smartphone.



Figure 3.11. My Cloud Mirror – Consumer Series

Refer the Figure 3.12. is one of expert series product, My Cloud EX4. It has 0TB – 16TB of capacity. The other series is Expert Series. High-performance, four or two-bay NAS for the home or small office with advanced features and a full suite of apps for a truly customized NAS experience.



Figure 3.12. My Cloud EX-4 – Expert Series

3.2.6.Digital Home Product

Digital home product is another product from Western Digital for home entertainment. Refer the Figure 3.13. is WD TV product, WD TV enables users to play and watch video file from many formats. This product also enables users to watch movie with streaming online. WD TV can be used to play video from many storage devices.



Figure 3.13. WD TV – Digital Home Product



Figure 3.14. WD Elements Play

Refer the Figure 3.14. the other digital home product. It is WD Elements Play. This product enables users to watch movie with high resolution. This product also has a feature to record and store the movie. So, users can replay the movie whenever they want.

3.3. Production Process

Based on Appendix 2, the production process for 3.5inch hard disk drive was starting from the receiving department and will ended on shipping department.

a. Receiving Material

In this process the receiving department, received the materials that coming from supplier. The supplier was sent the material in the box, therefore in this process the receiving department should open the boxes and move material from

receiving department to the kitting department. Besides of products that need to be kitting in clean room, there are some material that can be used in other departments (for example label for helium seal installer), then that material only need to be sent to that department directly.



Figure 3.15. Receiving Department

b. Kitting Out

In the kitting department, material that was coming from the receiving department will be prepared before assembly process. Kitting department was consisted on three functions, the Kitting Out Process, Cleaning Process, and Kitting In Process, and all of them were performed inside the clean room. The Kitting Out process is the process when the operator open the first layer of the plastic bag that protect the material. Then there are several material that need to be clean first before go to kitting in process, and there are material that does not need to be cleaned first.



Figure 3.16. Kitting Out

c. Compound

In this room, the materials that need to be cleaned from the kitting out will be washed in this room. The material will be washed using the O2 inside the machine. Mostly material that need to be cleaned is the material that was coming from teardown station to be reworking later.

d. Kitting In

Kitting In is the process to open another layer of material packaging if they have it. And move the material to the tray that will be used in assembly line.



Figure 3.17. Kitting In

e. Auto Stack Dis Stack and Media Writing (ASDS & MDW)

This process was performed only for 2.5" products for media part, before assembly line and does not operate on 3.5" products. The objective on this process is to write the signal on the media for the hard disk, while for 3.5" was performed on seeding process.

This process started with Dis Stack the media from the package that coming from the supplier, then write the signal using MDW machine, after that stacking again the media for the assembly process.

f. Assembly

Assembly line is the process to assembly the material to be a hard disk drive. There are some operations i.e. install media, balances drives, install the head stack, install top cover, install bottom cover, etc. After each process, the operator

also did the Visual Manual Inspection, if the product is defect then products need to be removed from the line and placed in to the rework products.



Figure 3.18. Assembly Line

g. Seeding

Seeding is the process to write the signal to the media that used. This process only for 3.5inch products, because for 2.5inch product the writing signal process was done on Media Drive Writer (MDW).

This is the main difference between process of 2.5inch and 3.5inch. The 2.5inch process is write the signal first, then assembly the whole part while the 3.5inch process is assembly the part first then writing the signal.



Figure 3.19. Seeding

h. Print Circuit Board Assembly

Print circuit board assembly (PCBA), is the first process that was performed outside the clean room. The operator received the disk from the conveyor then started to assembly the product using the PCBA station.



Figure 3.20. Print Circuit Board Assembly

i. Helium Charge

This process is filling the hard disk drive with helium gas, and seal them using a label on other station.



Figure 3.21. Helium Charge

j. Filler

Filler is the process of filling hard disk drive. This process was performed using two types of machines, X-Caliber Machine, and SPT Machine.



Figure 3.22. SPT Filler Machine

k. Helium Discharge

Before testing the hard disk drive, the next process is removing the helium that was filled before. The process starting with removes the seal label on the seal removal station, and move to the helium discharge station.

l. Back End Tester

Back end testing is the process to check the quality of the hard disk drives that was performed 100%. There are 3 different machines for 3.5inch product that used to this task, X-Caliber, Omega, and Saturn, while for 2.5inch using X-Caliber and Optimus.



Figure 3.23. Back End Tester Machine

m. Sorting

In back end tester, the products was processed in aggregate. Therefore before packs the products need a sorting process to identify each type of products.



Figure 3.24. Sorting Station

n. Back End Stream Line (Pack I and DCM)

This process was form by two different station, DCM station and Pack I station. DCM station is the station that was printed the label in hard disk drive, while Pack I station is the station that was printed each batch/tote and also identified each hard disk drive.



Figure 3.25. Back End Stream Line

o. Quality Assurance

This process is re-testing several hard disk drives with sampling method. The number of hard disk that needed to be tested is depends on the requirement from each customer. However the hard disk that doesn't need to be tested cannot go through the next process, because needed the batch acceptance first. Therefore there are WIP sections nearby the quality assurance to place the holding products.

p. Packing II

After quality assurance test, the hard disk drive need to be packed before shipped to customer. In packing two stations, there are two processes, the operator will pack the hard disk drives into one plastic package and seal it then the operator will placed the hard disk inside one box until the box is full with hard disk. Then after one box is full the operator will send the box using conveyor to the carton sealer.



Figure 3.26. Packing II Station

q. Palletizing

After sealed the box, the hard disk drive boxes will re-organized in pallet. In this process, the hard disk drives also will divide for each customer.



Figure 3.27. Palletizing Station

r. Shipping

The shipping action will perform by external company, because western digital does not have shipping department. The trucks from vendor will pick the products and deliver it directly to the customer or to the ports.

3.4. Production Facility

Refer the Table 3.1. Western Digital Thailand has 2 factory sites. The first factory is located in Industrial Estate Authority of Thailand (I-EA-T Free Zone) at BangPa – In Industrial Park, Ayutthaya. There are 7 buildings in this site. Each building has different operation for manufacturing. The second factory is located in Navanakorn Industrial Park, Pathumtani. This site is used to manufacture Head Gimbal Assembly. This site was HGST factory before acquired by Western Digital. The building 1 and 2 that used for assembled wafer into HGA, tooling, with work hour 24 hours. Building 2 and 3 manufacturing HSA and HGA, Building 4 for manufacturing HDD and engineering labs. Building 6 also as place for manufacturing HDD, HGA, and HSA

Table 3.1. Production Facilities

No.	Building	Function
1.	Building 1&2 	<input type="checkbox"/> Finished wafer processing into slider form and assembled into HGA <input type="checkbox"/> Process/Tooling R&D <input type="checkbox"/> Working hour: 24 hour/7days
2.	Building 2/Level 3 	<input type="checkbox"/> Manufacturing HSA to Support Desktop & Mobile HDD <input type="checkbox"/> Process, Equipment, Tooling and Automation Development <input type="checkbox"/> Manufacturing HSA and HGA
3.	Building 4 	<input type="checkbox"/> Manufacturing HDD for Desktop & Mobile application <input type="checkbox"/> Engineering labs
4.	Building 6 	<input type="checkbox"/> Manufacturing HDD for Desktop <input type="checkbox"/> Manufacturing HSA and HGA
5.	Navanakorn Site 	<input type="checkbox"/> Manufacturing HGA

CHAPTER 4

INTERNSHIP ASSIGNMENT

This chapter would be the explanation of the job that was assigned to the author during internship, and the result of the job that assigned. Hence, this chapter will be filled by the assignment scope, the author responsibilities on company, methodology to do the assignment and also the result of the job.

4.1. Assignment Scope

I was placed on Industrial Engineer Hard Disk Drive Department that has office on Building 3. However, the Industrial Engineer department job was controlled the Hard Disk Drive manufacturing operation on building 4. Supported the mentor's job that related to improvement project and conducted own experiment project was the job that assigned.

Before started the improvement experiments project, at the first 4 weeks, author's mentor were assigned the author to learn the whole process by doing the direct observation at the shop floor, and read the company documents. The objective of this task is to know the condition and to do the problem formulation that related with the current situation. During the problem formulation, author was found the topics that can be used for the projects that will assigned.

The project that was conducted is an assessment on the new layout that will be implemented on the Clean Room. The project is the part of the Clean Room improvement. The clean room improvement project is the project that was develop by the manufacturing department and Industrial Engineer department. The objective of the project is to reserve the place for the new line machine that will operate on February 2018. The new line machine cannot fix in the current layout due the line is longer than the current layout.

The first step of the improvement project is the data collection. Author was find the cycle time of each process in clean room, and the capacity from each machine. The data was provided from the database. However not every data was provided in the database, therefore author was collecting the data directly from the shop floor. During the data gathering, author was also worked with the manufacturing department that has office on building 4. The reason of the author

project was related with the manufacturing department that has more specific data rather than the Industrial Engineer Department.

The next step of the clean room improvement is designing the new layout based on the propose requirement. The designing process was done by author's mentor. The new machine line will located on phase 1 of the clean room. The reason is the new product line cannot be placed on phase 2 because the phase 2 has already fixed their position. However in the phase 1, the current layout does not have enough space. Hence, there will be a swap in the layout, Seeder machine cell in phase 1 will be swap with the assembly line machine and the seeder machine will be placed after assembly line. After the relocation the production process will become a flow shop on phase 1.

After that the job that was conducted is asses the layout changing. The objective is to prove that the propose clean room layout is better than current layout, because the its reducing the production flow, and reduce the number of equipment and operator. The data that was needed is the distance between two station before and after layout changing. And the calculation sheet of the seeder requirement. The result of the equipment and employee requirement used in the decision making before the project was approved by the project member.

4.2. Rights and Responsibilities

Author responsibility was conducting the preliminary research, and finds the data that support the layout designing process. Therefore the right that given is to find the data from the database, and go to the shop floor for direct observation. After that the designing layout process was conducted by author's mentor. After the new layout developed, author job's is to assess the propose layout before it presented to the team member.

During the observation, author should consulted author's job with author's mentor, and also make a weekly presentation. At the end of the internship, author also should conducted the final presentation, in fron of the management.

Here are the rights that author has in the company :

- a. Author permitted to observe the whole process inside the manufacturing site, and also to documented the process and gathered the data.

- b. Author was allowed to ask all of the information that needed from the responsibility party (other employee).
- c. Author permitted to doing a discussion with the mentor related with the strategy that might be implemented in the project.
- d. Author was permitted to access the company database using internal intranet site.

And the author's responsibilities :

- a. Author should do the problem formulation to find if there is problem inside the production process
- b. Author, should observe the flow in the company, and report the data related to the mentor.
- c. Author should make weekly presentation progress, and discussion with the mentor
- d. Author should make the final presentation in front of the management.

4.3. Methodology to complete the assignment

Author project in Western Digital was to change the layout process in the Clean Room Area to support the new machine that produce new products, and also to integrate the material flow to the back end area on the next processes.

Author was conducted the research experiments that explained by the figure 4.1.

Author started the project by learn the whole production process, and also gather the data that needed in the production process. During the direct observation, author also was assigned to find the process time of every process and also did the identification for every place group in the operation process, and the distance for every process or area. After doing the direct observation, author was found the problem and makes the problem formulation before reported to the author's mentor.

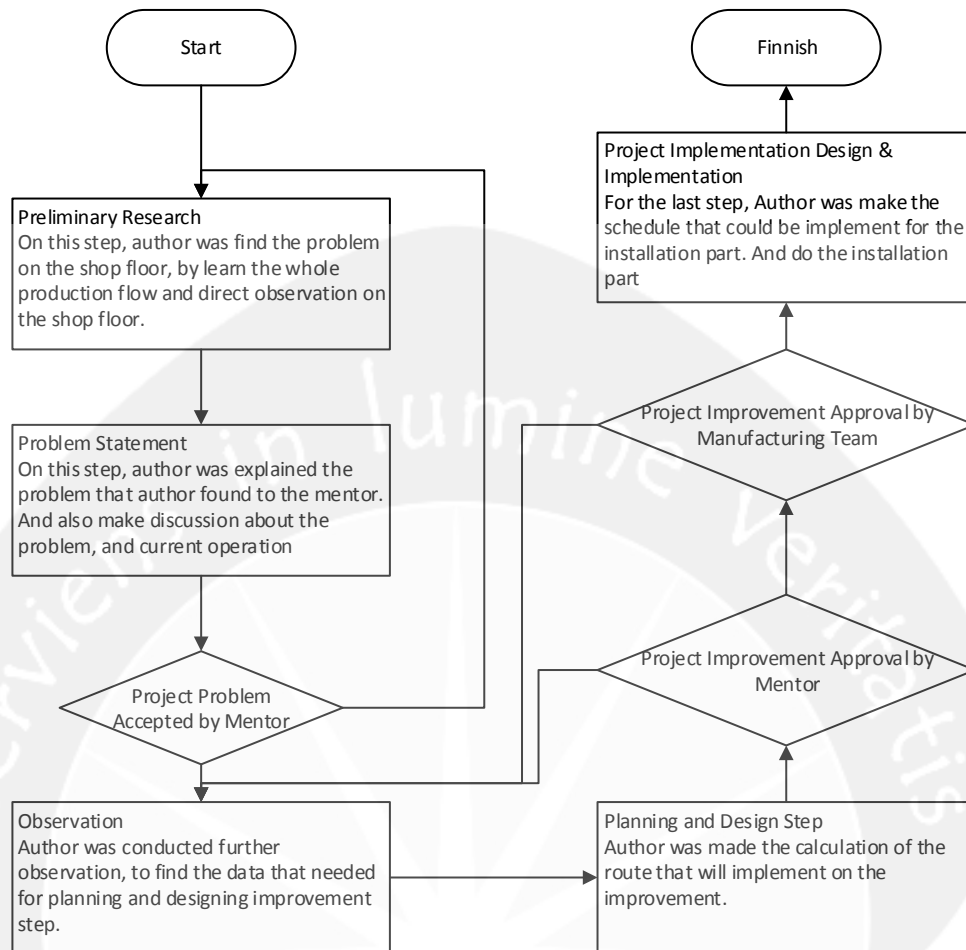


Figure 4.1. Flowchart Methodology

After the report brought to the author's mentor, Author mentor gave several corrections for the current problem that author brought, and ask author to do the revision. After the problem formulation was right, author was approved to do the next step that is the main observation.

On the main observation, author was conducted two different experiments that is the time and motion study experiments, and also the capacity planning calculation. This data would be used for the planning and design because, to know the benefit of the projects. For gathering the capacity planning experiments, author was helped by other member of IE Departments that responsible for Clean Room, Tester Scheduling, and Back End.

On the planning and design step, author job was to support the data and did the calculation for the new flow that was provided from the author's mentor. And find the benefit of the transportation time, and the number of operator requirement.

After finished the calculation and design, author's mentor was accepted author job and did the presentation for the manufacturing department to implement the design of the clean room improvement during the manufacturing project meeting.

Then, when the project almost ready to be implemented, author also was helped author's mentor to schedule the progress that will be doing for the improvement and make the timeline based on the requirement day.

4.4. Result of Assignment

In this sub-chapter author will divided the explanation into three different parts, that is the assignment related to the operation flow, experiment project improvement.

a. Operation Flow

Before author found the problem on the project, author was assigned to make the whole process and also to mapping the machine on the shop floor. On this project, there are several documents that made to complete the task.

The process flow document was made on excel spreadsheet, and the map was made on AutoCAD Software. The objective of this assignment is to make author know the layout of the whole manufacturing area, and to find the direct problem while conducting the observation.

Process Flow For 3,5" HDD (Prime)										
No	Process	Description	Machine/Tester slot capacity	Process WIP		Process2process handling method		Number Handling WIP	Process To	Distance
				Name (Pallets / Row) Shelf/Rack	Photo	Name (Trolley/Type) Shelf/Rack/ Trolley (for different seeder line)	Photo			
e	Assembly	Process to join the body of the hard disk drive, with certain methods.						56		Lane 1a: 39.7m; Lane 1b: 38.9m (automat); Lane 2: 2.5m
f	Seeder	Giving the media with the capacity that can be used to hard disk	60	Shelf/Rack		feeder		40 Drives	f	Lane 1a : 3.76m; Lane 1b: 1.5m; 1c : 7.5m; lane 2:0.5m
	Auto Seal Leak Test	Send the drives to outside the clean room using the conveyor	-	Shelf/Rack		Conveyor		$n = \text{capacity of conveyor}$ $a = \text{HDD Length, } 14.5\text{cm} + \text{space of 1st and 2nd HDD } 17\text{cm}$ $= 31.5\text{cm}$ $b = \text{HDD Length } 14.5\text{cm} + \text{Space of each HDD } 2.5\text{cm}$ $= 17\text{cm}$ $c = \text{HDD Length } 14.5\text{cm}$ $s = \text{Length of Conveyor } 400\text{cm}$ $S = a + (n-2)b + c$ $400 = 31.5 + (n-2)17 + 14.5$ $354/17 = n-2$ $n = 20.82$ $n \approx 20$		
g	PCBA	Put the drives with the Circuit board	1	Kanban Rack		kanban trolley				4m helium 3rd floor SEEDER LINE 1a : 148.3m; 1b: 24.5m; line 1c: 14.8m; line 2: 233.2m; helium

Figure 4.2. Process Flow for 3.5" Products



Figure 4.3. Western Digital Layout for Building 4 Level 1

Map Key

- Receiving Department
- Saturn Machine for Back End Tester
- Omega Machine for Quality Assurance Machine
- Packaging II Area
- Back End Automation Area
- Back End Stream Line



Map Key :

Tester for Prachinburi Drives

- Helium Charging and Discharging Process
- EOT Machine to Filler Process
- X-Calliber Machine for Back End Process
- X-Calliber Machine for Filler Process
- Omega Machine for Back End Tester
- Back End Tester for 2,5" Hard Disk Drive

Figure 4.4. Western Digital Layout for Building 4 Level 2

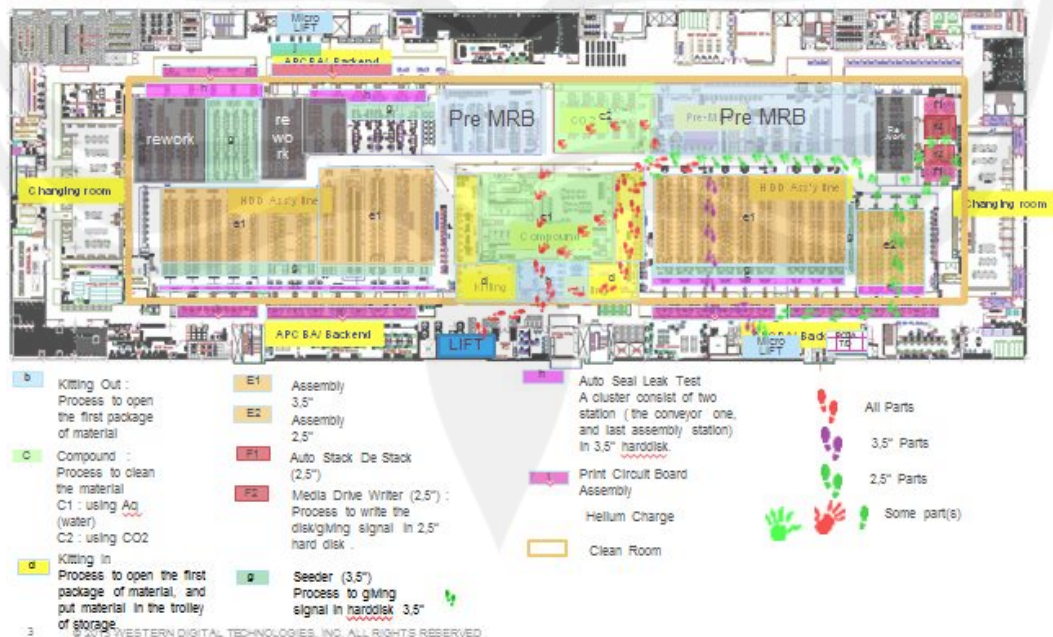


Figure 4.5. Western Digital Layout for Building 4 Level 3

b. Experiment project improvement

After conducting the preliminary research, author was doing the problem formulation to identify the problem was coming from. To identify the problem, author was made a fishbone diagram.

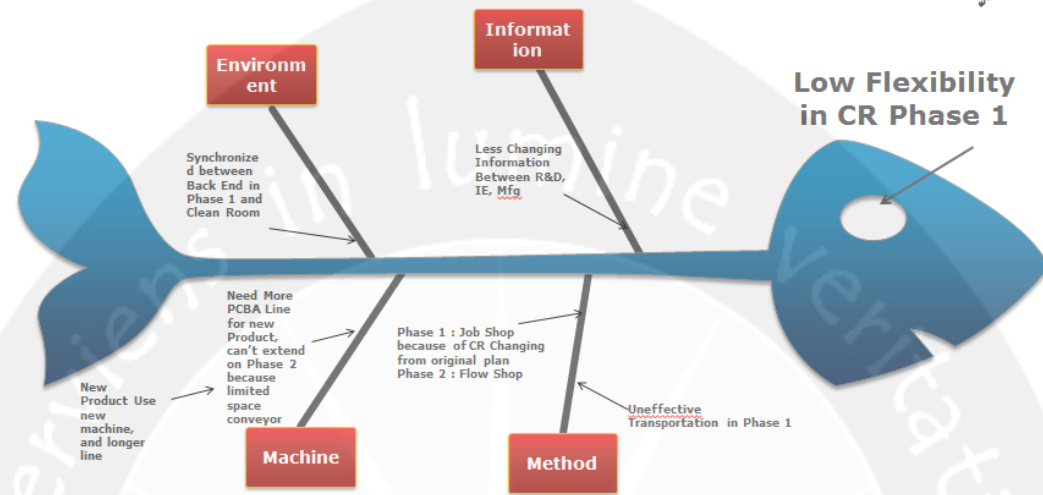


Figure 4.6. Fishbone Diagram for Problem

Based on the fishbone diagram on figure 4.6., author was known that there is problem on the clean room. The problem is there's no enough flexibility for the clean room phase 1 compare to clean room phase 2.

As seen on figure 4.7, the distance for the process movement from assembly line to the seeder in clean room phase 1 is 40m and it remark with blue line, and in phase 2 is only 0,5meter. The other process that have different distance, is from PCBA process to Lift that remark with yellow line, in phase 1 the distance is 150m, while the process from phase 2 distance is only 25m.

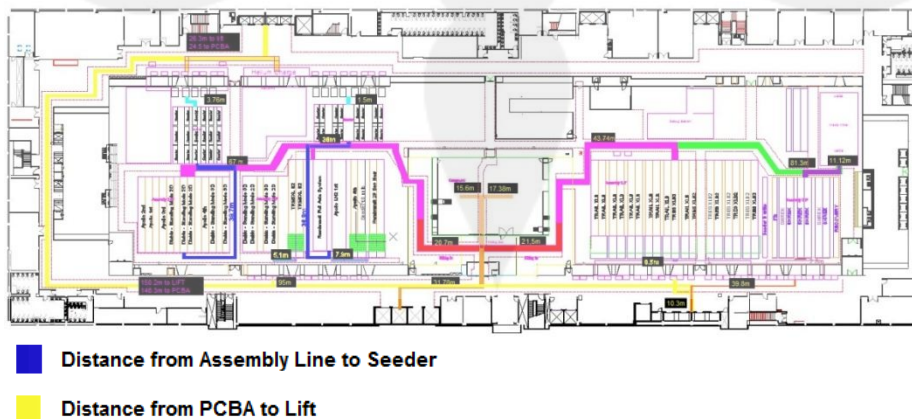


Figure 4.7. Building 4 Level 3 Layout with Path

The next reason is there will be a new products type that will build on clean room, and it required a different type of machine. The new assembly machine length is longer than the current assembly line machine, and it will not fit with the current layout. And the new products also required more machine on PCBA Station, from current products that is 2 PCBA station/assembly line become 3 PCBA station/assembly line. However the new products only can be built on phase 1 clean room, because on phase 2 there is no space left.



Figure 4.8. Building 4 Level 2 Layout with Area

The other reason is that on the back end tester that located on 2nd level of the building only located on phase 1 of the building (on the right side), the phase 2 was performed back end test for hard disk that were built on PRB Plan Clean Room. Hence, the optimization of layout should be performed on Clean Room Phase 1.

After the problem formulation, author was started the projects with find the other data that used for designing the new layout. Author, was find the cycle times for several process that doesn't have standardize cycle time and also the cycle times capacity for several types on machine.

TIME STUDY SHEET																			
Operation : Load In EOT				Studied By : Eleonora Maria Pribadi															
Product : HDD 3.5"				Date : 20/6/2017															
No.	Element Description	Category	Frame (29 Frame / Sec.)	9%										Freq / Cycle	Avg / Unit (Sec)	%Rating	Basic Time	Std. Time	Remarks
				1	2	3	4	5	6	7	8	9	10						
1	Move the drive from trolley to EOT	Man	Start	2.08	3.03	3.91	4.87	5.92	6.81	7.82	9.01	9.89	11.14	1.000		100%			
			End	3.03	3.91	4.87	5.92	6.81	7.82	9.01	9.89	11.14	12.46						
			Convert to Sec	0.950	0.880	0.960	1.050	0.890	1.010	1.190	0.880	1.250	1.320						
			Start	12.46	13.34	14.44	15.48	16.31	17.46	18.53	19.43	20.80	21.63	1.000		100%			
			End	13.34	14.44	15.48	16.31	17.46	18.53	19.43	20.80	21.63	22.55						
			Convert to Sec	0.880	1.100	1.040	0.830	1.150	1.070	0.900	1.370	0.830	0.920						
2	Close the EOT Gauge	Man	Start	22.56	23.56	24.58	25.67	26.76	27.73	28.69	29.62	30.73	31.87	1.000	1.03	100%	1.03	1.12	
			End	23.56	24.58	25.67	26.76	27.73	28.69	29.62	30.73	31.87	33.02						
			Convert to Sec	1.010	1.020	1.090	1.090	0.970	0.960	0.930	1.110	1.140	1.150						
			Start	0.91	1.49	1.95	2.45	2.92	3.43	3.89	4.40	4.93	5.38	1.000					
			End	1.49	1.95	2.45	2.92	3.43	3.89	4.40	4.93	5.38	5.87						
			Convert to Sec	0.580	0.460	0.500	0.470	0.510	0.460	0.510	0.530	0.450	0.490						
3	Scan the EOT Gauge	Man	Start	5.87	6.23	6.71	7.19	7.75	8.38	8.79	9.26	9.72	10.42	1.000					
			End	6.23	6.71	7.19	7.75	8.38	8.79	9.26	9.72	10.42	10.87						
			Convert to Sec	0.360	0.480	0.480	0.560	0.630	0.410	0.470	0.460	0.700	0.450						
		Man	Start	10.87	11.34	11.90	12.44	12.98	13.49	14.03	14.54	15.09	15.57	1.000	0.51	100%	0.51	0.55	
			End	11.34	11.90	12.44	12.98	13.49	14.03	14.54	15.09	15.57	16.08						
			Convert to Sec	0.470	0.560	0.540	0.540	0.510	0.540	0.510	0.550	0.480	0.510						
3	Scan the EOT Gauge	Man/Machine	Start	52.930	54.570	56.080	57.610	59.270	60.850	62.440	63.970	65.480	67.010	1.000					
			End	54.570	56.080	57.610	59.270	60.850	62.440	63.970	65.480	67.010	68.540						
			Convert to Sec	1.640	1.510	1.530	1.660	1.580	1.590	1.530	1.510	1.530	1.530						
		Man/Machine	Start	68.54	70.15	76.93	78.57	80.12	81.62	83.050	84.590	86.150	87.780	1.000					
			End	70.150	71.730	75.570	80.120	81.620	83.050	84.590	86.150	87.780	89.430						
			Convert to Sec	1.610	1.580	1.640	1.550	1.500	1.430	1.540	1.560	1.630	1.650						
3	Scan the EOT Gauge	Man/Machine	Start	89.430	90.96	92.510	94.000	95.660	97.140	98.650	100.140	101.780	103.340	1.000	1.57	100%	1.57	1.71	
			End	90.960	92.510	94.000	95.620	97.140	98.650	100.140	101.780	103.340	104.930						
			Convert to Sec	1.530	1.550	1.490	1.620	1.580	1.610	1.540	1.620	1.570	1.560						

Figure 4.9. Example of Time and Motion Study Sheets

		TRAILS XLB	TRESXLB2	DIABLO 2S	DIABLO 3S	embrnDT -LN	APOLLO	SHREK LT	HREKLT US	FBLITE	MAX	AVERAGE	MIN
PRT Ratio	Prime + Rework	85.42%	86.63%	75.41%	84.97%	51.87%	51.21%	52.85%	55.16%	70.83%	87%	78.01%	51
	RECYCLE	9.12%	8.47%	13.37%	9.57%	20.83%	38.34%	25.54%	24.78%	15.70%	38%	13.49%	8
	Tear Down	5.46%	4.90%	11.22%	5.45%	27.30%	10.45%	21.61%	20.06%	12.89%	27%	8.45%	5
BE Yield	100.00%	93.99%	88.39%	92.94%	94.41%	88.56%	92.74%	90.00%	91.32%	92.30%	94%	90.88%	0.88
Blended Output		11370	11443	7812	8979	10245	8063	7924	8211	9341	11443	10237	7811.7
Assembly	CT (sec)	11.5	11.5	15	15	7.5	15	12.5	12.5	15	15	12.4	7
	Yield	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99.16%	99
	DGR	7043	7043	5400	5400	10800	5400	6480	6480	6480	10800	6658	54
	Capacity/ hrs	314	314	240	240	480	240	288	288	288	480	296	24
	capacity after ra	268	272	181	204	249	123	152	159	204	272.01784	233	122.89
MDW TT	minute							4.5	4.5	5.5	5.5	5	4
	DGR							300	300	246	300	274.068022	24
ASDS TT	second							20.00	20.00	50	50	34	7
	DGR							4050	4050	1620	4050	2883	16
Ratio ASDW and MDW	TT (min)							14	14	7	13.5	10	6.5853
Seeder	Yield	9.20	8.71	11.50	18.50	21.00	23.00				23	11	8.7
	DGR	99.60%	99.70%	99.30%	99.20%	98.70%	97.50%				100%	99%	98
	DGR	2348	2480	1879	1168	1029	940				2480	2155	9
	DGR											0	
APCBA	CT (s)	14	14	14	14	25	14	15	15	15	25	14	7
	DGR	5496	5496	5496	5496	3078	5496	5130	5130	5130	5496.4286	5393	30
	DGR											0	
	DGR											0	
	Helium Charge (190	190	431	431	1020	431	250	250	250	1020	265	15
	Down Time	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	1	0.5
	DGR	12150	12150	5356	5356	2263	5356	9234	9234	9234	12150	10036	22
	DGR											0	
	Seal Install (sec)	6	6	6	6	6	6	6	6	6	6	6	6
	Down Time	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95
	DGR	13500	13500	13500	13500	13500	13500	13500	13500	13500	13500	13500	1350
	DGR											0	
	Seal Removal	6	6	6	6	6	6	6	6	6	6	6	6
	Down Time	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95
	DGR	13500	13500	13500	13500	13500	13500	13500	13500	13500	13500	13500	1350
	DGR											0	
	Helium Discharge	300	300	431	431	800	431	250	250	250	800	327	24
	Down Time	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95
	DGR	7695	7695	5356	5356	2885	5356	9234	9234	9234	7695	7387	28
	DGR											0	
Filler Yield		99.40%	99.50%	99.40%	99.30%	98.90%	98.60%	98.40%	98.40%	98.30%	100%	1	98
BE Test Time	Filler EOT	10.5	7.7	15.8	16.33333333	38	25				38	11.7	7
	Down Time	95%	95%	95%	95%	95%	95%				95%	95%	95
	DGR	268	366	178	172	74	112				366	237	7
	DGR											0	
	Filler Neptunes	7.6	6.5	12.1	13.93333333	38	23	11	11	8.4	38	10	6

Figure 4.10. Capacity Planning Sheet Example

After found that data, the next step is makes the design of the clean room. The designing process was finished by author's mentor. The new design of clean room phase 1 will based on clean room phase 2 that seeder will placed directly

[illegible]

For the loop 2, the trolley that was used is kanban trolley that has 120 products for the capacity. Refer from table 4.2., the number of trolley requirement for current layout is 22 trolleys and for propose layout is 19 trolleys. The number of feeder also reduces on the 2nd loop, from current layout 5 people become only 1 person.

Table 4.14. Benefit of Propose Layout

Refer to the table 4.14, there are cost difference if implement the propose layout that coming from saving cost. From usage of L-Trolley is \$460/month, kanban trolley \$795/month, and from feeder is \$6.522/month. That benefit calculation is the calculation without new products consideration. If there is new products, the benefit will increase because new products line have capacity greater than the current products line.

CHAPTER 5

CLOSURE

This chapter will explain the conclusion of the project and the recommendation that could be implemented for company.

5.1. Conclusion

On this projects Author have been made conclusion as following:

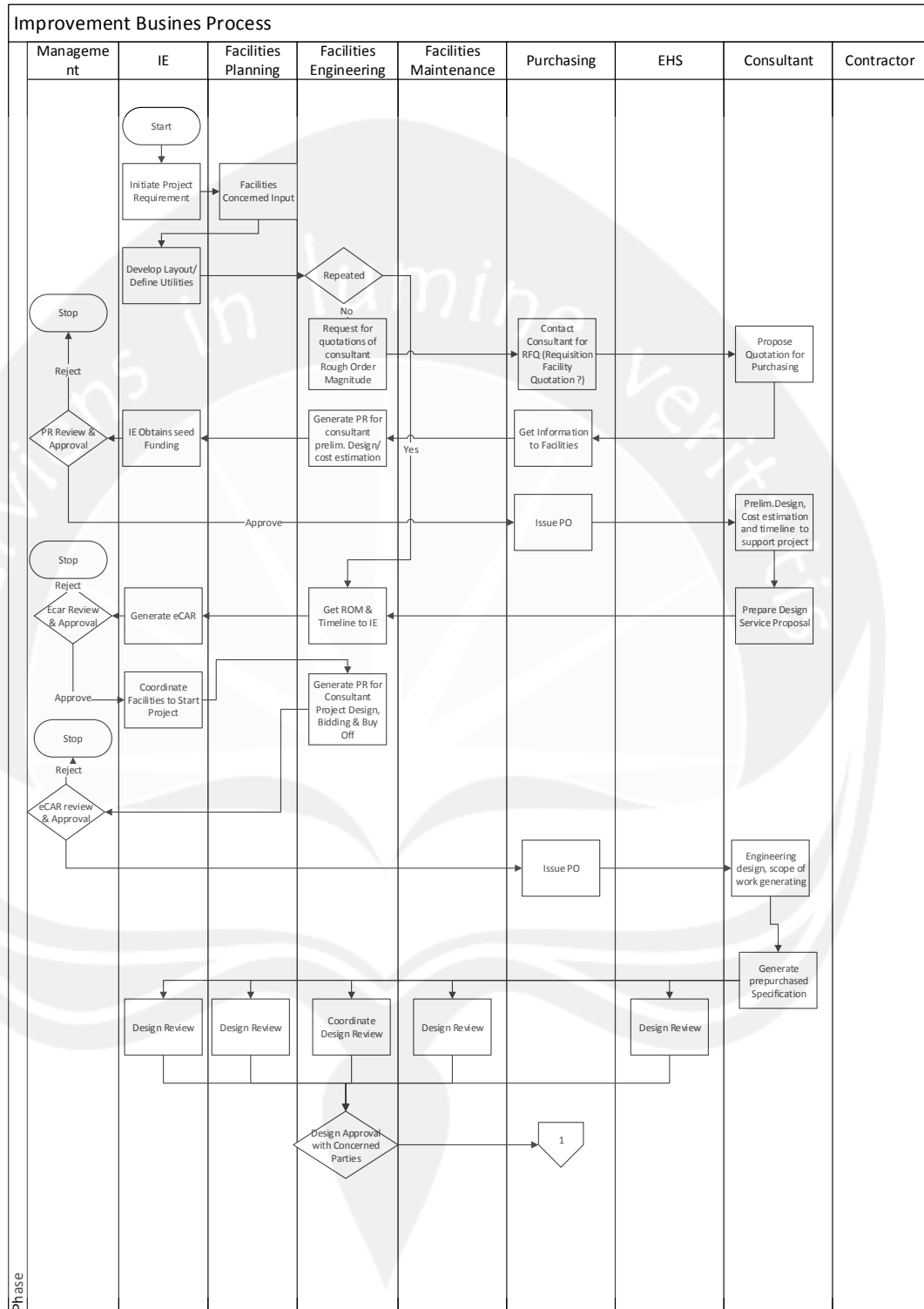
- a. Author have been conducted the projects to improve the flow inside the clean room.
- b. This project was limited on calculate the benefit that can be received
- c. This project was limited by the ability of author to used only English language to asking the employee
- d. This project was resulted the feasibility of the benefit that could be given if changing the layout.

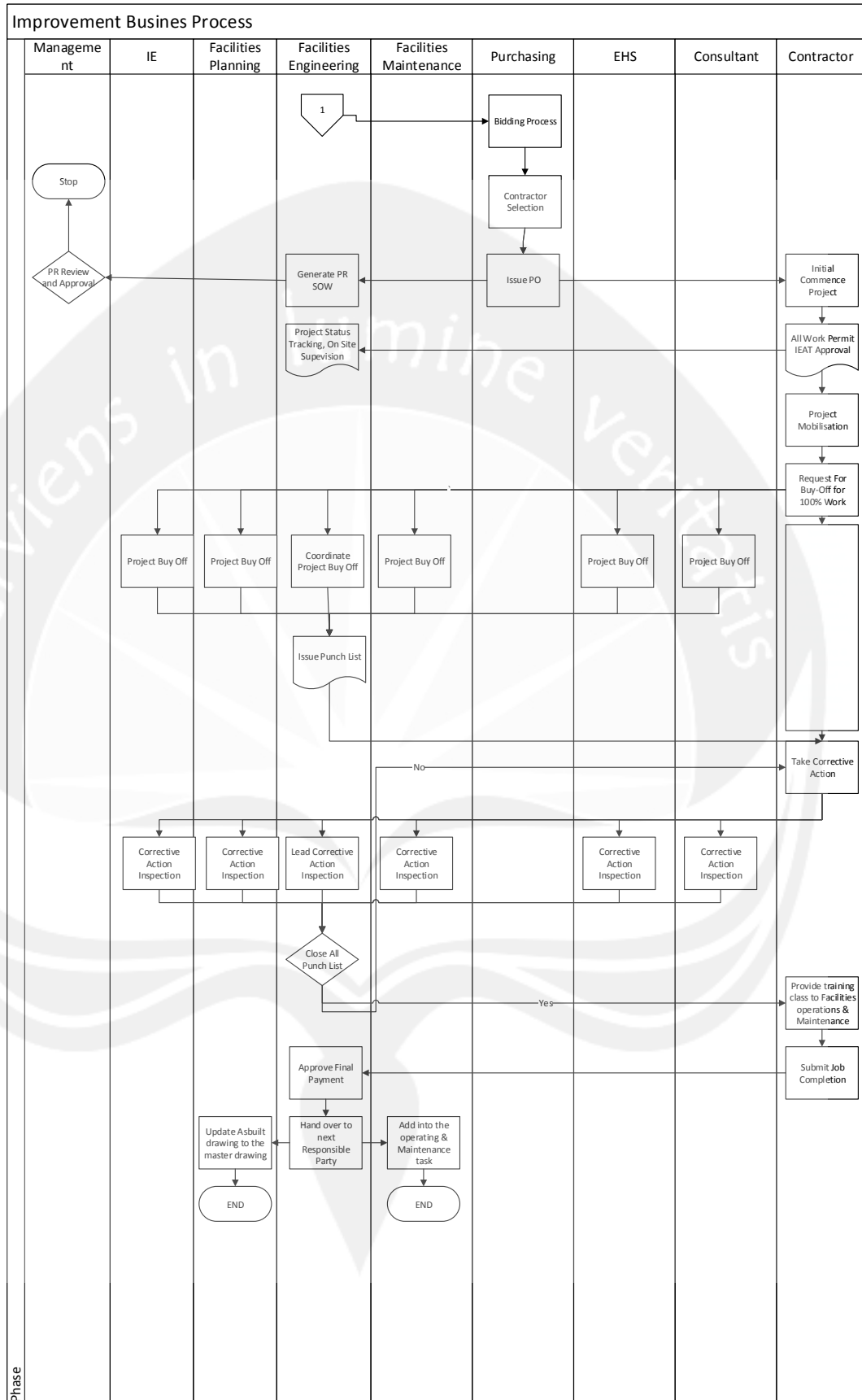
5.2 Recommendation

The recommendation is the improvement that could be implemented on the company, and also for student who is doing internship on Western Digital:

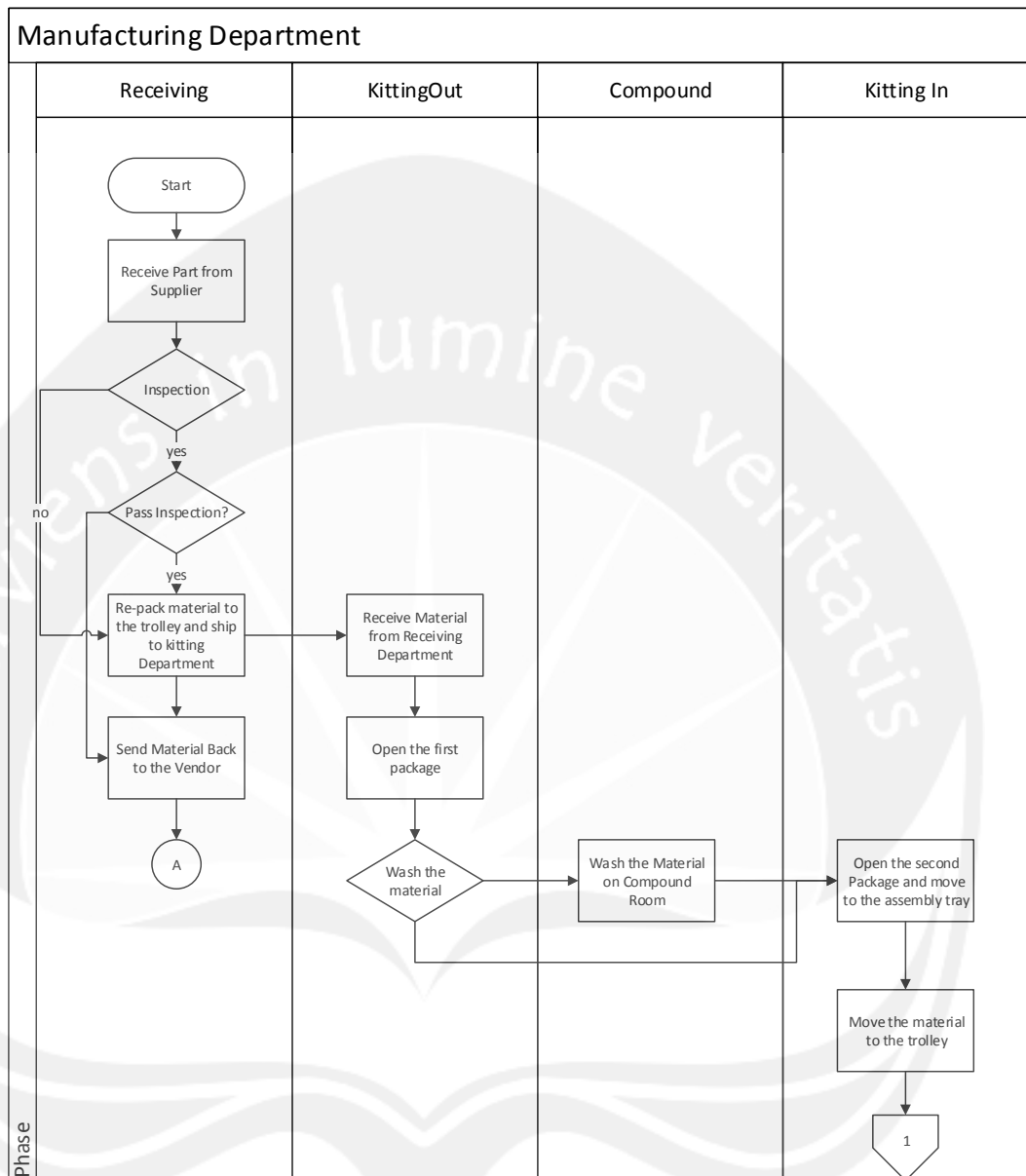
- a. The company could have ERP system for officer worker, because the data that provided on the intranet is a little bit hard to find (needed data number first, that requested manually).
- b. The company can help the ability of Thai language for international co-op student, to improve their job skill in the company
- c. The student should be active to ask question to the responsible party in the company, because there are limitation in language it is a bit difficult

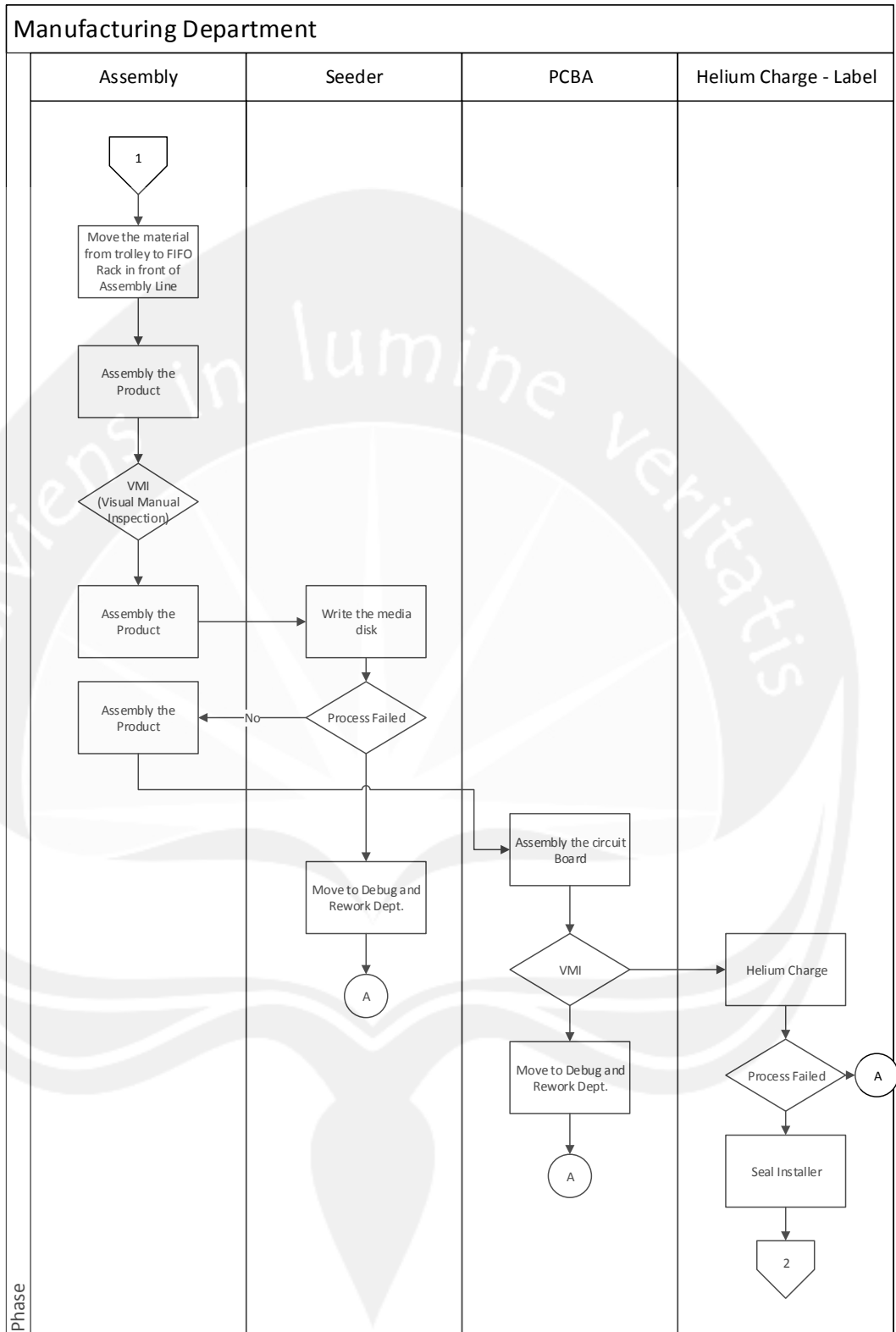
Appendix 2. Improvement Business Process

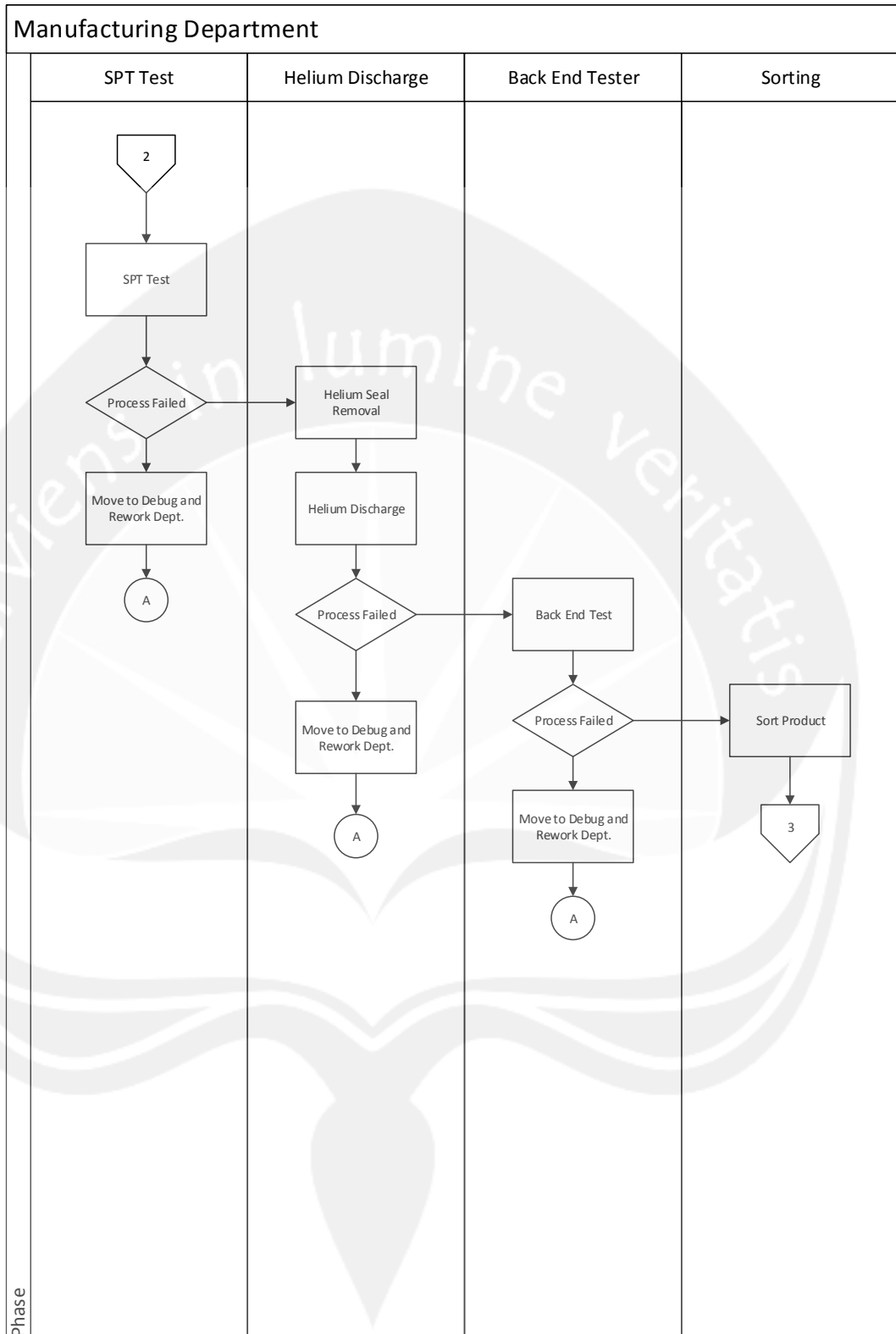


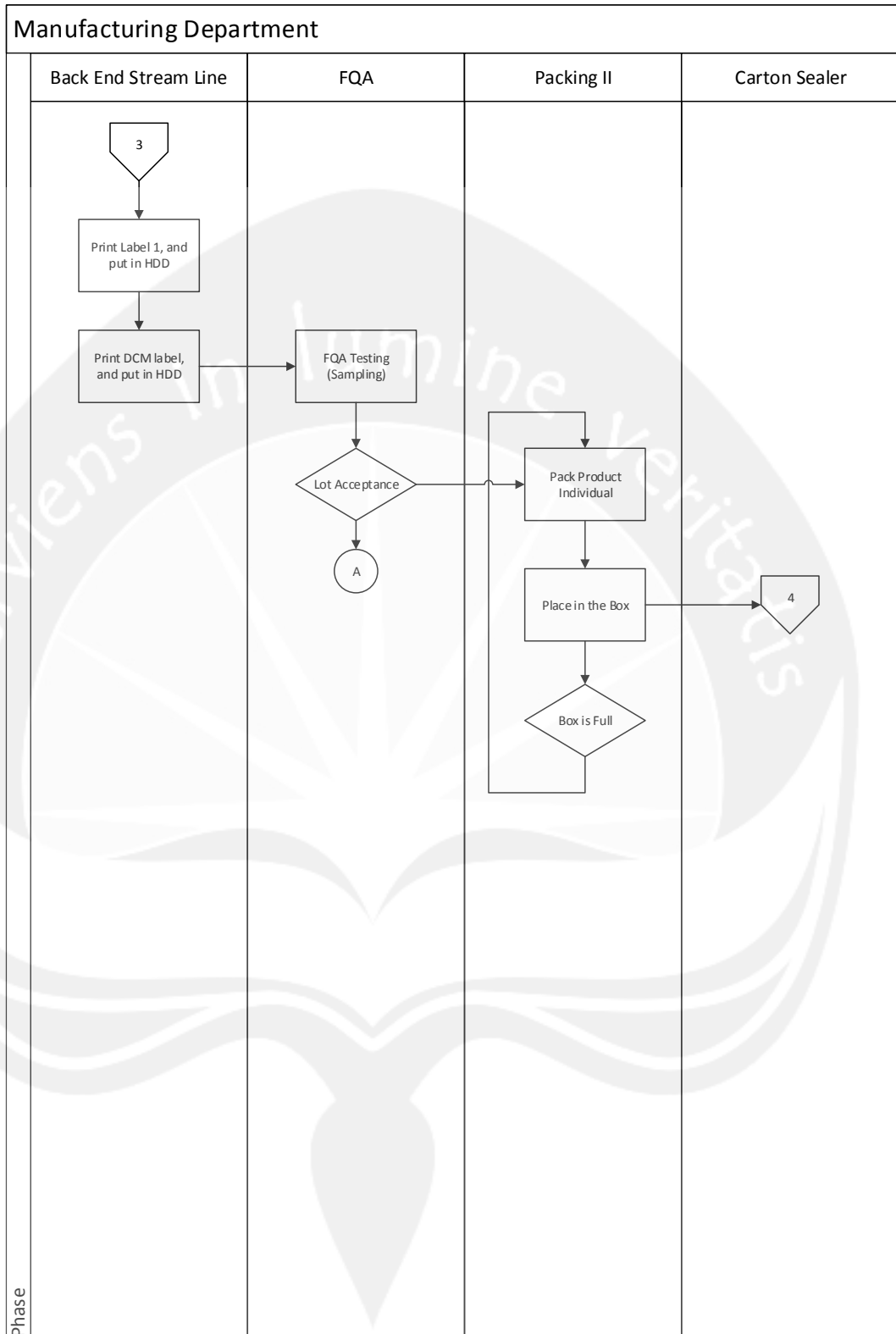


Appendix 3. Manufacturing Business Process









Manufacturing Department

