(Subject-Industrial Engineering and Quality Control,6th MECH)

Academic syllabus for topic TQM:

8.0 Contemporary Quality Management concepts (6)
8.1 Concept of total quality management (TQM)
8.2 ISO-9000/14000, concept & its evolution & implications.
JIT, Six Sigma, 7S, Lean manufacturing

(Period-1)

TOPIC (TOTAL QUALITY MANAGEMENT):

Total quality management ensures that every single employee is working towards the improvement of work culture, processes, services, systems and so on to ensure long term success.

Total Quality management can be divided into four categories:

- Plan
- Do
- Check
- Act

Also referred to as PDCA cycle.

Planning Phase

Planning is the most crucial phase of total quality management. In this phase employees have to come up with their problems and queries which need to be addressed. They need to come up with the various challenges they face in their day to day operations and also analyze the problem's root cause. Employees are required to do necessary research and collect relevant data which would help them find solutions to all the problems.

Doing Phase

In the doing phase, employees develop a solution for the problems defined in planning phase. Strategies are devised and implemented to overcome the challenges faced by employees. The effectiveness of solutions and strategies is also measured in this stage.

Checking Phase

Checking phase is the stage where people actually do a comparison analysis of before and after data to confirm the effectiveness of the processes and measure the results.

Acting Phase

In this phase employees document their results and prepare themselves to address other problems.

The 8 Principles of TQM-

Many of the recent day Quality Management Systems are evolved based on TQM in particular ISO 9000, Malcolm Baldrige Model etc. To illustrate here are the 8 principles of TQM

1. Customer focus: The success of the organization depends on customer satisfaction. While all the actions in the organization (designing, training, cost savings etc) are aim to fulfill the customer needs and expectations.

2. Total employee involvement: All employees in the organization to involve to achieve the organization goals and also customer needs.

3. Centered on processes: Process mind set is the fundamental aspect of TQM. Systematic process is a series of internal steps converts the inputs to quality output that are deliver to the customers. Hence process needs to be defined, monitored and controlled to meet the customer requirements.

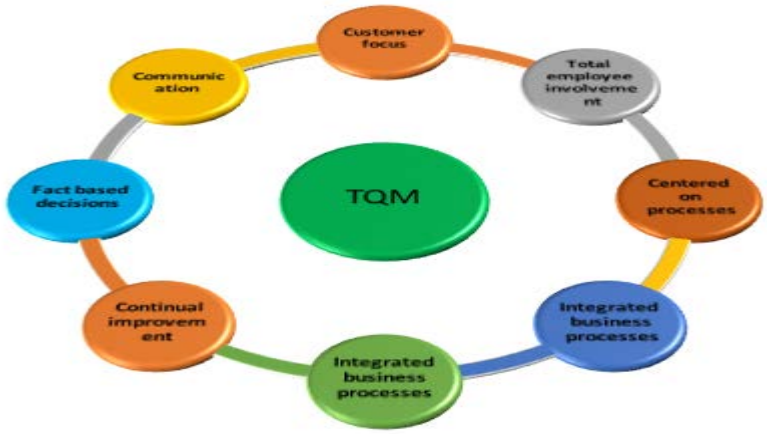
4. Integrated business processes: Surely it is impossible to achieve the excellence in the business without Quality culture in the organization. Thus, all the departments or functions must be integrate to achieve the business goals

5. Systematic, strategic approach: The important aspect of quality management systems is the systematic, strategic approach to achieve the organizational mission, vision and also goals.

6. Continual improvement: The much focused element in TQM is continual improvement. In other words continual improvement is to monitor and improve the process for better outcomes.

7. Fact based decisions: For any organization it is necessary to have performance measure system in-place to know how far it meets the set targets. In other words organization needs to continually monitor the process performance and take the appropriate actions based on the data.

8. Communication: It is impossible to maintain the TQM without effective communication to every level of employee/department. The effective communication is more important to keep the morale of the employees



(Period-2)

Benefits of TQM-

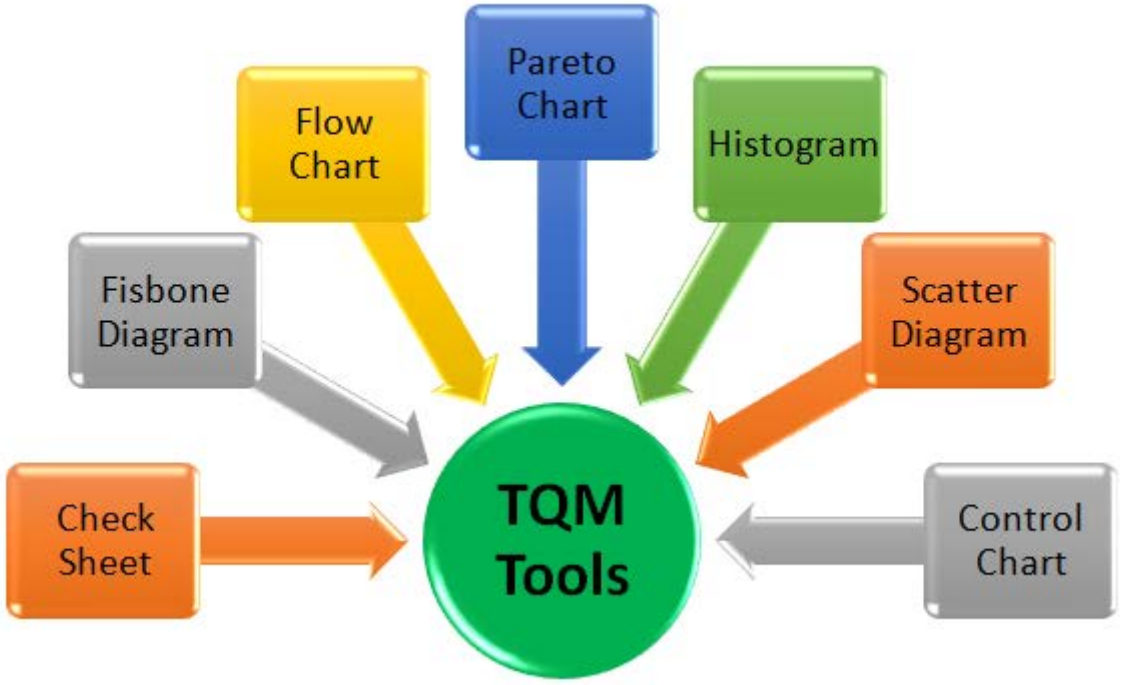
Following are the befits to the organization due to TQM

- Provides Quality product and services to the customers
- Improves employee morale
- Increase the productivity and lower the cost of manufacturing or services
- Achieves higher profitability
- Improved organizational processes
- Improves employee engagement
- Positive work environment

TQM Tools-

TQM tools helps organization to identify, analyze quality issues through data collection, analyzing data, identification of root cause and measuring results. The tools used in TQM are:

- **Check Sheet:** Check sheet a simple document to collect data in real time.
- **Fishbone Diagram / Ishikawa Chart:**It shows the relationship of all causes and the effect. Helps to identify root causes.
- **Flow Chart:** It is a type of diagram that represents a process step by step with the help of various kind of box shapes connecting with arrows.
- **Pareto Chart:** A bar chart that helps to prioritize actions by arranging elements in descending order of occurrence
- **Histogram:** Histogram also known as frequency distribution because height of the bars represents the frequency of occurrence
- **Scatter Diagram:** Scatter diagram is a tool to study the possible relationship between two variables.
- **Control Chart:** A control chart is a line graph indicates variation on time order interval. In other words a graph to study the process change over time



ISO 9000/14000:

- ISO 9000 is defined as a set of **international standards on quality management and quality assurance** developed to help companies effectively document the quality system elements needed to maintain an efficient quality system. They are not specific to any one industry and can be applied to organizations of any size.

(Period-3)

ISO 9000 series Quality Management Principles:

The ISO 9000 series are based on seven quality management principles (QMP)

The seven quality management principles are:

- QMP 1 – Customer focus
- QMP 2 – Leadership
- QMP 3 – Engagement of people
- QMP 4 – Process approach
- QMP 5 – Improvement
- QMP 6 – Evidence-based decision making
- QMP 7 – Relationship management

Principle 1 – Customer focus

Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations.

Principle 2 – Leadership

Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives.

Principle 3 – Engagement of people

People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit.

Principle 4 – Process approach

A desired result is achieved more efficiently when activities and related resources are managed as a process.

Principle 5 – Improvement

Improvement of the organization's overall performance should be a permanent objective of the organization.

Principle 6 – Evidence-based decision making

Effective decisions are based on the analysis of data and information.

Principle 7 – Relationship management

ISO 9000 EVOLUTIONS:

The ISO 9000 standard is continually being revised by standing technical committees and advisory groups, who receive feedback from those professionals who are implementing the standard.

Year	Edition of ISO 9001
1987	1st Edition
1994	2nd Edition
2000	3rd Edition
2008	4th Edition
2015	5th Edition

1987 version-

- ISO 9001:1987 *Model for quality assurance in design, development, production, installation, and servicing* was for companies and organizations whose activities included the creation of new products.
- ISO 9002:1987 *Model for quality assurance in production, installation, and servicing* had basically the same material as ISO 9001 but without covering the creation of new products.
- ISO 9003:1987 *Model for quality assurance in final inspection and test* covered only the final inspection of finished product, with no concern for how the product was produced.

1994 version-

ISO 9000:1994 emphasized quality assurance via preventive actions, instead of just checking final product, and continued to require evidence of compliance with documented procedures. As with the first edition, the down-side was that companies tended to implement its requirements by creating shelf-loads of procedure manuals, and becoming burdened with an ISO bureaucracy. In some companies, adapting and improving processes could actually be impeded by the quality system.

2000 version-

The 2000 version also demanded involvement by upper executives in order to integrate quality into the business system and avoid delegation of quality functions to junior administrators. Another goal was to improve effectiveness via process performance metrics: numerical measurement of the effectiveness of tasks and activities. Expectations of continual process improvement and tracking customer satisfaction were made explicit.

ISO 9000 Requirements include:

- Approve documents before distribution;
- Provide correct version of documents at points of use;
- Use your records to prove that requirements have been met; and
- Develop a procedure to control your records.

2008 version-

The 2008 version only introduced clarifications to the existing requirements of ISO 9001:2000 and some changes intended to improve consistency with ISO 14001:2004. There were no new requirements. For example, in ISO 9001:2008, a quality management system being upgraded just needs to be checked to see if it is following the clarifications introduced in the amended version.

ISO 9001 is supplemented directly by two other standards of the family:

- ISO 9000:2005 "Quality management systems. Fundamentals and vocabulary"
- ISO 9004:2009 "Managing for the sustained success of an organization. A quality management approach"

2015 version-

The new *ISO 9001:2015* management system standard helps ensure that consumers get reliable, desired quality goods and services. This further increases benefits for a business.

The 2015 version is also less prescriptive than its predecessors and focuses on performance. This was achieved by combining the process approach with risk-based thinking, and employing the Plan-Do-Check-Act cycle at all levels in the organization.

Some of the key changes include:

- High-Level Structure of 10 clauses is implemented. Now all new standards released by ISO will have this high-level structure
- Greater emphasis on building a management system suited to each organization's particular needs
- A requirement that those at the top of an organization be involved and accountable, aligning quality with wider business strategy
- Risk-based thinking throughout the standard makes the whole management system a preventive tool and encourages continuous improvement
- Less prescriptive requirements for documentation: the organisation can now decide what documented information it needs and what format it should be in
- Alignment with other key management system standards through the use of a common structure and core text
- Inclusion of Knowledge Management principles
- Quality Manual & Management representative (MR) are no longer mandatory

Advantages-

Proper quality management can improve business, often having a positive effect on investment, market share, sales growth, sales margins, competitive advantage, and avoidance of litigation.According to ISO the 2015 version of the standard brings the following benefits:

1. By assessing their context, organizations can define who is affected by their work and what they expect. This enables clearly stated business objectives and the identification of new business opportunities.
2. Organizations can identify and address the risks associated with their organization.
3. By putting customers first, organizations can make sure they consistently meet customer needs and enhance customer satisfaction. This can lead to more repeat customers, new clients and increased business for the organization.
4. Organizations work in a more efficient way as all their processes are aligned and understood by everyone. This increases productivity and efficiency, bringing internal costs down.
5. Organizations will meet necessary statutory and regulatory requirements.
6. Organizations can expand into new markets, as some sectors and clients require ISO 9001 before doing business.

(Period-4)

ISO 14000:

> **ISO 14000** is a family of standards related to environmental management that exists to help organizations (a) minimize how their operations (processes, etc.) negatively affect the environment (i.e. cause adverse changes to air, water, or land); (b) comply with applicable laws, regulations, and other environmentally oriented requirements; and (c) continually improve in the above.
>
> ISO 14000 is similar to ISO 9000 quality management in that both pertain to the process of how a product is produced, rather than to the product itself. As with ISO 9001, certification is performed by third-party organizations rather than being awarded by ISO directly. The ISO 19011 and ISO 17021 audit standards apply when audits are being performed.

Prior to the development of the ISO 14000 series, organizations voluntarily constructed their own EMSs, but this made comparisons of environmental effects between companies difficult; therefore, the universal ISO 14000 series was developed. An EMS is defined by ISO as: "part of the overall management system, that includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, and maintaining the environmental policy.

ISO 14000 series EVOLUTION:

The ISO 14000 family includes most notably the ISO 14001 standard, which represents the core set of standards used by organizations for designing and implementing an effective environmental management system (EMS). Other standards in this series include ISO 14004, which gives additional guidelines for a good EMS, and more specialized standards dealing with specific aspects of environmental management. The major objective of the ISO 14000 series of norms is to provide "practical tools for companies and organizations of all kinds looking to manage their environmental responsibilities.

The ISO 14000 series is based on a voluntary approach to environmental regulation.The series includes the ISO 14001 standard, which provides guidelines for the establishment or improvement of an EMS. The standard shares many common traits with its predecessor, ISO 9000, the international standard of quality management, which served as a model for its internal structure, and both can be implemented side by side. As with ISO 9000, ISO 14000 acts both as an internal management tool and as a way of demonstrating a company's environmental commitment to its customers and clients.

ISO 14001 standard:

ISO 14001 defines criteria for an EMS. It does not state requirements for environmental performance but rather maps out a framework that a company or organization can follow to set up an effective EMS. It can be used by any organization that wants to improve resource efficiency, reduce waste, and reduce costs. Using ISO 14001 can provide assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved.ISO 14001 can also be integrated with other management functions and assists companies in meeting their environmental and economic goals.

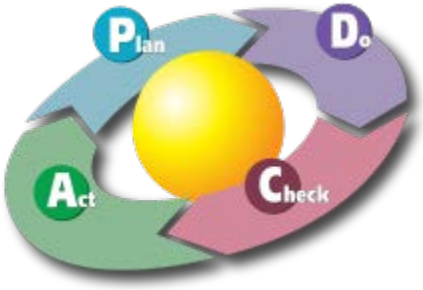
ISO 14001, like other ISO 14000 standards, is voluntary, with its main aim to assist companies in continually improving their environmental performance and complying with any applicable legislation. The organization sets its own targets and performance measures, and the standard highlights what an organization needs to do to meet those goals, and to monitor and measure the situation.The standard does not focus on measures and goals of environmental performance, but of the organization. The standard can be applied to a variety of levels in the business, from the organizational level down to the product and service level.

ISO 14001 is known as a generic management system standard, meaning that it is relevant to any organization seeking to improve and manage resources more effectively. This includes:

- single-site to large multi-national companies
- high-risk companies to low-risk service organizations
- the manufacturing, process, and service industries, including local governments
- all industry sectors, including public and private sectors
- original equipment manufacturers and their suppliers

Year	Description
1996	1st Edition
2004	2nd Edition
2015	3rd Edition

ISO 14000Basic principles and methodology:



The PDCA cycle

The basic principles of ISO 14001 are based on the well-known Plan-Do-Check-Act (PDCA) cycle.

Plan: Establish objectives and processes required-

Prior to implementing ISO 14001, an initial review or gap analysis of the organization's processes and products is recommended, to assist in identifying all elements of the current operation, and if possible, future operations, that may interact with the environment, termed "environmental aspects". Environmental aspects can include both direct, such as those used during manufacturing, and indirect, such as raw materials. This review assists the organization in establishing their environmental objectives, goals, and targets (which should ideally be measurable); helps with the development of control and management procedures and processes; and serves to highlight any relevant legal requirement, which can then be built into the policy.[14]

Do: Implement the processes-

During this stage, the organization identifies the resources required and works out those members of the organization responsible for the EMS' implementation and control. This includes establishing procedures and processes, although only one documented procedure is specifically related to operational control. Other procedures are required to foster better management control over elements such as documentation control, emergency preparedness and response, and the education of employees, to ensure that they can competently implement the necessary processes and record results. Communication and participation across all levels of the organization, especially top management, is a vital part of the implementation phase, with the effectiveness of the EMS being dependent on active involvement from all employees.

Check: Measure and monitor the processes and report results-

During the "check" stage, performance is monitored and periodically measured to ensure that the organization's environmental targets and objectives are being met. In addition, internal audits are conducted at planned

intervals to ascertain whether the EMS meets the user's expectations and whether the processes and procedures are being adequately maintained and monitored.

Act: Take action to improve performance of EMS based on results-

After the checking stage, a management review is conducted to ensure that the objectives of the EMS are being met, the extent to which they are being met, and that communications are being appropriately managed. Additionally, the review evaluates changing circumstances, such as legal requirements, in order to make recommendations for further improvement of the system. These recommendations are incorporated through continual improvement: plans are renewed or new plans are made, and the EMS moves forward

List of ISO 14000 series standards-

- **ISO 14001** Environmental management systems - Requirements with guidance for use
- **ISO 14004** Environmental management systems - General guidelines on implementation
- **ISO 14005** Environmental management systems - Guidelines for a flexible approach to phased implementation
- **ISO 14006** Environmental management systems - Guidelines for incorporating ecodesign
- **ISO 14015** Environmental management - Environmental assessment of sites and organizations (EASO)
- **ISO 14020** to **14025** Environmental labels and declarations
- **ISO/NP 14030** Green bonds -- Environmental performance of nominated projects and assets; discusses post-production environmental assessment
- **ISO 14031** Environmental management - Environmental performance evaluation - Guidelines
- **ISO 14040** to **14049** Environmental management - Life cycle assessment; discusses pre-production planning and environment goal setting
- **ISO 14050** Environmental management - Vocabulary; terms and definitions
- **ISO/TR 14062** Environmental management - Integrating environmental aspects into product design and development
- **ISO 14063** Environmental management - Environmental communication - Guidelines and examples
- **ISO 14064** Greenhouse gases; measuring, quantifying, and reducing greenhouse gas emissions

(Period-5)

SIX SIGMA:

Six Sigma (**6σ**) is a set of techniques and tools for process improvement. It was introduced by American engineer Bill Smith while working at Motorola in 1986. Jack Welch made it central to his business strategy at General Electric in 1995. A six sigma process is one in which 99.99966% of all opportunities to produce some feature of a part are statistically expected to be free of defects.

Six Sigma strategies seek to improve the quality of the output of a process by identifying and removing the causes of defects and minimizing impact variability in manufacturing and business processes. It uses a set of quality management methods, mainly empirical, statistical methods, and creates a special infrastructure of people within the organization who are experts in these methods. Each Six Sigma project carried out within an organization follows a defined sequence of steps and has specific value targets, for example: reduce process cycle time, reduce pollution, reduce costs, increase customer satisfaction, and increase profits.

The term *Six Sigma* (capitalized because it was written that way when registered as a Motorola trademark on December 28, 1993) originated from terminology associated with statistical modeling of manufacturing processes. The maturity of a manufacturing process can be described by a *sigma* rating indicating its yield or the percentage of defect-free products it creates—specifically, to within how many standard deviations of a normal distribution the fraction of defect-free outcomes corresponds. Motorola set a goal of "six sigma" for all of its manufacturing.

Six Sigma Principle

- Continuous efforts to achieve stable and predictable process results (e.g. by reducing process variation) are of vital importance to business success.
- Manufacturing and business processes have characteristics that can be defined, measured, analyzed, improved, and controlled.
- Achieving sustained quality improvement requires commitment from the entire organization, particularly from top-level management.

Features that set Six Sigma apart from previous quality-improvement initiatives include:

- A clear focus on achieving measurable and quantifiable financial returns from any Six Sigma project.
- An increased emphasis on strong and passionate management leadership and support.
- A clear commitment to making decisions on the basis of verifiable data and statistical methods, rather than assumptions and guesswork.

The term "six sigma" comes from statistics and is used in statistical quality control, which evaluates process capability. Originally, it referred to the ability of manufacturing processes to produce a very high proportion of output within specification. Processes that operate with "six sigma quality" over the short term are assumed to produce long-term defect levels below 3.4 defects per million opportunities (DPMO).

"Six Sigma" was registered June 11, 1991 as U.S. Service Mark 1,647,704. In 2005 Motorola attributed over US$17 billion in savings to Six Sigma.

In recent years, some practitioners have combined Six Sigma ideas with lean manufacturing to create a methodology named Lean Six Sigma. The Lean Six Sigma methodology views lean manufacturing, which addresses process flow and waste issues, and Six Sigma, with its focus on variation and design, as complementary disciplines aimed at promoting "business and operational excellence".

In 2011, the International Organization for Standardization (ISO) has published the first standard "ISO 13053:2011" defining a Six Sigma process. Other standards have been created mostly by universities or companies that have first-party certification programs for Six Sigma.

Difference from lean management-

Lean management and Six Sigma are two concepts which share similar methodologies and tools. Both programs are Japanese-influenced, but they are two different programs. Lean management is focused on eliminating waste using a set of proven standardized tools and methodologies that target organizational efficiencies while integrating a performance improvement system utilized by everyone, while Six Sigma's focus is on eliminating defects and reducing variation. Both systems are driven by data, though Six Sigma is much more dependent on accurate data.

Six sigma Application

Although the scope of Six Sigma differs depending on where it is implemented, it can successfully deliver its benefits to different applications.

-Manufacturing

-Engineering and construction

-Finance

-Supply chain

-Healthcare

Six Sigma and Total Quality Management:

What are the Similarities between Six Sigma and Total Quality Management?

Six Sigma and TQM are both methods to monitor quality of products, processes, and services. While TQM is an application of quantitative methods and human resources to improve all the processes within the organization. Six Sigma is a problem solving approach and the main aim is defect reduction and variation management. While both aim to decrease the number of defects and errors created.

What are the Differences between Six Sigma and Total Quality Management?

Furthermore TQM emphasize all the departments to collaboratively work on general improvements based on the problem. Six Sigma also tells that all the departments' efforts required for problem solving. However, Six Sigma follows the statistical and data driven approach to reduce the process variation and product defects. Six sigma aims for less than 3.4 defects per million.

In fact, to implement Six Sigma certified professionals are required like Green belt, Black Belt and Master Black belts where as TQM does not required any certified professionals, however training to be provided to all the employees on TQM principles.

- Six Sigma: Defect focused. Looks for causes of defects and, where appropriate, amends processes.
- TQM: Process focused. Looks for improvements that can be made to processes, assuming that better processes will cause fewer errors.

(Period-6)

The Contents of 7S PRINCIOPLE:

- **1S** ---- SORT
  classify the articles as used and unused, and treat well the unused ones.
- **2S** ---- STRAIGHTEN
  after arrangement, the necessary articles are reclassified and put in order.
- **3S** ---- SWEEP
  wipe out the dirt and ensure clean operation workplace
- **4S** ---- SANITARY
  standardize the above 3s
- **5S** ---- SENTIMENT
  improve the quality of staffs and standardize staff behavior and promote good habits.
- **6S** ---- SAVEING
  better utilize the time, space and resources to maximize the use, creating a highly efficient workplace.

- **7S** ---- SAFETY
  remove risks to ensure both human safety and product quality safety, prevent further accidents

Lean Manufacturing-

Lean Manufacturing or Lean Production is a series of methods which are based on the Toyota Production system created by Taiichi Ohno. First implemented in the 1940s and developed until the 1970 together with Eiji Toyoda. The term "lean" was taken from John Krafcik's 1988 article "Triumph of the Lean Production system".

The main objectives of lean manufacturing are:

- Minimise waste and costs.
- Maximise productivity and quality.
- Ensure continuous improvement.

These objectives are achieved by following the principles described by the Toyota Production System. They have now become synonymous with Lean Manufacturing principles and are applied all over the world by project management.

Lean Manufacturing Principles-

These are the principles to follow when applying Lean Manufacturing:

- Maximise share of value-adding activities.
- Implement stable and standardised processes.
- Create a self-learning, continuously improving organisation.
- People development is the key success factorTake a holistic supply chain perspective.

How to Apply Lean Manufacturing?

The first step is identifying what is known as the seven wastes of lean. The objective of Lean Manufacturing is to eliminate waste. These wastes are described by the Toyota Productive System as follows:

Transportation

This waste involves the unnecessary movement of materials or people within a process. It can result in production delays, handling damage and extra time that doesn't contribute to productivity. Long transportation also impacts communication which affects the quality of the product.

Examples of transportation waste include:

- Temporary storage of work-in-progress (WIP) instead of moving the WIP to the next step
- Frequent transport of raw materials or parts within the factory due to poor layout

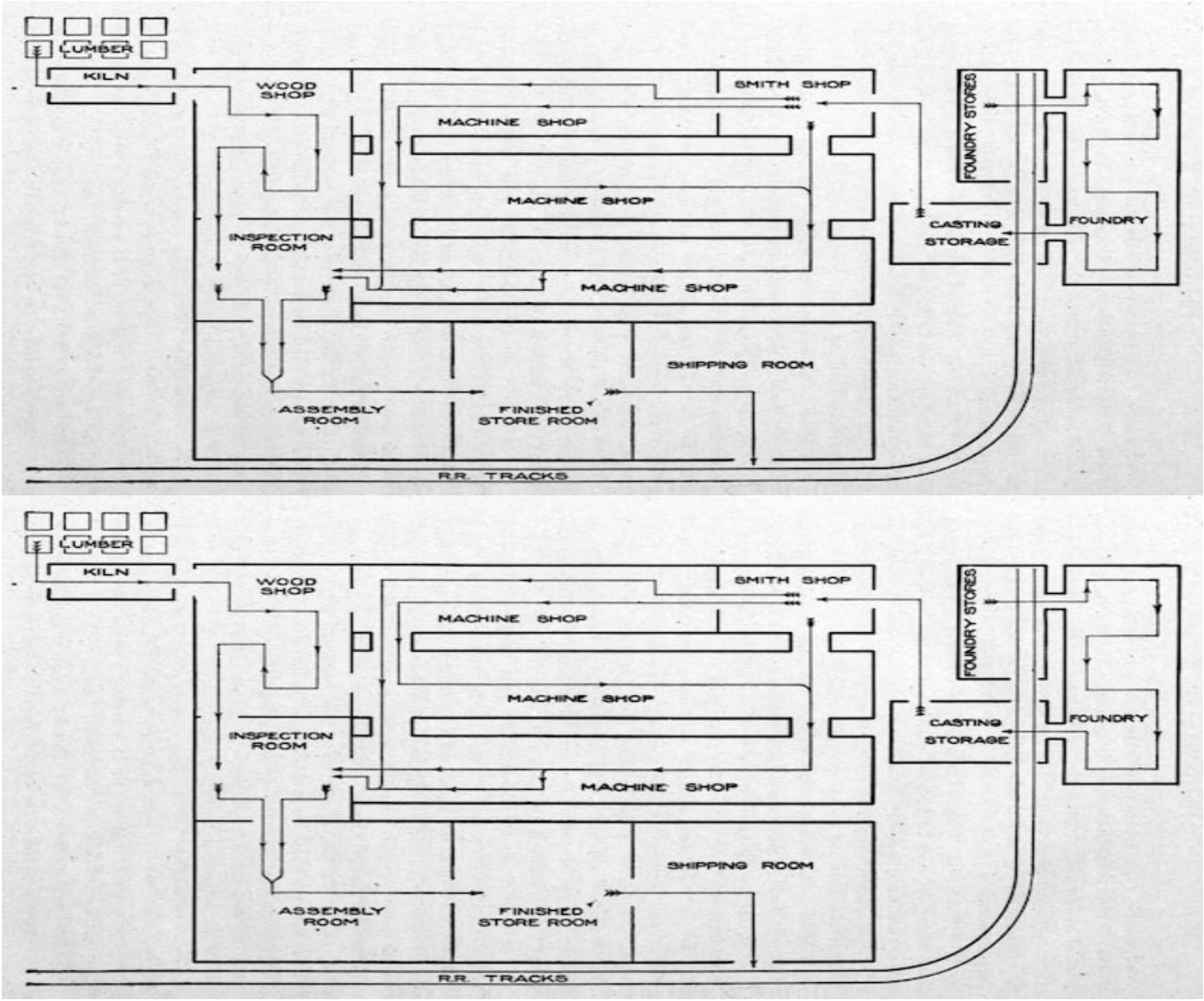
Inventory

This refers to the storage of raw materials, work in progress or finished goods. It usually

means there are problems in the process that are hidden behind rising stock levels. This results in increased operational costs and production lead times.

Motion

Although seemingly similar to transportation, it is not the same. Motion refers to unnecessary movement of people or machines within a process.



LUMBER
KILN
WOOD SHOP
SMITH SHOP
MACHINE SHOP
MACHINE SHOP
INSPECTION ROOM
MACHINE SHOP
FOUNDRY STORES
CASTING STORAGE
FOUNDRY
SHIPPING ROOM
ASSEMBLY ROOM
FINISHED STORE ROOM
R.R. TRACKS

Factory layout can be a source of waste

Some examples of motion waste include:

- Movement of people to fetch tools for a changeover process
- Movement of machine operators between different controls of a machine

- The necessity to stretch or bend over to complete a task

Waiting

This waste involves people or machines waiting for the completion of a work cycle. For example, waiting for raw materials to arrive, waiting for a process to finish or waiting for maintenance.

Over-Processing

Over-processing refers to waste related to an operation or process that is not necessary to meet customer demands. Examples of over-processing are:

- Producing to specifications tighter than the customer requires
- Unnecessary quality checks

Performing operations that are not required to produce the final product, etc

Overproduction

It means producing sooner, faster, or in greater quantities than customer demand. Over-produced items end up as inventory or scrap, thus creating more waste. Moreover, overproduction takes time away from value-added activities.

Some examples of overproduction are:

- Producing in larger batches to avoid changeovers
- Producing more than requested because of potential quality issues

Lean Manufacturing Techniques

Takt Time

Takt means “cycle” in German. This Lean Manufacturing technique helps to determine the cycle of the production.

This time is calculated by dividing the time available in a period by the demand in a period. For example, 480 minutes of work per day (8h) to produce 2400 units results in a takt time of 480/2400 = 0.2 minutes.

By calculating this time, it is possible to align the pace of production with customer or market demand. It usually results in a reduction of transportation, inventory, motion, waiting, over-processing, overproduction and defects. So all the seven wastes of Lean Manufacturing.

Batching

Batching, also known as cellular manufacturing, is another popular Lean Manufacturing technique. This lean tool looks at the optimal use of machinery to achieve a continuous flow in production.

For example, let’s say you are manufacturing 2 separate parts for a series of machines on the same work-bench. Batching means that those 2 parts should be produced in batches. Thus, you don’t need

to set up the machine for each part every time. It has a significant effect on productivity. At the same time, it results in an increase of inventory, one of the wastes of Lean Manufacturing.

Batching is suitable when:

- The machine capacity is fixed
- The raw material is also in batches
- There is only one machine available that needs regular setup activities

Single Minute Exchange of Dies (SMED)

Depending on the type of industry, setups are often necessary to add flexibility to the production line. However, set ups also waste a considerable amount of time. For example, changing tools in a press line take a lot of time as they tend to weigh tons.

This lean manufacturing technique aims to reduce set-up times to less than 10 minutes by following these steps:

- Measure total changeover time
- Determine internal and external steps
- Move external steps outside of the changeover
- Shorten internal steps
- Improve external steps
- Standardise new changeover procedure

There are several benefits in applying SMED. It improves capacity, increases batch sizes without additional inventory investments, reduces overall process flow time and increases flexibility.

Total Productive Maintenance (TPM)-

Overall Equipment Effectiveness (OEE)

This is a key metric and tool to manage equipment-intensive production processes. It measures a system's productivity

Just-in-time (JIT)

It refers to producing only what is needed, when it is needed and in the needed quantity. One should enforce this throughout the production process.

Just-in-Time is one of the key elements of quantity control in lean production. But there are certain requirements, such as a very stable production system without excessive burden.

The main benefits include reduced inventory, reduced flow time, faster identification of work process problems, reduced waiting times and improved continuous flow.

Workplace Visualisation

This is a core technique of Lean Production. It consists of making all the important information about the workplace clearly visible and understandable.

Workplace visualisation includes what is done, how it is done, the current status, where things belong, etc. All this information is necessary to improve communication throughout the company.

5 S:

One of the most popular Lean Manufacturing techniques, it is also one of the tools to achieve workplace visualisation. The 5S are:

- Sort – sort through all inventory and remove unnecessary items
- Set in order – put all the items in the right place regarding functionality
- Shine – inspect all the machinery and maintain it regularly
- Standardise – standardised work helps to keep everything in order
- Sustain – make it a habit, so no one needs guidance

5S is one of the just-in-time manufacturing concepts that originates from Japan. This Lean Manufacturing tool is something more than just housekeeping. It is a systematic and sustainable method to organise the workplace.

The reduction of waste is achieved by maximising efficiency while improving morale and motivation.

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The main benefits include

Reduced inventory.

Reduced flow time.

Faster identification of work process problems.

Reduced waiting times and improved continuous flow.

Possible Questions-

2marks-Define total quality management?

What is just in time principles?

Define Lean manufacturing?

Advantages of six sigma policy?

What is 7s principle?

5marks-Explain total quality management principles?

Describe six sigma policy?

Describe just in time system?

7marks-State and explain ISO9000 principles?

Explain ISO14000 evolutions?

Describe 7s techniques for quality management?

How TQM helps in quality production,Explain?

(The End)