# STUDY ON ACHIEVING PRODUCTION OUTPUTS FOR MANUFACTURING START-UP COMPANY

by

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# Table Of Content

# List of Figures

# List of Tables

# Abbreviation Definition

LVM – Low Volume Manufacturing

HVM- High Volume Manufacturing

MST- Memory Storage Technology

M/C- Machine

Opt- Operator

UPH- Unit per Hour

# Abstrak

Meningkatkan pengeluaran adalah sukar bagi kilang yang baru mula beroperasi seperti “Memory Storage Technology”. Kumpulan pengeluaran telah diberi sasaran pengeluaran harian bagi mencapai setiap suku daripada pihak pengurusan. Sasaran suku pertama adalah 100K units/hari dan bagi suku kedua 600K units/hari. Akhirnya pada akhir tahun 2015 pengeluaran maksima yang perlu dicapai adalah 1Million units/hari. Manakala pencapaian sebenar pada suku pertama adalah 50K units/hari. Dan hanya berjaya memperolehi 100K units/hari di pertengahan suku kedua. Kajian kes ini bertujuan untuk mengkaji isu-isu yang berbangkit di kilang yang baru beroperasi untuk memenuhi pengeluaran harian yang ditetapkan. Kajian bermula dengan memahami cara kerja yang praktikan di MST Malaysia. Isu- isu berbangkit seperti kurang pengetahuan dan kemahiran, kekurangan tenaga kerja, peralihan pekerja, kurang kecekapan dan ralat dalam sistem akan dibincang secara terperinci. Untuk memahami dengan lebih lanjut punca sebenar masalah, kajian secara terperinci dan komprehensif dilakukan dengan kaedah menemubual dan menggunakan analisis seperti atau “fishbone” atau gambarajah tulang ikan, Pareto analisis, “5Why” dan “Benchmarking” analisis. Tujuan sebenar kajian kes ini adalah untuk mengenalpasti langkah terbaik untuk mencapai pengeluaran harian yang di tentukan oleh pihak pengurusan. Cadangan disenaraikan pada akhir kajian kes.

# Abstract

Production ramp up is very much challenging for Start-up Company like Memory Storage Technology (MST). Production team has been given daily production output goal to meet every quarter by top management. The goal is, by end of first quarter to produce 100K units per day and by end of 2nd quarter to achieve 600K units per day. Finally, by year end 2015 to produce maximum 1Million units per day. However the actual performance in first quarter is 50K units per day and only managed to achieve 100K units in the middle of 2nd quarter. This case study looks into the issues encounter in this newly Start-up Company in order to meet daily production output. The study begins with understanding the existing workflow. Current issues such as lack of skill & knowledge, less headcount, employee turnover, poor employees training and system errors were discussed in details. To further understand the potential root causes of those issues, a comprehensive analysis is performed using Interview, Fish bone, Pareto, Benchmarking and 5Why analysis tools. The objective for this case study is to find out the possible solutions to achieved daily production output. Recommendation listed in the end of the case study.

# Executive Summary

Memory Storage Technology (Malaysia) is manufacturing company that has just started to operate 3 months ago in Penang. After product qualification run, now the factory is moving toward aggressive production ramp up. Successfully ramp up and achieved goal that set by top management will enable the organization in Malaysia grow bigger and could demand for better employee benefits as well.

Mr. Amir is the Sr. Operation Director of MST project in Penang. He recently discovered that the plant in Malaysia struggling and firefighting to meet daily production output. He knows that this is an issue because the target that management set to him is 1 Million units per day by year end 2015.

The objective of this case study is to find out the possible root causes leading to the production downtime issues and provide recommendations to improve the situation.

The study begins with reviewing current issues that the team faced with by looking at every angle. Currently, entire operations team started to investigate the list of issues faced by reviewing in the daily operation meeting, head by Sr. Operation Director. The issues faced by the team are more than just technical issues.

Case study analysis applied includes interview has been performed to the related people from planning, NPI, production, engineering, Human Resources as well as the Sr. Operation Director. Followed by a fish bone analysis that identifies the potential root causes may contribute for production team not to meet daily target. Root causes are identified and grouped into six categories, Man, Method, Machine, Material, Measurement and Environment. For Man related root causes are lack of skill and knowledge, improper material and machine handling had contributed to high failure rate. No material has led to the production line idling. Method related a root cause such as communication breakdown between NPI team and planning team caused no demand product has been qualified. Limited machine capacity from machine category and longer machine downtime is contributing to the issue too.

These potential root causes are grouped and weighted based on the re-occurrence times of the same root cause in those 5 main issues. Through a Pareto analysis to identify the root causes that has higher severity level. The current practices of higher contributors are benchmarked against the practice in manufacturing plant in China (MST, China) to understand the performance gaps.5 Why analysis were applied to analyze the root cause of the production not meeting daily output goal from interviews and document support.

Base on the analysis, this paper recommends MST Malaysia to enforce NPI team to monitor until 1$^{st}$ 100K HVM run, Strategic Group Action, Enhance Technical Training and finally Cross Departmental Communication. 3 out of 4 of the action plan has been taken into implementation.

# 1. Introduction

Mr. Amir is the Sr. Operation Director at Memory Storage Technology for Malaysia Plant. He direct reports to Senior Vice-President, Global Manufacturing Operation Memory Storage Technology. Report's entire operations related item such as production, planning, cycle time, on-time delivery, equipment and product quality to Senior Vice-President. Memory Storage Technology starts operations in Malaysia 3 months ago. After ground breaking ceremony within 9 months the plant is ready for operation and shipped its 1st batch of product that manufactured in this plant on 28th February 2015

This is new record for Memory Storage Technology and also to Malaysia. Memory Storage Technology successfully qualified 1st product without any major quality issue in Malaysia plant. Besides quality, reliability cycle also meet the requirement as well. Customer already gives green light to run and the next step is to turn on production. The challenges are begin when the mode changed from qualification build to production build. As qualification build required small quantity while mass production running at high volume.

In the beginning Memory Storage Technology Malaysia decided to run 50K units per day whereby, in China plant they are building 2Mil units per day. Units here referring to number of product build in one day. Started

with low volume manufacturing because to warm up the brand new factory, machines, tools, cleanroom's and also in the same time train manufacturing team to familiar with operation activities.

During Production mode, Memory Storage Technology faced difficulty to meet daily production output target. Mr. Amir is the head of operation and responsible for entire production ramp up. He is the one answerable to top management if production failed to ramp up as per timeline given by top management. He is under pressure seeing the team struggling to meet daily output. Its look like a lot of things needs to fix along the way to achieve production output goal. Therefore, it's important to identify all the issues faced by the team and resolve it as soon as possible. Production output is a key measurement tool to represent brand new Memory Storage Technology Malaysia plant capability. Even CEO level highly hope that Memory Storage Technology Malaysia could ramp up to 1M units per day by year end 2015. This has been talked by him during his visit to Malaysia. Expectation is very high from top management because as of now Memory Storage Technology Malaysia delivered and meets all the deadlines without any fail and excuses, since the plant in the construction mode.

A lot of things has been promised by CEO if Memory Storage Technology Malaysia delivered 1M unit per day. For example, Malaysia plant further expansion, add-on more employee's benefits, health care, bonus, profit

sharing, annual dinner, family day and so on. The question is how Mr. Amir going to bring the team to meet production goal which highly expected by top management. Currently the team starts to question whether production goal is practical and achievable for Startup Company like Memory Storage Technology.

It is not easy to get things done when everything is new, new machine, new process, new factory system, and new people. There were unhappy moments when Sr. Operation Director pushing everyone until the maximum. For example, sometime engineers needs to works 24 hours, work during weekends and also most of the time supporting night shift. Team members were all frustrated with this type of working environment. This is the current situation and how to resolve this? This is one of the important tasks for Mr. Amir to looking at because he understands that with unhappy employees he can't achieve company goal. He doesn't want to fail and give up as well. Any failure it might cause the business will go back to subcontractor, Malaysia plant can't grow in the bigger scale and Plant in China might expand the business, in other word Malaysia plant might loss the business as well. Thus, Mr. Amir started wondering how to tackle this problem, based on his 20 years of working experience in manufacturing industry as well as in Start-up Company. He strongly believes in the team and moving aggressively to coach them.

It’s now the time to investigate and understand what is actually causing this issue, and four research questions have been identified here:

1) What is the strategy for Memory Storage Technology to achieve production goal?
2) What causes Memory Storage Technology not meeting production output? (5Why Analysis)
3) How to improve the productivity?
4) What are the challenges faced in order to meet production goal?

## 2. Industry Background


Figure 2.1 Memory Storage Technology Products

Memory Storage Technology is a U.S. based Multinational Corporation that specializes in delivering data storage solutions and technology. Memory Storage Technology produces several types of flash memory, from USB and removable storage memory products to embedded products for cameras, mobile phones, and other electronics as reflected in figure 2.1. Based in Silicon Valley, Memory Storage Technology is a S&P 500 company with over half of its nearly $6 billion in sales coming from Overseas operations.

## 3 Company Background

Memory Storage Technology has Manufacturing plant in China and now in Malaysia. Product research and development done in various countries, US, India, Israel and also in China. In this case research, the focus will be in Malaysia. Whereby, Malaysia plant is a start-up manufacturing company and second manufacturing plant for Memory Storage Technology.

### 3.1 Global

Memory Storage Technology was founded by Dr. Tim Kellner, Ravinder and William Jack. Dr. Tim Kellner and Ravinder formerly, from Intel while, William Jack was from Micron Electronics. In 1988 three of them decided quitting their current job and focus on developing a flash based memory solution. Memory Storage Technology was Tim Kellner's second startup, having just come from a failed startup company also in the flash memory space.

As the digital memory market was in its infancy, Memory Storage Technology realized that the future of flash memory would be in smaller memory chips, small enough to use in digital cameras that would drive a need for digital memory. Tim Kellner believed the potential existed for flash memory standards to be created like Kodacolor or Fujifilm which could be licensed to other manufacturers and become industry standards.

With this future in mind, Tim, Ravinder, and William, set out to develop a high capacity solid state disk based on flash memory. They initially approached several venture capitalists who all said that what they were attempting could not be done with the present technology. Eventually they reached out to Thomas, a venture capitalist in Silicon Valley who saw Tim's vision and provided the initial funding that got Memory Storage Technology off the ground.

Initially they approached Kodak, offering the flash card technology to be integrated in to their cameras. Kodak offered to fund the development of the technology with the condition that they would receive a three year exclusive contract for 'digital film' or flash based memory card technology. Memory Storage Technology rejected the offer believing that competition in the digital camera marketplace would help the growth of flash memory card technology.

By 1990 they had almost finished their first product, a 20 megabyte 2.5 inch solid state disk that would cost $2,000 and competed with hard drives. Unfortunately, there was almost no market, and they were almost out of money. Luckily, Eric, the CEO of Seagate and a long time entrepreneur, saw the potential of Memory Storage Technology and approached Memory Storage Technology with an offer of investment. The final offer that emerged was a 30% stake in Memory Storage Technology for a $35 million investment. The board of Memory Storage Technology wanted to add a $7 million penalty clause to the contract with Seagate if they pulled out of the deal after it was announced. Seagate's board of directors balked at the request and in a call between Eric and Tim, the two gave each other their word that the deal would go through and they would do everything in their power to make sure it would. Based on that promise, Tim went against the instruction of his board, and risked getting fired if the deal did

not materialize. The deal was announced at Comdex and closed shortly afterwards. Three years later, in 1995 Memory Storage Technology was planning on going public.

Today Memory Storage Technology has been expanding the possibilities of storage for more than 25 years. From a three-person start-up in Silicon Valley to a global brand with over 9,000 employees, Memory Storage Technology has maintained a consistent commitment to advancing technologies and anticipating their customers' needs. Today, Memory Storage Technology storage products can be found in many of the world's largest data centers, in your favorite mobile devices and electronic products, and at hundreds of thousands of retail stores around the world.

Memory Storage Technology patent portfolio is consistently recognized as one of the strongest in the technology industry; Memory Storage Technology hold close to 5,000 patents worldwide, and Memory Storage Technology continue to innovate. With ongoing research into 3-D memory and advances that continue to reduce costs, increase capacities, and make new devices possible, Memory Storage Technology continue to transform the industry every day.

**A Company Founded on Diversity**

Memory Storage Technology has deep roots in diversity. Since Memory Storage Technology founding by three immigrants from China, Israel, and India, Memory Storage Technology have celebrated and embraced cultural diversity. Today Memory Storage Technology have offices in 20 countries and employees in every region of the world. Memory Storage Technology actively recruits individuals who bring different strengths, perspectives, and ideas from different backgrounds.

Memory Storage Technology firmly believes that this diversity has helped drive Memory Storage Technology success and encourage the open exchange of ideas so that Memory Storage Technology can continue to benefit. For 15 years, Memory Storage Technology HQ employees have celebrated this cultural diversity at annual Memory Storage Technology International Day where employees enjoy everything from music, dance, and traditional dress to an amazing array of cuisines from around the world. In 2014, over 25 cultures were represented at this event.

**Diversity Initiatives**

While Memory Storage Technology proud of cultural diversity, Memory Storage Technology know that there is more work to do. Memory Storage Technology consistently looking for more ways to address the existing gaps and to offer more support to groups that are underrepresented in the tech industry, including women globally and Latinos and African-Americans in the US. Since 2003, Memory Storage Technology have been working with schools and community groups in K-12 grades. During this time period, Memory Storage Technology have donated $33M to over 1,400 organizations worldwide, with a particular focus since 2011 on improving education in Science, Technology, Engineering and Math (STEM) for underrepresented groups. In 2014, Memory Storage Technology employees volunteered over 33,000 hours. Here are a few examples of the programs Memory Storage Technology supported.

Working in partnership with a local charity called the Puzhi Organization, Memory Storage Technology volunteers in China help teach economically disadvantaged students whose parents recently immigrated to Shanghai. To date, 50 Memory Storage Technology volunteers have volunteered over 185 teaching hours.

Since 2006, employee volunteers at our Kfar-Saba, Israel location have partnered with Kadima Youth Center to tutor and mentor at-risk children.

Memory Storage Technology support of the youth center also includes program funding, equipment donations and hosting local holiday celebrations for youth center participants.

In India, Memory Storage Technology supports the Pratham Education Foundation. Pratham focuses on a broad range of education programs targeting skillsets from reading, writing and basic arithmetic to second chance programs for school drop-outs to vocational training.

Memory Storage Technology is also a founding partner of US2020, an organization that focuses on increasing access to STEM careers for girls, underrepresented minorities, and low-income children. Memory Storage Technology has provided over $1 million in funding in addition to organizing STEM mentoring and hands-on volunteer opportunities for employees on-site and in our communities via partners such as Citizen Schools, Junior Achievement, Mentor Net, the Breakthrough Collaborative, and MOUSE squad.

At the university level, Memory Storage Technology scholarship program in China, Japan and the US has provided 300 scholarships worth $3.5M since 2012, with 90% of funds given to members of underrepresented groups who want to study computer science and engineering. To accomplish this, in the US Memory Storage Technology partner with a number of groups, including the United Negro College Fund, the Hispanic

Scholarship Fund, Silicon Valley Community Foundation, NSBE, SWE, and ABI. These are just a few of the many programs Memory Storage Technology support in the US and in countries around the world.

### 3.2 Driving the Future of Storage

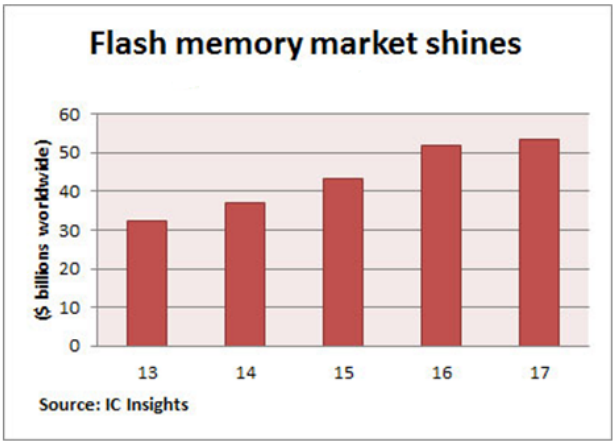



Figure 3.1 Demand forecast for flash memory

The world of digital content grows exponentially every day. From mobile devices to data centers, Memory Storage Technology delivers the peace of mind that data is readily available and reliable, even in the most challenging environments. Flash memory demand globally has been forecast to increase from year 2013 to 2017 in figure 3.1. This is due to increase in usage in smartphones, solid state drive, and camera. Memory Storage Technology would like to acquire their competition and increase their market share in the flash memory technology. As of now the demand for flash memory is very strong. In fact, due to existing factory in China not able to support current

demand, Memory Storage Technology decided builds another manufacturing plant in Malaysia.

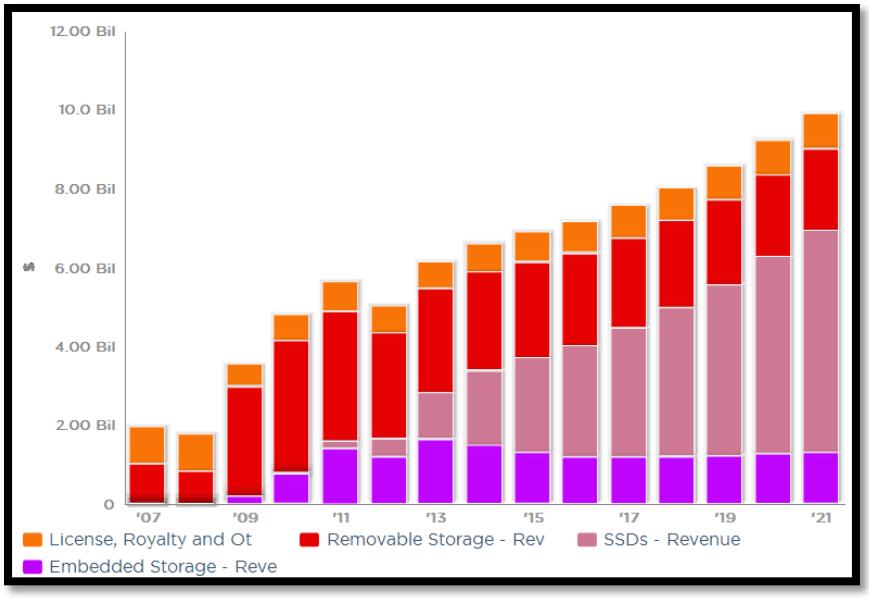
It's all part of delivering on Memory Storage Technology mission to enrich people's lives through digital storage anytime, anywhere. Since 1988, companies and consumers around the world have counted on Memory Storage Technology storage solutions in many areas, including:

**Data Center** - In the data center or in the cloud, Memory Storage Technology leading-edge flash technology enables fast, reliable access to mission-critical data. The Flash-Transformed Data Center: Flash Adoption Is Growing Across the Enterprise

**Computing** - Memory Storage Technology solid state drives offer energy-efficient, compact, and durable alternatives to traditional hard-disk drives for desktops, laptops, and ultra-thin PCs.

**Mobile** - High performance flash storage is essential in smartphones, tablets, and other mobile devices. We deliver embedded memory solutions to every major mobile device manufacturer.

**Consumer Electronics** - From cameras to USB drives to MP3 players, the quality and performance of Memory Storage Technology is in many of your favorite devices.




*Source: Memory Storage Technology Financial report 2014.*

Figure 3.2: Total Revenue forecast for Memory Storage Technology Product

Plant in Malaysia very much focus on SSD (Solid State Drive) production and the only manufacturing plant that going to build SSD product for Memory Storage Technology. Figure 3.2 shows revenue forecasted for product that builds in Memory Storage Technology. Especially for SSD product revenue expected to increase from year 2013 to year 2021, very strong demand for SSD device globally compared to other storage product. Thus, there is high potential for Malaysia plant to grow up by producing SSD devices.

Figure 3.3 Shows Net income forecast for Memory Storage Technology in overall. Also shows that SSD is one of the main revenue contributors for Memory Storage Technology compare to other storage product. Therefore, SSD ramp up expected happen in a very short period of time in Malaysia by owner of Memory Storage Technology.

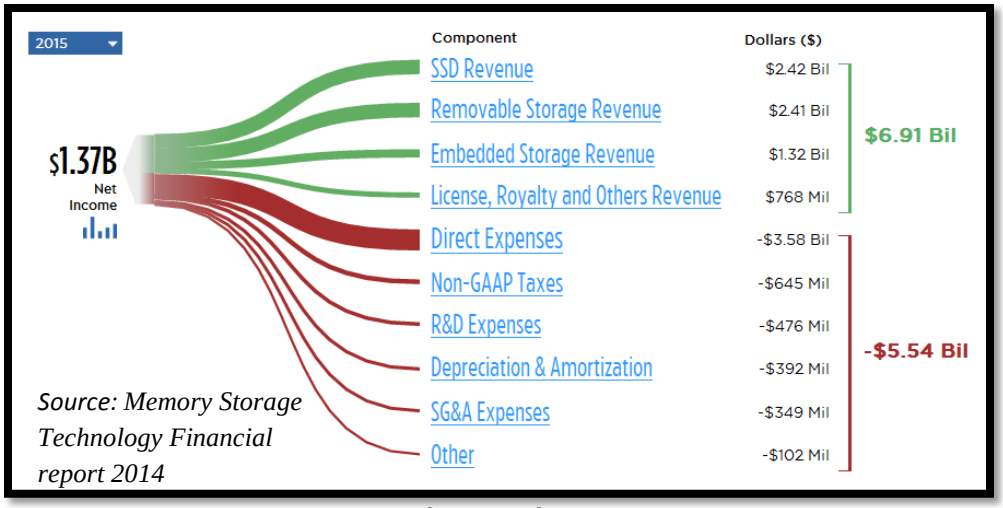



Figure 3.3: 2015 Net income forecast for Memory Storage Technology

### 3.3 Memory Storage Technology Vision, Mission and Core value

Memory Storage Technology Ventures combines the best characteristics of traditional venture funds with the technical insight, scale and experience of strategic investors. Memory Storage Technology offers the best-value proposition for portfolio companies and co-investors alike. Memory Storage Technology collaborate with cutting-edge entrepreneurs and investors who share Memory Storage Technology vision in memory storage, cloud, data center, mobile, wearables, and big data.

Memory Storage Technology's mission is to enrich people's lives through digital storage anytime, anywhere. To that end, flash memory has transformed the consumer electronics landscape enabling hundreds of millions of people to capture, share and enjoy digital content. Memory Storage Technology invented flash mass storage cards, which sparked the digital photography revolution and spurred the emergence and growth of digital music and digital

video; and pioneered the USB flash drive, which ranks among the most popular forms of digital storage.

At Memory Storage Technology, focused on a simple goal: enriching people's lives through digital storage anytime, anywhere. Memory Storage Technology count on employees to carry out this charge by innovating, collaborating, and implementing new ways to make the digital experience even better. Memory Storage Technology passionate about products. Memory Storage Technology move quickly and decisively. And Memory Storage Technology want employees to see and celebrate the positive impact their everyday efforts have on people around the world.

Memory Storage Technology do this by finding creative, passionate individuals who can help drive Memory Storage Technology goals from conception to completion. Memory Storage Technology's core values are innovation, execution, adaptability, agility, integrity, and teamwork. These values are embraced by Memory Storage Technology employees and contribute to Memory Storage Technology's global success.

Toshiba, Micron, Samsung, Seagate and WD are among the competitor for Memory Storage Technology. Flash memory manufacturing is a red ocean business. Toshiba, Micron, Samsung, Seagate and WD are the biggest survivor in the red ocean. Figure 3.4 shows; MST is the second player after

Samsung in the flash memory technology, 31% of the market share holds my MST itself.

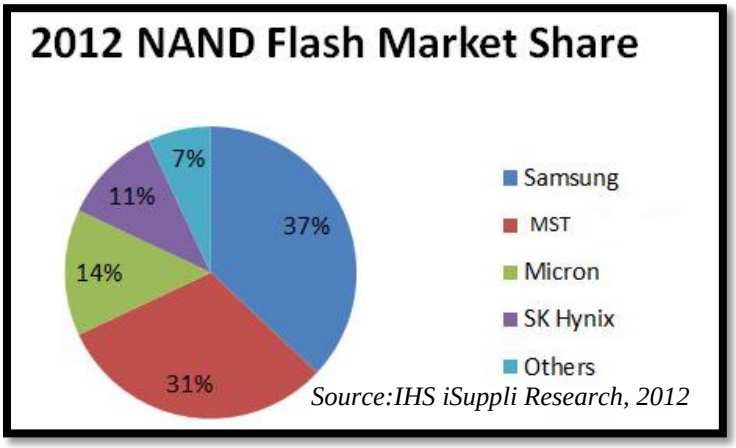



Figure 3.4: Flash Memory Market Share among MST's Competitors

### 3.4 Memory Storage Technology in Malaysia

Malaysia Plant only started to operate production end of February 2015(2 month). This is the second largest manufacturing plant for Memory Storage Technology (MST) after Shanghai plant (China). Current capacity for Malaysia plant is 1Million units per day. Future plan is to build another 3 similar buildings to produces 4Million units per day.

Penang Government offered free land to MST to build up factory in Malaysia. In the return Penang government wants MST to develop technical people thru file the patents. Therefore, MST Malaysia highly encourages all the local engineers to come out with innovative ideas and also management focusing on people development, in other word is Human Capital Development.

This brand new start-up Company runs the operation with total 9 Process Engineers, 9 Equipment Engineers, 4 Test Engineers, 2 Quality Engineers, 200 Operators, 15 Technicians, 1 Process Engineering Manager, 1 Production Manager, 1 Test Engineering Manager, 1 Equipment Engineering Manager, 4 Supervisors, 1 Production Planner , 1 NPI engineer and 1 Sr. Operation Director. In total there is 250 head count in the operations team as of now.

### 3.5 Organization Chart Memory Storage Technology in Malaysia

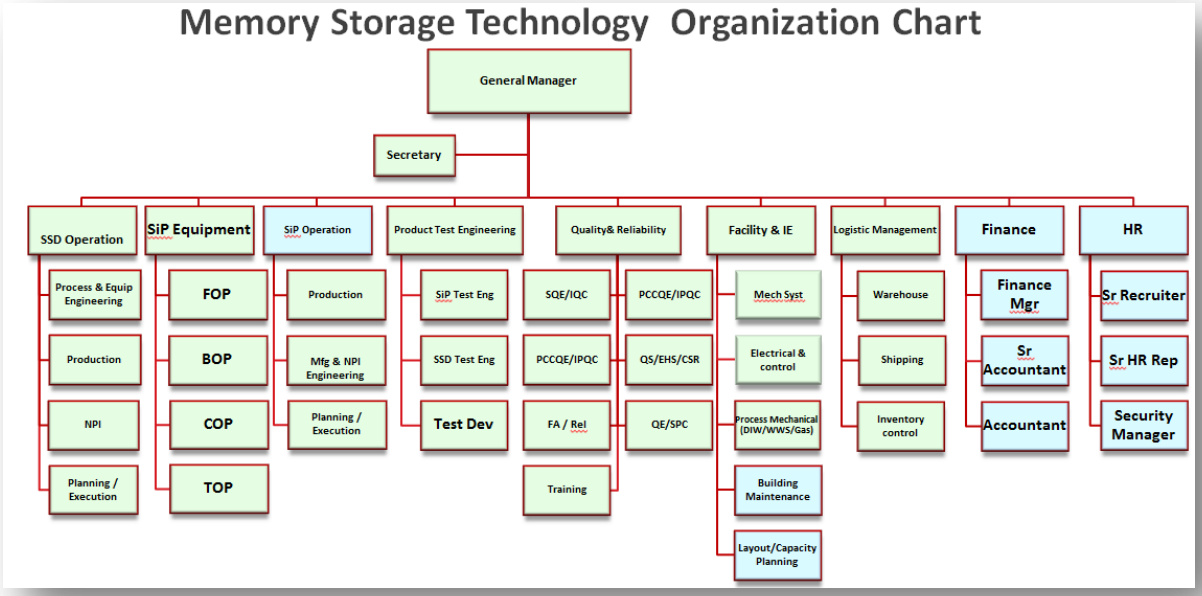



Figure 3.5: Organization structure Memory Storage Technology in Malaysia

There are nine main divisions consisting of a total of close to 450 employees in Memory Storage Technology for the startup. Namely, SSD operation, SiP operation, Equipment, Product & Test, Quality & Reliability, Facility, Logistic, Finance and HR. All division head's reports to GM whereby, GM

reports to Sr. Vice President. Refer to Figure 3.4 for the reporting structure. The Operation divisions lead by Sr. Director, Mr. Amir. Operation division consists of Process Engineering, Production, Equipment Engineering, NPI and Production Planning. Refer to Figure 3.5**.**

Process Engineering creates process parameter and defining product specification; Production team responsible to build product as per specification define by process engineering; Equipment Engineering is the owner for machine in the production floor, mainly focusing on machine trouble shooting, maintenance, machine conversion; NPI team work on product qualification; Production Planner are the one determine which product has the demand and what product to load into production floor. Mr. Amir, Sr. Operation Director is the final decision maker for all operations related activities

### 3.6 Operation Team Organization Chart

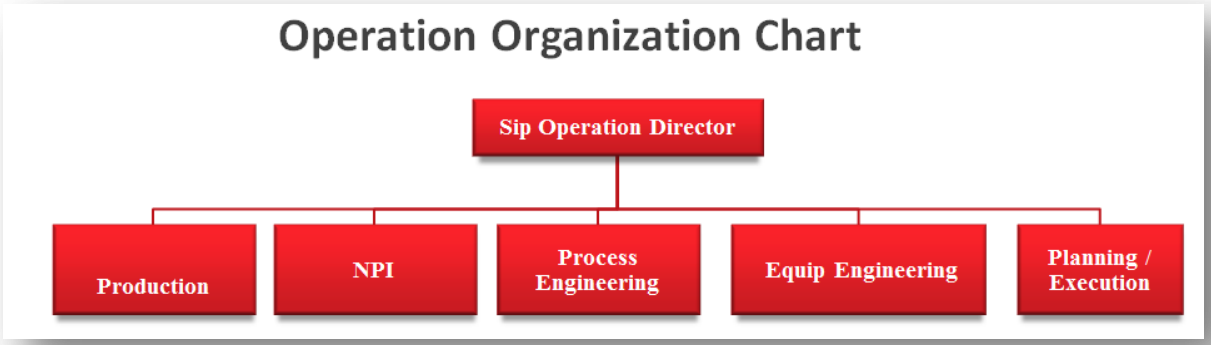



Figure 3.6: Organization structure of the operational group

The operation team leads by Sr. Operation Director. This team consists:

(a) Production(1 Sr. Production Manager, 4 Production supervisor)

(b) NPI( 1 Staff Engineers)

(c) Process Engineering( 1 Manager, 9 Sr. Engineer)

(d) Equipment Engineering(1 Manager, 9 Sr. Engineer)

(e) Planning(1 Sr. Planner)

In my case research, I am focusing only in the operations organization because they are the one directly involved in production activities.

## 4. Case issue

Memory Storage Technology currently facing great challenge to achieve production output 100K unit per day. The goal is to build 100K in Q1 2015, 600K in Q2 2015, 800K in Q3 2015 and finally Q4 2015 expected to build 1Mil unit per day. Refer to figure 4.1. This will be performance measurement for Malaysia plant as well. Future expansion of Malaysia plant is very much depends on how the company moving aggressively in term of producing output. MST Malaysia maximum capacity is 1Mil unit per day with one building; Future plan is to build 3 more building with total production output 4Mil unit per day capacity. This has been announced by MST CEO, Ravinder thru web telecasting when Malaysia plant made its 1st shipment out on 28th Feb 2015.

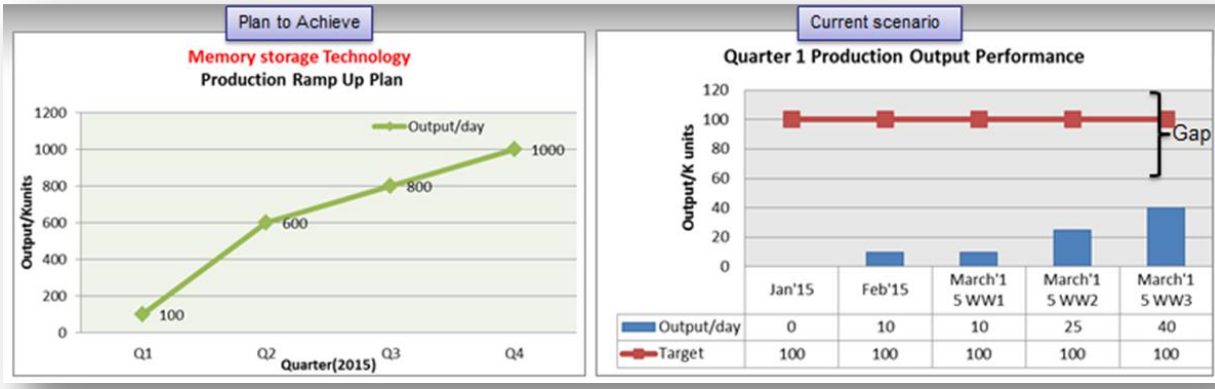



Figure 4.1: Memory Storage Technology Production Planning & Performance

Sr. Operation Director admitted this is an aggressive ramp up plan for Startup Company like Memory Storage Technology. But he had no other choice or

option rather than just delivered what the corporate wants. He is in the position that he can't give any reason for not meeting the production output goal. The direction from Sr. VP and CEO as well is to get back ROI within 2 years' time frame. Thus, Sr. Operation Director getting high pressure to meet 1Mil unit per day by year end 2015 without any major quality incident or customer return. Currently everyone in the company feels the pressure and pushes each other to meet the goal. Besides ROI, other factors that contribute for aggressive ramp up in newly build Malaysia plant is, current manufacturing plant in China not able to support customer demands. China plant now running at maximum capacity and no more additional space to support any new customer demands or orders. Therefore, top management wants to turn on Malaysia plant as quick as possible. By turn it on Malaysia plant, MST could support customer demand and deliver the product on time to customers. If customers not getting product they want on time, high possibilities for customer switched to competitors which could deliver the product timely. This will give big impact to Memory Storage Technology business growth because losing the customers and reputations as well.

Further, MST products life cycle is 6 month in an average. MST's research and development team are very dynamic in developing new product in very short period of time. For MST Malaysian in total 13 products has been planned to qualify in the start-up stage. As of now 6 products type has been successfully qualified. Every time MST launched new product in the market,

Memory Storage Technology needs to build and sell the product as much as can within 6 month. If not the products might become less demand or no longer valid. Product life cycle also play an important part for aggressive production ramp up. Memory Storage Technology business strategy is to sell most of their product in first 2 month after launching. MST want to be market leader and in the same time ahead competitors in memory technology. Toshiba, Micron, Samsung, Seagate and WD are among the competitor for Memory Storage Technology.

Memory Storage Technology's dream is to make Malaysia plant to become the only "vertical integrity plant" among other sites, means that from wafer level become final product that can be sellable to customer upon out from this plant or in other word Malaysia plant can produced/ build entire Memory Storage Technology products family. By doing this Memory Storage Technology can minimized risk on dependency to contract manufacturer as well.

According to Senior Operation Director as of now 40% of Memory Storage Technology's product build at contract manufacturer sites and targeting to bring down to 20%. Few factor caused Memory Storage Technology to pull business out from contract manufacturer besides minimizing dependency. Cost to build product at contract manufacturer site keep increasing every year.

Moving between one contract manufacturers to another is not a healthier process and its involved lot of capital especially on the qualification part.

By having own manufacturing facilities Memory Storage Technology believed can have better capital control and in reality experiencing this thru current plant in China. Protect product technology is another key factor for Memory Storage Technology to manufacture product in their own. This memory technology changed very fast and involved lot of investment in R&D as well, if information leaked to competitor's hand it will be big loss in term of money, time and energy to Memory Storage Technology.

## 4.1 Current Scenario in MST (Malaysia)

Manufacturing plants in Malaysia doesn't build stack dies or multi-layers, which involved 1 die to 16 dies stacked in one package. Packaging has become critical to integrating the multi-media features consumers demand in smaller, lighter products. This increasing functionality requires higher memory capacity in more complex and efficient memory architectures. New product designs, cell phones, digital cameras, PDAs, audio players and mobile gaming demand that these features be delivered in innovative form factors and styling. Stack die packaging is experiencing high growth and new applications by delivering the highest level of silicon integration and area efficiency at the lowest cost.