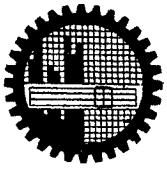
APPLICATION OF TPM IN A NEW PRODUCT LAUNCHING- A CASE OF UNILEVER BANGLADESH

By

MD. HASIM HASNAT



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CERTIFICATE OF APPROVAL

The thesis titled-**"APPLICATION OF TPM IN A NEW PRODUCT LAUNCHING- A CASE OF UNILEVER BANGLADESH''** submitted by Md. Hasim Hasnat, student no. 100708101 P ,Session October 2007, has been accepted as satisfactory in partial fulfillment of the requirements for the degree of **Master of Engineering** in Advance Engineering Management (Department of IPE) on October'2011

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This dissertation is dedicated to my parents

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ABSTRACT

This thesis is related to the application of TPM in an innovation project and this is based on a case study of Unilever Bangladesh Limited. And for this a specific project is chosen "Local (onshore) manufacturing of conditioner".

The objective of this thesis work is to analyze TPM activities during launch phase of an innovation project and to find out how the TPM activities are giving benefit to a manufacturing organization. For justification of this objective some KPI's were selected: on time, innovation ramp up, vertical start up and OEE).

During this project implementation activity few TPM tools were applied as a part of early management process which helped smooth execution of the project. To find out different activities and share roles and responsibilities for individuals a details network was done with Gantt chart. To identify different losses, problems and find out a solution -a 4M analysis was done by studying the whole process. Again a FMEA process was done to identify the probable failure of the project, and accordingly necessary solutions were kept ready to face the problem. A detail WWBLA analysis was also done to know the root cause of a specific problem/issue. This problem was occurring frequently and tried to find out a logical solution by using WWBLA. As TPM is already established in Unilever Bangladesh, during the study of this innovation project other established activities (as a part of TPM) impacts were also checked; such as: Planned maintenance (PM), planned inspection schedule (PIS) etc. Safety is always first- so to ensure proper safety for this innovation project detail risks assessment was done using different safety risk assessment tools, like: PHA, HAZOP, THA and SOP etc. All those risk assessments were done during different stages of the projects starting from very initial stage. Beside those as a part of early management process some other activities were also done, like: trials, MOD (to ensure proper change management), One point lesson (share key information to all).

After completion of the project the different KPI's were measured which were as per target. And the results are: on time start of the project, Innovation ramp up 95.27%, vertical start up- 24 hours, OEE-87%. This analytical data is also proving that TPM is giving benefit in terms of Productivity, Quality, Cost, Safety health and environment, Moral, Innovation and Delivery in case of a new project launching.

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1.1 Introduction

"The ultimate goal of TPM is to implement 'perfect manufacturing'". Originally introduced as a set of practices and methodologies focused on manufacturing equipment performance improvement, TPM has matured into a comprehensive equipment-centric effort to optimize manufacturing productivity. "Total Productive Maintenance is based on teamwork and provides a method for the achievement of world class levels of overall equipment effectiveness through people and not through technology or systems alone [1]. There are eight pillars for TPM. But in this study we will focus only "Initial flow control" or "Maintenance Prevention".

Initial flow control (Management aspect)

From the management perspective: once the TPM have been established for day to day activities, it is usual to find that significant improvements have been made in existing plant to make them more effective, more reliable and easier to maintain. The knowledge which has been developed to achieve these improvements is now directed toward the development, design and implementation of new plant items before they arrive in the factory. Initial flow control is akin to a process of simultaneous engineering, but involves mining the deep, practical, knowledge and understanding of what makes for good production developed during the earlier pillars, rather than purely theoretical engineering knowledge. In this way, new plant and equipment should be capable of *vertical startup*, where they achieve their planned performance level immediately, rather than after a period of commissioning.

Initial flow control (integrated aspect)

As an integrated aspect, early Management creates a system to deal with communication, detailed study and small experiments before introduction of innovation so that company can look forward to the positive step change in performance from the next change or innovation.

1.2 Background Information:

TPM can be considered as the medical science of machines. Total Productive Maintenance (TPM) is a maintenance program which involves a newly defined concept for maintaining plants

and equipment. The goal of the TPM program is to markedly increase production while, at the same time, increasing employee morale and job satisfaction.

TPM brings maintenance into focus as a necessary and vitally important part of the business. It is no longer regarded as a non-profit activity. Down time for maintenance is scheduled as a part of the manufacturing day and, in some cases, as an integral part of the manufacturing process. The goal is to hold emergency and unscheduled maintenance to a minimum.

TPM was introduced to achieve the following objectives. The important ones are listed below.

- Avoid wastage in a quickly changing economic environment.
- Producing goods without reducing product quality.
- Reduce cost.
- Produce a low batch quantity at the earliest possible time.
- Goods send to the customers must be non defective. [2]

1.3 Objectives

General Objective

The main objective of this thesis work is to know about the TPM implementation and its effectiveness in case of initial flow control. The thesis work is done based on a project in Unilever Bangladesh Kalurghat factory. The area of the work is covering from the very beginning of the project & it ends after implementation the project.

Specific objectives:

- Successful completion & handover the project as per network
- New product or equipment development. New equipment needs to be-
    - Easy to operate
    - Easy to clean
    - Easy to maintain and reliable
    - Have quick set-up times
- Establish systems to shorten & desired productivity achieved
- Deliver quality products
- Maximum efficiency
- Operate at the lowest life cycle cost

Chapter-2
Literature review

2.1: Introduction

The working definition for TPM is- Total Productive Manufacturing is a structured equipment-centric continuous improvement process that strives to optimize production effectiveness by identifying and eliminating equipment and production efficiency losses throughout the production system life cycle through active team-based participation of employees across all levels of the operational hierarchy [3].

The key elements of this definition are:

- Structured Continuous Improvement Process.
- Optimized Equipment (Production) Effectiveness.
- Team-based Improvement Activity.
- Participation of employees across all levels of the operational hierarchy.

The TPM is structured continuous improvement process. One of the most significant elements of the structured TPM implementation process is that it is a consistent and repeatable methodology for continuous improvement. For world-class competitors, minimal performance requirements include repetitive and predictable year-over-year actual per-unit cost reductions, ever-reducing variation, improved product quality, and extraordinary customer service. Winning requires an institutionalized management proof process that is sustainable despite changes in leadership, strategy, and business conditions – a corporate culture dedicated to manufacturing excellence.

2.2: TPM history

TPM is an innovative Japanese concept. The origin of TPM can be traced back to 1951 when preventive maintenance was introduced in Japan. However the concept of preventive maintenance was taken from USA. Nippondenso was the first company to introduce plant wide preventive maintenance in 1960. Preventive maintenance is the concept wherein, operators produced goods using machines and the maintenance group was dedicated with work of maintaining those machines, however with the automation of Nippondenso, maintenance became a problem as more maintenance personnel were required. So management decided that the

routine maintenance of equipment would be carried out by the operators. (This is Autonomous maintenance, features of TPM). Maintenance group did only essential maintenance works. [4] Thus Nippondenso which already followed preventive maintenance also added autonomous maintenance done by production operators. The maintenance crew went in the equipment modification for improving reliability. The modifications were made or incorporated in new equipment. This leads to maintenance prevention. By then Nippon Denso had made quality circles, involving the employee's participation. Thus all employees took part in implementing Productive maintenance. Based on these developments Nippondenso was awarded the distinguished plant prize for developing and implementing TPM, by the Japanese Institute of Plant Engineers (JIPE). Thus Nippondenso of the Toyota group became the first company to obtain the TPM certification. [5]

*** Breakdown maintenance (1951)**

It means that people waits until equipment fails and repair it. Such a thing could be used when the equipment failure does not significantly affect the operation or production or generate any significant loss other than repair cost [6]

*** Preventive maintenance**

It is daily maintenance (cleaning, inspection, oiling and re-tightening), to retain the healthy condition of equipment and prevent failure through the prevention of deterioration, periodic inspection or equipment condition diagnosis. Just like human life is extended by preventive medicine, the equipment service life can be prolonged by doing preventive maintenance [6].

*** Corrective maintenance (1957)**

It improves equipment and its components so that preventive maintenance can be carried out reliably. Equipment with design weakness must be redesigned to improve. [6]

*** Maintenance prevention (1960)**

Leading to failure prevention, easier maintenance and prevents of defects, safety and ease of manufacturing) and are incorporated before commissioning a new equipment. [6]

*** Productive maintenance**

Preventive maintenance along with maintenance prevention and maintainability improvement gave birth to productive maintenance. The aim of productive maintenance was to maximize plant and equipment effectiveness to achieve optimum life cycle cost of production equipment. [6]

2.3: Pillars of TPM

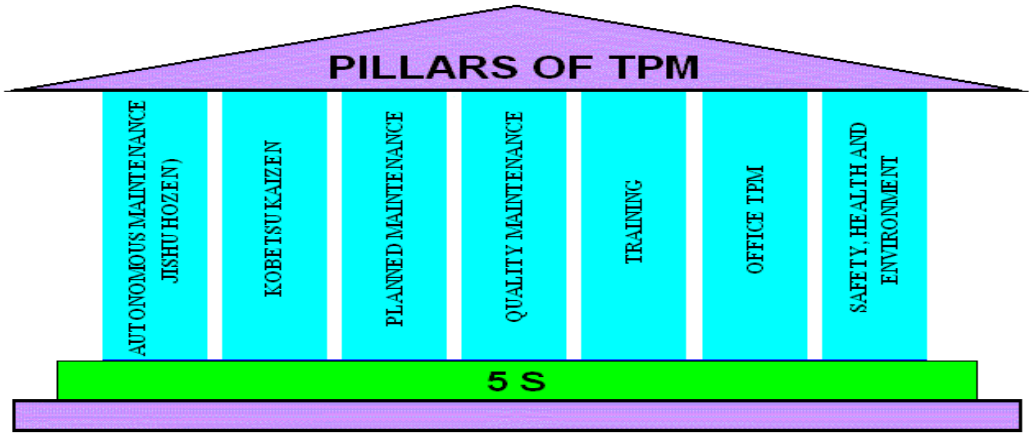


Figure 2.1: TPM pillar

2.3.1: *Pillar 1* - 5S:

TPM starts with 5S. Problems cannot be clearly seen when the work place is unorganized. Cleaning and organizing the workplace helps the team to uncover problems. Making problems visible is the first step of improvement.

Table: 2.1: 5S meaning

Japanese Term	English Translation	Equivalent 'S' term
Seiri	Organization	Sort
Seiton	Tidiness	Systematize
Seiso	Cleaning	Sweep
Seiketsu	Standardization	Standardize
Shitsuke	Discipline	Self - Discipline

Unilever Bangladesh activities on 5S

Unilever Bangladesh believes that 5S is the base of TPM. So, its 5S principle is

- 5S is the platform of TPM
- 5S is helping each other
- 5S is symbol of success
- 5S is Nationalism

By implementing 5S Unilever Bangladesh's target is to ensure:

- World class manufacturing
- Expense reduction
- Wastage elimination
- Flawless quality product
- Safety in work place
- Productivity improvement

Unilever Bangladesh believes that with the help of 5S the following benefit can be achieved

- Wastage reduction
- Accident reduction
- Accident elimination
- Higher quality
- Higher confidence & business mind
- Improve performance
- Quick changeover
- Safety & environment
- Quality system [7]

2.3.2: *Pillar 2*- JISHU HOZEN (Autonomous maintenance):

This pillar is geared towards developing operators to be able to take care of small maintenance tasks, thus freeing up the skilled maintenance people to spend time on more value added activity and technical repairs. The operators are responsible for upkeep of their equipment to prevent it from deteriorating.

Unilever Bangladesh activities on Autonomous maintenance (Jishu Hozen)

Aim

- To change mind-set of Operators from "*My machine, I operate it - you fix it*" to "*My machine, I operate it, I fix it"*
- Through step-wise activities.
- Achieve "Zero Breakdown", "Zero Defect" and " Zero Accident" by
    - Eliminating failures due to poor Jishu Hozen.
    - To upgrade skills of Operators for abnormality detection and

- Elimination (Tagging & De-tagging)
- To improve overall working environment.

Unilever Bangladesh is doing the autonomous maintenance in its factory side. The following 7 steps are followed in autonomous maintenances

Table: 2.2: Autonomous maintenance steps

Step	Name	Activities
1	**Initial cleaning (cleaning is inspection)**	Eliminate dust and dirt from main body of equipment, lubricate and tighten, expose and deal with equipment problems.
2	**Contamination sources and hand-to-access areas**	Reduce housekeep in time by eliminating or containing sources of dust, dirt or other contamination, and improving places that are hand to clean, lubricate, tighten or check.
3	**Provisional Autonomous Maintenance standards**	Formulate provisional standards to enable cleaning, lubricating, tightening and checking to be sustained dependably with minimal time and effort(this will mean establishing time slots for routine and periodic maintenance).
4	**General equipment inspection**	Train operators in inspection procedures using inspection manuals, enabling them to expose and correct equipment defects by performing comprehensive equipment inspections.
5	**Autonomous inspection**	Formulate definitive cleaning, lubrication and inspection standards that can be followed efficiently and dependably, draw up autonomous inspection checklists and put them into use.
6	**Standardisation**	Develop a comprehensive housekeeping system by devising additional standards for items such the following: •Movement of materials around the shop floor •Data recording •Control of moulds, jigs, tools, etc. •Quality assurance data on the process
7	**Full self-management**	Roll out and implement company policies and objectives, and continually improve the equipment by keeping accurate MTBF and other maintenance records, analysing the data captured, and doing improvements as a routine part of the job

2.3.3: *Pillar 3* – KOBETSU KAIZEN:

"Kai" means change, and "Zen" means good (for the better). Basically kaizen is for small improvements, but carried out on a continual basis and involve all people in the organization. Kaizen is opposite to big spectacular innovations. Kaizen requires no or little investment. The principle behind is that -a very large number of small improvements are more effective in an organizational environment than a few improvements of large value. This pillar is aimed at reducing losses in the workplace that affect our efficiencies. By using a detailed and thorough procedure we eliminate losses in a systematic method using various Kaizen tools.

Unilever Bangladesh activities on KOBETSU KAIZEN

Objective: The factory has the vision to maximize output by

- Reducing cost by eliminating losses. Aim is zero
- Continuously improving equipment productivity

- Flexibility in operation and enhancing manufacturing capacity
- Achieve business target

Kaizen Policy: To maximize factory OEE by reducing all losses and increasing factory production capacity with minimal capital investment & reduce production cost

Approach:

- Identification of losses
- Classification of Losses in significant and not-so-significant losses
- To allocate projects to eliminate losses to circles

Strategy:

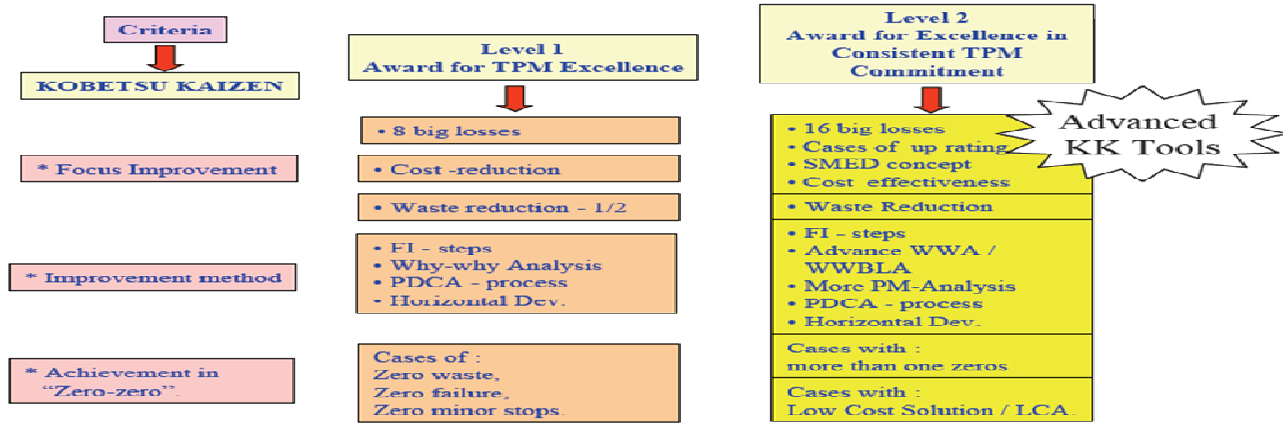


Figure: 2.2: KOBETSU KAIZEN strategy

2.3.4: *Pillar 4* - PLANNED MAINTENANCE:

It is aimed to have trouble free machines and equipments producing defect free products for total customer satisfaction. This breakdown maintenance which were defined earlier into 4 "families"

1. Preventive Maintenance
2. Breakdown Maintenance
3. Corrective Maintenance
4. Maintenance Prevention

With Planned Maintenance we evolve our efforts from a reactive to a proactive method and use trained maintenance staff to help train the operators to better maintain their equipment.

1. Prepare predictive maintenance system by introducing equipment diagnostic techniques
2. Evaluation of planned maintenance.

Unilever Bangladesh activities on Planned Maintenance

Objective:

- Breakdown free operation.
- Support to JH and E&T.
- Reduction in maintenance cost.
- Elimination of Black Boxes.
- Asset Care—Extension of Equipment Life.
- Innovation & In-house development.

Approach:

- Extensive use of Planned Maintenance Techniques
- Increase in-house repair & restoration
- Increase in-house development & innovation

Planned Maintenance Systems:

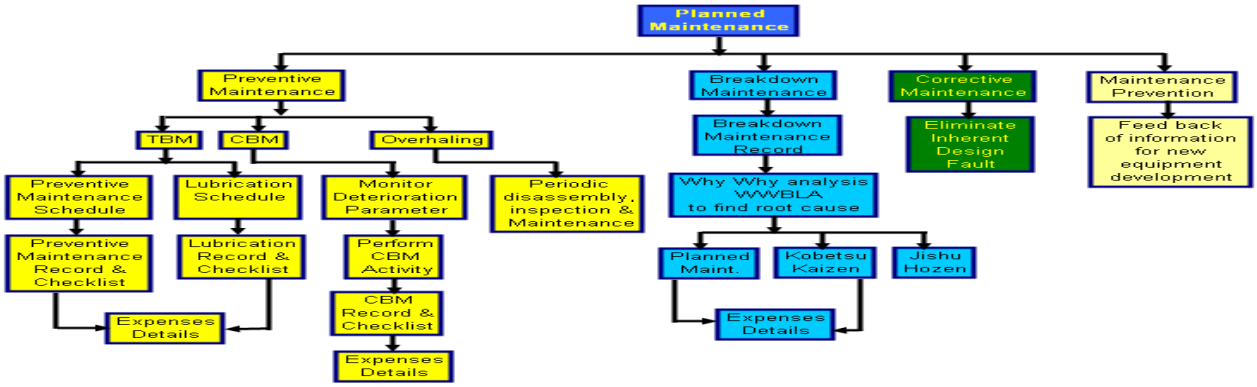


Figure: 2.3: Planned maintenance system

Implementation Approach:

- Classification of equipment: Classify equipment into A, B and C rank based on criticality in terms of P, Q, C, D, S & M
- Roles and Responsibility of Operation Department and Maintenance Department.
- Technical support and development for JH.
- Carryout of PM step-by- step activity:
    - Zero Failure activities
    - Implementation of TBM and CBM activities
    - Corrective maintenance.
    - Maintenance Prevention.

- Spare parts management activities.
- Lubrication management activities.
- Maintenance cost reduction activities
- In-house development/modification
- Low Cost Automation

2.3.5: *Pillar 5* - QUALITY MAINTENANCE:

It is aimed towards customer delight through highest quality through defect free manufacturing. Focus is on eliminating non-conformances in a systematic manner, much like Focused Improvement. We gain understanding of what parts of the equipment affect product quality and begin to eliminate current quality concerns, and then move to potential quality concerns. Transition is from reactive to proactive (Quality Control to Quality Assurance).
QM activities are to set equipment conditions that preclude quality defects, based on the basic concept of maintaining perfect equipment to maintain perfect quality of products. The conditions are checked and measure in time series to very that measure values are within standard values to prevent defects. The transition of measured values is watched to predict possibilities of defects occurring and to take counter measures before hand.

Unilever Bangladesh activities on Quality maintenance

Aim:

To produce defect free safe product by analyzing processes & equipment to identify & maintain conditions that do not lead to defect.

Objective:

- To ensure Safe & Quality products to end consumer
- Continuously drive ZERO defect
- To support FTR in all Innovation
- To reduce the COST of poor quality.
- Integrate Quality Parameters fully with AM and PM pillar activities
- To Strengthen GMP and Hygiene practices
- To comply with all core and few extended requirement of UQCSRM.
- Inculcate culture of “Shared Responsibility” i.e. Ownership

How Unilever Bangladesh maintaining this:

By maintaining some quality KPIs. Those are:

- Quality Demerit Index (QDI) : QDI Calculation: 1 x %A defects + 0.65 x %B defects + 0.3 x C defects + 0.1 x %D defects
- Number of Consumer and Customer Complaints (Quality tracker)
- Quality failure and non-conformances
- Integrate Quality Parameters fully with AM and PM pillar activities

10 steps are used to implement quality maintenances:

Step 1: Check quality characteristics

Step 2: Survey process

Step 3: Survey and analyze 4M conditions

Step 4: Study malfunction and restore equipment condition

Step 5: Use PM analysis where immediate counter measures are not available

Step 6: Evaluate result

Step 7: Review and set PM conditions that produce non defective products

Step 8: Survey and improve checking method intensification and fixation

Step 9: Prepare quality check matrix and simplify

Step 10: Standardize

2.3.6: *Pillar 6* - TRAINING:

It is aimed to have multi-skilled revitalized employees whose morale is high and who has eager to come to work and perform all required functions effectively and independently. Education is given to operators to upgrade their skill. It is not sufficient know only "Know-How" by they should also learn "Know-why". By experiencing they gain, "Know-How" to overcome a problem what to be done. This they do without knowing the root cause of the problem and why they are doing so. Hence it become necessary to train them on knowing "Know-why". The employees should be trained to achieve the four phases of skill. The goal is to create a factory full of experts. The different phase of skills is

Phase 1: Do not know.
Phase 2: Know the theory but cannot do.
Phase 3: Can do but cannot teach
Phase 4: Can do and also teach.

Unilever Bangladesh activities on Trainings

Objective:

To ensure that the factory has adequate human resources with the knowledge, skills and competencies necessary for becoming a world class factory.

Policy:

- Focus on improvement of knowledge, skills and techniques.
- Creating a training environment for self learning based on felt needs.
- Training curriculum / tools /assessment conductive to employee revitalization
- Training to remove employee fatigue and make work enjoyable.

Target:

- Eliminations of losses due to poor skill
- Enhancing capability of using analytical tools
- Multi-skilling and rendering support to epoch making events
- Increase employee participation in TPM
- Align mindset to continuous change , flexibility & innovation

Identification of training needs

- At recruitment stage – by the Line Manager and HR Department.
- Year-end review of training requirements assessment
- Ad-hoc training needs - when an employee is given additional or higher responsibility
- Training needs identified & recommended in various loss analyses e.g. Loss Tree Analysis, breakdown analysis, why-why analysis etc.

Target group

- Management and Non-Management staff.
- Workforce of business partners

Training methodologies are different here:

- On the job
- Training events
- Reading
- Structured learning experience
- Coaching
- Specialized training
- Practical hands on

Figure 2.4: Training session

2.3.7: *Pillar 7* - OFFICE TPM:

Office TPM should be started after activating four other pillars of TPM (JH, KK, QM, and PM). Office TPM must be followed to improve productivity, efficiency in the administrative functions and identify and eliminate losses. This includes analyzing processes and procedures towards increased office automation. Office TPM addresses twelve major losses. They are

1. Processing loss
2. Cost loss including in areas such as procurement, accounts, marketing, sales leading to high inventories
3. Communication loss
4. Idle loss
5. Set-up loss
6. Accuracy loss
7. Office equipment breakdown
8. Communication channel breakdown, telephone and fax lines
9. Time spent on retrieval of information
10. Non availability of correct on line stock status
11. Customer complaints due to logistics
12. Expenses on emergency dispatches/purchases

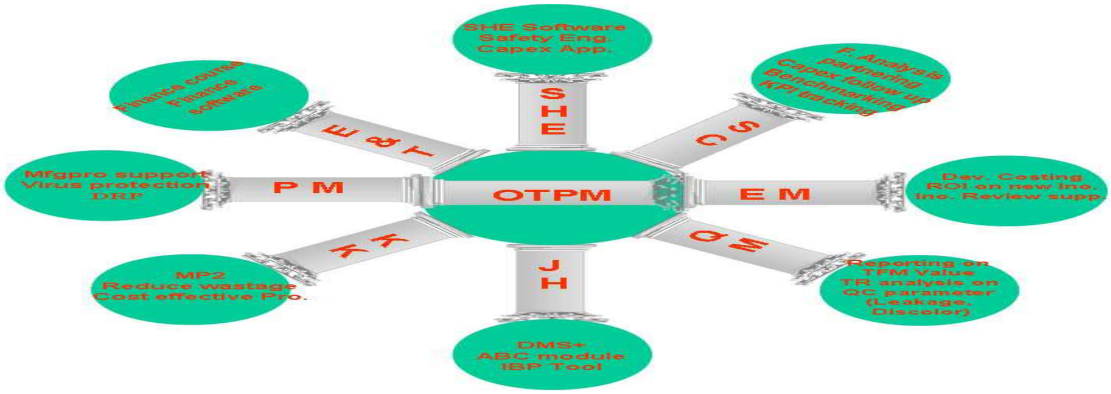


Figure 2.5: OTPM link with other pillar

Unilever Bangladesh activities on Office TPM

OTPM targets & projects*:* Sub-circle projects through 5 pillar activity at factory

Offices TPM pillar aim:

- Customer satisfaction by creating responsive, accurate & actionable information by harnessing IT
- High quality information support
- Instantly responsive system
- Multi skilled Employees–Reducing costs
- Driving Cost Effectiveness Programs

Office TPM activities –overview:

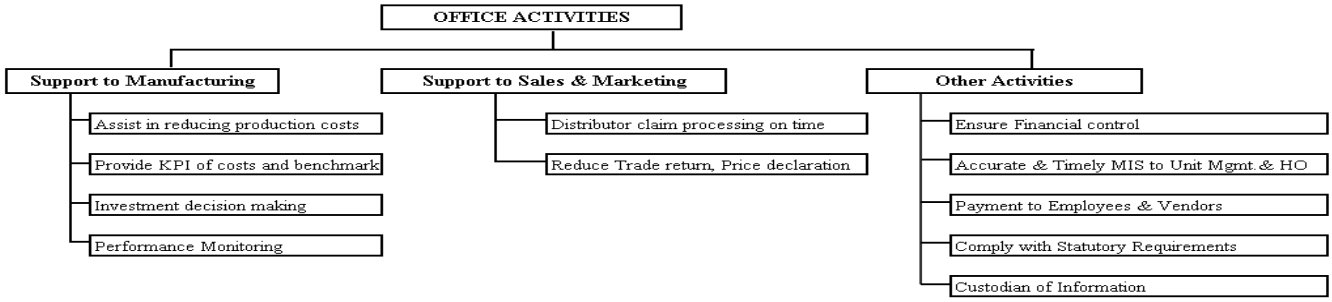


Figure 2.6: OPTM activities

2.3.8: *Pillar 8* - SAFETY, HEALTH and ENVIRONMENT (SHE):

Target:

1. Zero accident,
2. Zero health damage
3. Zero fires.

In this area, focus is on to create a safe workplace and a surrounding area that is not damaged by our process or procedures. This pillar will play an active role in each of the other pillars .

A committee is constituted for this pillar which comprises representative of officers as well as workers. The committee is headed by factory manager. Utmost importance to safety is given in the plant. Manager (Safety) is looking after functions related to safety. To create awareness among employees various competitions like safety slogans, Quiz, Drama, Posters, etc. related to safety can be organized at regular intervals.

Unilever activities on Safety, Health and Environment

Unilever Bangladesh has a clear cut policy on occupational health safety and environment. And this company is strictly maintaining this.

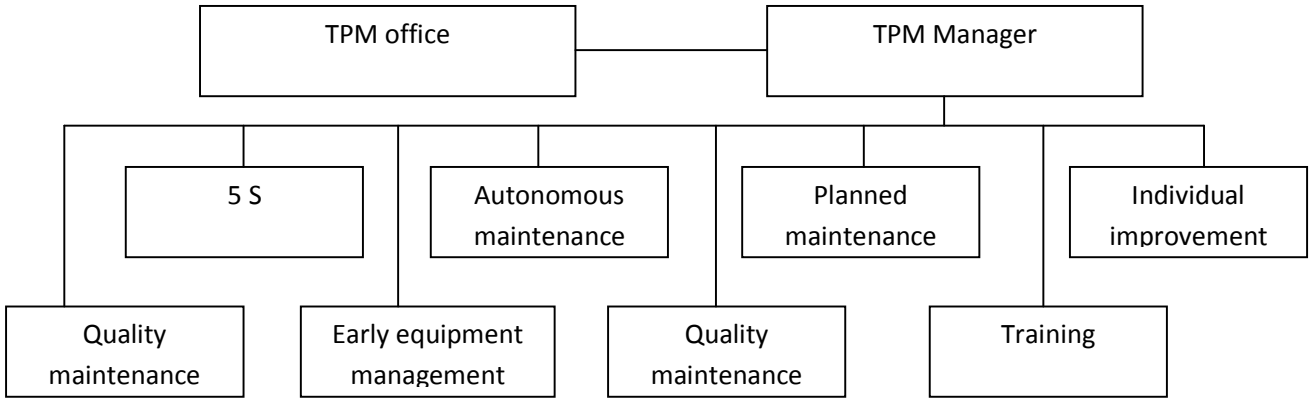
Table 2.3: Unilever SHE policy summary

	Occupational Health & Safety(OHS)	**Environmental Care(EC)**
Highlight	You have a Lifetime of Commitments. Please work Safely.	Leaving behind a better environment for our children.
Objective	UBL is committed to continuously improve the standard of Occupational Health & Safety at work to prevent ALL occupational injuries and illness.	UBL is committed to continuously strive to maintain the highest standards of environmental care by minimizing any adverse impact on the environment.
Goals	-Designing, operating and maintaining facilities and processes that are safe and without risk to health & safety - Maintaining Occupational Health and Safety Management Systems to meet Unilever and statutory requirements -Setting annual improvement targets and reviewing these to ensure that they are being met at all levels - Involving everyone at Company sites in implementation of this policy and providing appropriate training - Investigating all injuries and incidents and use the learning for continuous improvements - Rewarding employees for demonstration of exemplary safe behavior and disciplining for unsafe acts -Implementing Behavior Based Safety as an integral part of operations at all Unilever sites and for business travel - Integrating Road Travel Safety as a prime area of consideration for business travel - Leading Safety by the top Management Team through the Central Safety Health and Environment	-Complying with the National Legislation and Unilever guideline on Environment -Continuously analyzing and improving the environmental impact of our products, processing and packaging operators. -Minimizing the environmental impact of our operations by: -Storing, handling and using chemicals / materials in a safe manner -Maximizing energy efficiency and minimize harmful emissions -Curtailing dust and noise levels -Reducing water consumption and effluent discharge nature. -Minimizing waste generation at source and increase recycle -Minimizing the use of hazardous materials -Maintaining effective procedures for prompt investigation and response to all incidents. -Co-operating and interacting with national environmental authorities. .

	Commitment	-Ensuring all employees understand and comply with their environmental responsibilities – through appropriate training.
Responsibility	-Every employee/contractor is responsible for respective work scope & this is a condition of their employment. -Chairman has overall responsibility.	-Every employee/contractor is responsible for respective work scope and this is a condition of their employment/contract. -Chairman has overall responsibility.
Scope	-The policy applies to all employees and contractors working at UBL manufacturing facilities, offices, warehouses and for employees during business travel.	-The policy applies to all employees and contractors working at UBL manufacturing facilities, offices, warehouses.

2.4. TPM organizational structure

A typical TPM organizational structure is given below [8]



2.5: Unilever Bangladesh TPM policy

Unilever Bangladesh Limited firmly believes that to survive in the increasingly competitive marketplace and crush our competitors – both at home and abroad – we must achieve outstanding performance in terms of cost, quality and customer service levels. This can only be achieved by unleashing the creativity and harnessing the full involvement of each of our employees. As such, we are committed to the implementation of TPM as the vehicle to achieve these objectives and attain world class status in Manufacturing.

Objectives

- To eliminate all forms of waste.

- To reduce costs throughout the extended Supply Chain.
- To continuously improve quality of our products to exceed the expectation of our consumers.
- To improve the reliability of our manufacturing systems & extended Supply Chain to provide timely customer service.
- To safeguard our employees together with the environment we will leave behind for our children.

Implementation

This will be ensured by

- A concerted effort to disseminate the concept of TPM and its impact via intensive training.
- Inculcating a cultural change whereby every employee will care for his equipment and workplace as an extension of his family.
- Instilling a strong sense of ownership, team-working and continuous improvement amongst all employees.
- Promoting a culture of employing a structured approach to identify the root causes of problems and eliminating them.
- Encouraging multi- skilling and creativity so that all employees can make a visible difference to the quality of his works via his knowledge and innovativeness.
- Above all making work an enjoyable and satisfying experience for all employees.

The overall responsibility for meeting the objectives of this policy rests with the Supply Chain Director.

2.6: Early Equipment Management

Innovation project is a combination of most of the pillars. As in innovation smooth execution is a challenge so use of most of the pillars is a common phenomenon in all innovation projects. But mainly the applicable one is early equipment management which is also known as maintenance prevention (MP) or initial flow control. [9]

When new equipment is installed, problems often show up during test running, commissioning, and start-up, even though design, fabrication, and installation appear to have gone smoothly. During this period, production and maintenance engineering people work hard to eliminate

"bugs" in the new equipment. They often make many improvements before normal operation begin. Problems can be caused by

1) Poor selection of materials at the design state,
2) Errors occurring during fabrication of the equipment, or
3) Installation errors.

The delays caused by such problems are very costly. Even then, the repairs, inspections, and adjustments needed during the start-up period, and the initial lubrication and cleaning needed to prevent deterioration and breakdowns are often so difficult to carry out that supervising engineers become thoroughly discouraged. As a result inspection, lubrication and cleaning may be neglected, which needlessly prolongs equipment downtime for even minor breakdowns. Many of these troubles can be avoided when the appropriate processing and operating conditions are built into the equipment through the application of MP design principles. Early equipment Management also minimizes these errors or omission and the delays they cause by identifying or predicting them at the stage in which they occur and taking action at that time to prevent them. The key strategy is simple – the same one operator apply in improving their own cleaning and inspection procedures –thoroughly listing all abnormal conditions , systematically addressing all. Generally, people notice very few problems at the design stage, but the cost of correcting them later is considerably higher. Virtually 95 percent of LCC (life-cycle cost) is determined at the design stage. Certainly, maintenance and energy costs of operation are determined by the equipment's original design. Efforts to reduce LCC after the design stage will affect only 5 percent of the overall figure.

MP design and early equipment management both attempt to reduce the cost of human error and inadequate planning. MP design reduces the cost of the normal operating life of equipment, and early equipment management reduces the cost of the early failure period. To smooth the ride on the road to "Zero breakdowns" and "Zero defects", autonomous maintenance and specialized maintenance activities must be closely coordinated with the work

Unilever Bangladesh aim:

Excellence in execution by achieving vertical start-ups and faster roll-out in all innovations and early Management projects

- *Through Team Working*
- *Structured Early Management Process and*
- *Leveraging knowledge and experience of People*

Chapter-3
Methodology

2.1. Background

Before the TPM the following problems were faced during innovation phase:

- Quality defect and drastic fall of productivity with new product introduction
- Design review for new equipment not done- long period of tome taken to streamline performance of new machines & to achieve desired OEEs plan conformance suffered.
- Projects not managed professionally-falling to meet deadline was natural phenomenon
- Past experience and improvements not documented properly
- Same design flaws remained in new projects.

So for a better start of an innovation project business always wants from R&D (Research and Development) department to do the following things:

❖ Develop any product whose design is manufacturing friendly
- Product design with proper knowledge inline manufacturing capability
- Understand when and where the knowledge is required

❖ Identify the key manufacturing activities
- Influence product designers to modify the design

❖ Products are factory friendly without reducing consumer appeal

So the initial phase management of new product introduction, commissioning of new equipment or production line & new projects R&D needs to ensure the following things-

1. On time and first time right
2. Vertical startup
3. Innovation ramp up

The above 3 will help to achieve the following things which is part of factor overall target

- OEE (Overall Equipment efficiency)

On time & First time right

On time & first time right of a project means the project is started as per the planned network & delivered rightly from the very beginning

Vertical start up

A new plant or line that quickly reaches its target OEE that can make a positive contribution to the overall OEE and consumer service of the whole factory.

Innovation Ramp up

Innovation ramp up of project means the project delivered as per the required demand. It is the plan versus actual production status of any innovation project. The actual production should meet the plan in case of a successfully delivered project.

OEE

OEE stands for Overall Equipment Effectiveness. Essentially, it is a single figure that signifies the utilization of a machine. OEE is a function of the three factors:

1) Equipment Availability
2) Performance Efficiency and
3) Rate of Quality Products.

2.2: Innovation project under TPM activities

2.2.1: Methodologies of project onshore manufacturing of conditioner

The project local manufacturing of conditioner is an important project for Unilever Bangladesh limited (UBL). Unilever Bangladesh imported this item from other country. Later considering the growing demand UBL decided to manufacture it locally. And this is a challenge to deliver this innovation on time. The target of the project was:

On time in Full: Implementation
Innovation ramp up: 95% (as per factory target)
Vertical start up: 350 hour (as per factory target)
OEE: more than 85%

2.2.2.: Early management activities in project onshore manufacturing of conditioner

Early management is a 9 step process

- EPM planning
  - Technical evaluation
    - Concept selection
      - Design for supply chain
        - EEM planning
          - MP design
            - Installation & commissioning
              - Product start up
                - Review

Early product management (EPM)

Early equipment management (EEM)

Early product management:

Early product management was done globally. The following things happen in globally:

- Product developed globally and formulation adopted locally
- Label artwork developed globally and adopt locally. Added values as per local regulatory requirement
- Packaging specification done globally
- Exclusive raw materials sourcing done regionally

Early equipment management

Early equipment management is the final stage in implementation site. This is the successful smooth implementation of the project maintaining proper planning and using some tools.

The following tools were used for this project:

- Networking of the whole project
- 4 M analysis
- FMEA analysis
- MP information
- Safety risk assessment **(**PHA , HAZOP, THA,SOP)
- WWBLA (Why Why Because Logical Analysis)
- MOD
- Trials
    - Pilot scale
    - Large scale
        - processing trials
        - Filling/ packing trial
- One point lesson

Chapter-4
Innovation project study

4.1. Role of innovation in Unilever Bangladesh limited

- 12~15% sales generated from innovation projects
- Due low cost local competition , speedy and consumer relevant FTR innovation key success factor for growth
- Till 2010 the innovation related sales grown up more than thousand million which is about 15% of the Unilever HPC (Home and personal care) business
- Contributing double digit growth since 1999

4.2. Project local manufacturing conditioner: Some information

Conditioner is a premium product. This is mainly used for conditioning the hair. In country like Bangladesh people mainly think first to wash their hair and this purpose is served by shampoo. But in developed country conditioner is used after washing hair to condition hair. Now a day as economy is growing in Bangladesh, the demand of premium product is also increasing. So, conditioner demand and usage is also significantly increasing in Bangladesh.

Unilever Bangladesh Hair care commands a dominant value share. The lead brands are Sunsilk, Clear and Dove. But in all cases the main product is shampoo. The conjunction usage of shampoo and conditioner can be a huge potential. Unilever Bangladesh had imported conditioners for the premium channels. To drive penetration, wider availability and affordability of conditioners is needed in the form of sachets and tubes through local production.

Figure-4.1.a: conditioner tube

Figure-4.1.b: conditioner sachet

4.2.1: Milestone: Launch of local manufacturing of conditioner:

- Roll out in Bangladesh in Q1'2010
- Background:
  - The highly competitive hair market
  - Income level of people is increasing
  - Consumer wants variation : different product in hair category
  - Conditioner is imported from other country, so price is high
  - On time market availability is not possible due to import
  - Different pack size can be possible due to local manufacturing

4.2.2: Project local manufacturing conditioner- launch proposition

- Company wanted to adopt global formulation
- To reach maximum level of user by increasing penetration and habit

So the project was happened based on the following:

- New global formulation
- Superior pack tube and sachet
- Powerful impact of sensorial through perfume and visual display
- Robust design / better out put

4.2.3. EEM (Early Equipment Management) process followed: Project local manufacturing conditioner

EEM planning

- Factory team was first briefed on June 2009
- Capability evaluation of tube and cap production locally
- Formulation shared along with exclusive raw material and packaging structure
- Supply chain starts evaluation souring of tube and cap
- Transfer docket received from regional technology centre on 2nd April 2009
- Project brief meeting with factory team conducted on August'09
- Pilot trial done 5th October 2009
- Main plant trial done 12th November 2009
- Filling trial done for packaging on 13th November 2009
- 4M analysis conducted and major sources of losses identified

4.3: Early Management Tools

The following tools were used for this project:

- Networking of the whole project
- 4 M analysis
- FMEA analysis
- MP information
- Safety risk assessment **(**PHA , HAZOP, THA,SOP)
- WWBLA (Why Why Because Logical Analysis)
- MOD
- Trials : Pilot scale and Large scale
- One point lesson

4.3.1: Network: for project local manufacturing of conditioner:

A “Project” is a set of activities which ends with specific accomplishment and which has (1) Non-routine tasks, (2) Distinct start/finish dates, and (3) Resource constraints (time/money/people/ equipment). “Tasks” are activities which must be completed to achieve project goal. The project is broken into tasks and subtasks. Tasks have start and end points, are short relative to the project and are significant.
Each task has duration. It is very difficult to estimate duration accurately.
“Milestones” are important checkpoints or interim goals for a project. And can be used to catch scheduling problems early. Plan will evolve so be flexible and update on a regular basis. It also helps to identify risk areas for project, for example things if anyone don't know how to do but will have to learn. These are risky because one may not have a good sense for how long the task will take. Or, one may not know how long it will take to receive components you purchased for a project.
Gantt charts are a project planning tool that can be used to represent the timing of tasks required to complete a project because Gantt charts are simple to understand and easy to construct, they are used by the most.
The whole project ‘**local manufacturing of conditioner’** was much planned. And it was an involvement of all concern departments. It was uploaded in online through IPM (Innovation project Management). So, to clearly identify each department’s responsibility (more specifically each position’s responsibility) a planned network was identified.

Figure: 4.2: A network meeting

The network of the project is given below:

Table 4.1: Sunsilk conditioner sachet network

Project network: Sunsilk Conditioner Sachet Launch						
ID	**Task Name**	**Duration**	**Start**	**Finish**	**Predecessors**	**Resource**
0	**Sunsilk Conditioner Sachet Launch.**	**81d**	**12/6/2009**	**3/29/2010**		
1	PM	**54 d**	**12/6/2009**	**2/17/2010**		
2	Receive artwork from Region	1d	12/6/2009	12/6/2009		
3	Provide design & ED to agency	1d	12/7/2009	12/7/2009	2	
4	Provide key ingredients list to agency	1d	12/8/2009	12/8/2009	3	
5	Receive locally adapted artwork from agency	5d	12/30/2009	1/6/2010	4	
6	Lab report	3d	1/6/2010	1/11/2010	5	
7	Incorporate Changes recommended by LAB	2d	1/11/2010	1/13/2010	6	
8	Get authorization schedule approved	1d	1/13/2010	1/14/2010	7	
9	Send Final design to region	2d	1/14/2010	1/18/2010	8	
10	Receive feedback from region	0d	1/18/2010	1/18/2010	9	
11	Hand over final cd output to Buying	1d	1/18/2010	1/19/2010	10	
12	Chromalin from Supplier	3d	1/19/2010	1/24/2010	11	
13	Approval from Lab of Chromalin	3d	1/24/2010	1/27/2010	12	
14	Cylinder Fabrication	7d	1/27/2010	2/3/2010	13	
15	Cylinder Delivery	1d	2/3/2010	2/4/2010	14	
16	Proofing & approval	3d	2/4/2010	2/7/2010	15	
17	PR for bulk production	1d	2/7/2010	2/8/2010	16	
18	Bulk production	7d	2/8/2010	2/15/2010	17	
19	Dispatch	1d	2/15/2010	2/16/2010	18	
20	ETA of laminates at factory	1d	2/16/2010	2/17/2010	19	
21	Storage test	90d	12/22/2009	3/22/2010		
22	Production	5d	3/22/2010	3/29/2010	21	
23	Bulk Production of sachet conditioner	7d	3/22/2010	3/29/2010	20	
24	Primary	0d	3/29/2010	3/29/2010	23	

4.3.2: 4M analysis for project local manufacturing of conditioner

4M analysis is analysis of

- Man
- Machine
- Method
- Material

For any process the reason for any problem should be the 4M (Man, Machine, method or Material). So, man- machine- method- material analysis is done and in this way the problem can be identified before starting the process. If it is identified ago, the preventive steps can be taken to overcome that. For local manufacturing of conditioner a 4M analysis is also done do identify those problem and to solve those. A team was formed to do the 4M analysis of the whole project. The team identified the project step by step, and then probable problems are identified and actions are given there also to solve the problem:

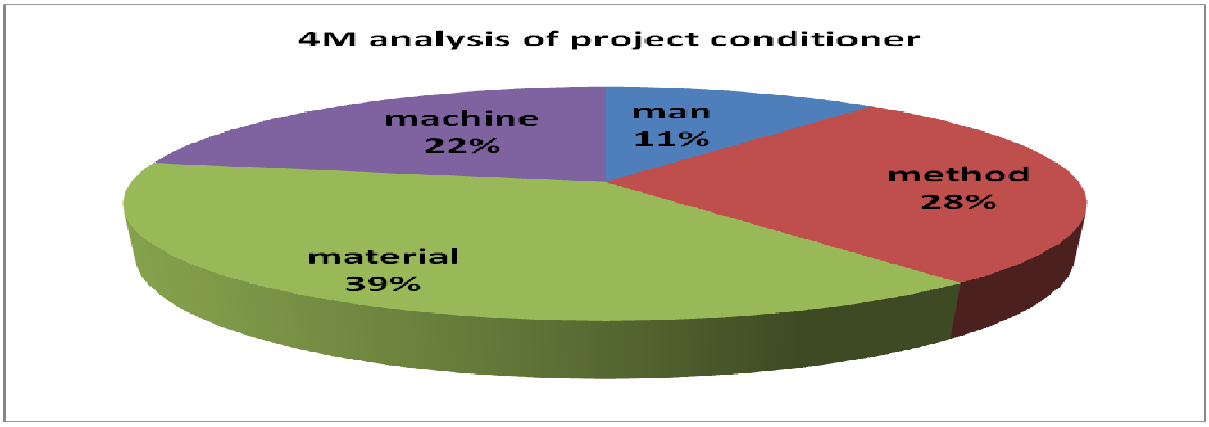


Figure 4.3: Pie chart of 4M analysis of project local mfg of conditioner

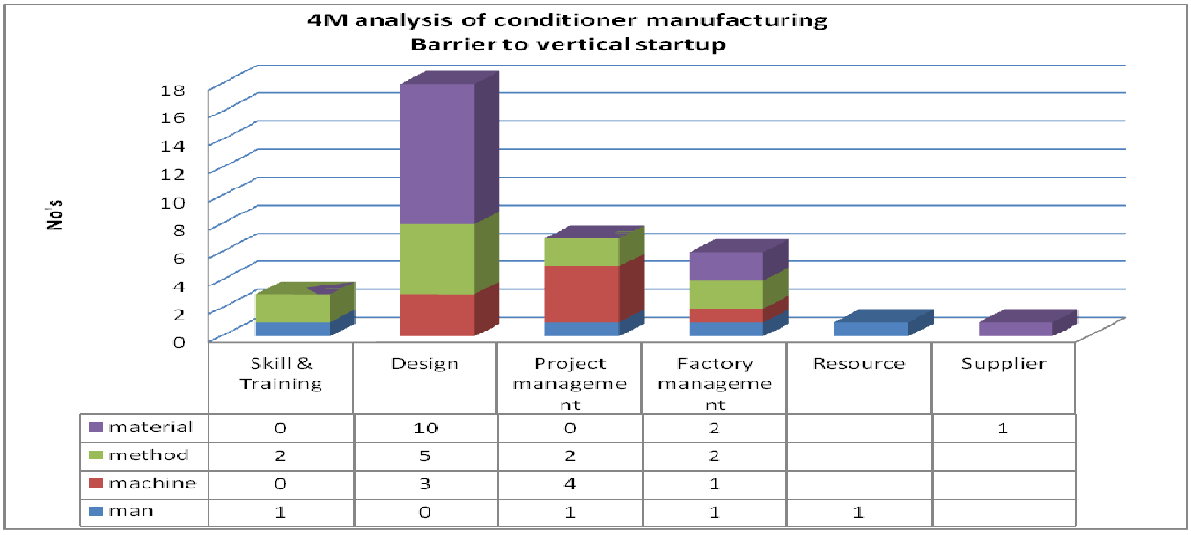


Figure 4.4: Bar chart of 4M analysis of project local mfg of conditioner

4.3.3: FMEA (Failure Mode & Effects Analysis)

Failure modes and effects analysis (FMEA) is methodology for analyzing potential reliability problems early in the development cycle where it is easier to take actions to overcome these issues, thereby enhancing reliability through design. FMEA is used to identify potential failure modes, determine their effect on the operation of the product, and identify actions to mitigate the failures. A crucial step is anticipating what might go wrong with a product. While anticipating every failure mode is not possible, the development team should formulate as much extensive list of potential failures modes as possible.

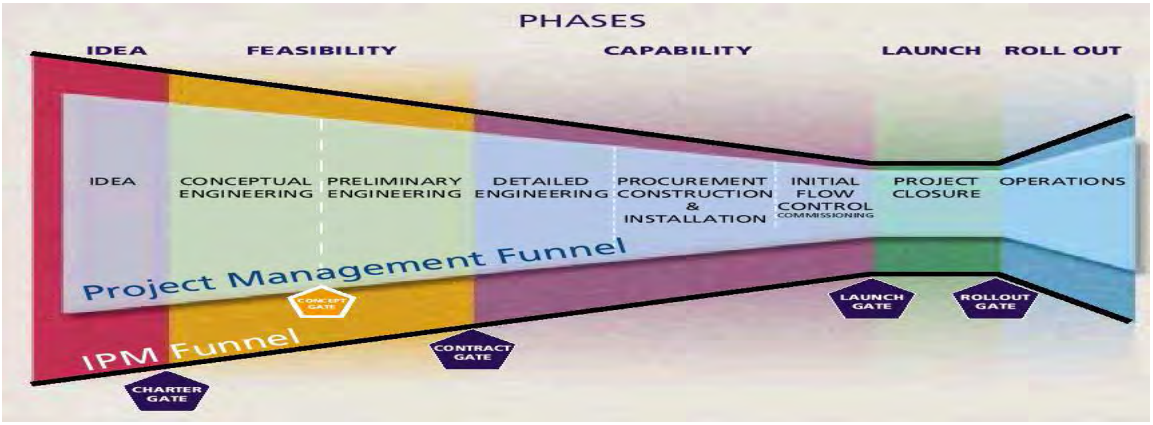


Figure 4.5: Project phase-IPM funnel

The early and consistent use of FMEAs in the design process allows the engineer to design out failures and produce reliable, safe, and customer pleasing products. FMEAs also capture historical information for use in future product improvement

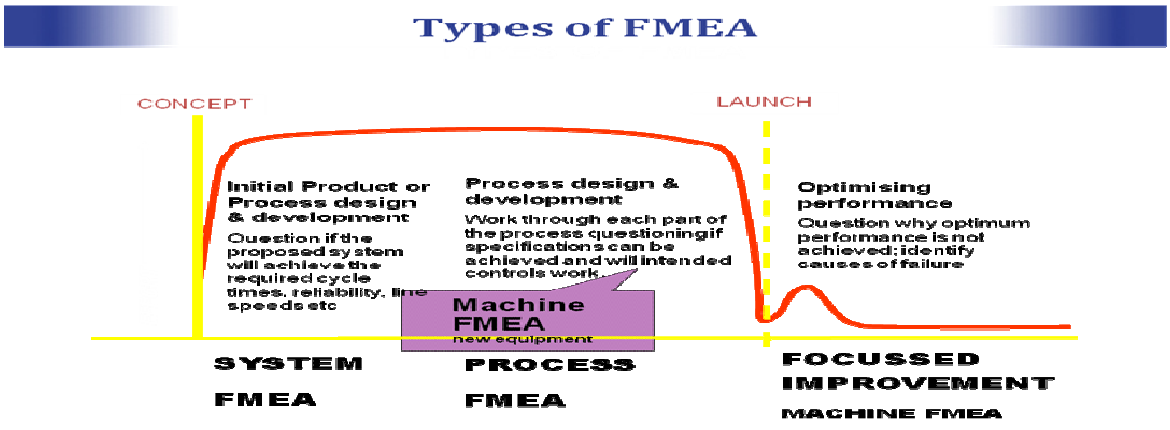


Figure 4.6: FMEA type

For the project onshore manufacturing of conditioner a FMEA analysis was also done which covers the whole process anticipating what could the possible failure so that it can be identified and eliminated. The FMEA analysis of this project is given below

4.3.4: MP (Maintenance planning) information of the equipment

In implementing lean manufacturing practices, machine availability plays an important role. Preventive maintenance is a key aspect in ensuring machine availability. This practice achieves maximum efficient usage of machines through total employee involvement.
Unilever Bangladesh has created an organizational culture that encourages employee participation, which is essential for successful TPM. Group activities are promoted among the shop-floor team members. The knowledge base of all the employees is used to improve equipment reliability and productivity thereby lowering maintenance and operating costs. Two other important aspects of TPM are training and open communication between operators and engineering. Production personnel are trained to perform routine maintenance.
The traditional approach to preventive maintenance is a clear-cut division of labor.

- Machine operators perform routine maintenance functions.
- Maintenance technicians are responsible for specialized maintenance and for improving maintainability.
- Engineering is responsible for improving the process.

This practice is not capable of achieving the TPM targets, as there is a lack of communication between operating and maintenance teams.
There are two different types of philosophies of TPM. Firstly, there is the centralized maintenance approach. This requires maintenance personnel to be cross-trained, thus providing flexibility of using a number of workers for scheduling maintenance tasks. This flexibility is essential because as workers move up in seniority level, there is a tendency to opt for convenient shifts instead of third shift. The second approach is decentralization. As personnel become more experienced in one functional area, they gain more expertise. Sometimes it requires six months of training before a person becomes proficient in a new area. Thus, frequent job rotations may result in under-utilization of skills gained through training. Each department has a separate maintenance team.
Unilever has a centralized maintenance function with cross-trained employees. The benefits of decentralized maintenance are derived from the use of technicians. These technicians are experts in their areas. However, availability of limited maintenance personnel necessitates cross-trained employees. As a part of early management in maintenance planning pillar Unilever Bangladesh maintains the following things for any projects:

- Maintenance practices (MP)
- PM schedule
- Planned inspection schedule (PIS)
- Trial (specific project) report findings

4.3.4.1. Maintenance practices (MP)

For the project local manufacturing of conditioner was also as part of the running TPM practices. However we will discuss the following section how the MP (maintenance practices) benefitted the local manufacturing of conditioner. The MP function of this specific project was done for-

SHE (safety health and environment) requirements are identified

- Requirements are being incorporated during the **design stage**
- Detail process & equipment **risk assessments** done
- Consideration and action taken to improve **cleaning, lubrication, inspection & changeover** tasks given
- Equipments being purchased ensuring necessary technical **performance** requirement
- Every investment was approved by higher authority through the **CAPEX**

After detail discussion during the project the following things were identified:

- No modification of wrapping machine is required
- Chiller required
- Conditioner is shear sensitive product, so need to avoid friction after product produced
- Some line modification required

4.3.4.2. Planned maintenance (PM) schedule

Kalurghat factory performed a planned maintenance schedule for the every equipment.

For this specific project the equipment used mainly

- Universal mixer -for product manufacturing
- AM machine- for product packing
- Utilities
    - Chiller
    - Boiler
    - Vacuum pump

All equipments are under the PM schedule. So there maintenance is ongoing after every certain interval for all equipments. The PM schedule of the machine where the conditioner was packed is given in the next pages

4.3.4.3. Planned inspection schedule (PIS)

Inspection is part of ensuring proper service receive from any equipment & avoid unplanned shutdown of that equipment. It is also help to ensure proper safety.
Unilever Bangladesh maintains a proper inspection schedule for all section of a plant. The PIS schedule mainly covers some specific points /issues for all equipments. And it is done by different person throughout the year. It is done by planned way and schedule is shared at the start of each year. And the innovation projects are also delivered on time with this kind of activities
Some major points covered in planned inspection schedule:

1. Emergency Stop switch
2. Machine Door/ Micro switch (M)
3. Visual earthing (panel Board)
4. Visual earthing /gland (Motor)
5. E-Inverter, Panel board & transformer
6. Gland
7. E-Earthing / Motor cover/ Coupling Cover (M)
8. Noise Level.
9. Dust level.
10. Floor/ Staircase.
11. Fire Extinguisher/ Fire Hydrants.
12. Weighing Scales./ Electronics balances.
13. Personal Protective Equipment (PPE).
14. Wooden Planks for Tidal Bore.
15. Steam System checklist
16. Tools.
17. Environmental Safety
18. V-belt.
19. Mechanical Lift
20. Spray Insect Killer

Table 4.7: Planned inspection schedule (PIS)

Unilever Bangladesh Limited

2010 Annual Inspection Schedule of Personal Products Departments (SANKALP)

SL #	Items.	Month	January				February				March					April					May					June					July					August					September					October					November					December				
		Week #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
			7-Jan	14-Jan	21-Jan	28-Jan	4-Feb	11-Feb	18-Feb	25-Feb	4-Mar	11-Mar	18-Mar	25-Mar	1-Apr	8-Apr	15-Apr	22-Apr	29-Apr	6-May	13-May	20-May	27-May	3-Jun	10-Jun	17-Jun	24-Jun	1-Jul	8-Jul	15-Jul	22-Jul	29-Jul	5-Aug	12-Aug	19-Aug	26-Aug	2-Sep	9-Sep	16-Sep	23-Sep	30-Sep	7-Oct	14-Oct	21-Oct	28-Oct	4-Nov	11-Nov	18-Nov	25-Nov	2-Dec	9-Dec	16-Dec	23-Dec	31-Dec
1	Emergency Stop switch		Abdur Rob Majumder ID # 196		Alamgir Hossain ID # 200		Mazharul Islam ID # 202		Rezaul Karim Akon ID # 1424		Abdur Rob Majumder ID # 196		Alamgir Hossain ID # 200			Mazharul Islam ID # 202		Rezaul Karim Akon ID # 1424			Abdur Rob Majumder ID # 196		Alamgir Hossain ID # 200			Mazharul Islam ID # 202		Rezaul Karim Akon ID # 1424		Abdur Rob Majumder ID # 196		Alamgir Hossain ID # 200			Mazharul Islam ID # 202		Rezaul Karim Akon ID # 1424		Abdur Rob Majumder ID # 196		Alamgir Hossain ID # 200			Mazharul Islam ID # 202		Rezaul Karim Akon ID # 1424		Abdur Rob Majumder ID # 196		Alamgir Hossain ID # 200			Mazharul Islam ID # 202		Rezaul Karim Akon ID # 1424		
2	Machine Door/ Micro switch (M)																																																									
3	Visual earthing (panel Board)																																																									
4	Visual earthing/gland (Motor)																																																									
5	E-Inverter, Panel board & transformer C-Gland																																																									
6	E-Earthing/ Motor cover/ Coupling Cover (M)																																																									
/	Noise Level.		1337 (Zakir)				1337 (Zakir)				1337 (Zakir)					1337 (Zakir)					1337 (Zakir)					1337 (Zakir)					1337 (Zakir)					1337 (Zakir)					1337 (Zakir)					1337 (Zakir)					1337 (Zakir)				
8	Dust level.		1337 (Zakir)								1337 (Zakir)										1337 (Zakir)								1337 (Zakir)								1337 (Zakir)								1337 (Zakir)									
9	Floor/ Staircase.		505 (Kamal)				530 (Bari)				9051 (Atul)					9110 (Mahbub)					505 (Kamal)					530 (Bari)					9051 (Atul)					9110 (Mahbub)					505 (Kamal)					530 (Bari)					9051 (Atul)				9110 (Mahbub)			
10	Fire Extinguisher/ Fire Hydrants.		1241 (Sawkat)				1233(Kiran)				1234 (Bazlu)					1241 (Sawkat)					1233(Kiran)					1234 (Bazlu)					1241 (Sawkat)					1233(Kiran)					1234 (Bazlu)					1241 (Sawkat)					1233(Kiran)				1234 (Bazlu)			
11	Weighing Scales./ Electronics balances.		1245 (Masud)				1239(Khaleq)				1363 (Masud)					1245 (Masud)					1239(Khaleq)					1363 (Masud)					1245 (Masud)					1239(Khaleq)					1363 (Masud)					1245 (Masud)					1239(Khaleq)				1363 (Masud)			
12	Personal Protective Equipment (PPE).		1233(Kiran)				1287(Shyamol				1238 (Nazrul)					1233(Kiran)					1287(Shyamol					1238 (Nazrul)					1233(Kiran)					1287(Shyamol					1238 (Nazrul)					1233(Kiran)					1287(Shyamol				1238 (Nazrul)			
13	Wooden Planks for Tidal Bore.		530 (Bari)				9051 (Atul)				9110 (Mahbub)					505 (Kamal)					530 (Bari)					9051 (Atul)					9110 (Mahbub					505 (Kamal)					530 (Bari)					9051 (Atul)					9110 (Mahbub				505 (Kamal)			
14	Steam System checklist		115 (Alam)				122(Rubin)				124(Basar)					125 (Nazim)					115 (Alam)					122(Rubin)					124(Basar)					125 (Nazim)					115 (Alam)					122(Rubin)					124(Basar)				125 (Nazim)			
15	Tools.		Mr. Pradip				Mr. Hossain				Mr. Mahbub					Mr. Abeed					Mr. Pradip					Mr. Hossain					Mr. Mahbub					Mr. Abeed					Mr. Pradip					Mr. Hossain					Mr. Mahbub				Mr. Abeed			
16	Environmental Safety		Mr. Mahbub				Mr. Abeed				Mr. Pradip					Mr. Hossain					Mr. Mahbub					Mr. Abeed					Mr. Pradip					Mr. Hossain					Mr. Mahbub					Mr. Abeed					Mr. Pradip				Mr. Hossain			
17	V-belt.		Nazim Uddin ID # 125													Nur E Alam ID # 115														Rubin Hembrom ID # 122														Abul Bashar ID # 124											
18	Mechanical Lift		Mazharul Islam ID # 202													Abdur Rob Majumder ID # 196														Rezaul Karim Akon ID # 1424														Alamgir Hossain ID # 200											
19	Spray Insect Killer		3P				3P				3P					3P					3P					3P					3P					3P					3P					3P					3P				3P			

	Managers
1	Mr. Atiqur Raza. (Circle Leader)
2	Mr. Prodip Kumar Dhar
3	Mr. Anwarul Islam
4	Mr. Hossain Uddin
5	Mr. Mahbub Uddin
5	Mr. Abeedur Rahim

AREA/ EQUIPMENT

1	Fryma Mixer # 1 & Side pot.	9	AM-2000	17	Autopack Vaseline	25	Cooling Tower # 1	33	SHUBHAM # 3	41	Dust Collector Area.
2	Fryma Mixer # 2 & Side pot.	10	NM-1002 & NP-2002	18	5-LN Hassia	26	Cooling Tower # 2	34	SHUBHAM # 4	42	All Feed Pump.
3	Universal Mixer # 1 & Side po	11	Wuxi # 1	19	5-LN Tecmar	27	Distilled Water Plant.	35	SHUBHAM # 5	43	All Vacuum Pump
4	Universal Mixer # 2 & Side po	12	Wuxi # 2	20	Chiller 1	28	Effluent Discharge Pump.	36	SHUBHAM # 6	44	All Panel Board.
5	Universal Mixer # 3 & Side po	13	Autopack (Bottle)	21	Chiller 2	29	Air Compressor	37	SHUBHAM # 7	45	All Switch Board.
6	Universal Mixer # 4 & Side po	14	Autopack (Jar)	22	IPS.	30	All FLEX	38	Mechanical Lift.	46	All Transfer Pump.
7	Universal Mixer # 5 & Side po	15	Autopack (Aerofiller)	23	Mechanical Lift.	31	SHUBHAM # 1	39	Water Cooler.	47	Kissan room
8	Vaseline Mixer	16	Liquid (Aerofiller) 1	24	Day Tank	32	SHUBHAM # 2	40	Pneumatic Pump.	48	

TEAM MEMBERS

1	Mr. Abdul Bari. ID # 530	6	Mr. Abul Basher, T.# 124	11	Mr. Mazharul Islam, T.# 202	16	Mr. Shyamol Biswas, T.# 1287	21	Mr. Masud Khan, T.# 1363
2	Mr. Kamal Chy. ID # 505	7	Mr. Nazim Uddin, T.# 125	12	Mr. Rezaul Karim, T.# 1424	17	Mr. Zakir Hossain. T.# 1337	22	Mr. Hemlal Howlader T.# 1366
3	Mr. Atul Peris. ID # 9051	8	Mr. Jahangir Alam. T.#127	13	Mr. Nazrul Islam, T.# 1238	18	Mr. Jasio Polash. T.# 1358	23	Mr. Kiran Das, T.#1233
4	Mr. Nore Alam. T.# 115	9	Mr. A. R.Majumdar. T.#196	14	Mr. Abdul Khaleq, T.# 1239	19	Mr. Sattyajit Roy. T.# 1359	24	Mr. A. Zaman. ID # 9109
5	Mr. Rubin Hambrom T.# 122	10	Mr. Alamgir Hossain, T.# 200	15	Mr. Masud Khan T.# 1245	20	Mr. Prince Mistry. T.# 1361	25	Mr. M. Rahman. ID # 9110

4.3.4.4. Trial (specific project) report findings

Trials are the part of capability building of any projects. Trial is done to check the gaps & later recommendations were given to do modification for smooth execution of the project.
In case of local manufacturing of conditioner total 2 trials were done to identify the gaps.

- Pilot basis trial
- Main plant trial.

In both cases after completion of trial product were analyzed and compare with the recommended specifications.
Later formal reports were shared with concerned people. And modifications were suggested in that report.
Project conditioners manufacturing the main recommendations were:

1. Cooling facility ready in side pot of a mixer
2. New Chillers need to install
3. By pass line for homogenizer

Later as per recommendations modification were completed.

4.3.5: Safety risk assessment for the project:

Safety is the first priority for Unilever. For doing anything the safety ensures should be must. To ensure safe and user friendly work place is the main motto for Unilever. In the innovation project the same polity is also applicable. For a project the safety assessment are done in following way:

- Preliminary Hazard Analysis (PHA)
- Hazard and operability analysis (HAZOP)
- SEAC(Safety & environmental assurance centre) clearance through SIMAS (safety in manufacturing & supply) apply
- Task Hazard Analysis (THA)
- Standard operating procedure (SOP)

PHA is mainly hazard or risk analysis of any project from the very beginning, initial stage of the project. It is one kind of risk anticipation. And based on the anticipation the project is started. PHA analysis is done by cross functional team so that major risk can be identified initially and sudden surprises don't come later. Normally experts from each department join in this PHA analysis session.

Hazard and operability analysis (HAZOP) is done when the project has clear visibility. It is hazard analysis of the project. Normally when the project layout is finalized and the construction is going on then the HAZOP study is started. HAZOP is done by cross functional team, where the relevant manufacturing department, engineering team, SHE team, R&D team, project team participates. As it is a detail analysis, so all kind of safety risk is tried to identify there. And finally recommendations are given to the project team so that a safe system can be established.

SEAC clearances are taken for specific project. SEAC is an online approval process where the safety risks are analyzed by the global Unilever safety evaluation team. In this online system SEAC team ask some question. After evaluating that other questions are asked step by step. If they are satisfied with the system and answer, then project is approved. Otherwise they recommend some more action which needs to be addressed in the proposed process.

Task hazard analysis (THA) is done after completing the process and before start. Here step by step full process is identified. Then the hazards associated in each steps are identified. Then hazard ratings are given and controls are also included there.

Standard operating procedure (SOP) are identified or written after doing the THA. When THA is completed then based on that SOP is written

4.3.6: WWBLA (Why Why Because Logical Analysis) for the project

In this project we used WWBLA (Why Why Because Logical Analysis). WWBLA technique is a worksheet which identifies the root causes of a problem. In this technique, each major problem is considered separately and a worksheet is prepared. For each major problem, a cause is identified and called it first factor for problem. Then it is verified whether it can be divided into further root causes. If it is possible, then it is marked as G. Here, G stands for Go. Then a second factor for problem is identified and verified. In this way, a third, fourth problems are identified. If it is not possible to identify further, then verification is marked as NG, (NG stands for No Go). Finally, countermeasures are identified for each root causes of the problem [10].

In case of this project local manufacturing of conditioner we did WWBLA for specific problem. The issue is “low cooling efficiency with the current system”, which needed to be identified to increase the efficiency level of this specific project process system, as well as current ongoing system.
The team consists of representative from cross function (Manufacturing, Engineering, R&D) worked and tried to find out the issues with solutions.

4.3.7: MOD for design

MOD is short form of modification. MOD is a systematic process; by using this most of the major modification change is done. It is very important tool for change management.
MOD is a form where the change is described. The following things are presented in a MOD:

- Current system (Pictorial /Drawing attached),
- The proposed system (with probable drawing).
- Benefit with the change
- Safety Risk assessment

Normally MOD is initiated by user side, then it is evaluated by technical side, safety department & finally circle leader. After implementation of the MOD, detail communication is done in the floor level so that no confusion arises. And THA, SOP are updated accordingly
In the project local manufacturing of conditioner, initially the project was not capable to produce the product. So, some major modifications were identified without this the project cannot be possible.
Some major modifications are:

- Chillers facility up gradation
- Different Line modification

As this are something changes which were done by modified current system. So total systematic approach was done by using a MOD informing and taking approval from all stakeholders.

4.3.8: Trials for project local manufacturing of conditioner

Project local manufacturing of conditioner manufacturing process was very new for Unilever Bangladesh. So trial was necessary to build the capability as well as confidence. For this project 2 type of trial was done.

1. Pilot plant trial and 2. Main plant trial

For a trial the following things were maintained.

- Initial works
- Check list
- Trial authorization
- Report
- Product storage

- **Initial works:** There are some initial works for trial:
  - Check the formulation; find out the exclusive raw materials which are not currently available in the system.
  - Then raise product & packaging structure in the EPR (enterprise resource system)
  - Order for necessary raw & packaging material for trial
  - After raw material /pack material arrival do necessary lab analysis

    Physio-chemical and Microbial
- **Check list:** This list covers the all preparation of a trial. It is a list which is applicable for all stage of a project (Idea, feasibility, capability, launch & post launch). The main benefit of this list is it's automatically help to identify what to do next in each stage.

- **Trial authorization:** Trial authorization is very systematic approach before going to start any trial. It covers the purpose of trial, changes, safety risk assessment of that specific trial. Normally trial authorization is initiated by R&D department, and then it goes to concerned manufacturing dept, QA dept, SHE dept & finally Factory head.
- **Report :** After completion of trial a formal report is shared to all concern

- **Product storage:** After trial the product was kept in different storage condition so that the characteristic of that product can be identified. The trial product is checked in each month for 3 months & report shared. After successful completion of storage the launch of any product will happen.

4.3.9: One point lesson for project local manufacturing of conditioner

OPL (One point lesson) is a method of communication of any important message to mass level. After completion of any task, the change needs to be communicated to the mass level. That's why the one point lesson is very useful tool to share the desired information.

OPL is a sheet where the correct or wrong thing is present pictorially in the single page so that everyone identifies/ understands the right or wrong. Later understanding the matter both mentor & teacher sign in the sheet. And this process continues

Table: 4.15:OPL

Chapter 5
Performance measuring tools

5.1: Overall Equipment Effectiveness (OEE)

OEE helps us analyze the problem and make improvements. OEE measures the availability, performance and output quality of a machine. [11]

- OEE analysis starts with theoretical production time. That is the amount of time any plant is open and available to produce parts.
- From the theoretical production time, need to subtract the scheduled downtimes (e.g. Lunch, breaks, mass meetings, periods where there is nothing to produce, scheduled maintenance). The remaining time is the **Planned Production Time**
- Within that available period of time there may be problem for **Downtime Losses, Speed Losses and Quality Losses.** That will reduce the maximum achievable output and the goal is to reduce or eliminate these losses.

Overall Equipment Effectiveness (OEE) accounts for losses due to equipment downtime, slowed production and product defects;

Overall Equipment Effectiveness (OEE) = Availability x Performance x Quality Yield

5.1.1. Availability

Availability is its measure of losses due to equipment downtime;

Availability takes into account the downtime losses. This includes all events that stop production for certain period of time, which can be considered as a 'traceable event', normally several minutes. Equipment failures, no material and change over times have to be considered. The remaining time is called the **Operating Time or Utilization**

Rate of Quality Products Availability = (time available for production – downtime Time) /available for production

5.1.2. Efficiency

Performance efficiency is its measure of losses due to slowed production;

Efficiency takes into account speed losses. This includes all inhibitors that cause the machine to operate in a speed lower than the maximum. Possible reasons are worker inefficiency, mis feeds, speed, machine wear or simply not optimized processes.

We call the remaining time Net Production Time

Performance efficiency = (ideal cycle time x number of parts produced)/ operating time

5.1.3. Rate of Quality Products

Rate of Quality Products (Quality Yield) is its measure of losses due to product defects.

Quality Losses includes produced parts or products that do meet the quality standards and have to be reworked or scraped.

The remaining time is the Effective Production time

Quality Yield = (Total number of parts produced – defective parts) / total number of parts produced

So, Overall Equipment Effectiveness (OEE) = Availability x Performance x Quality Yield

The OEE tells how effective is the machine or piece of equipment works or in other words….what the relation of added value vs. wastage is.

It considers the most common and important sources of production losses. OEE is the best way to monitor and to improve the effectiveness of a machine, equipment, manufacturing cell or even an assembly line.

Based on the experience of successful TPM companies, the ideal factors for OEE are:

Availability.... greater than 90%

Performance efficiency.... greater than 95%

Rate of quality products ... greater than 99%

Chapter 6
Performance measurement

6.1. Target of the project

The target of the project was:

- On time: Implementation
- Vertical start up: 350 hour (as per factory target)
- Innovation ramp up: 95%(as per factory target)
- OEE: more than 85%

6.2. Target: Status

6.2.1: On time: Project delivered on time:

As per the network of the local manufacturing of conditioner commercial production was in April'10. The production starts on time in the month of April without fail. Initially in that month the production ran for 5 days starting from 13th April. Later second phase - production started on 16th May and continued for 3 days without fail.

6.2.2: Vertical start up:

In terms of vertical start up the project achieved its target very successfully. Thought the target was to achieve within 350 hours, but for this project it achieved within 24 hours.

Production started on 13th April and in initial day the target of production was

- In machine: 1----2 ton
- In machine: 2----1 ton

And in both machine the production was achieved successfully

Table 6.1: Production plan VS actual production

		13Apr'10	14Apr'10	15Apr'10	16Apr'10	17Apr'10	18Apr'10
Machine: 1	**Plan (Ton)**	**2**	**No production**	**2**	**3**	**3**	**3**
	Prod(Ton)	**2.12**		**1.64**	**2.13**	**3.10**	**1.95**
Machine: 2	**Plan(Ton)**	**1**		**2**	**3**	**3**	**3**
	Prod(Ton)	**1.96**		**2.89**	**3.09**	**2.83**	**1.77**

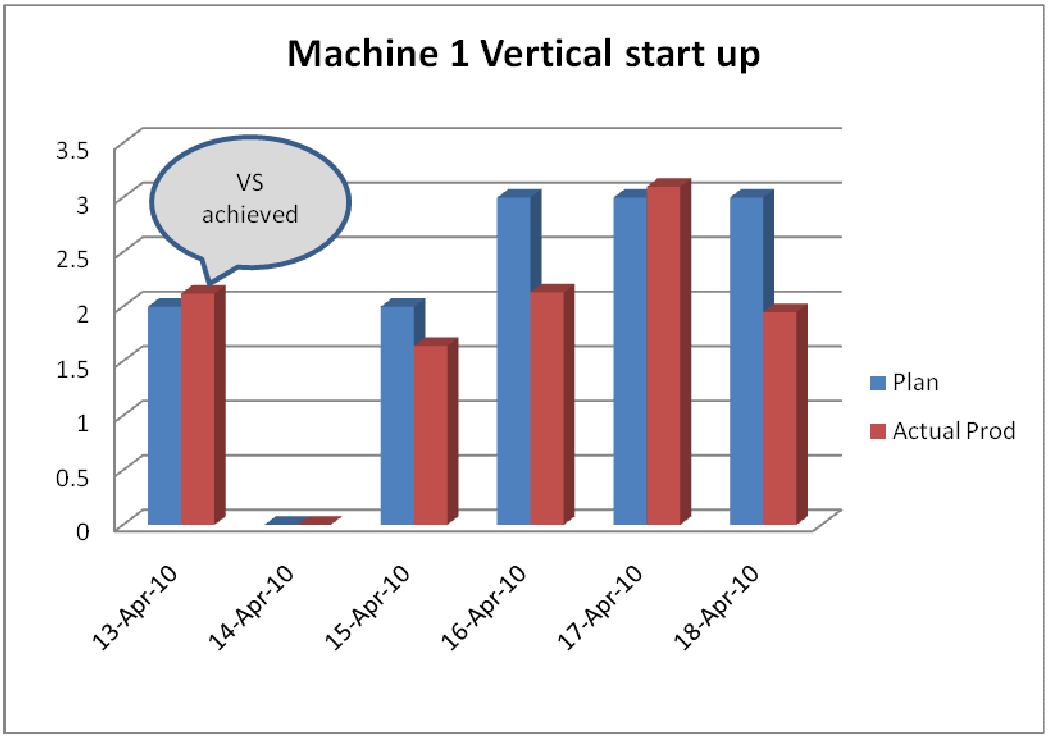


Figure 6.1: Vertical start up (machine 1)

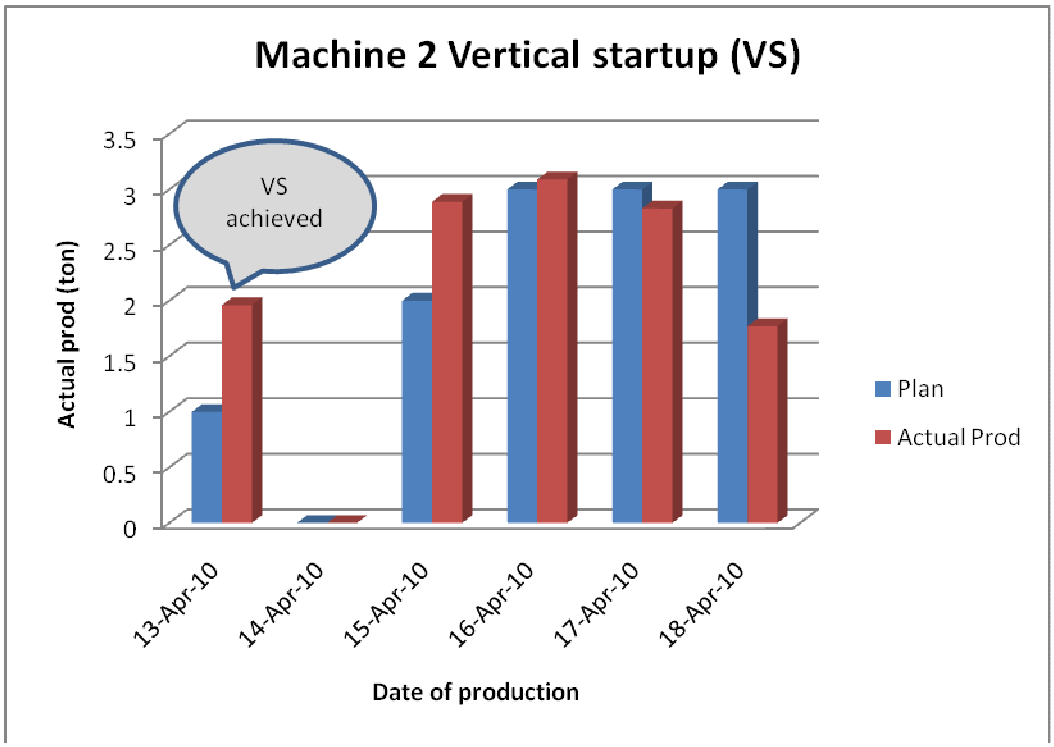


Figure 6.2: Vertical start up (machine 2)

6.2.3: Innovation ramp up:

In terms of innovation ramp up the project was completely successful. Normally innovation ramp up is calculated considering for 4 week (1 month) production data. It means what is the total plan in this time and what achieved.

For the project local manufacturing of conditioner, it was started on 13th April '10. However initially it ran for 5 days. Then again it started it production in 14th may and continued for 3 days ending at 18th may. So, we have calculated the production data from 13th April to 18th may. In between this time the total production plan was 41 ton and actual production happened 39.06 ton. So, total production achieved against plan: **39.06/41=95.27%.**

Table 6.2: April'10 plan VS production (considering both machines)

April	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Plan(Ton)	3	0	4	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0
Prod(Ton)	4.08	0	4.53	5.22	5.93	3.72	0	0	0	0	0	0	0	0	0	0	0	0

Table 6.3: May'10 plan VS production (considering both machines)

May	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Plan(Ton)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	6	6
Prod(Ton)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.05	6.79	7.74

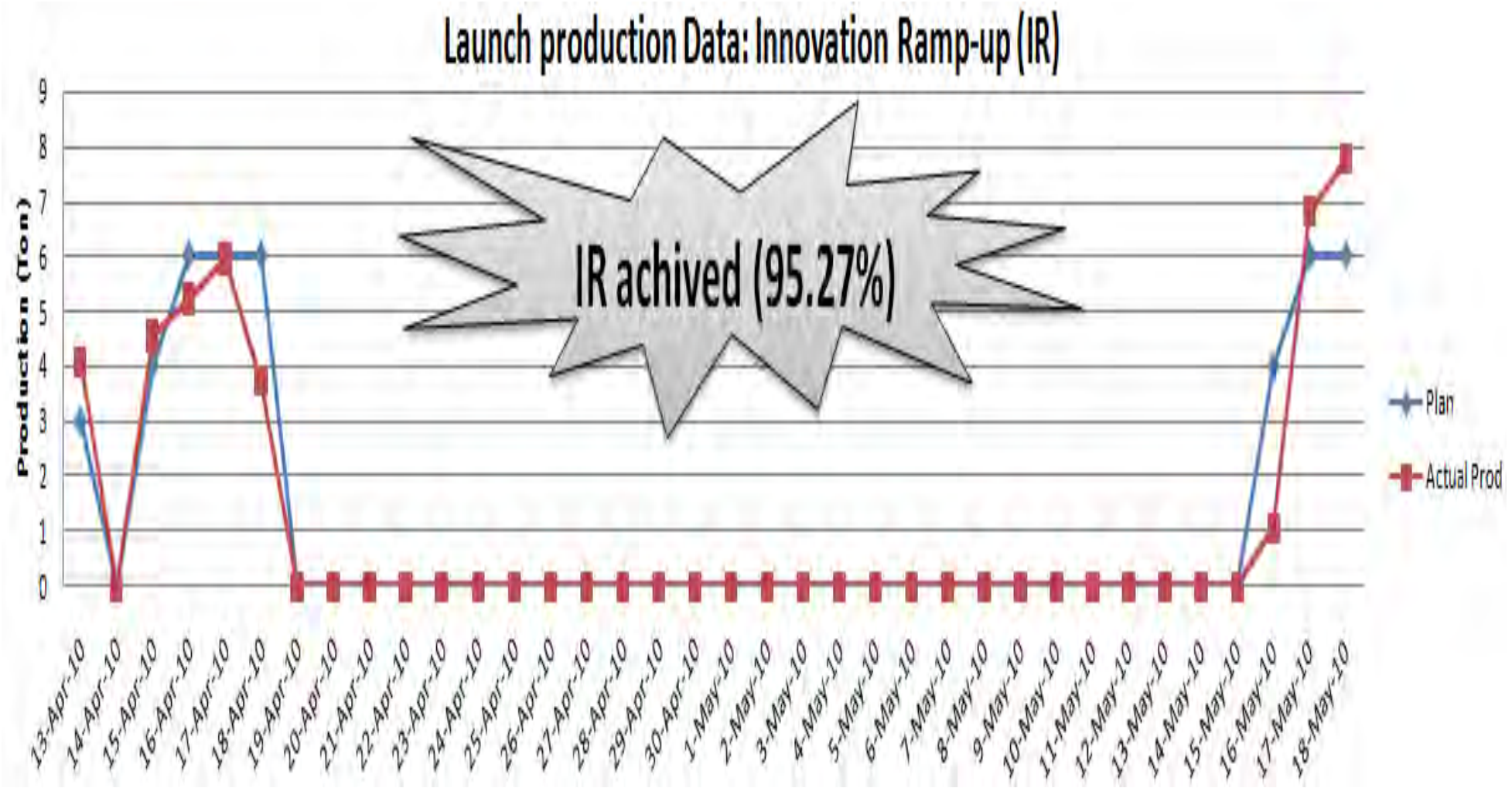


Figure 6.3: Innovation ramp up

6.2.4: OEE:

OEE is calculated in two stages (sachet & tube individually) for the innovation project. And finally the average OEE is taken. In both cases and the average OEE achieved the target.

OEE = Availability x Performance x **Quality rate**

For the production in between 13th April **t**o 18th April '10:

Table 6.4: Vertical start up (machine 1)

13-Apr-10 to 18 April	**Unit 1 (7 ml)**		**Unit 2 (7 ml)**		
	M/C - 1	M/C - 2	M/C - 3	M/C - 4	M/C - 5
AVAILABILITY	75%	68%	76%	76%	77%
PERFORMANCE RATE	110%	132%	110%	132%	125%
QUALITY PRODUCT RATE	99%	99%	99%	100%	97%
OEE	81%	89%	83%	100%	93%
Avg OEE	**89%**				

For the production in between 16th May to 18th May '10:

Table 6.5: Vertical start up (machine 2)

16/5/2010~18/5/2010	**Unit 3**
	Conditioner 90 ml
AVAILABILITY	90%
PERFORMANCE RATE	97%
QUALITY PRODUCT RATE	98%
OEE	**85%**

Considering both the avg OEE is:

OEE	**87%**

The details of the calculation are given in next pages:

Chapter 7
Conclusion

In this thesis work TPM activity of an innovation project at Unilever Bangladesh was observed and how this company is benefitted with this TPM application was tried to find out. TPM is a huge concept and not only Unilever Bangladesh but also other Unilever companies in the world have already adopted this concept and benefitted. Unilever Bangladesh has adopted this concept in year 2001 & already completed 2 level of TPM certification. After adopting the concept the company has done extremely well in all sectors including innovation projects implementation by doing early management. If we see that last 5 years data (from 2004~2009) the vertical startup (VS), innovation ramp up (IR) and on time delivery everything were above 90%, which reflects a planned & successful use of TPM tools. Now a day Unilever Bangladesh limited is practicing the culture of delivering all innovation projects as per timeline with full success.

The main achievement of this thesis project is to show how a TPM culture can make the difference in any system. For this we have chosen a details project "local manufacturing of conditioner", we observed the full project from very beginning stage – how the project concept shared to relevant people, network prepared, find out necessary bottle neck for the project and solve these problem by using different tools. In case of Unilever Bangladesh as TPM already in practice, so lots of good practices are already in the system which helping the full system along with innovation projects. After doing all those things the following are the benefits for the company & the consumer from this specific innovation project:

P: Productivity:

The production of this local manufacturing of conditioner was started without any fail. The launch target was achieved as per plan. And OEE was more than 85% (actually 87%)

Q: Quality:

In this project the quality of the product was ok, that's why the OEE achieved as per target.

C: Cost:

In this thesis we observed that by applying different TPM concept (WWBLA, FMEA, 4M, PM etc) as a part of early management, helped to reduce the unnecessary cost. That's why conditioner has already taken a stronger position in market against competition.

D: Delivery

A systematic approach from TPM (network, risk assessment, check list etc) tools made possible to deliver right product at right quantity at right time. In this project Unilever target for deliver CCFOT (Customer Case Filled on Time) was more than 95%. And this was achieved by delivering innovation ramp-up 95.27%

S: Safety health & environment

In this thesis we have shared how Unilever Bangladesh is doing necessary risk assessment (PHA, HAZOP, THA, SOP MOD etc) on all innovation projects including this project. And this project local manufacturing of conditioner happened on time without any fail.

M: Moral

In this innovation project TPM tools- training, shared learning etc were used to learn & share knowledge with the employee, as a result project was implemented on time.

I: Innovation

In this thesis we have seen how TPM tools helped to deliver the project on time.

TPM is itself an adaptive process, changing to support increasingly complex environments. And innovation projects are very important for any company like Unilever Bangladesh- who are working with consumer goods where positive change is normal demand from the customer end. And in an observation an innovation project is very important as it delivers about 15% sales during launch stage compare to overall sales of that product in a year comes. And by doing innovation projects- company can achieve a certain growth each year. In this thesis we have tried to find out how Unilever Bangladesh is benefitted especially during innovation project by using TPM concept. The total study has given us an idea about the activities and results achieved during the launch stage. And after completion of each stage we have seen finally that the results are positive-average OEE is 87%. Thus this proves that TPM tools help a successful, flawless implementation of an innovation project.

However in future a detail work can be done comparing Unilever Bangladesh innovation projects KPI's and other countries (TPM and non TPM) innovation KPI's. This will help to understand how TPM is doing in case of innovation projects in Unilever world. And also will give an idea how Unilever Bangladesh is doing and will help to set more stringent KPI's target and to achieve it.

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