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MINISTRY OF SKILL DEVELOPMENT
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Participant Handbook

Sector
Electronics

Sub-Sector
Generic

Occupation
Generic – Planning & Management

Reference ID: **ELE/Q7902**
NSQF LEVEL: 6

Quality Manager-Electronics

Published by
Electronics Sector Skill Council of India (ESSCI)
ESC House, 2nd Floor 155, Okhla Industrial Estate, Phase-3, New Delhi-110020, India
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First Edition, March 2022

Printed in India at

Electronics Sector Skill Council of India (ESSCI)

ESC House, 2nd Floor 155, Okhla Industrial Estate, Phase-3, New Delhi-110020, India

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Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission.

Shri Narendra Modi
Prime Minister of India

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for

SKILLING CONTENT - PARTICIPANT HANDBOOK

Complying to National Occupational Standards of
Job Role/Qualification Pack: **Quality Manager-Electronics** QP **NSQF ELE/Q7902 Level 6**

Date of Issuance: 16/12/2020

Valid up to : 16/12/2025

**Valid up to the next review date of the Qualification Pack or the 'Valid up to' date mentioned above (whichever is earlier)*

Authorised Signatory
(Skilling India In Electronics)

Acknowledgements

This participant's handbook meant for Quality Manager-Electronics is a sincere attempt to ensure the availability of all the relevant information to the existing and prospective job holders in this job role. We have compiled the content with inputs from the relevant Subject Matter Experts (SMEs) and industry members to ensure it is the latest and authentic. We express our sincere gratitude to all the SMEs and industry members who have made invaluable contributions to the completion of this participant's handbook.

I would like to thank the team of Feedback Advisory for their support to develop the content, the SME and the team at the ESSCI along with the industry partners for the tireless effort in bringing the handbook in the current format.

This handbook will help deliver skill-based training in the field of drone service and maintenance. We hope that it will benefit all the stakeholders, such as participants, trainers, and evaluators. We have made all efforts to ensure the publication meets the current quality standards for the successful delivery of QP/NOS-based training programs. We welcome and appreciate any suggestions for future improvements to this handbook.

About this Book

This participant handbook has been designed to serve as a guide for participants who aim to obtain the required knowledge and skills to undertake various activities as a Quality Manager-Electroincs. Its content has been aligned with the latest Qualification Pack (QP) prepared for the job role. With a qualified trainer's guidance, the participants will be equipped with the following for working efficiently in the job role:

- Knowledge and Understanding: The relevant operational knowledge and understanding to perform the required tasks.
- Performance Criteria: The essential skills through hands-on training to perform the required operations to the applicable quality standards.
- Professional Skills: The Ability to make appropriate operational decisions about the field of work.

The handbook details the relevant activities to be carried out by a Quality Manager-Electronics. After studying this handbook, job holders will be adequately skilled to carry out their duties efficiently according to the applicable quality standards, with minimum supervision.

The handbook has been divided into an appropriate number of units and sub-units based on the content of the relevant QP. We hope it will facilitate easy and structured learning for the participants. We sincerely hope that participants will obtain enhanced knowledge and skills after studying this handbook and make career progress in the relevant and senior job roles.

The Participant Handbook is designed based on the National Skill Qualification Framework (NSQF) aligned Qualification Pack (QP) and it comprises of the following National Occupation Standrads (NOS)/ topics:

1. ELE/N7906 Manage quality in the product design process
2. ELE/N7907 Manage the supplier relationship and receipt inspection process
3. ELE/N7908 Manage quality in the production process and final output
4. ELE/N7909 Manage recruitment, training and drive quality initiatives
5. ELE/N9905 Work effectively at the workplace
6. ELE/N1002 Apply health and safety practices at the workplace

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1. Introduction to Role of a Quality Manager

Unit 1.1 - Roles and Responsibilities of Quality Manager

Bridge Module

Key Learning Outcomes

At the end of this module, the trainee will be able to:

1. Discuss the job role of a Quality Manager

Unit 1.1 Introduction to the Electronics Industry

Unit Objectives

At the end of the unit, the trainee will be able to:

1. Describe the size and scope of the Electronics industry and its sub-sectors
2. Discuss the role and responsibilities of a Quality Manager
3. Describe various employment opportunities for a Quality Manager

1.1.1 Introduction to Electronic Industry

The electronics industry is the economic sector that manufactures electronic devices. It is one of the world's largest and fastest-growing industries. Today's society is totally dependent on a plethora of electronic devices manufactured in industrially run automated or semi-automated factories. Electronic products have a huge impact on our lifestyle. With the world more connected than ever before, and the digital push induced by the COVID-19 pandemic, demand for electronic devices has risen steadily and remained a significant economic driver around the world. The global electronics industry is rapidly expanding. In 2020, the global electronics industry is projected to be worth $2.9 trillion. In comparison, the global value of the electronics industry is nearly equal to India's current GDP of US$ 2.9 trillion. Asian countries such as China, Taiwan, Singapore, and South Korea dominate the electronic market. The industry is distinguished by rapid innovation and speed to market, a short product life cycle, highly automated manufacturing, and high volume production, all of which result in consistent quality at a low cost and profit accrual through volume.

Exhibit 1: Global market size of key product segments in 2020-21 (US$ billion)[4]

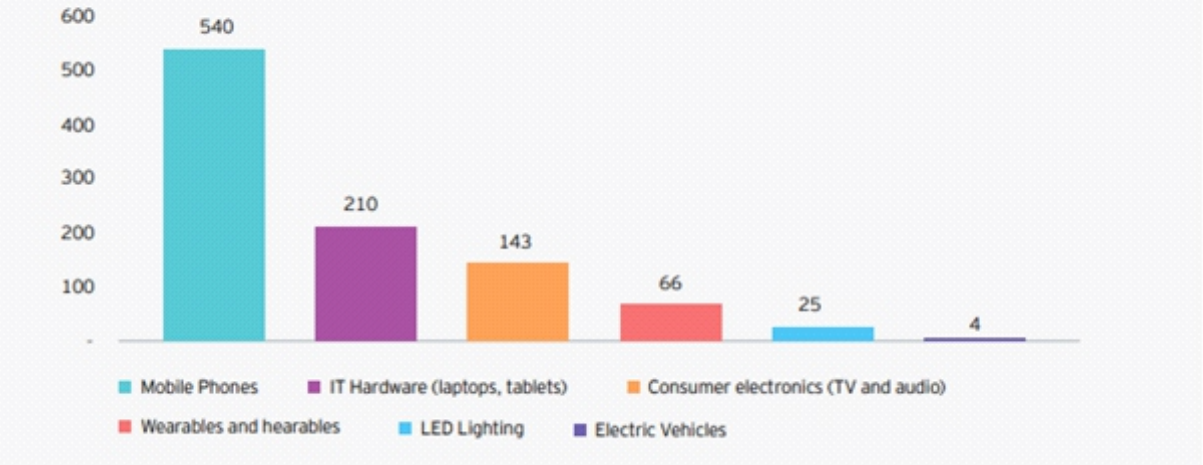
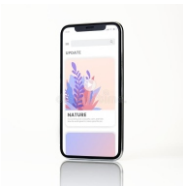


Fig1. Global Market Size 2020-21
(Source: IDC, Allied Market Research and ICEA estimates)

The electronics industry is not only self-sufficient in itself but also supports various other sectors like automotive, aviation, entertainment, healthcare, defence, telecommunications, etc. The industry is driven by innovation. Many resources are invested in research and development to design and improve electronic parts and products and improve various processes and procedures like manufacturing, quality, etc. Electronic companies always face tough competition to implement innovative ideas and first introduce the newest technology in the market. This apparently creates a lot of pressure on the entire organization. For example, design and engineering teams need to develop innovative products and services faster and cheaper, and sales and marketing teams have pressure to drive sales and make sure that the profits always remain more than the production and operational costs.

The Government of India's National Policy for Electronics, 2019 ('NPE') recognizes the electronics industry's growth potential and strategic importance. NPE was founded with the goal of positioning India as a global hub for Electronics System Design and Manufacturing (ESDM), among other things, by creating an enabling environment for the industry to compete globally. Furthermore, the ESDM industry has been identified as one of the 25 priority sectors in the government's Make in India initiative and serves as a significant pillar in contributing to India's economic growth.

The Indian electronics industry is segmented into several sub-sectors:



Communications and Broadcasting Electronics

- Mobile Phones, Tablets, Wired, and Wireless Connections

Consumer Electronics

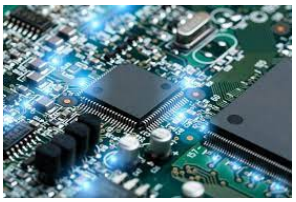
- Home Appliances, viz., Refrigerators, Washing Machines, Air Conditioners & Microwaves,Televisions, Music Systems, and Home Theatres, Direct-to-home and Set Top Boxes

Industrial Electronics

- UPS, Supervisory Control and Data Acquisition (SCADA), Programmable Logic Controller (PLC), AC Drive Systems

Medical Devices

- Heart-rate monitors, Dialysis machine, ventilator, x-ray machines etc.



Electronic Components

- Semi-conductors, Capacitors, Resistors, Picture-tubes, X-ray tubes, and caters to the Consumer
- Electronics, Telecom, Defense, and IT segment of the electronic industry

Strategic Electronics

- Satellite-based Communication, Navigation, and Surveillance Systems, Sonar, Underwater
- Electronics Systems, Radar, Infrared-based Detection and Ranging Systems

Computer Hardware

- Desktop Computers, Laptops, Notebooks, Netbooks, and Servers

LED

- LED Lights in Automobiles, Communications, Signage, Signalling, Architecture, and
- Entertainment Sectors

Fig. 1.2 Sub-Sectors of Electronic Industry

Consumer electronics is the most crucial segment of the Indian electronics hardware industry. The segment accounts for approximately 28 percent of the country's electronic industry production. In 2009, the estimated turnover for this segment was 260 billion. Around half of the workforce is employed in the consumer electronics sector's production function. The current consumer electronics employment pattern is around 0.9 million approx. Electronic components accounted for the lion's share of exports in 2008, accounting for 45 percent of total exports. According to the report "Human Resource and Skill Requirements in the Electronics & IT Hardware Sector (2022)," the electronics industry's output is expected to rise from $844 billion in 2008 to $7,520 billion by 2022. This is a good sign because it would increase overall employment from 0.9 million to over 4 million by 2022.

1.1.2 Roles and Responsibilities of a Quality Manager

A Quality Manager is in charge of developing and implementing inspection, testing, and evaluation methods to ensure that products adhere to company standards. They design and implement quality control tests to ensure that the company's output is as expected, inspecting at various stages of production and writing reports on their findings to take appropriate action. They also prepare reports by gathering data on inspections or other aspects such as production line cleanliness, which is then thoroughly analyzed. Before going to market, quality managers ensure that all company products and services meet quality standards. Understanding customer expectations and needs, outlining quality standards, and developing quality control processes are among their primary responsibilities. Quality managers hold important positions and must be highly conscientious and responsible employees, as defective products can result in significant losses for a company.

1.1.2 Roles and Responsibilities of a Quality Manager

Understand what a customer expects and needs from a product	Create quality control procedures	Produce product specifications
Ensure products are designed with adherence to legal and safety standards	Supervise employees and keep track of production standards	Examine the raw materials used in production for quality
Monitor and evaluate internal production processes	To determine the quality of a product, evaluate its final output.	Reject products that do not meet quality standards
Engage with customers and gathering product feedback	Produce quality standard statistical reports	Report to upper management on quality standard issues
Evaluate product recalls	Improve production efficiency and managing waste	

Fig. 1.2 Roles and Responsibilities of Quality Manager

A great quality manager is detail-oriented and well-versed in their products. They are meticulous in everything they do, are always willing to assist when needed, and provide good leadership that sets the tone for how things should be done. Since quality managers are responsible for a wide range of tasks., having a diverse set of skills can help them get through the process. Let's take a look at the key competencies or skills required of a quality manager in the electronic industry.

Degree in business administration or relevant field	Quality control certification advantageous	Excellent verbal and written communication
Data analysis and statistical aptitude	Good interpersonal skills	Proven experience as quality manager
Conscientious and responsible	A keen eye for detail and a results driven approach	Excellent organizational and leadership skills
Proficient in MS Office	In depth understanding of quality control procedures and relevant legal standards	Excellent math abilities and working knowledge of data analysis/statistical methods

Fig. 1.3 Key Competencies of Quality Manager

1.1.3 Various Employment Opportunities for Quality Manager

India has one of the world's fastest-growing GDPs, making it a haven for investors from all over the world. The scope of quality management is massive. Quality managers' career prospects are highly favourable because they can advance while remaining within the quality function, which is becoming increasingly important in the activities of organizations. Appointments are made at all levels of management, all the way up to the board of directors. In many organizations, the scope of quality management has expanded. Many organizations are looking for talented quality managers who can design and implement quality control systems, analysis, and inspection processes. A person should be able to correct all flaws in a product's quality.

A QA Manager is at the epicentre of all innovation activity, reviewing and testing technology before it reaches users' hands. Today, a technical job is a highly desirable career path. A QA Manager's job is not one in which you do the same thing every hour or day. Over the last decade, QA Manager and related QA roles have consistently topped lists for job happiness (aside from the recent Glassdoor survey, it also made CNN Money's 2015 Best Jobs list and the CareerBliss happiest jobs list in 2012 and 2014). Without a doubt, QA Manager is the job of the future. QA Managers will become even more in demand.

And, with this role's growing value to organizations, as well as its numerous opportunities, flexibility, and consistent happiness, it's a career path worth reconsidering. Quality Manager salaries in India generally range from 3.2 Lakhs to 20.0 Lakhs per annum approx., with an average annual salary of 8.1 Lakhs approx. At the entry-level, one can earn between Rs 15000 and Rs 20000/- approx. per month. After three or four years of experience, the person's monthly salary could range between Rs 30000 and Rs 35000 approx. per month. A well-experienced quality assurance manager's monthly salary can exceed Rs 50000 approx. per month.

Summary

- The electronics industry is the economic sector that manufactures electronic devices. It is one of the world's largest and fastest-growing industries.
- In 2020, the global electronics industry is projected to be worth $2.9 trillion. In comparison, the global value of the electronics industry is nearly equal to India's current GDP of US$ 2.9 trillion.
- The industry is distinguished by rapid innovation and speed to market, a short product life cycle, highly automated manufacturing, and high volume production, all of which result in consistent quality at a low cost and profit accrual through volume.
- The Government of India's National Policy for Electronics, 2019 ('NPE') recognizes the electronics industry's growth potential and strategic importance.
- The Indian electronics industry is segmented into seven sub-sectors - communications and broadcasting electronics, consumer electronics, industrial electronics, electronic components, strategic electronics, computer hardware and LED.
- Consumer electronics is the most crucial segment of the Indian electronics hardware industry. The segment accounts for approximately 28 percent of the country's electronic industry production.

- A Quality Manager is in charge of developing and implementing inspection, testing, and evaluation methods to ensure that products adhere to company standards. They design and implement quality control tests to ensure that the company's output is as expected, inspecting at various stages of production and writing reports on their findings to take appropriate action.
- A great quality manager is detail-oriented and well-versed in their products. They are meticulous in everything they do, are always willing to assist when needed, and provide good leadership that sets the tone for how things should be done.
- Quality managers' career prospects are highly favourable because they can advance while remaining within the quality function, which is becoming increasingly important in the activities of organizations.
- A QA Manager is at the epicentre of all innovation activity, reviewing and testing technology before it reaches users' hands. Today, a technical job is a highly desirable career path.
- At the entry-level, one can earn between Rs 15000 and Rs 20000/- approx. per month. After three or four years of experience, the person's monthly salary could range between Rs 30000 and Rs 35000 approx. per month. A well-experienced quality assurance manager's monthly salary can exceed Rs 50000 approx. per month.

Notes

QR Code

Scan the QR Code to watch the related video

youtube.com/watch?v=7EhkenV4T7g

1.1.1 Roles and Responsibilities of a Quality Manager

Exercise

Answer the following questions:

1. Explain electronic industry and its sub-sectors.

_____
_____
_____

2. List the roles and responsibilities of Quality Manager.

_____
_____
_____

3. Write a short note on employment opportunities for Quality Manager.

_____
_____
_____

4. List any three key competencies of Quality Manager.

_____
_____
_____

Choose the correct option:

1. Asian countries such as _____, _____, and South Korea dominate the electronic market.
   a. Thailand, Japan
   b. China, Singapore
2. The average annual salary of quality manager with 1-4 years of experience_____ per month.
   a. 30000-35000/-
   b. Above 50000/-
3. Electronic Sectors consist of _____.
   a. Computers
   b. Radio
4. Quality Managers are responsible for_____.
   a. Planning and Developing Ideas
   B. Dealing with customers

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2. Process of Managing Quality in the Product Design Process

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Unit 2.1 - Identify the Customer Needs and Concerns

Unit 2.2 - Carry out Advanced Product Quality Planning (APQP)

ELE/N7906

Key Learning Outcomes

At the end of this module, the trainee will be able to:

1. Describe the process of identifying the customer needs and concerns
2. Demonstrate the process of carrying out Advanced Product Quality Planning (APQP)

Unit 2.1 Identify the Customer Needs and Concerns

Unit Objectives

At the end of the unit, the trainee will be able to:

1. Describe different methods of connecting with the target customers such as surveys, focus groups, social listening to understand their expectations/ concerns with the product offered by the organisation
2. Elaborate the practice of collecting data and analyse it to draw reliable conclusions regarding customer expectations/ concerns

2.1.1 Various Methods for Connecting with Target Customers

Any quality manager must constantly research and understand the needs and requirements of their target customers. It is essential to comprehend their expectations and concerns regarding the organization's product. The customer's quality expectations are a statement about the product's quality. Customer satisfaction is created when customer expectations for product quality, service quality, and value-based price are met or exceeded.

A **target market** is a group of people who share specific characteristics and have been identified by the company as potential customers for its products. Identifying the target market helps a company make decisions as it designs, packages, and markets its product. It is typically defined first by industry and represents a specific subset of the larger market that the industry serves. It is usually based on factors - such as behavioral tendencies, geographic location, and demographic characteristics.

A **target customer** is someone who is most willing to purchase the product. It is also a part of the overall target market. For example, if the target market is females aged 13 to 25, a target customer could be females aged 13 to 16 years old.

Customer requirements are the named and unnamed needs that customers have when they interact with the organization, their competitors, or search for the provided solutions. Collect feedback from the customers at each stage of the process to identify their needs and desires. Quality Managers can identify customer needs in a variety of ways, including focus groups, listening to customers or social media, and conducting keyword research. The following are various methods for connecting with target customers to understand their expectations/concerns about the organization's product.

 **Focus Groups**	A **focus group** is a face-to-face meeting with a representative sample of customers to learn about their needs and perspectives. Customers can also learn more about the company through focus groups. Focus groups are not a replacement for understanding market problems, but they can assist. It is a market research technique in which a small group of people representing the target audience is interviewed collectively.

Continued...

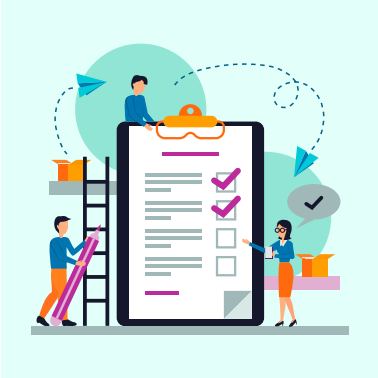
	The following are the steps to lead a productive focus group: **Step 1:** Establish the goals **Step 2:** Prepare a Questionnaire **Step 3:** Find participants who represent the target audience **Step 4:** Lead the discussion **Step 5:** Analyze the customer feedback and incorporate it into the strategic plan
 **Market Surveys**	A **market survey** is a research and analysis of the market for a specific product/service that includes an investigation into customer preferences. It is a study of various customer capabilities, such as investment characteristics and purchasing power. A well-designed survey can reveal what the customers want, what motivates them to buy, and how to gain a market advantage. Methods for conducting a market survey **Step 1:** Contextualize the business **Step 2:** Define the broader target market **Step 3:** Perform secondary market research **Step 4:** Assemble the questions and answers, having at least 10 **Step 5:** Carry out the survey
 **Social Listening's**	Social listening is the process of gathering data from social media channels for keywords, topics, or feedback relevant to your brand. When an organization understands what its target audience is interested in, it can respond quickly and appropriately to its concerns. It also monitors and analyses what people are saying about the company or industry on social media.

Table 2.1 Various Methods for Connecting with Target Customers

2.1.2 Analysing and Collecting Data Regarding Customer Expectations and Concerns

Identifying customer expectations and concerns is critical for companies that want to create a product that truly solves their customers' problems. Not to mention, the simplest way to intelligently position their brand in the market is to align the internal teams around the specific needs of the customer. The following figure explains the customer needs analysis, a four-step procedure for determining and meeting the requirements of customers.

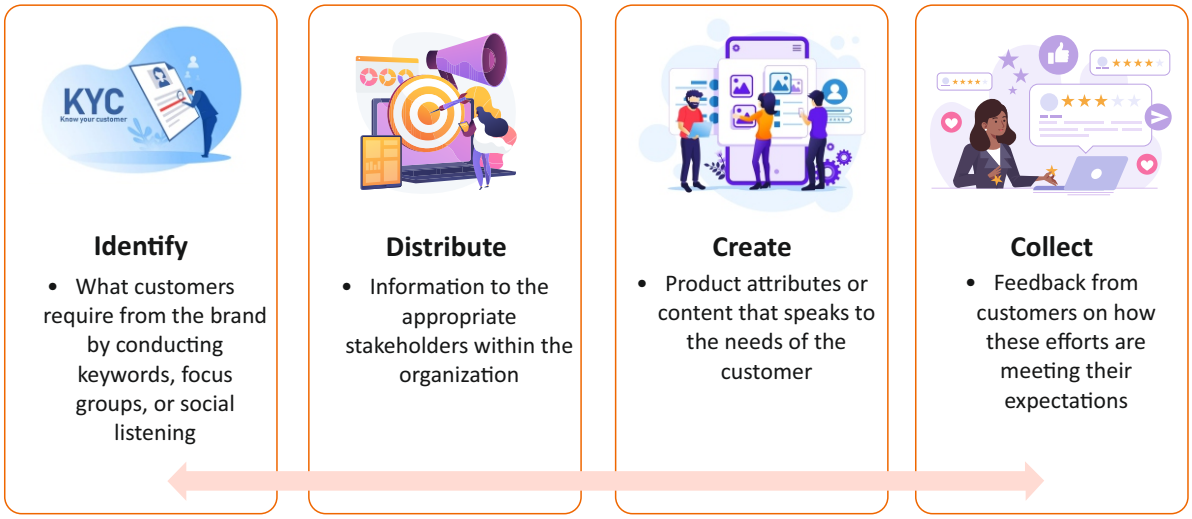


Fig 2.1 Process of Analyzing the Collected Data for Meeting Customer's Needs

Notes

QR Code

Scan the QR Code to watch the related video

youtube.com/watch?v=h5-LpwwQJ6M

2.1.1 Various Methods for Connecting with Target Customers

youtube.com/watch?v=yOU_s0xzc-Y

2.1.2 Analysing and Collecting Data Regarding Customer Expectations and Concerns

Exercise

Answer the following questions-

1. Who are target customers?

_____
_____
_____

2. Explain the various methods for connecting with target customers.

_____
_____
_____

3. Explain the process for determining and meeting the requirements of customers.

_____
_____
_____

4. What is target market?

_____
_____
_____

Fill in the Blanks -

1. _____ is the process of gathering data from social media channels for keywords, topics, or feedback relevant to your brand.
2. _____ is a market research technique in which a small group of people representing the target audience is interviewed collectively.
3. A _____ can reveal what the customers want, what motivates them to buy, and how to gain a market advantage.
4. _____must constantly research and understand the needs and requirements of their target customers.

Unit 2.2 Carry out Advanced Product Quality Planning (APQP)

Unit Objectives

At the end of the unit, the trainee will be able to:

1. Explain the importance and process of carrying out Advanced Product Quality Planning (APQP)
2. Elaborate how to prepare a plan and define the program as per the customer needs and expectations from the existing or proposed product(s)
3. Explain the importance of conducting production trial runs and testing the product output to confirm the effectiveness of the deployed manufacturing approach before launching full-scale production
4. Explain the importance and process of identifying issues and start corrective actions to support continual improvement and reduce process variations
5. Discuss the applicable legal and safety standards to be followed in the designing process

2.2.1 Importance and Process of Carrying out Advanced Product Quality Planning

Complex products and supply chains present numerous opportunities for failure, especially when new products get launched in the market. APQP is a systematic procedure for product and process development. This framework is a standardized set of quality requirements that allows developers to create a customer-satisfying product.

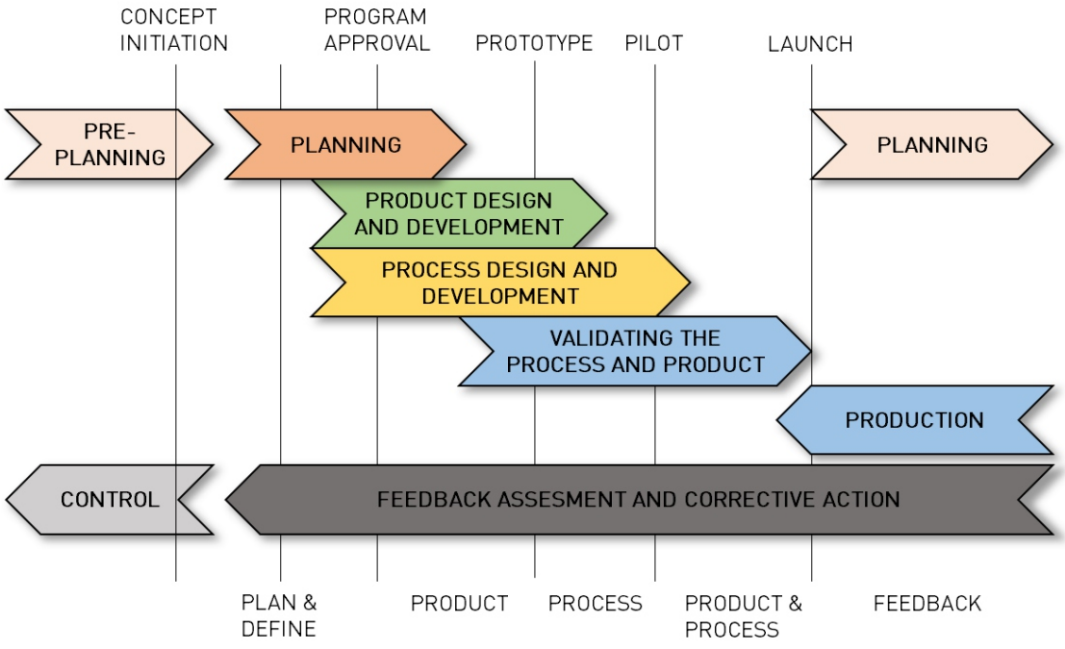


Fig 2.2 Framework of APQP
(Source: https://www.improvians.com/blogs/advanced-product-quality-planing.html)

The following figure explains the importance of Advanced Product Quality Planning in production process.

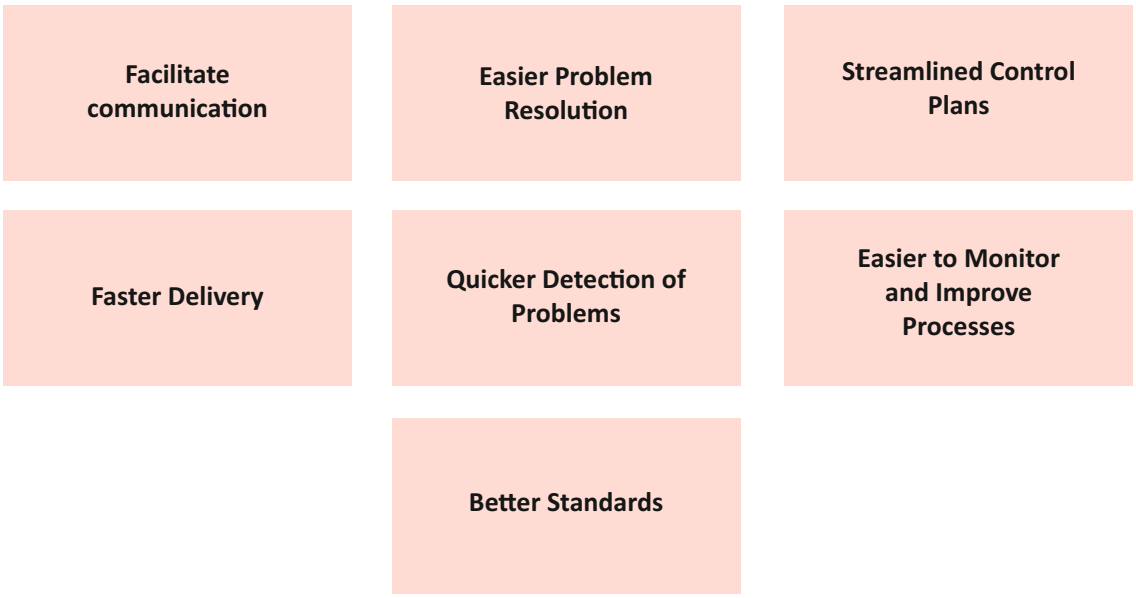


Fig 2.3 Importance of APQP

Product quality planning's primary goal is to improve communication and collaboration between engineering activities. The APQP process employs a Cross-Functional Team (CFT) comprised of marketing, product design, procurement, manufacturing, and distribution. APQP ensures that the customer's voice (VOC) is clearly understood and translated into requirements, technical specifications, and special features.

The benefits of the product or process are built-in through prevention. APQP encourages the early detection of both intentional and unintentional change. These modifications may result in exciting innovations that support customer delight. Failure and customer dissatisfaction result from poor management. The goal of APQP is to use tools and methods to reduce the risks associated with the change in a new product or process.

Notes

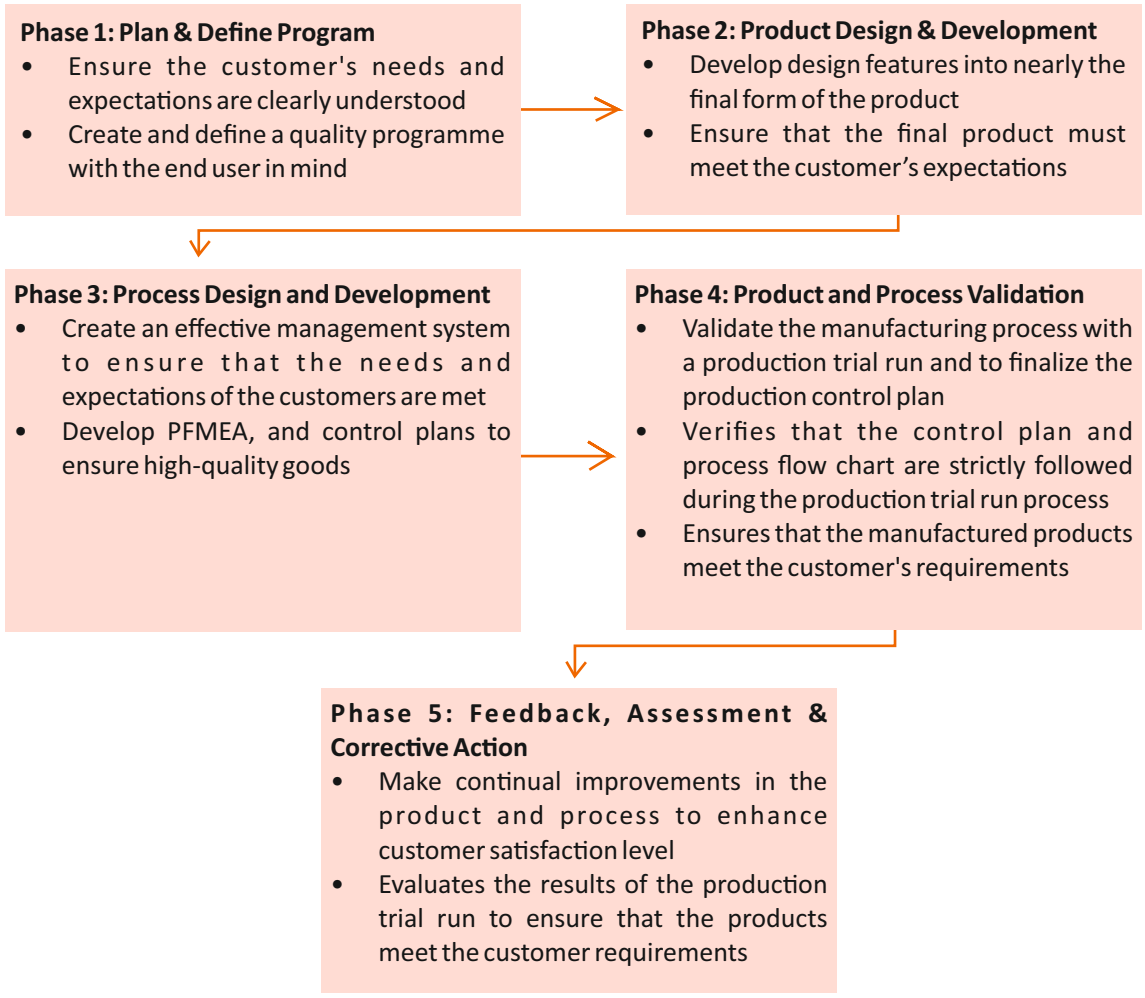


Fig 2.4 Process of APQP

APQP encourages the never-ending quest for continuous improvement. The first three phases of APQP, which focus on planning and prevention, account for 80 percent of the APQP process. The fourth and fifth phases, which focus on validation and evidence, support the remaining 20% of APQP.

The fifth section allows an organization to specifically communicate learnings and provide feedback in order to develop standard work and processes. The following are some of the advantages of APQP:

Fig 2.5 Benefits of APQP

APQP helps to improve communication between the supply chain and the organization/customer. As the process progresses, requirements that translate into more detailed specifications are clarified and decomposed to greater detail.

APQP is applied in two ways:

1. **New Product Introduction (NPI) Support:** APQP supplements product development processes by emphasizing risk as an alternative to failure. It enables the team to take action on the risk rather than waiting for failure to occur in testing or in the hands of the customer. APQP employs risk-based tools to address all aspects of product and process design, service, process quality control, packaging, and continuous improvement. Because of the percentage of new content, changes to current off-the-shelf technology, or past failure history, each APQP application may be distinct from previous applications.
2. **Post-release Product or Process Change:** Outside of Product Development, APQP monitors a product or process change to ensure that the risk of change is managed successfully by preventing problems caused by the change.

2.2.2 Product Program Planning as Per Customer Needs and Expectations

Quality planning is essential because failing to do so makes delivering a high-quality finished product more difficult. Before the execution, the quality manager establishes the plan's standards to meet to qualify the production as a success. A **quality plan** specifies the quality standards, procedures, resources, specifications, and the sequence of activities for a specific product. A business or organization must consider four major customer needs. These are **price, quality, variety, and ease of convenience.** The steps for developing a quality plan vary depending on the project, but are generally as follows:

a. Determine the quality standards for the product.

b. Define the team's responsibilities.

c. Establish acceptance criteria for each deliverable.

d. Create a project plan.

e. Obtain plan approval

1. **Product planning** is the continuous process of identifying and communicating market requirements that define the feature set of a product. It serves as the foundation for pricing, distribution, and promotion decisions. Product planning entails **searching for ideas, screening them thoroughly, turning them into tangible products, and introducing the new product to the market.** It also includes establishing **product policies and strategies.** Product planning encompasses all internal decisions, steps, and tasks required to create a successful product. In other words, it includes everything that impacts the end product. The following figure explains the process of product planning.

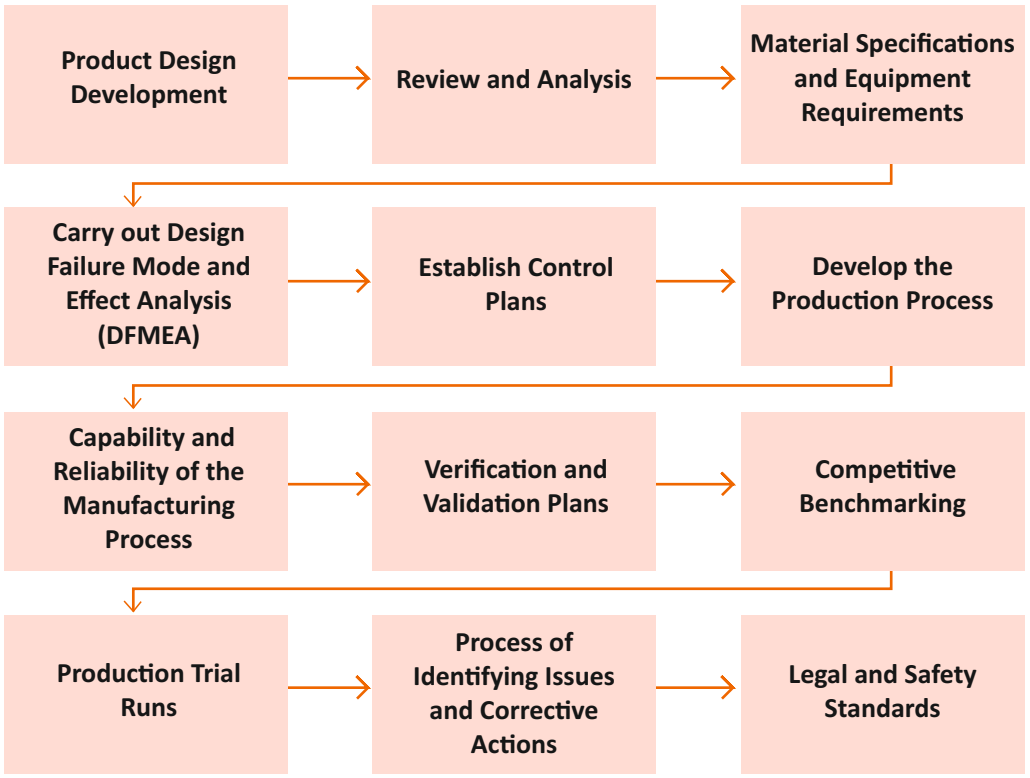


Fig 2.6 Product Planning Process

2.2.3 Prepare, Review, and Verify Product Design

A product design process is a series of steps taken by the product team to develop a design solution. It is a set of design tasks that follows a product from beginning of the concept till its completion, commercially available to the target customer. It is impossible to provide a universal design process that applies to all products, tangible or intangible. It's all about tailoring the process to the specific needs and goals for a product or services. However, a series of steps that should be present in some way in every product design process can be described:

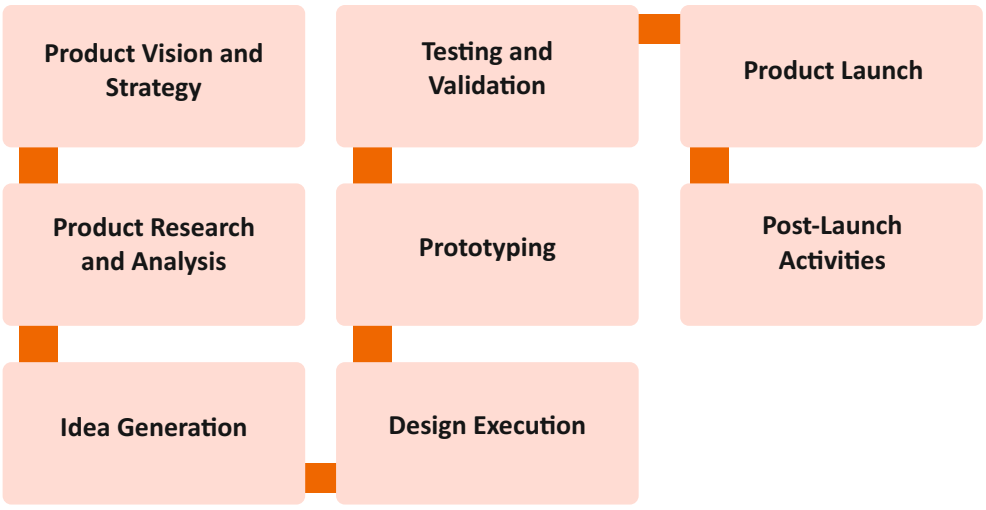


Fig 2.7 Product Design Process

A design review is a product development milestone in which a quality manager evaluates a product design against specified standards. Before implementation, the design review phase may identify the flaws of the current product design or prototype. The product design is evaluated by the quality management team during the design review process. Product developers present the design at a design review meeting, and participants provide feedback in the form of questions, challenges, and suggested improvements.

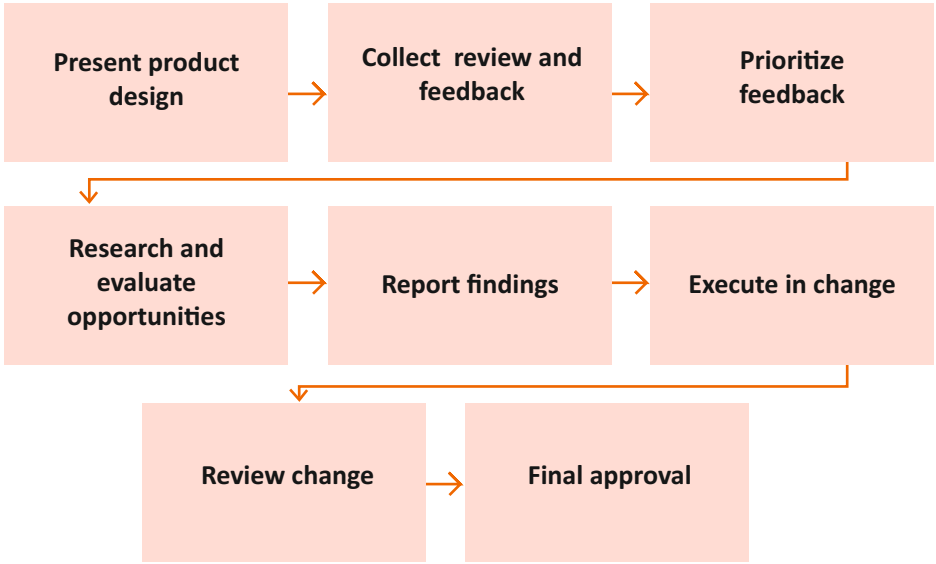


Fig 2.7 Review Process of Product Design

2.2.4 Material Specifications and Equipment Requirements

Material Specifications are the requirements, tolerances, shelf life, specifications, suppliers, and safety data for the material. On the other hand, equipment specifications are written documents or manuals that specify the method of production capacity, power requirements, fabrication methods, and other finer details of the equipment that make it suitable for use. To avoid equipment breakdowns, all production employees, including the quality manager, should have a thorough knowledge of the equipment and material specifications of the product. The material and equipment specification specifies the project's intent, performance, and construction. It refers to the quality and standards that should be followed in the production process. Defined materials and products from manufacturers are easy to identify installation, testing, and handover requirements.

Material specifications should include the following information:

a. Material's name

b. A description of the material's chemical, and physical properties

c. Material composition and processing aids

d. Origin country

e. Production method

2.2.5 Process of carrying out Design Failure Mode and Effect Analysis (DFMEA)

Design failure mode and effect analysis (DFMEA) is a comprehensive and systematic set of activities used to identify and assess the potential system, product, or process failures. DFMEA identifies the consequences and outcomes of these failures or actions. It eliminates or reduces failures and provides a written record of the work done.

DFMEA determines what might go wrong, how terrible the consequences might be, and how to avoid or mitigate them. DFMEA assists engineers in detecting failures as early as possible so that they can be corrected without incurring huge costs. It is useful in disciplines where risk reduction and failure prevention are critical, such as manufacturing, business processes, etc.

DFMEA investigates failure from multiple perspectives to determine why the expected or intended function did not occur under the specified conditions. There are four areas of DFMEA investigation:

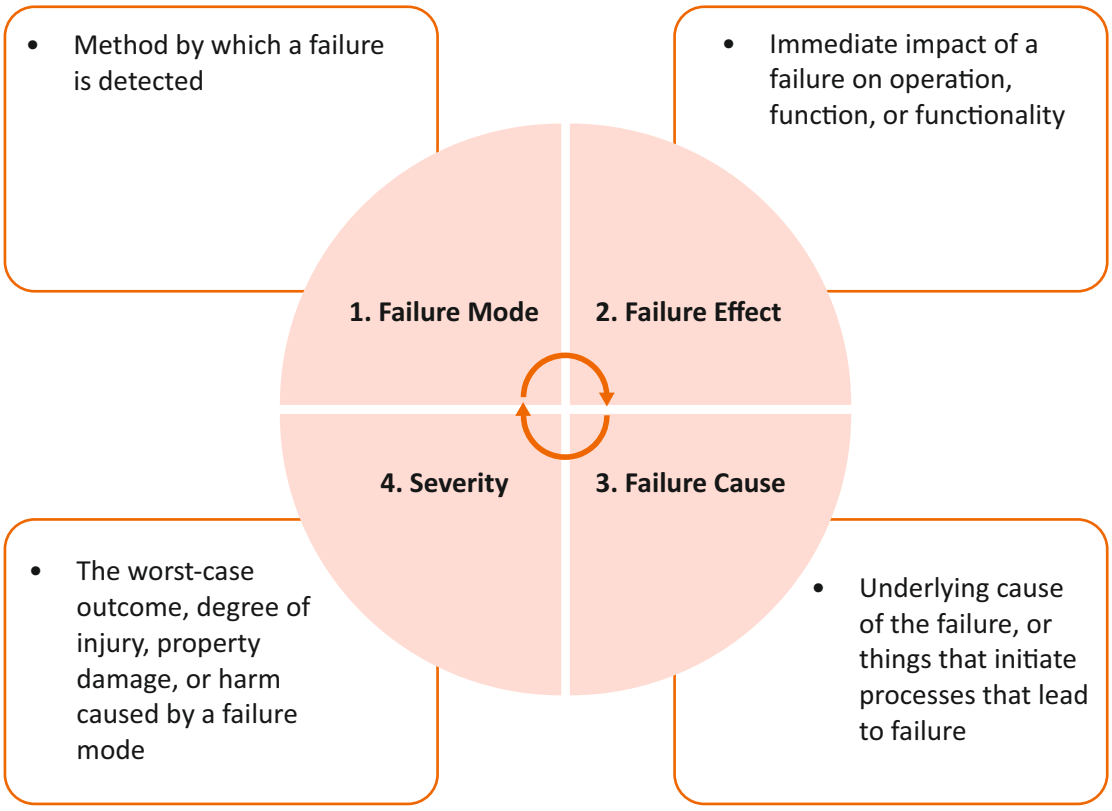


Fig 2.8 DFMEA Process

The results are then refined further by calculating a risk priority number (RPN) based on several variables:

1. **The severity of the failure effect (SEV):** a value from 1 (low) to 10 (high) (high)
2. **Failure occurrence frequency (OCCUR):** a value from 1 (infrequent) to 10 (frequent) (frequent)
3. **DETEC:** a value assigned on a scale of 1 (very detectable) to 10 (very preventable) (not detectable)
4. **RPN** is calculated by multiplying SEV, OCCUR, and DETEC together.

As a result, the RPN can range from 1 (low risk) to 1,000. (high risk). Users can then define what is acceptable and unacceptable for the failure under investigation.

2.2.6 Control Plans for Product Prototype Creation

A prototype control plan is used during the early stages of development when the part or process is defined or configured. This control plan will detail the controls for the required dimensional measurements, materials, and performance tests. It is a living document that outlines the methods used to ensure the quality of critical inputs/features to deliver outputs/products that meet customer expectations. Control plans are:

1. Real-time maintenance
2. Written descriptions of the measurements, inspections, and checks used to control manufacturing parts and processes
3. Updated if process changes occur or new processes are implemented to apply for a new PPAP if necessary

A control plan is made up of data from various sources, such as a process flow diagram and a PFMEA. This data is used to develop a comprehensive plan of action for understanding production processes and identifying potential problems to ensure that production quality meets customer expectations.

Information flow

a. **Process flow chart -** This chart illustrates the process flow and identifies the process inputs and outputs.

b. **PFMEA** (process failure mode effects analysis) – This detect potential problems in the manufacturing process.

c. **Control Plan** - This generates a quality control plan based on the process flow diagram and PFMEA.

Control plans are classified into three types that correspond to different stages of production. The control strategy employed is determined by the processes being monitored.

Prototype control plan	• Applicable if a component is in the early stage of development • Describes dimension measurements, materials, and performance tests performed during prototype development
Pre-launch control plan	• Applicable when a component's prototype phase is complete but full production stability has not yet been achieved • Includes descriptions of size measurements, materials, and performance testing performed once the prototype phase is complete, with increased quality checks and frequency
Production control plan	• Applicable when a component is in full production • Includes characteristics, process controls, tests, and measurements conducted through full production

Fig 2.9 Types of Control Plan

The following figure explains the process to develop control plan in production.

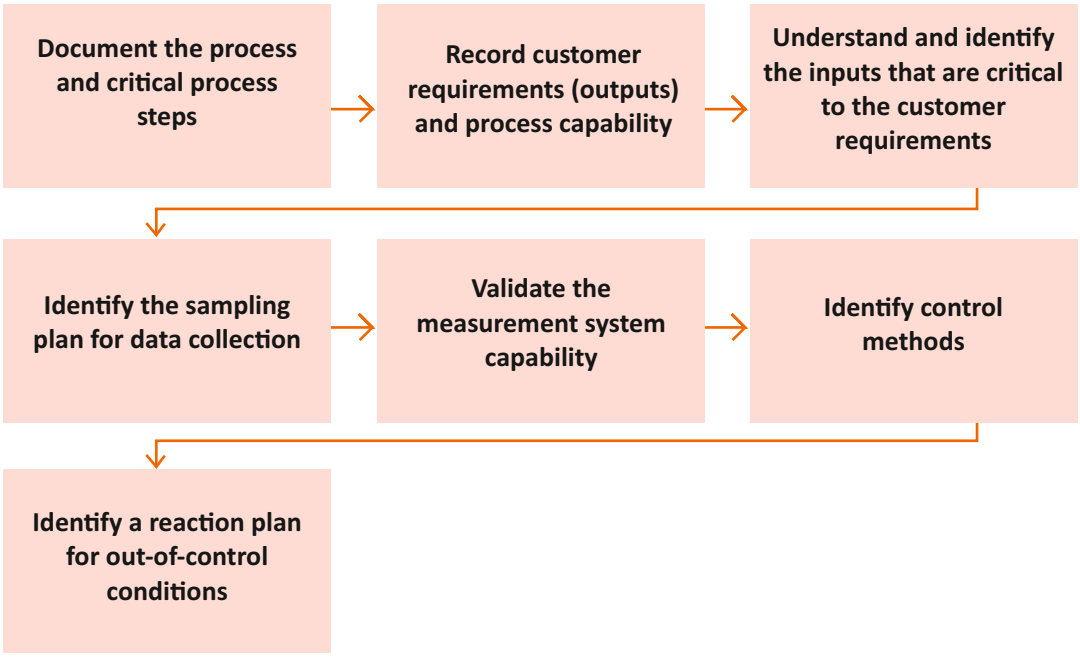


Fig 2.10 Process to Develop Control Plan

Control plans assist suppliers in overcoming critical challenges and concentrating on product quality, process efficiency, and cost reduction.

Fig 2.11 Importance of Corrective Plan

2.2.7 Product Design and Production Process Development

As earlier discussed, the production development process includes all steps necessary to bring a product from concept to market availability. Identifying a market need, researching the competitive landscape, conceptualizing a solution, developing a product roadmap, building a minimum viable product, and so on are all part of this process. The seven stages of product design and development are as follows:

Fig 2.12 Stages of Product Design and Production Process Development

2.2.8 Process Capability and Reliability Analysis for Product Quality

Process capability is a collection of tools that determines how well a given process meets a set of specification limits. In other words, Process Capability Analysis assesses the efficiency of a process. A process capability analysis is a significant technique for determining how well a process meets a set of specification limits. Capability analysis is typically based on a sample of data taken from a process and results in:

a. The DPMO's estimate (defects per million opportunities)

b. At least one capability indices

c. An estimate of the process's Sigma Quality Level

Product reliability analysis is defined as the likelihood that a device will perform its required function under specified conditions for a given period of time. Product reliability is measured as MTBF (Mean Time Between Failures) for repairable items and MTTF (Mean Time to Failure) for non-repairable items.

2.2.9 Verification Process, Validation plans, & Effective Quality Control

Verification is a process that determines the product's quality. Verification encompasses all of the activities involved in producing a high-quality product, such as testing, inspection, design analysis, specification analysis, etc. Verification is a relatively objective process in the sense that if the various processes and documents are expressed precisely enough, no subjective judgment is required to verify the product.

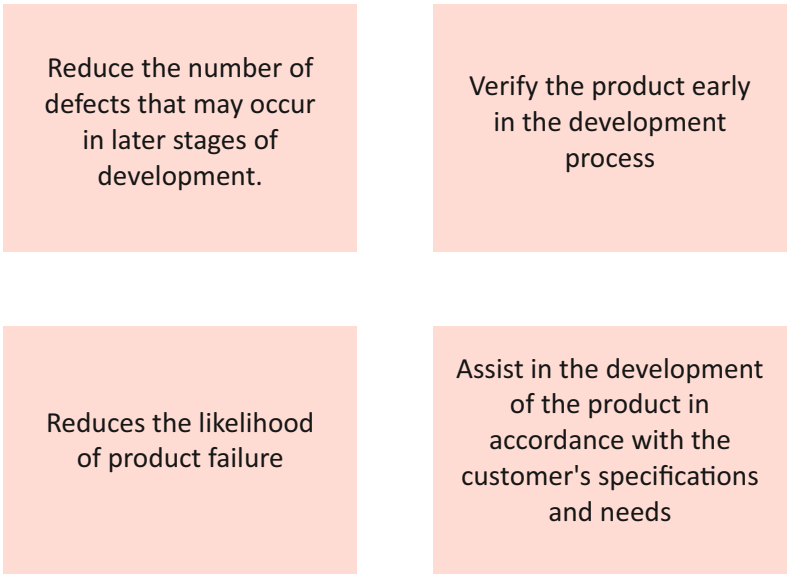


Fig 2.13 Advantages of Verification Process in Production

Validation is the process of ensuring that the product functionality meets the customer requirements and needs. Validation occurs at the end of the development process after all verifications have been completed.

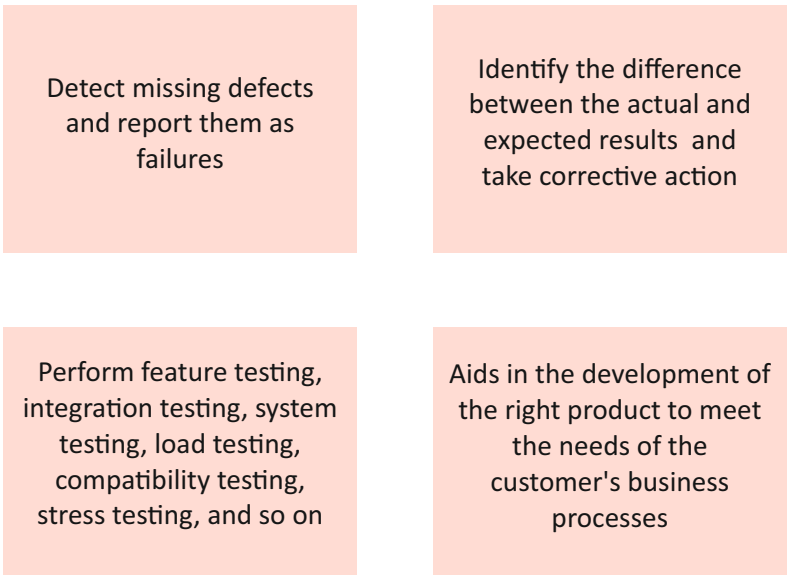


Fig 2.14 Advantages of Validation Plans

The verification process involves checking documents, designs, codes, and programs, whereas the validation process involves testing and validating the actual product. Verification does not involve code execution, whereas Validation does.

The following figure explains the five phases of validation process in production.

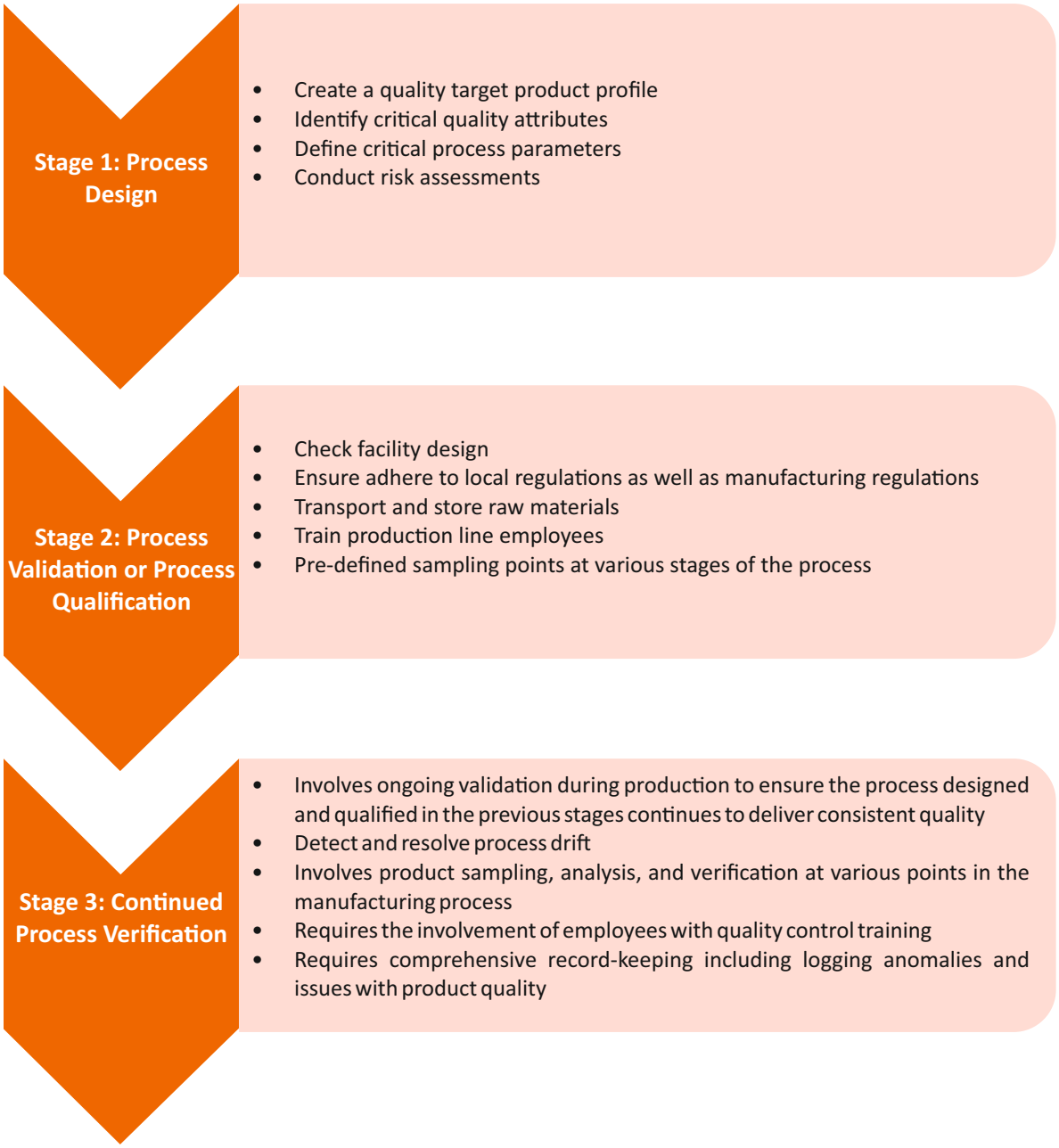


Fig 2.15 Process of Validation

Effective quality control entails testing units to see if they meet the specifications for the final product. The testing is done to assess whether any corrective actions are required in the manufacturing process. Effective quality control assists businesses in meeting consumer demands for better products. Quality Planning, **Quality Assurance, Quality Control, and Continuous Improvement** are the four main components of a quality management process. The six steps to developing a quality control process are as follows:

1. Establish your quality standards
2. Choose which quality standards to prioritize
3. Create operational processes to ensure quality delivery
4. Examine results
5. Receive feedback
6. Make improvements

Notes

2.2.10 Competitive Benchmarking

Competitive benchmarking assesses where and how your company compares to its competitors. Benchmarking allows you to compare your company's performance to competitors and other best-in-class brands by using a set of predetermined metrics. The steps for conducting competitive benchmarking are as follows:

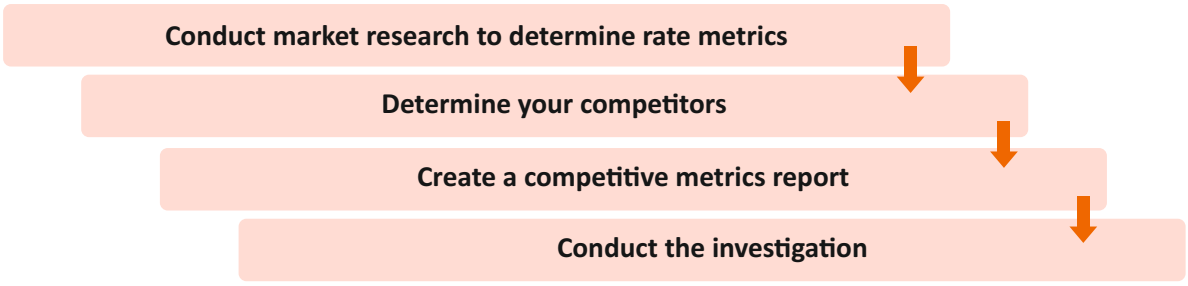


Fig 2.16 Process of Competitive Benchmarking

2.2.11 Production Trial Runs and Testing

Production Trial Run (PTR) is a systematic evaluation and validation of the manufacturing process before serial production. During a PTR, the project team evaluates and validates the incorporation of design requirements and customer expectations into the manufacturing process. The project team evaluates and validates the integration of design requirements and customer expectations into the manufacturing process by producing products with serial circumstances based on a pre-launch Control Plan. PTR is a significant component of Advanced Product Quality Planning (APQP), particularly its fourth section, Product and Process Validation. PTR is a required component in the electronic manufacturing industry, but it can be used in any other industry to ensure that pre-defined processes are followed and customer requirements are met during the manufacturing process.

PTR must be completed before the launch of a new product, so it must occur before the start of production (SOP). Furthermore, both the Product and Process design phases must be completed prior to the PTR. The following are the general requirements and inputs for PTR:

Quality system review	Floor layout	Process Flow Chart (PFC)
Pre-launch Control Plan (pre-launch CP)	Released Process Failure Mode and Effects Analysis (PFMEA)	Finalized process instructions (e.g. work instructions, inspection instructions)
Measurement System Analysis plan (MSA)	Preliminary process capability study plan	Packaging standards and specifications

Fig 2.17 Elements of Production Trial Run

A proper PTR cannot be performed or evaluated without the above-mentioned elements. Following the PTR, it provides critical information and inputs to the team, allowing them to evaluate and assess the maturity and effectiveness of the production. PTR and parallel quality processes produce the following results:

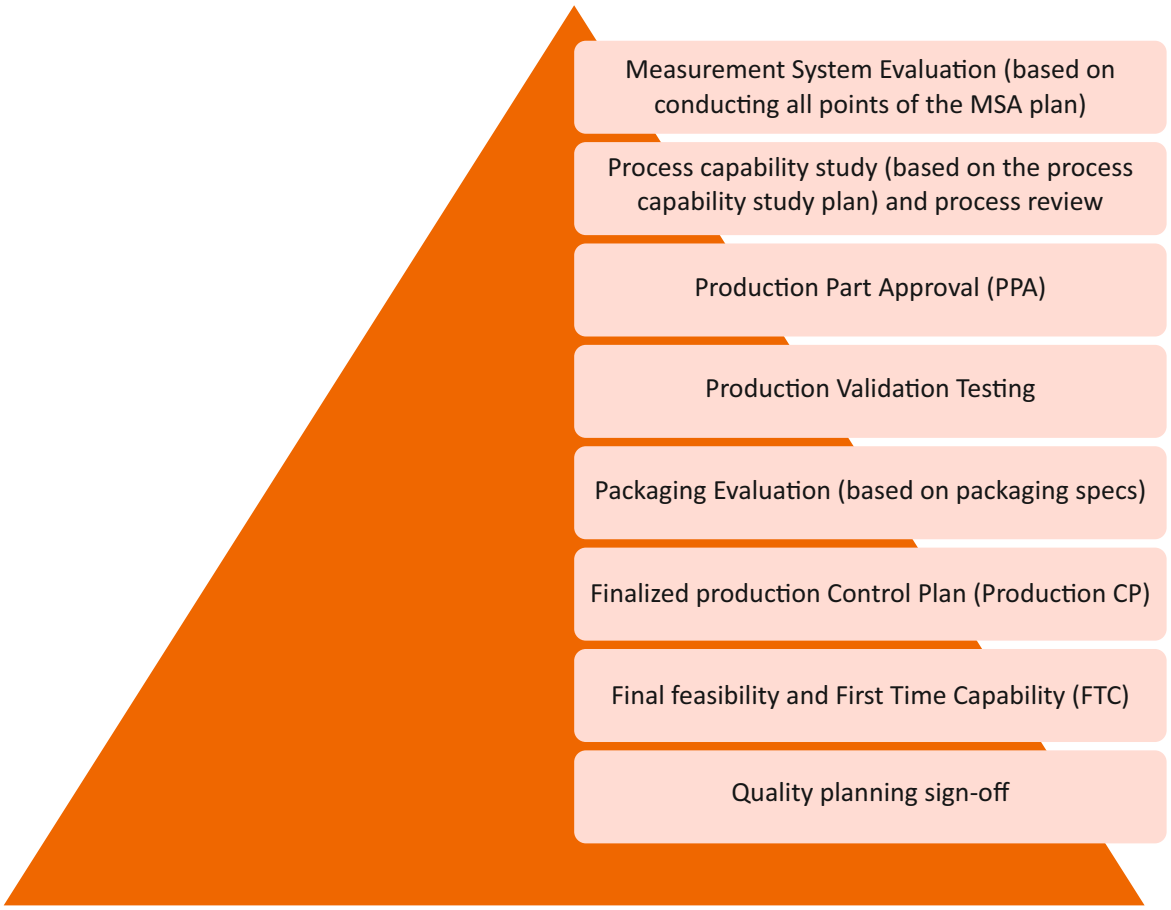


Fig 2.18 Output/Results of Production Trial Run

2.2.12 Importance and Process of Identifying Issues and Corrective Actions

Continuous improvement drives the enhancement of both processes and products. Organizations that actively seek ways to improve their operations will invariably raise the value of their products and services. It will result in more sophisticated and economically competitive offerings. Simply words, a correction is an immediate action taken to fix an issue discovered during an audit or while monitoring, and corrective action works to resolve the issue's root cause. A preventative action is one taken to avoid a future safety problem.

A quality management system's goal is to assist businesses in improving their ability to meet customer or regulatory requirements. A corrective action plan that adequately addresses non-conformance is a critical component of a successful system. W. Edwards Deming, a quality pioneer, introduced the Plan-Do-Study-Act (PDSA) cycle as a tool for planning, implementation, and continuous improvement. In quality circles, it became known as the Plan-Do-Check-Act (PDCA) cycle. This tool can be applied to an entire quality management system or to individual components.

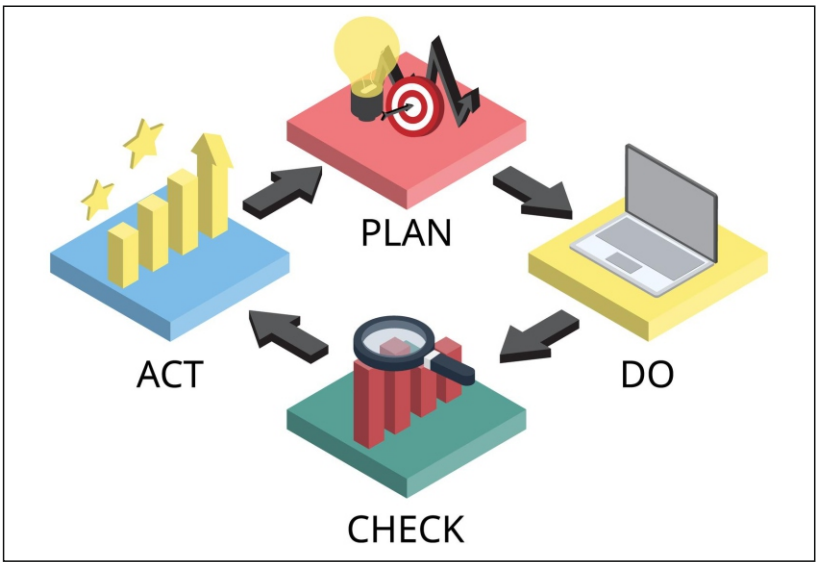


Fig 2.19 PDCA Cycle

Corrective action systems can regain their footing in seven critical steps by using the cycle.

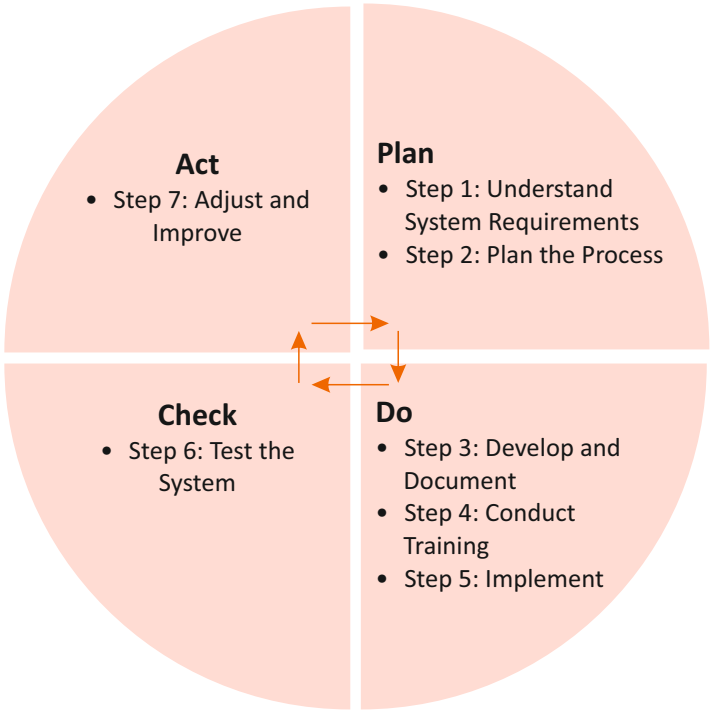


Fig 2.20 Steps of PDCA Cycle

2.2.13 Relevant Legal and Safety Standards

ISO 45001 is an international standard for workplace health and safety developed by government standards committees at the national and international levels. An Occupational Health and Safety Management System (OHSMS) is a critical component of a company's risk management strategy. Implementing an OHSMS allows businesses to:

1. Safeguard its employees and others under its control
2. Follow all legal requirements
3. Encourage continuous improvement

Note: The current version of the ISO 45001 standard is **ISO 45001:2018**

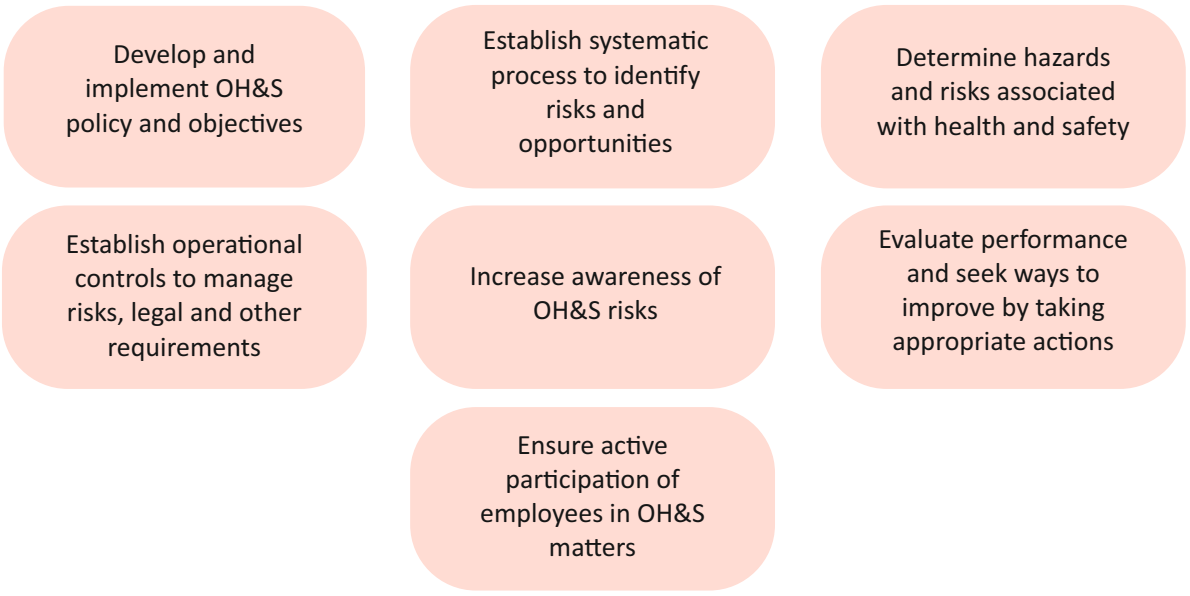


Fig 2.21 Benefits of OHSMS

The following figure explains the process flow of ISO 45001 (OH&SMS) in an organization.

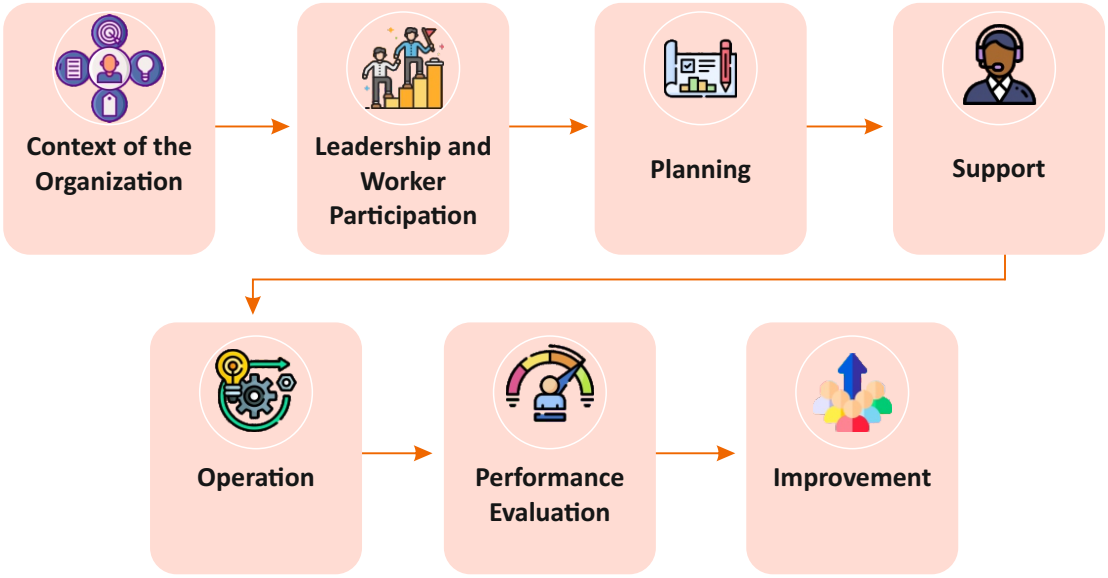


Fig 2.22 Process-flow of OHSMS

The Indian Constitution lays out detailed provisions for citizens' rights and the Directive Principles of State Policy, which establish a goal to guide the state's activities. The government is committed to regulating all economic activities of workplace safety and health risks and ensuring safe and healthy working conditions for all working men and women in the country. The **Factories Act of 1948** and the **OSH Code draft** require employers to protect workers' health and safety. The Factories Act, 1948, enacted labour welfare legislation with the primary goal of safeguarding factory workers from industrial and occupational hazards. It addresses a variety of issues concerning the safety, health, efficiency, and well-being of workers in the workplace. It was replaced by the **Occupational Safety, Health, and Working Conditions Code in 2020.**

To prevent hazards and risks at workplace, the employees must obey and follow standard precautions and safety measures at work as per organization guidelines and rules.

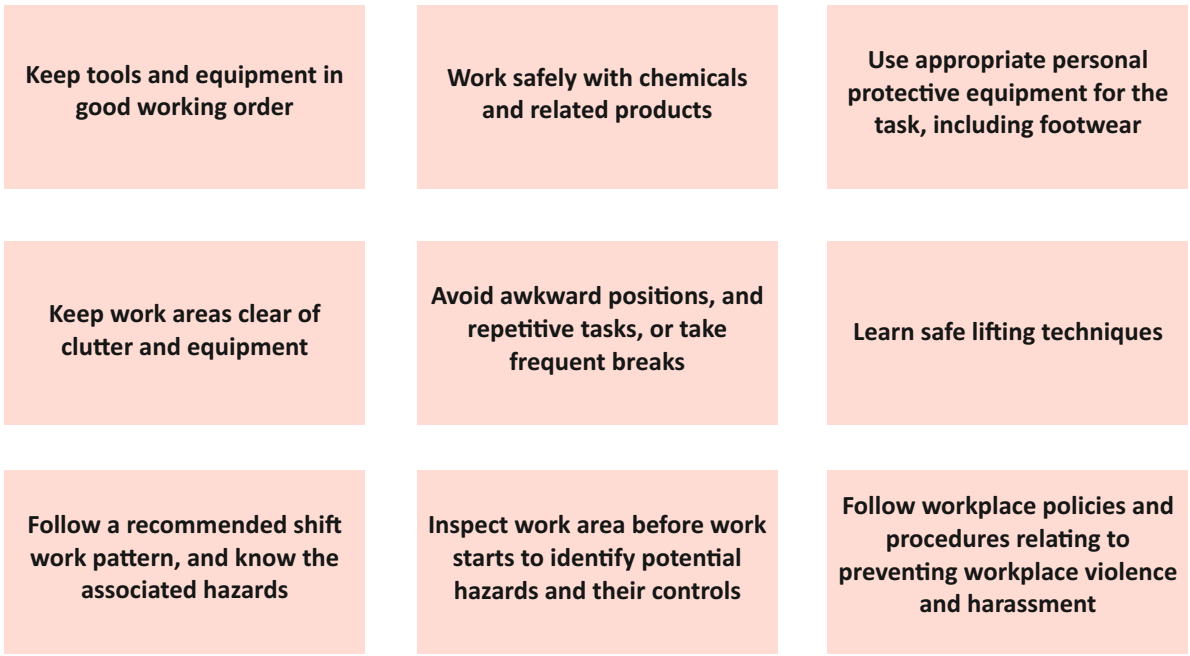


Fig 2.23 Standard Safety Rules at Workplace

Summary

- It is essential to comprehend their expectations and concerns regarding the organization's product. The customer's quality expectations are a statement about the product's quality. Customer satisfaction is created when customer expectations for product quality, service quality, and value-based price are met or exceeded.
- A target market is a group of people who share specific characteristics and have been identified by the company as potential customers for its products.
- A target customer is someone who is most willing to purchase the product. It is also a part of the overall target market.

- Customer requirements are the named and unnamed needs that customers have when they interact with the organization, their competitors, or search for the provided solutions.
- Customer requirements are the named and unnamed needs that customers have when they interact with the organization, their competitors, or search for the provided solutions.
- A market survey is a research and analysis of the market for a specific product/service that includes an investigation into customer preferences.
- Social listening is the process of gathering data from social media channels for keywords, topics, or feedback relevant to your brand.
- Advanced Product Quality Planning (APQP) is a systematic procedure for product and process development. This framework is a standardized set of quality requirements that allows developers to create a customer-satisfying product.
- The APQP process employs a Cross-Functional Team (CFT) comprised of marketing, product design, procurement, manufacturing, and distribution. APQP ensures that the customer's voice (VOC) is clearly understood and translated into requirements, technical specifications, and special features.
- The benefits of the product or process are built-in through prevention. APQP encourages the early detection of both intentional and unintentional change.
- APQP helps to improve communication between the supply chain and the organization/customer. As the process progresses, requirements that translate into more detailed specifications are clarified and decomposed to greater detail.
- Quality planning is essential because failing to do so makes delivering a high-quality finished product more difficult. Before the execution, the quality manager establishes the plan's standards to meet to qualify the production as a success.
- Product planning is the continuous process of identifying and communicating market requirements that define the feature set of a product.
- A product design process is a series of steps taken by the product team to develop a design solution. It is a set of design tasks that follows a product from beginning of the concept till its completion, commercially available to the target customer.
- A design review is a product development milestone in which a quality manager evaluates a product design against specified standards. Before implementation, the design review phase may identify the flaws of the current product design or prototype.
- Defined materials and products from manufacturers are easy to identify installation, testing, and handover requirements.
- Design failure mode and effect analysis (DFMEA) determines what might go wrong, how terrible the consequences might be, and how to avoid or mitigate them. DFMEA assists engineers in detecting failures as early as possible so that they can be corrected without incurring huge costs.
- A prototype control plan is used during the early stages of development when the part or process is defined or configured. This control plan will detail the controls for the required dimensional measurements, materials, and performance tests.
- Control plans assist suppliers in overcoming critical challenges and concentrating on product quality, process efficiency, and cost reduction.

- Process capability is a collection of tools that determines how well a given process meets a set of specification limits.
- Product reliability analysis is defined as the likelihood that a device will perform its required function under specified conditions for a given period of time.
- Verification is a process that determines the product's quality. Verification encompasses all of the activities involved in producing a high-quality product, such as testing, inspection, design analysis, specification analysis, etc.
- Validation is the process of ensuring that the product functionality meets the customer requirements and needs. Validation occurs at the end of the development process after all verifications have been completed.
- Effective quality control assists businesses in meeting consumer demands for better products. Quality Planning, Quality Assurance, Quality Control, and Continuous Improvement are the four main components of a quality management process.
- Competitive benchmarking assesses where and how your company compares to its competitors. Benchmarking allows you to compare your company's performance to competitors and other best-in-class brands by using a set of predetermined metrics.
- Production Trial Run (PTR) is a systematic evaluation and validation of the manufacturing process before serial production.
- A corrective action plan that adequately addresses non-conformance is a critical component of a successful system. W. Edwards Deming, a quality pioneer, introduced the Plan-Do-Study-Act (PDSA) cycle as a tool for planning, implementation, and continuous improvement.
- ISO 45001 is an international standard for workplace health and safety developed by government standards committees at the national and international levels.
- The Factories Act, 1948, enacted labour welfare legislation with the primary goal of safeguarding factory workers from industrial and occupational hazards. It addresses a variety of issues concerning the safety, health, efficiency, and well-being of workers in the workplace. It was replaced by the Occupational Safety, Health, and Working Conditions Code in 2020.

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QR Code

Scan the QR Code to watch the related video

youtube.com/watch?v=jIE23969kH8

2.2.1 Importance and Process of Carrying out Advanced Product Quality Planning

youtube.com/watch?v=xkHW6ak3xf8

2.2.2 Product Program Planning as Per Customer Needs and Expectations

youtube.com/watch?v=N_HiqvF7U5I

2.2.5 Process of carrying out Design Failure Mode and Effect Analysis (DFMEA)

youtube.com/watch?v=w2m5eU8XDVI

2.2.7 Product Design and Production Process Development

youtube.com/watch?v=JC4CaksviQY

2.2.10 Competitive Benchmarking

youtube.com/watch?v=RfCkkcVuBfg

2.2.12 Importance and Process of Identifying Issues and Corrective Actions

youtube.com/watch?v=MIssDGB7pJc

2.2.13 Relevant Legal and Safety Standards

Exercise

Answer the following questions-

1. What is APQP?

2. What is a quality plan?

3. Explain the product design process.

4. Write a short note on:

   a. DFMEA Process

   b. Validation Process

   c. ISO 45001 Process-flow

5. List down types of control plan in production.

6. What are the advantages of validation plans?

7. Explain the significance of trial run in production process.

8. List any five elements of production trial process.

_____
_____
_____

9. What is competitive benchmarking?

_____
_____
_____

10. Explain the importance and process of identifying issues and corrective actions.

_____
_____
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Match the Followings-

Column A	Column B
DFMEA	Plan-Do-Check-Act
PTR	Advanced Product Quality Planning
APQP	Occupational Health and Safety Management System
ISO 45001	Production Trial Run
PDCA	Design Failure Mode and Effect Analysis

Skill India
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N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

3. Process of Managing the Supplier Relationship and Receipt Inspection Process

ESSCI
Skilling India in Electronics

Unit 3.1 - Manage the Supplier Relationship

Unit 3.2 - Manage Receipt Inspection

ELE/N7907

Key Learning Outcomes

At the end of this module, the trainee will be able to:

1. Explain the importance of managing the supplier relationship
2. Describe the process of managing receipt inspection

Unit 3.1 Manage the Supplier Relationship

Unit Objectives

At the end of the unit, the trainee will be able to:

1. Explain the importance of formulating quality standards for components and the process of monitoring their compliance by the supplier
2. Explain the importance and process of training the supplier such as CAPA and train them to ensure the components they manufacture comply with the applicable quality and regulatory standards
3. Elaborate different ways to minimize the time and cost of the inspection
4. Explain the importance of receiving components from the supplier in a timely manner to avoid any negative impact on the company production process
5. Elaborate how to detect deviations on part of the supplier in following the quality standards and taking corrective action promptly

3.1.1 Importance of Quality standards and Compliance Monitoring Process

Quality standards are guidelines, methods, systems, requirements, and/or specifications developed by industry advisory groups to assist manufacturers in achieving and demonstrating consistent production and product quality. Its standards and requirements make it easier for businesses to meet what their customers consider "quality," and they improve the company's overall vision. Quality standards are intended to ensure that businesses meet the minimum requirements to join almost every industry. It isn't just about making money or outperforming a competitor. It's all about keeping customers safe, keeping promises, and meeting basic customer expectations. Companies, on the other hand, often reap greater profits and reduce losses by adhering to quality standards. Those who exceed quality standards stand out from the crowd, increasing their profit potential and customer loyalty.

A product is said to be of high quality if it is free of manufacturing flaws, deficiencies, or significant variation. To do so, specific standards must be established in order to achieve uniformity across the entire set of products being manufactured. The quality standards defined should be such that the features and specifications offered by the product are capable of meeting the implied need of the product. The following figure explains the importance of quality standards in general.

Encapsulation of best Practice	**Avoids repeititon of past mistakes**	**Involves checking standard compliance**

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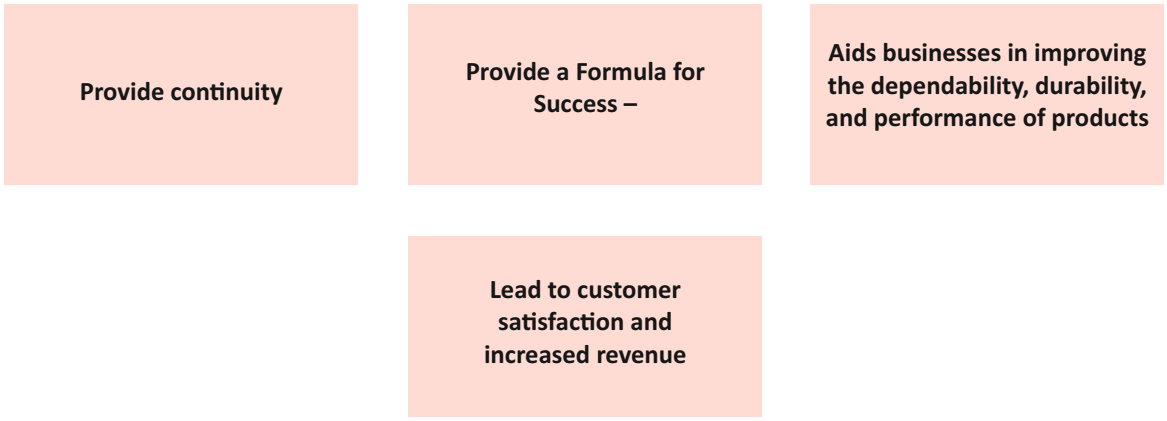

Fig 3.1 importance of Quality Standards

Accreditation with a recognized quality standard, such as ISO 9001, published by the International Organization for Standardization, can assist businesses in developing a reputation for excellence. In terms of the global economy, quality standards facilitate the cross-border movement of goods, services, and personnel, ensuring that goods manufactured in one country can be sold and used in another.

Examples of quality management standards –

a. ISO 9000 family, including ISO 9000 and ISO 9004

b. Environmental management systems in the ISO 14000 family

c. ISO 19011 for auditing management systems

The following figure explains the advantages of Quality Standards:

Fig 3.2 Advantages of Quality Standards

Three levels of quality standards –

1. Acceptable quality
2. Appropriate quality
3. Aspirational quality

Compliance monitoring is a continuous process that ensures all policies and procedures outlined in the manual are followed by employees, suppliers, and stakeholders. Its goal is to identify compliance risk issues in the operations or functions of a company. In other words, working with such organizations necessitates meeting quality standards to comply with industry regulations. In contrast, establishing efficient business processes in a company necessitates extensive knowledge and experience.

Identify which vendors require monitoring

- These relationships should always include critical and high-risk vendors, but they can also include lower-risk but equally important relationships.

Define the indicators you want to monitor

- They should include both quantitative and qualitative indicators (numerical data that can be objectively captured and measured).

Organize data sources

- Questionnaires, policy and procedure documents, SOC and audit reports, surveys, and third-party data intelligence tools, to name a few, are all good places to start collecting monitoring data. Make sure to have the required data to feed the indicators you want to track.

Clarify roles & responsibilities

- While the person who owns the vendor relationship should be primarily responsible for monitoring their vendors, many other subject matter experts are involved in the process. Make it a point to specify who will do what and when.

Line up subject matter experts

- Subject matter experts are the people who have the specialized skills you'll need to support certain aspects of monitoring. They frequently include information security, business continuity, compliance, information technology, and legal experts.

Establish escalation procedures

- When issues arise during the vendor monitoring process (which they always do), it's critical to understand which should be escalated and what options you have for resolving them. This can include conducting additional due diligence, updating contingency plans, or even changing (or terminating) the contract. Your framework should specify the types of issues that require escalation as well as the procedures that can be used.

Leveraging technology

- The vendor monitoring process is way easier when you leverage technology. This includes your vendor management system and continuous monitoring solutions that give you access to external data sources.

Fig 3.3 Seven Pillars of an Effective Supplier/Vendor Monitoring Process

The following figure exhibit the steps to improve supplier compliance:

1. Assess capability

- Supplier information is a critical starting point and must be relevant to the service or goods that they are providing.
- Double-check the supplier information. This evidence should not only be checked once a year, but it should always be live, up to date, and easily accessible.
- Once a supplier has been thoroughly checked and approved for any given product or service, ensure that all departments use suppliers from this list.
- All too often, different departments deviate from the approved supplier list to appoint non-approved suppliers based on a lower price. This can be very expensive if the decision also 'buys-in' risk.

2. Manage supply contracts

- Establish clear policies and rules so that suppliers understand what is expected.
- Contracts and specifications, b. Formalize your requirements so that nothing is overlooked.
- Restraints and controls Ensure that suppliers are aware of any control processes that must be followed, such as site access control on construction sites or railway lines, or exposure to heat, radiation, and so on.

3. Monitor suppliers

- Actions - Don't let your monitoring's rigor lull your suppliers into complacency and remove their sense of accountability for their own compliance and performance. It is critical to understand who is responsible.
- Examine - While physical audits have their place, technology can provide an audit trail at a lower cost. This can replace lengthy spreadsheets, reducing timeframes and increasing efficiency.
- Metrics of performance (KPIs) - It is often said that what is not measured is not done. It is critical to collect, measure, and analyze statistics that demonstrate whether the desired outcomes and objectives were met, such as percentages delivered on time, percentages fixed the first time, and percentages call outs completed within the target time frame.

Fig 3.4 Steps to Improve Supplier Compliance

Supplier relationship management is essential for smooth running of production process. The following figure exhibits few important tips to improve supplier relationships.

Fig 3.5 Tips to Improve Supplier Relationships

3.1.2 Significance of Training Suppliers Such as CAPA

CAPA stands for corrective and preventive actions. The term is most commonly associated with quality assurance and refers to improvements to an organization's processes to avoid undesirable situations such as product nonconformities.

CAPA can assist organizations in determining what is causing a problem, how to fix it, and how to prevent it from happening again. As a result, businesses correct the problem and prevent it from recurring.

Fig 3.6 Corrective and Prevention Actions

Application of CAPA Principles – The CAPA method is applicable in a variety of disciplines, including:

1. Manufacturing
2. Product Design
3. Testing Verification and Validation
4. Distribution, Shipping, Transport, and Packaging

CAPA is used extensively in a variety of industries, including electronics, automobiles, food processing, medical device development, pharmaceuticals etc. CAPA is also important in terms of quality management. Certain quality control systems and standards require meticulous documentation of these processes.

A good CAPA procedure includes several key stages. The stages are depicted in detail in the figure below.

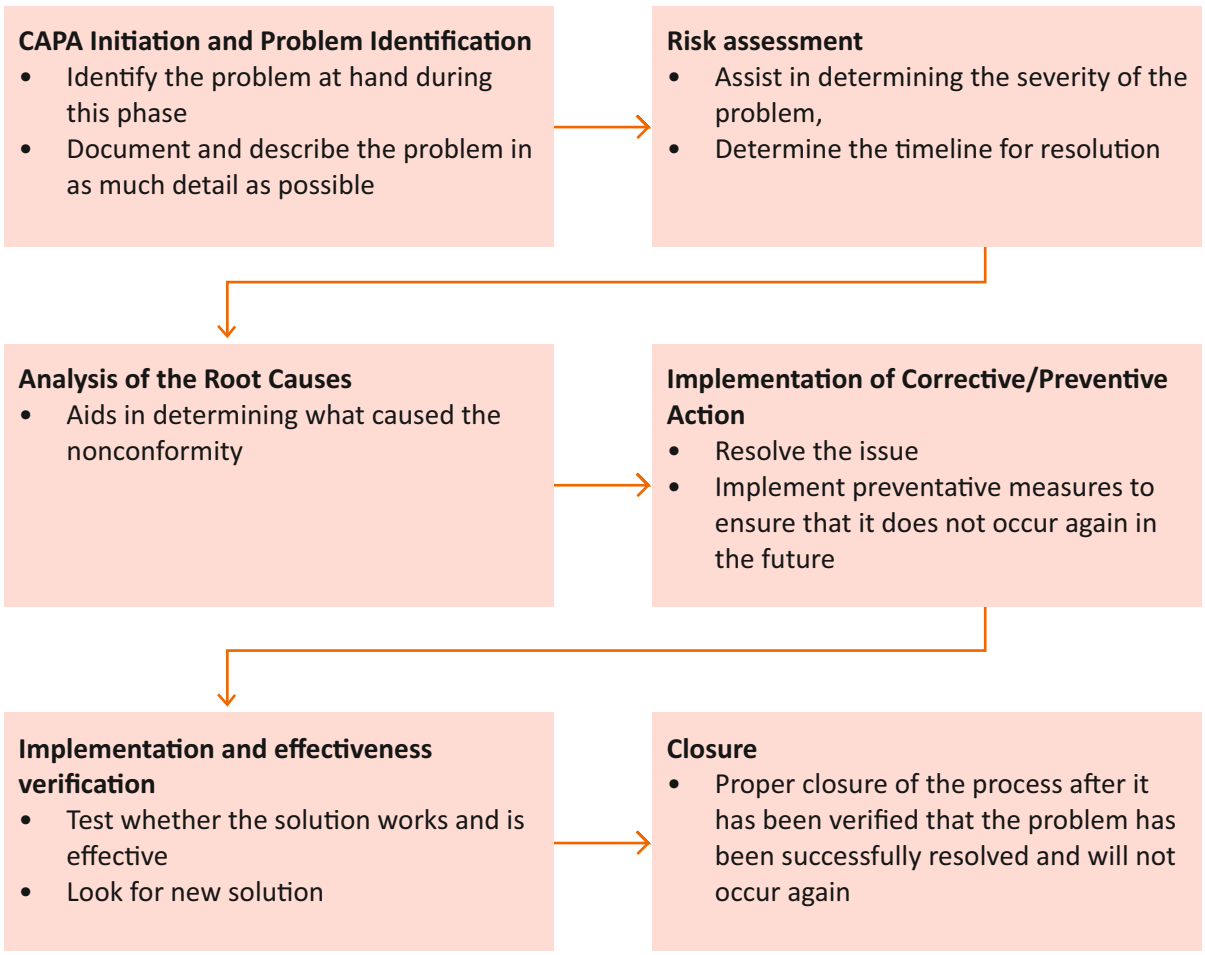

Fig 3.7 Different Stages of CAPA Process

Corrective action (CA) is the process of removing the root cause of a problem and preventing it from happening again. The corrective action should correspond to the previously identified root cause in order to eliminate the true root cause and prevent the problem from recurring.

Seven-Step Corrective Action Process:

1. **Define the issue -** Describe the issue. Ascertain that the problem is, in fact, a real problem, rather than a perceived problem. Describe who, what, when, where, and why. Describe the expected outcome and how to resolve the problem.
2. **Establish the scope -** Make sure to understand the scope of the issue at hand. Provide context for the magnitude of the problem. Is this something that happens every day? Is it limited to a specific product, transaction, or customer.
3. **Corrective Actions -** These Measures Make a temporary fix to stop the problem while look for the root cause and resolution. This is about immediate checks or stop-gap measures that will catch the problem again if it reoccurs while looking for the root cause.

4. **Determine the Root Cause -** Finding the root cause is not always simple. There are specific root cause analysis techniques that can help with this. The goal is to identify the underlying cause rather than just the apparent problem. It's similar to a doctor's diagnosis when a patient complains of stomach pain but the doctor diagnoses it as something specific, such as diverticulitis.

5. **Plan a Corrective Action -** Create measurable, doable solutions with realistic deadlines that are centered on the root cause. It must include the steps required to eliminate the root cause. Depending on the size of the problem, it may necessitate a cost-benefit analysis with formal management approval before proceeding.

6. **Execute the Corrective Action -** Implement your actions and see them through to completion. It could be as simple as making changes to the software or the database. It could be an investment in new equipment in a manufacturing environment because the old equipment is no longer capable of meeting tolerance requirements.

7. **Follow up to make sure the Plan worked -** Document the process and conclude it with a debrief to determine what was done and to inform the team of the changes. Allow enough time to ensure that the problem does not reoccur. Take notes on any lessons learned. Finally, make certain that adequate detail has been recorded.

The following figure shows the sample plan of Corrective Action Plan is Given as:

ACTION ID NO	DEFICENCY DESCRIPTION	ACTIONS	155 DEFICIENCY RESOLVED	RESOURCES	LEAD	PLANNED COMPLETION DATE	ACTUAL COMPLETION DATE	REVIEW DATE
1-22	Order entry screen working when new customer order entry made	Check customer master record & link SOP screen	Yes	Sales Entry Clerk, Software programmer, Systems Analyst	Systems Analyst	23 March 2020	30 March 2020	15 April 2020

Fig 3.8 Sample of Corrective Action Plan
(Source: https://www.integrify.com/corrective-action-process/)

3.1.3 Effective Ways for Cutting Inspection Cost and Minimizing Time

Following are the five ways to reduce inspection costs –

1. **Review current inspection methods –**
   a. Part Inspection. Find out how parts are inspected.
   b. Measurement Tools - Hand tools are limited to a few types of measurements and can produce different results depending on who uses them.
   c. Inspection Reports- Manual record keeping makes statistical analysis, statistical process control (SPC) and custom reports laborious and time consuming.
   d. Quality Data Communication - Real-time data sharing via a computer network can increase efficiency.

2. **Define the objectives or goals of the new method -**
   a. During production, inspection must be objective, consistent, and standardized.
   b. Inspection must be quick, automatic, and meet modern metrology standards.
   c. Inspection data must be generated in a standard format and distributed via a computer network.
   d. New inspection methods must improve process control and profitability while lowering costs.

3. **Determine measurement equipment requirements –**
   a. The inspection machine must be capable of handling the largest parts being produced.
   b. It should be capable of measuring parts quickly enough to keep up with production.
   c. It must be tough enough to withstand the rigors of manufacturing.
   d. Machine accuracy must be at least three times that of the computer numerical control (CNC) machine and part tolerances.

4. **Evaluate organization and solicit feedback –**
   a. After reviewing current inspection methods, evaluate the organization and workflow.
   b. Listen to operators who use the equipment every day.
   c. Such dialogue will illustrate limitations or problems with the current methods and is critical to organizing part inspection.
   d. This feedback will bring to light new ways to increase productivity and accuracy.
   e. When quality measurement tasks are too difficult or time consuming, operators cannot do their jobs effectively and are more apt to make mistakes.
   f. A measurement program is created through user-friendly software.
   g. Appropriate individuals are alerted immediately to the parts' conformity via the network connection.

5. Organize data generation and management –

a. The effect of manufacturing process parameters on part conformity.

b. The design tolerance effect rejection and scrap rates.

c. Individual machine performance.

The primary goal of quality improvement is to increase profitability. Lower scrap levels, less rework, and lower raw material costs all contribute to lower manufacturing costs.

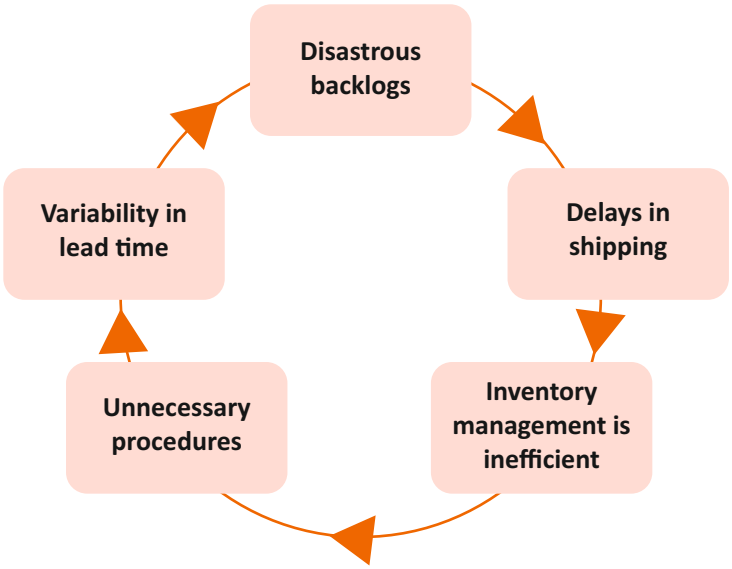

Fig 3.9 Common Factors Affecting Lead Times

The following figure exhibits different ways to reduce supply chain lead times:

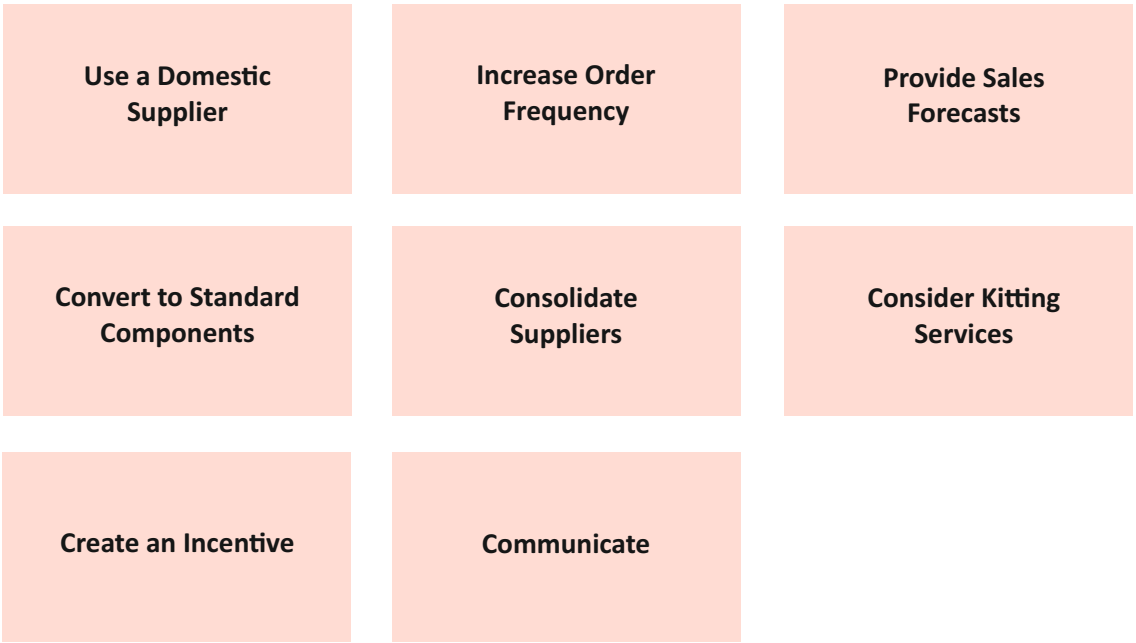

Fig 3.10 Ways to Reduce Supply Chain Lead Times

Automatic ordering reduces shipping time and costs by requesting inventory early enough to avoid stock outs. When the primary supplier is unavailable or out of stock, the company can keep a list of backup suppliers on hand to supply inventory. Lean tools such as SMED, 5S, Poka-yoke, Kanban, Just-in-time (JIT), Value Stream Mapping (VSM), Jidoka, and Cellular Manufacturing, among others, help to reduce lead time. Five Common Factors Affecting Lead Times

3.1.4 Significance of Effective Supplier Relationship Management

Supplier relationship management is significant because a long-term relationship between an organization and its suppliers allows for the free flow of feedback and ideas. It will result in a more streamlined, effective supply chain over time, which will benefit both costs and customer service. Suppliers supply the raw materials required by a company to manufacture its goods or services. Suppliers are in charge of transporting these materials. Suppliers provide the services required by a business to provide goods and services to its customers.

Benefits of Supplier Relationship Management –

1. The goal of SRM is to leverage supplier relationships to increase a company's value and profitability.
2. Supplier relationship management, when done correctly, can reduce wholesale costs, improve efficiency, and eliminate redundancies in the supply chain.

Benefits of Having a Solid Relationship with Your Suppliers:

a. Timely Delivery of Quality Materials

b. Smooth-sailing Production

c. Customer Satisfaction

d. More Business for You

e. Take Advantage of Great Deals

f. Excellent Support

g. Saves Your Company Money

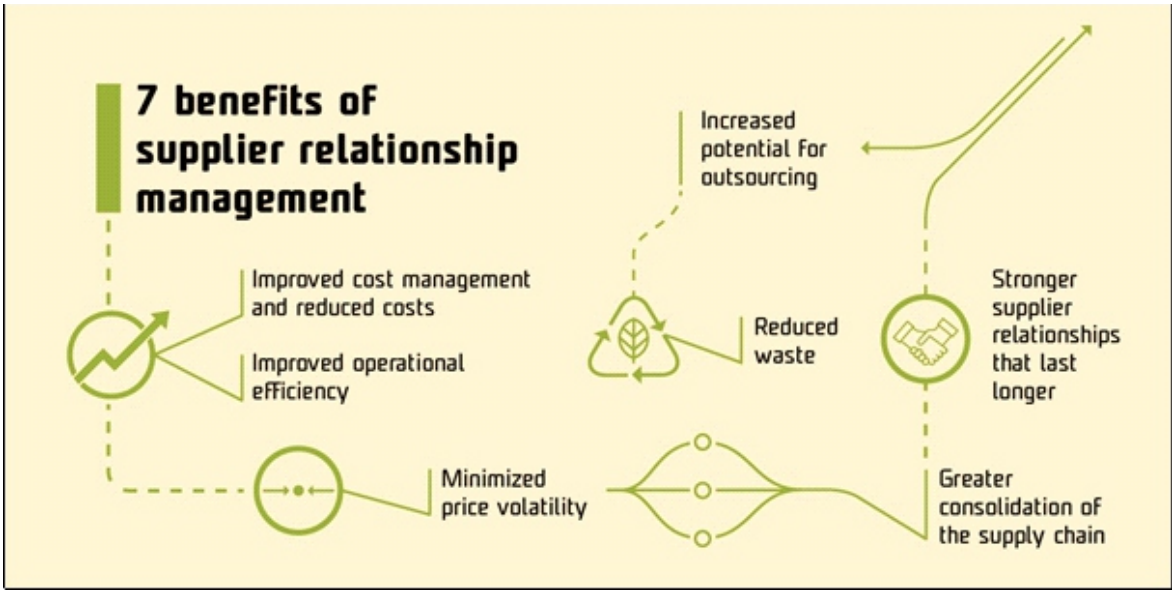

Fig 3.11 Benefits of Supplier Relationship Management
(Source: https://www.skaza.com/blog/plastic-manufacturing/7-benefits-of-supplier-relationship-management)

Supplier relationship management (SRM) is the process of integrating the technology, processes, resources, and tools required to align your organization with its suppliers to build stronger, more loyal relationships. It enables you to focus on what is most important to your business and provides a method for evaluating vendors who supply goods, materials, and services to your organization. It is an important aspect of business success and falls under the larger category of supply chain management.

Supplier relationship management consists of three major steps, which are as follows:

a. Supplier segmentation is the process of identifying risks and opportunities by distinguishing suppliers.

b. The process of determining the best way to interact with suppliers based on your company's goals and needs is known as supplier strategy development.

c. Execution of supplier strategy: Putting the previously designed strategy into action in an efficient manner to achieve the desired results in line with the company's objectives.

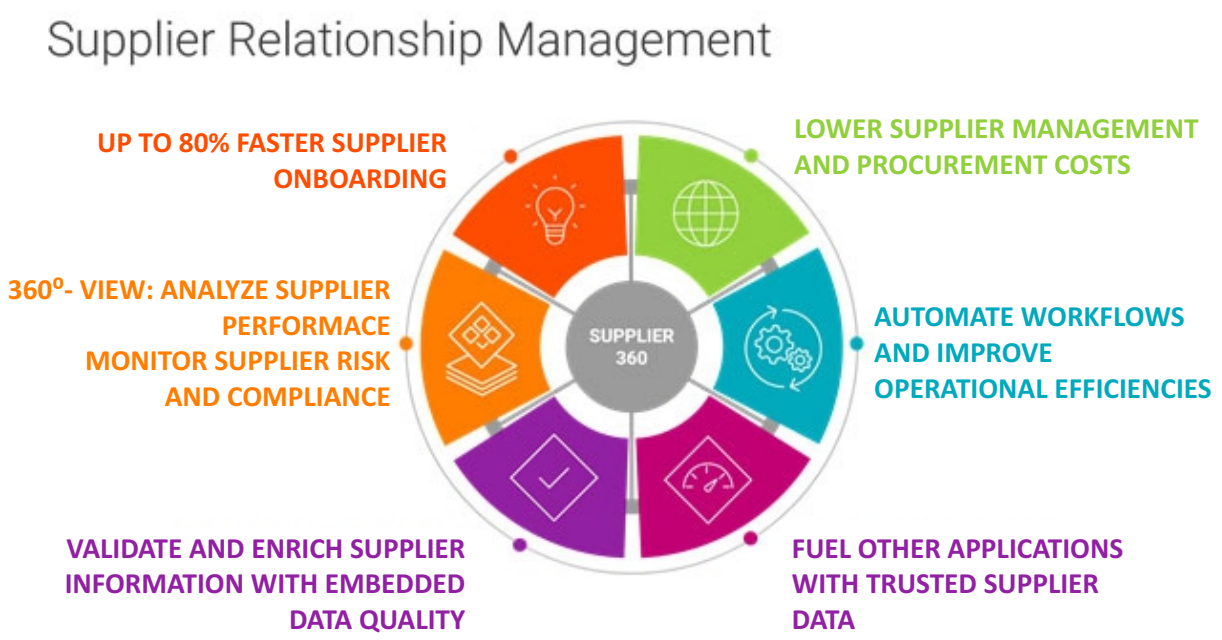

Fig 3.12 Supplier Relationship Management
(Source: https://www.informatica.com/resources/articles/what-is-supplier-relationship-management.html)

Notes

3.1.5 Supplier Performance Review as per Organization Policy

The seven steps for critically evaluating suppliers that can result in meaningful outcomes and a higher return on investment are as follows:

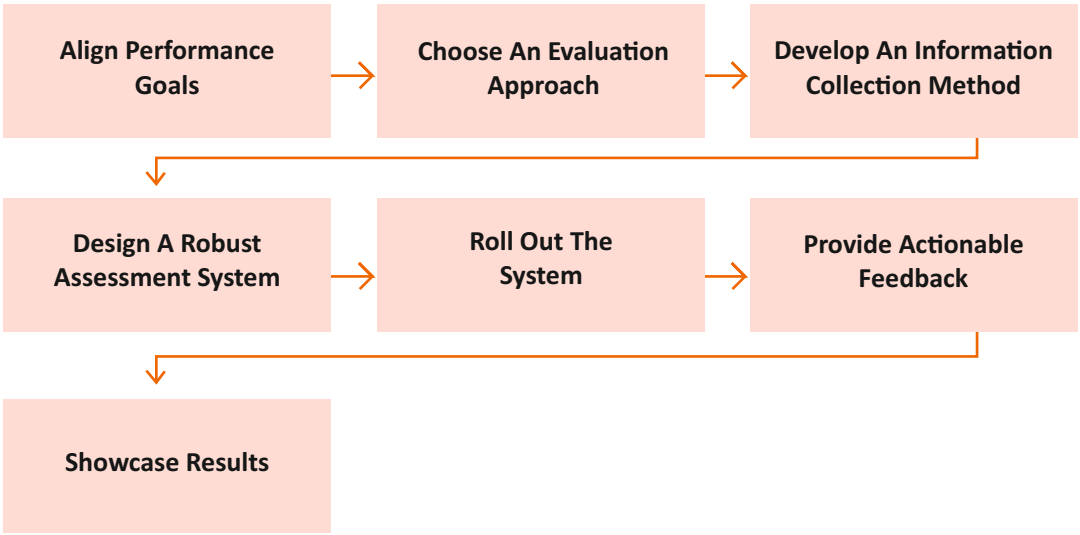

Fig 3.13 Evaluation of the Performance of the Supplier

The following are seven suggested supplier KPIs (Key Performance Indicators) to monitor:

1) Defect rates. Quality control is an important part of any buyer-supplier relationship
2) Lead times
3) Contract compliance
4) Return on Investment
5) Innovation
6) Risk and transparency
7) Customer service

The 10 Cs are selection criteria for potential suppliers: –

Fig 3.14 Criteria for Assessing the Suitable of a Potential Supplier

The system identifies and quantifies each supplier's strengths and weaknesses across multiple dimensions, as well as their suitability for each specific request, allowing employees to become more strategic buyers. Organizations can use the Supplier Rating System to analyse supplier performance using pre-configured KPIs. A supplier rating system, also known as a vendor rating system, "complements the evaluation and accreditation system by continuously measuring the performance of approved suppliers." It also allows for valuable feedback to assist suppliers in improving their performance.

The main objective of the supplier evaluation process is **to reduce purchase risk and maximize the overall value of the purchaser.** It typically involves evaluating, at a minimum, supplier quality, cost competitiveness, potential delivery performance and technological capability.

The three major benefits of regular vendor performance evaluations are:

Establish Benchmarks And Goals From Beginning To End

Build Stronger, More Innovative Partnerships

Support Cost Avoidance And Cost Reduction Efforts

Fig 3.15 Benefits of Regular Vendor Performance Evaluations

Notes

QR Code

Scan the QR Code to watch the related video

youtube.com/watch?v=XSAzVS3fvXA

3.1.1 Importance of Quality standards and Compliance Monitoring Process

Summary

- Supplier relationship management comprises of three important steps: supplier segmentation, supplier strategy development, and supplier strategy execution.
- A long-term relationship between the organization and its suppliers allows for the free flow of feedback and ideas, which is why supplier relationship management is so important. This will result in a more streamlined, efficient supply chain in the long run, which will reduce costs and improve customer service.
- The systematic approach to evaluating vendors who supply goods, materials, and services to an organization, determining each supplier's contribution to success, and developing strategies to improve their performance is known as supplier relationship management (SRM).
- Positive customer relations allow you to connect with your customers on a much more personal level. When you connect deeply with your target audience, you are much more likely to understand their needs, solve their problems, and build a sense of mutual understanding with them.
- The goal of SRM is to leverage relationships with suppliers in order to increase a company's value and profitability. When done correctly, supplier relationship management can reduce wholesale costs, improve efficiency, and eliminate redundancies in the supply chain.
- The business relationship with the international supplier can be either relational or transactional in nature. The relational approach denotes strong ties between two companies, implying that the relationship is personal and the parties communicate on a daily basis.
- Suppliers provide the raw materials that a company needs to manufacture its own goods and/or services. Those materials are transported by suppliers. Suppliers provide the services that a company needs to provide goods and services to its customers.
- A supplier is a person or company that sells or rents a product or service to another entity. A supplier's role in a company is to provide high-quality products from a manufacturer at a reasonable price to a distributor or retailer for resale.
- Suppliers provide the raw materials that a company needs to manufacture its own goods and/or services. Those materials are transported by suppliers. Suppliers provide the services that a company needs to provide goods and services to its customers.
- The advantages of close relationships include a focus on cost rather than price, early supplier involvement on key commercial and technical aspects, improved supplier performance in terms of quality and on-time delivery, and an abundance of communication.

Exercise

Answer the following questions-

1. Explain the types of supplier relationship management.
2. What is most important when negotiating with a supplier?
3. What is supplier relationship management and why does it matter?
4. What are the advantages of having good relationships with suppliers?
5. How do you evaluate supplier performance?

Fill in the Blanks-

1. _____ is a person or company that sells or rents a product or service to another entity.
2. The goal of _____ is to leverage relationships with suppliers in order to increase a company's value and profitability.
3. The _____ denotes strong ties between two companies, implying that the relationship is personal and the parties communicate on a daily basis.
4. A long-term relationship between the _____ and its _____ allows for the free flow of _____ and ideas.
5. Organizations can use the _____ to analyse supplier performance using pre-configured KPIs.

Unit 3.2 Manage Receipt Inspection

Unit Objectives

At the end of the unit, the trainee will be able to:

1. Describe the process of preparing an incoming inspection checklist setting the process and parameters to check the received components against
2. Explain the importance of carrying out random sampling and the applicable industry sampling standards
3. Explain the importance and process of carrying out critical tests to check the critical and technical parameters as per the product design provided by the design team
4. Explain the importance of maintaining accurate records with respect to the approved and rejected batches

3.2.1 Inspection Checklist and Process and Parameters

Supplier audit checklists are an excellent tool for businesses to evaluate the performance of their suppliers. Supplier audits can assist you in increasing profits and business relationships, identifying problem areas, and increasing productivity. The following steps are taken during supplier audits:

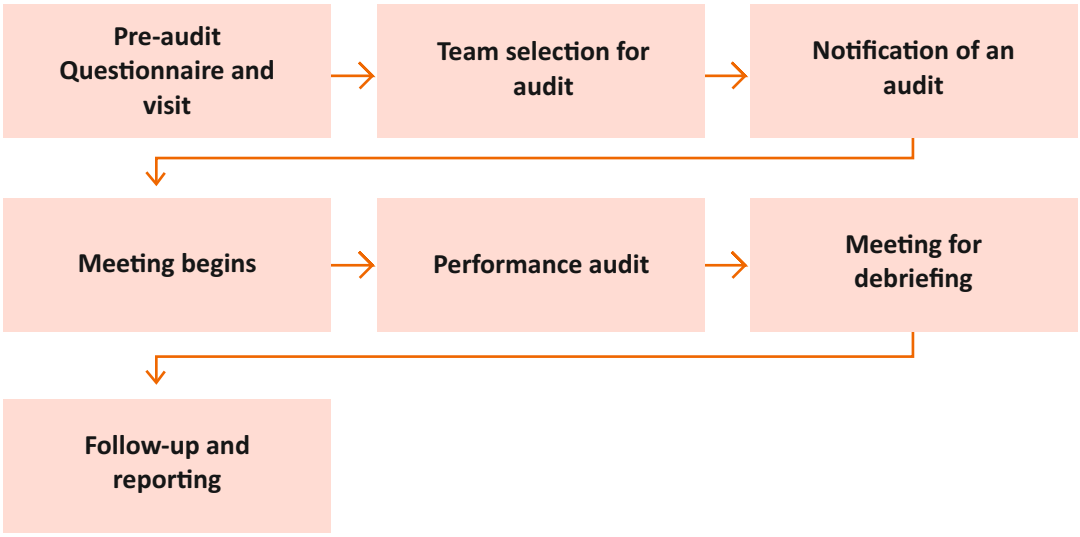

Fig 3.16 Process for Supplier Audits

An **incoming inspection**, also known as a receiving inspection or a material inspection, compares the quality of purchased raw materials to pre-defined acceptance criteria. Quality assurance personnel in the manufacturing facility resolve quality issues during pre-production. When an item is marked as accepted, conditionally accepted, or rejected, the incoming inspection results are routed through an identification tagging system to determine the next steps.

Quality assurance personnel use an incoming inspection checklist to confirm the quality of purchased raw materials against predetermined acceptance criteria. This incoming inspection checklist is developed to assist quality inspectors in determining inspection results and required actions by utilizing the identification tagging system. With this mobile-friendly checklist, QA personnel can easily complete the following tasks:

1) Specify the purchase order number, material description, and quantity
2) Capture and store unlimited photos of defects or tagged materials
3) Send real-time notifications for scheduled incoming inspections
4) Assign actions for accepted, conditionally accepted, or rejected materials
5) Complete the incoming inspection with digital signatures

Use of Inspection Checklists - Using a mobile-friendly incoming inspection checklist can help ensure raw material conformity to purchase order specifications, lower production costs, and produce high-quality products that meet or exceed quality standards, customer expectations, and safety regulations.

WORKPLACE INSPECTION CHECKLIST

Inspection Team:	
Name	Position

Inspection Site:
Inspection Date:

Note: ***S = Satisfactory***

Entrances and Exits	S	A

Walkways, Floors, and Stairs	S	A

Work Areas/Desks/Workstations	S	A

Fig 3.17 Inspection Checklist
(Source: https://www.generalblue.com/templates/inspection)

Understanding the Identification Tagging System:

An incoming inspection checklist specifies what quality assurance personnel should validate, including the size, colour, shape, markings, and packaging of sample material from the entire batch. The identification tagging system is used to express the purchase order acceptance criteria. Each inspection result is associated with the following actions:

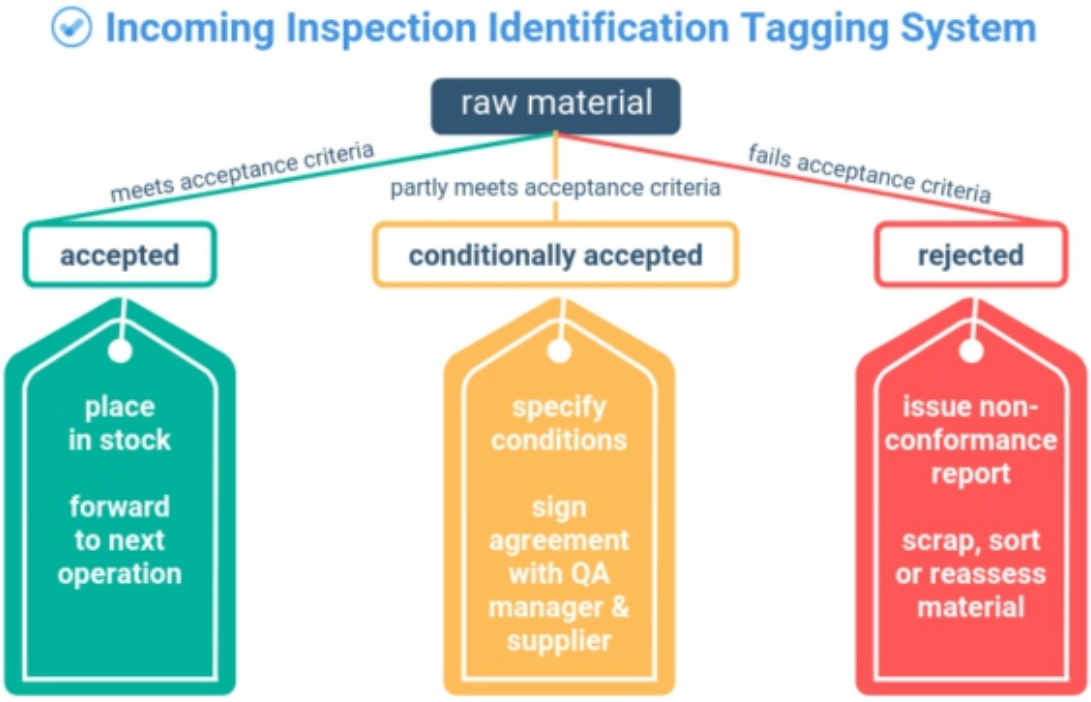

Fig 3.18 Inspection Identification Tagging System
(Source: https://safetyculture.com/checklists/incoming-inspection/)

Conditionally Accepted: Quality inspectors should look for minor or major defects such as functional and dimensional deviations, shipping damages, and improper markings to determine whether raw materials can be conditionally accepted. Specify the acceptance conditions, such as rework or replacement by the supplier, and ensure that the quality manager and a representative from the supplier sign off on them.

Rejected: Quality inspectors should issue a Non-Conformance Report (NCR) for rejected materials, indicating whether they will be scrapped, sorted, or reassessed against more specific acceptance criteria. Rejecting materials may cause shortages and disrupt the production schedule, but it avoids costly manufacturing issues like mass-producing unsafe and defective products.

Collaboration with the supplier on developing quality control inspection checklists has the unintended benefit of improving your relationship with your supplier.

3.2.2 Importance of Carrying out Random Sampling and Critical Testing

Random sampling and testing ensures that the results obtained from the sample are close to those obtained if the entire population was measured. The simplest random sample gives each unit in the community an equal chance of being chosen. Combining the random sampling technique with the representative sampling method reduces bias even further because no member of the representative population has a higher chance of being selected for the sample than any other.

- Conduct data analysis with a lower risk of error
- Equal chance of selection
- Requires less knowledge to complete the research
- Simplest form of data collection
- Multiple types of randomness can be used
- Easier to form sample groups
- Produce results for the larger

Fig 3.19 Importance of Random Sampling and Tests

3.2.3 Process of Identification & Classification of Batches & Determining AQL

A quality control concept is the Acceptable Quality Level (AQL). It is the smallest number of flaws in a manufactured product sample accepted for the entire batch. If the number of faults exceeds the AQL, the entire batch gets rejected. The acceptable quality level (AQL) is a product measurement that is defined as the "worst tolerable quality level" in ISO 2859-1. It indicates how many defective components are acceptable during random sampling quality inspections. All it needs to do as a manufacturer is to understand the products, the market in which they want to sell them, and the end-user of its products. If it is decided that the defect tolerance for the entire batch should not exceed 1.5 percent, that is the AQL. The AQL (Acceptable Quality Limit) Sampling method is a common way to define a production order sample to determine whether or not the entire product order met the client's specifications. Based on the sampling data, the customer can make an informed decision to accept or reject the lot.

There are a total of six types of AQL system followed in the manufacturing industry:

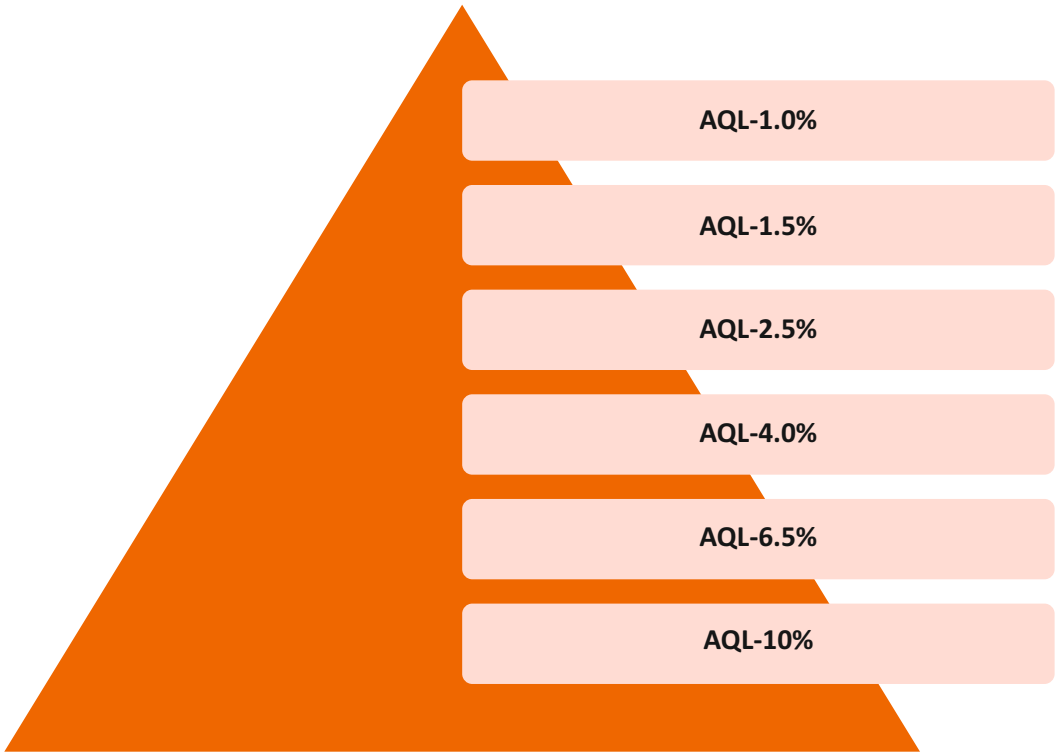

FIG 3.20 Types of AQL

AQL is highly adaptable because it allows customizing the product's quality tolerance as well as the three types of quality defects: critical, major, and minor. In consumer products, AQLs of 0, 2.5, and 4.0 are generally used for critical, major, and minor defects. The AQL table's special inspection level. The inspector uses a special sample size when inspecting the products manufactured concerning the customer's other requirements. It includes product dimensions and weights, packaging, labeling, and other details, as well as all on-site tests.

AQL query - In IBM® QRadar®, use Ariel Query Language (AQL) to extract, filter, and perform actions on event and flow data extracted from the Ariel database. AQL is used to obtain data that is not easily accessible via the user interface.

Batch Process - A batch process's output appears in material quantities or lots. A batch process has a start and an end. Batch processes have characteristics of both continuous and discrete processes. Typically, the batch process is repeated. A batch is the final result of a batch process. Sequential processes are a subclass of batch processes. Sequential processes do not always produce a product, whereas batch processes do.

Assign one or more values to each characteristic when classifying a batch. If the characteristic is a field from the batch master record, the value of that field is used as the characteristic value automatically. In batch determination, look for batches based on specific values or value intervals.

Levels of Batch:

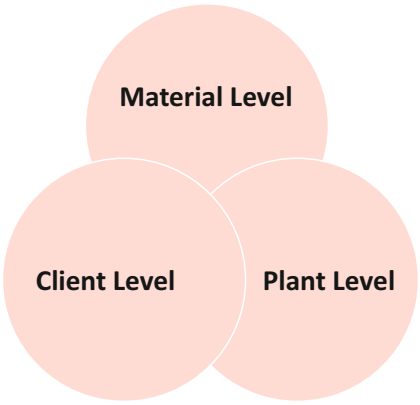

Fig 3.21 Levels of Batch

USE - It can be used to classify batches. For example, use the batch classification functionality to save specific batch data (such as active substance content, weight, or technical data) that is not included in the batch master record. To use the batch determination feature, first classify the batches.

Characteristics of a Class

Characteristics are criteria according to which one can search for batches. These characteristics are defined when creating a class. There are two different types of characteristic:

1) *User-defined characteristics*

   These are characteristics which are not defined as fields in the batch master record.

   Examples: Active ingredient potency, viscosity, color, weight

2) *Fields in the batch master record*

   Data that is stored in the batch master record can also be defined as characteristics of a class.

   Examples: Goods receipt date, shelf life expiration date, batch status

3.2.4 Importance of Maintaining Accurate Records

Without proper records, it can be difficult, if not impossible, to effectively monitor performance and productivity levels. A lack of such critical information can stymie both business growth and individual employee development, so accurate, up-to-date records benefit everyone. It is critical that your accounts are correct and up to date. Your accounts should be supported by complete and detailed records of all business income and expenditure, such as receipts, invoices, purchase orders, payments in and out, and so on.

Maintain Records and Documents:

Keeping meticulous records can also help us with tax returns and prevent fraud or theft. Using an effective record-keeping system will enable us to:

a) Keep track of your expenses, debts, and creditors, and apply for additional funding

b) Save time and money on accounting

c) Pay taxes accurately and on time to avoid penalties.

d) Apply for and receive the appropriate number of benefits or credits

If starting a new business, one must immediately implement a proper record-keeping keeping system.

a) Keep records in a variety of ways as long as they

b) Allow information to be presented in a readable format and how all information contained within a document

Importance of Good Record Keeping:

FIG 3.22 Key for a Successful Record Keeping

A successful business relies on accurate record-keeping. Every person involved in business must keep records, and the more organized the records, the more information can be retrieved from them.

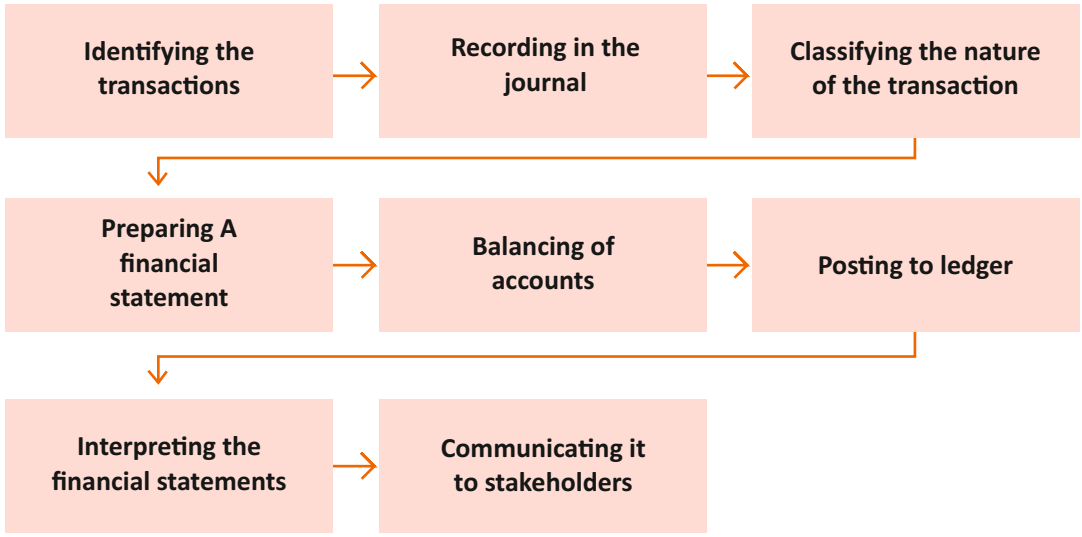

Fig 3.23 Steps to Record- Keeping Method

Summary

- Good records will help you do the following: Monitor the progress of your business. Prepare your financial statements. Identify sources of your income.
- Good recordkeeping helps you to conduct better business. Good recordkeeping can be your proof that you have made considered decisions and taken appropriate actions. Records become your protection if you are questioned or challenged. Without them, you are at risk.
- It allows both the teacher and learner to reassess the teaching and learning relationship. Without a well maintained system of record keeping for student examination and test performance there will be nothing to build on the progress of the student. Records provide a long term profile of achievement for each pupil.
- Types of records to be kept
  - Members' access to the records.
  - Privacy and confidentiality of records.
  - Custody and handover of records.
  - Record keeping and Consumer Protection.
  - Record keeping systems.
  - Record keeping and the rules.
  - Sample Form - Statutory Declaration.

- The 8 Principles are: Accountability, Transparency, Integrity, Protection, Compliance, Accessibility, Retention and Disposition. These are the "Principles" of good management of Records. ISO 15489: Records management is a globally recognized requirement.
- The Acceptable Quality Level (AQL) is a quality control concept. It is the minimum level of faults acceptable in a sample of a manufactured product for the entire batch of the product to be accepted. If the number of faults is higher than the AQL, then the entire batch is rejected.
- The process of sampling requires that some preliminary parameters be fixed, including the AQL that would feed into the final decision about accepting or rejecting a batch of product.
- The benefits of close relationships include a focus on cost rather than price, early supplier involvement on key commercial and technical aspects, improved supplier performance in the areas of quality and on-time delivery and an abundance of communication.
- The acceptable quality level (AQL) is a measure applied to products and defined in ISO 2859-1 as the "quality level that is the worst tolerable." The AQL tells you how many defective components are considered acceptable during random sampling quality inspections.
- Under normal inspection, AQL levels range from 0.065 to 6.5. The larger the AQL level, the more lenient the inspection. For general consumer products inspection, AQL level is usually set at 2.5, which implies a zero tolerance for critical defect, 2.5 for major defects, and 4 for minor defects.
- Acceptable Quality Level (AQL) is the maximum percent defective (or maximum number of defects per 100 units) that can be considered acceptable. AQL is measured in defects per 100 units.
- The acceptable quality level (AQL) is a measure applied to products and defined in ISO 2859-1 as the "quality level that is the worst tolerable." The AQL tells you how many defective components are considered acceptable during random sampling quality inspections.

Notes

Exercise

Answer the following questions-

1. What is normal AQL?

_____
_____
_____

2. What is AQL inspection level?

_____
_____
_____

3. What are the types of record keeping?

_____
_____
_____

4. What is the importance of record keeping?

_____
_____
_____

5. What is batch classification?

_____
_____
_____

Skill India
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4. Process of Managing Quality in the Production Process and Final Output

ESSCI
Skilling India in Electronics

Unit 4.1 - Manage Quality in Production Process

Unit 4.2 - Evaluate the Quality of Output

Unit 4.3 - Deal with Output's Quality-Related Problems

Unit 4.4 - Collect and Analyze Data

ELE/N7908

Key Learning Outcomes

At the end of this module, the trainee will be able to:

1. Describe the process of managing the quality in the production process
2. Demonstrate the process of evaluating the quality of output
3. Explain how to deal with output quality-related problems
4. Demonstrate the process of collecting and analyzing data

Unit 4.1 Manage Quality in Production Process

Unit Objectives

At the end of the unit, the trainee will be able to:

1. Explain the importance of ensuring that the personnel involved in the production process are trained in the use of relevant tools, equipment and Personal Protective Equipment (PPE)
2. Explain the importance of monitoring and evaluating the production process to ensure compliance with the defined quality standards
3. Elaborate how to identify deviations in the production process and take appropriate corrective action
4. Describe the process of developing and providing an Interim Corrective Action (ICA) plan to the production line to suggest rework or segregation in the existing stock when the production line experiences problems with components
5. Describe the process of analyzing the causes of the breakdown of tools, equipment and machineries and suggesting appropriate solutions
6. Explain the use of 7 Quality Control (QC) tools i.e., Stratification, Histogram, Check sheet, Cause and effect diagram, Pareto chart, Scatter diagram, Control chart and Corrective Action Preventive Action (CAPA) to collect and analyze information, investigate product and quality-related key problems, control fluctuations in product quality and find the appropriate solutions to avoid output defects
7. Describe the process of investigation product and quality-related key problems, control fluctuations in product quality and finding appropriate solutions to avoid output defects

4.1.1 Importance of Using of Relevant Tools, Equipment and PPE

There is no doubt that the manufacturing industry relies heavily on high-quality tools and equipment to produce large volumes of high-quality products daily. To make the process easier and more efficient, all production employees must have the proper knowledge and training in various tools, equipment, and applications. As a result, professionally trained personnel involved in the manufacturing process will not only save time, money, and effort but will also prevent mishaps and accidents at the workplace if they use appropriate tools, equipment, and Personal Protective Equipment (PPE).

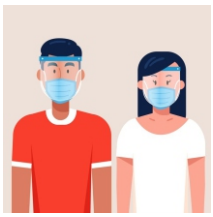
Every worker at a manufacturing facility is responsible for their safety as well as the safety of their coworkers. A person must take different precautions for different situations to avoid accidents and hazards. To begin, everyone involved in the production process, must wear Personal Protective Equipment (PPE) for their safety.

Fig 4.1 PPE

The quality manager ensures that all employees are aware of the importance of using the following personal protective equipment (PPE) during the manufacturing process.

PPE refers to the clothing or equipment designed to protect the workers/employees from shop floor hazards. It consists of items for example; hard hats, safety boots, coveralls, gloves, safety glasses, earplugs, high visibility clothing and lifejackets, fall protection, and respirators.

Common types of PPE include the following:



Eye and Face Protection

Hand Protection

Head Protection

Hearing protection

Foot Protection

Body Protection

Fall Protection

Respiratory protection

Fig 4.2 Types of Personal Protective Equipment

1. Eye and Face Protection

Possible eye and face injuries includes:

a. Eye injury during cutting, grinding, nailing

b. Chemical reactions from acidic substances, solvents, or solutions

c. Objects fly into the eye from chains, tools, tree limbs, or ropes. other hazardous

d. Radiant light during welding

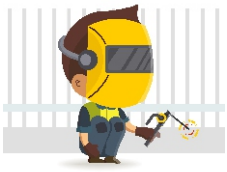
Following elements should take into consideration while selecting eye and face security equipment:

1. Capability to defend from hazards.
2. Wear suitably and comfortably.
3. Give unobstructed body movement and vision.
4. Durable
5. Permit unobstructed working of other equipment

Some of the most common types of eye and face protection equipment include the following:

Safety spectacles:
- Safety spectacles having frame with plastic and impact-resistant lenses.

Goggles:
- These are eye safety spectacles which cover the eyes tightly and give safety from dust and debris.



Welding shields:
- These are made of vulcanized fiber which is fitted in lens. Welding shields guard your eyes from fire sparkles produce during welding.

Fig. 4.3 Types of Eyes & Face Protection

2. Head Protection

Head protection in PPE terms is considered as protection against impact injury and some burn injuries.
Protective helmets or hard hats should do the following:

1. Oppose injuries by falling objects
2. Save from blows if any heavy object hits on the head
3. Guard from welding sparks

Fig 4.4 Workers wearing Hard Hats

3. Hand Protection

Employees face potential injury to hands and arms that cannot be eliminated through engineering and work practice controls. Potential hazards include skin absorption of harmful substances, chemical or thermal burns, electrical dangers, bruises, abrasions, cuts, punctures, fractures, and amputations. Hand Protective equipment includes gloves, finger guards, and arm coverings or elbow-length gloves.

Workers should wear the correct gloves for the job such as:

- Heavy-duty rubber gloves for concrete work
- Welding gloves for welding
- Insulated gloves and sleeves when exposed to electrical Hazards
- Nitrile coated fabric gloves for machine work

Fig 4.5 Safety Gloves

4. Foot Protection

Safety boots guard the feet from puncture wounds, injuries, and slipping.

Fig 4.6 Safety Boots

Make sure that foot protection is available where following risks are present:

1. When heavy objects roll on or fall on the feet
2. Working with pointed items like nails or wires
3. Risk of falling of molten metal on feet or legs
4. Working on warm, damp and greasy surfaces

5. Body Protection

Body protection is principally designed to protect the torso, i.e. the chest and abdomen, from various hazards and risks which can cause injuries due to:

1. Extreme temperatures
2. Hot splashes from molten metals and other hot liquids
3. Potential impacts from tools, machinery and materials
4. Hazardous chemicals

Fig 4.7 Safety Suits

There are many varieties of protective clothing available for specific hazards. In addition, protective clothing comes in a variety of materials, each effective against particular threats, such as:

1. **The paper-like fiber** used for disposable suits protects against dust and splashes.
2. **Treated wool and cotton** adapt well to changing temperatures, are comfortable and fire-resistant, and protect against dust, abrasions, and rough and irritating surfaces.
3. **Leather** is often used to protect against dry heat and flames.
4. **Rubber, rubberized fabrics, neoprene, and plastics** protect against certain chemicals and physical hazards.

6. Ear Protection

Employees' exposure to excessive noise depends upon several factors, including:

1) The duration of each employee's exposure to the noise
2) Whether employees move between work areas with different noise levels
3) Whether the noise is generated from one or multiple sources

Some types of hearing protection include:

Earplugs

- They are made of waxed cotton, foam, silicone rubber or fiberglass wool. They are self-forming and, when properly inserted, they work as well as most molded earplugs.

Earmuffs

- It require a perfect seal around the ear. Glasses, facial hair, long hair or facial movements such as chewing may reduce the protective value of earmuffs.

Fig 4.8 Types of ear Protection Buds

7. Other Safety Instruments

Safety belt:

- Safety harnesses protect workers from falling from heights.

Respirator:

- Respirators protect the respiratory system of the wearer from the attack of poisonous gases, fumes, mist and dust.

Fig.4.9 Safety Instruments

Maintaining PPE - Proper PPE maintenance is required to ensure that the equipment continues to provide the level of protection for which it was designed. It is critical to inspect the PPE regularly for any breaks, tears, or visible signs of stress or damage. Visual inspection, dusting, replacement, restoration, and functional testing are all examples of maintenance. The following figure represents the responsibilities of an employee regarding PPE:

PPE must be worn and used in accordance with the instructions provided	**Employees must take all reasonable steps to ensure that PPE is returned to proper storage after it has been used**	**PPE must be examined before use**
Any loss or obvious defect must be immediately reported to their supervisor	**Employees must take reasonable care of any PPE provided to them**	**Employees must not carry out any maintenance or repair of PPE unless trained and authorized to do so**

Fig. 4.10 Responsibilities of the Employees Regarding PPE

Importance of PPE - Personal Protective Equipment (PPE) is essentially a range items you can wear that will protect you against various hazardous conditions. PPE is important because **it prepares you for health and safety risks and gives you extra protection in the event of an accident or against the elements.**

a. When hazards cannot be eliminated through engineering and or/ administrative controls, PPE must be used to protect the eyes, face, head, feet, hands, arms, body, ears, and lungs.

b. Prevented Injuries (BGSU History)

a. Chemical burns to the eyes

b. Chemical irritation to the eyes and skin

c. Particulate matter in the eye

d. Heat burns

e. Slips, trips, and falls

f. Cuts and abrasions

Notes

4.1.2 Supervise Inspectors, Technicians and Other Staff

Quality managers supervise, guide, and oversee product development procedures daily to ensure that products meet quality and efficiency standards. The quality manager also collaborates with clients to ensure that the final products meet their needs and specifications. They also collaborate with a diverse group of specialists, such as programmers, quality control inspectors, statisticians, and other technical personnel. Quality Manager:

a. Frequently collaborate with engineering, production, marketing, customer service, and management departments

b. Regularly deliver presentations to coworkers, clients, and supervisors, as well as submit reports to senior management officials

c. Visits manufacturing sites to inspect equipment and make changes or upgrades

d. Monitor processes, perform audits, investigate quality issues

e. Implement quality control procedures at all levels of an organization

The Quality Manager directs and supervises the following staff members in carrying out the following responsibilities and duties during the production process:

- Train teams on quality control measures
- Monitor equipment and production facility
- Propose improvements to production process
- Understand the quality expectations for the product and supplies by reading blueprints and instructions
- Approve or reject raw materials based on quality standards, as well as keeping track of supplier performance
- Select and inspect testing output samples with appropriate methods
- Develop and maintain company inspection reports
- Ensure test equipment is calibrated and working correctly.

4.1.3 Importance of Monitoring and Evaluating Production Process

Monitoring and evaluation (M&E) is a continuous management function that assesses progress toward **expected results, identifies bottlenecks in implementation, and highlights any unintended consequences, positive or negative, in the production process.** Monitoring and evaluation are both tools and strategies that assist the production process in determining when plans are failing and when circumstances have changed. They provide the information required by the quality manager to make production decisions, as well as necessary changes for strategy or plans. In this sense, monitoring and evaluation are continuous.

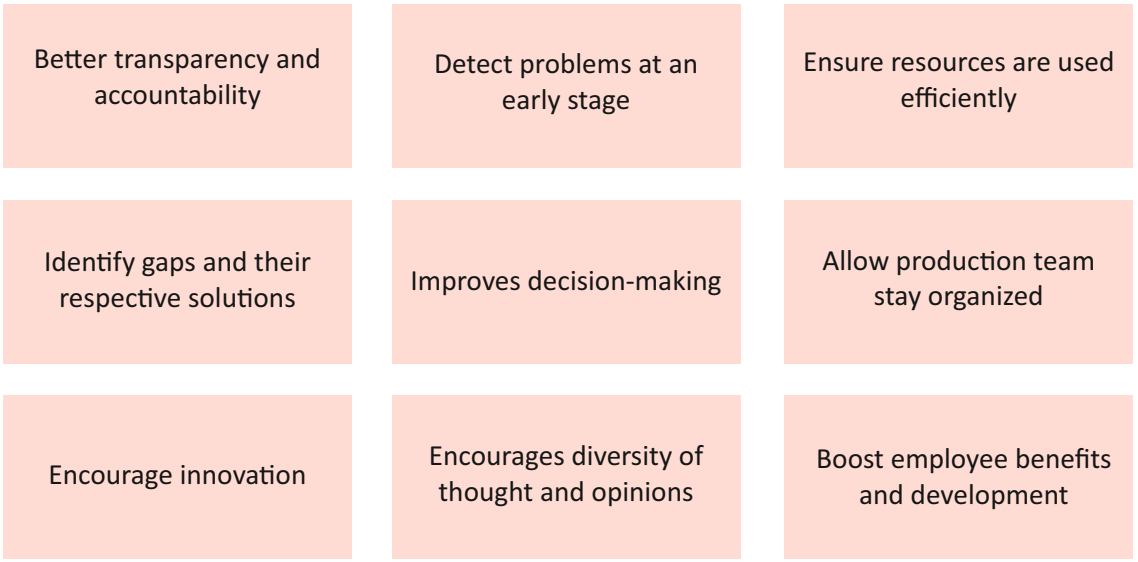


Fig 4.11 Importance of Monitoring and Evaluation in Production Process

Monitoring is the periodic evaluation of the production process to determine whether or not it is proceeding as planned. At the same time, evaluation entails assessing the production process in terms of results, milestones, and the impact of the outcomes using performance indicators. While monitoring and evaluation are distinct elements, they are both geared toward learning what to do and how to do it by focusing on several essential and shared goals.

Fig 4.12 Core Objectives of Monitoring and Evaluation

Both activities necessitate **dedicated funds, trained personnel, monitoring and evaluation tools, efficient data collection and storage facilities, and adequate time for effective field inspections.** The discussion concludes that monitoring and evaluation are both necessary management tools for informing decision-making and demonstrating accountability. Monitoring is not a substitute for evaluation, and neither is an evaluation a substitute for monitoring. Systematically generated monitoring data are required for a successful evaluation.

The following figure explains the different characteristics of monitoring and evaluation:

Monitoring

- Continuous process
- Tracks, supervises, analyses, and documents progress
- Tracks, supervises, analyses, and documents progress
- Answers what activities were carried out and the outcomes obtained
- Notifies managers of problems and provides options for corrective action.
- Self-evaluation of production managers, supervisors, and community stakeholders

Evaluation

- Periodic at crucial points, such as the midpoints of production implementation, at the end or a significant period after production completion
- In-depth analysis and comparison of planned and actual results
- Focuses on outputs to inputs, costs to results, processes used to achieve results, overall relevance impact, and sustainability.
- Answers why and how results were obtained, and contributes to the development of theories and models for change.
- Provides strategy and policy options to managers
- Internal and/or external analysis by managers, supervisors, community stakeholders, donors, and/or external evaluators

Fig 4.13 Characteristics of Monitoring and Evaluation

Monitoring and evaluation are required to ensure that the production process is completed within the time frame specified by the activities to be carried out by production staff. It coordinates and directs the production process to meet customer and regulatory requirements while continuously improving its effectiveness and efficiency. It also ensures that the product meets the defined quality standards. Quality products assist in maintaining customer satisfaction and loyalty while reducing the risk and cost of replacing faulty items. Companies can establish a reputation for excellence by being assessed against a recognized quality standard.

Fig 4.14 Procedure for Quality Monitoring and Evaluation

4.1.4 Identify Deviations in Production Process and take Appropriate Corrective Action

A deviation can occur during the sampling and testing, raw material acceptance and manufacturing, and finished product acceptance and manufacturing processes. When manufacturing steps deviate from the established guidelines in some way, this is referred to as a **"deviation".**

The deviation applies to all industries, including manufacturing and service industries. In most industries, we encounter deviations while working on process activities. If a product in any organization does not meet the parameters, referred to as a deviation. If the production team did not use any of the processes that they desired to use in the production, also referred to as deviation.

The **deviation** is defined as the difference between the actual and planned performance. For example, if the plan is to produce 100 units but only 80 units are produced, the deviation is 20 units. Deviations are discrepancies between observed and expected values for a process or product condition, or variations from a documented standard or procedure.

ISO-certified organizations reduce the possibility of deviation by providing the best process guidelines. As a result, one organization should apply for ISO certification in India to decrease the likelihood of deviation.

In the manufacturing industry, there are four types of deviation to consider: man, machine, material, and method. However, there are numerous types of deviations that occur in the manufacturing process, including **location, supplier, quality quantity, and delivery time deviation.**

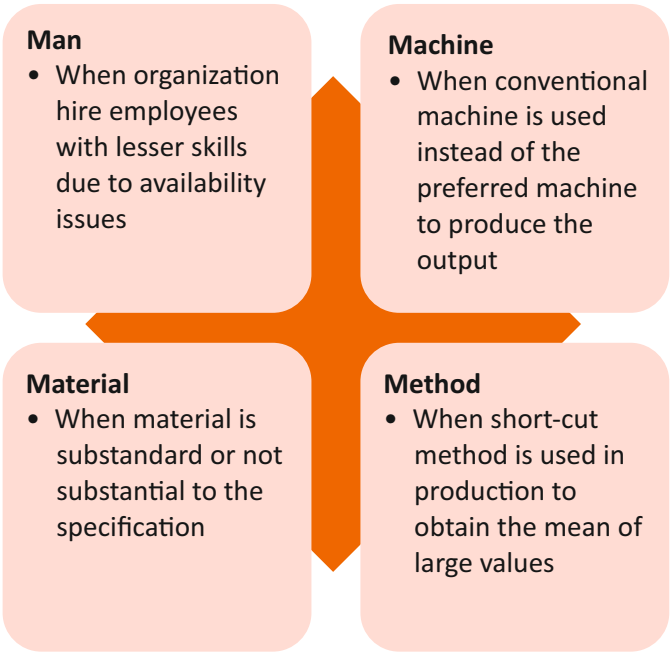


Fig 4.15 Different Types of Deviation

The following figure explains the advantages of a Deviation Process in Manufacturing process are as follows –

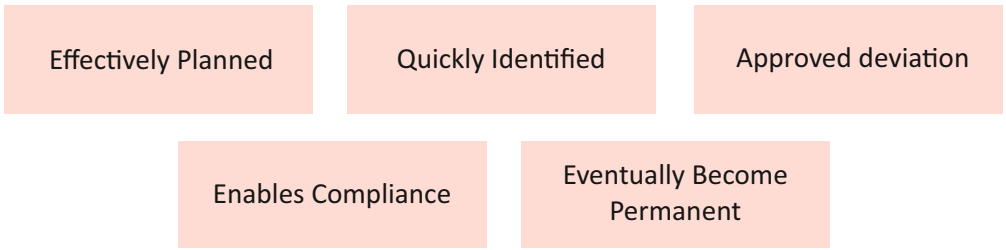


Fig 4.16 Advantages of a Deviation Process

The following figure explains the appropriate corrective steps for the aforementioned deviations in the manufacturing process.

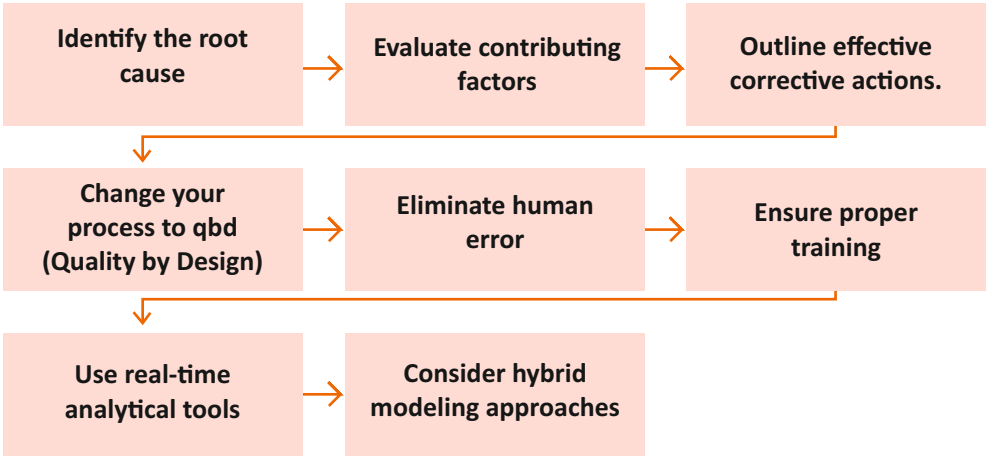


Fig 4.17 Corrective Steps to Deal Production Deviation

Deviations are defined as unexpected or unplanned departures from current good manufacturing practices (cGMPs), regulations, standards, procedures, or specifications that may affect a product's safety, quality, identity, potency, or purity (SQIPP). These deviations are typically recorded in a deviation within a deviation management (DM) system for cGMP compliance and continuous improvement.

Risk management is the process of identifying, assessing, and prioritizing deviations. Any deviation, for example, can be classified into three levels for ease of assessment: **minor, major, and critical**, usually based on the magnitude and seriousness of the deviation.

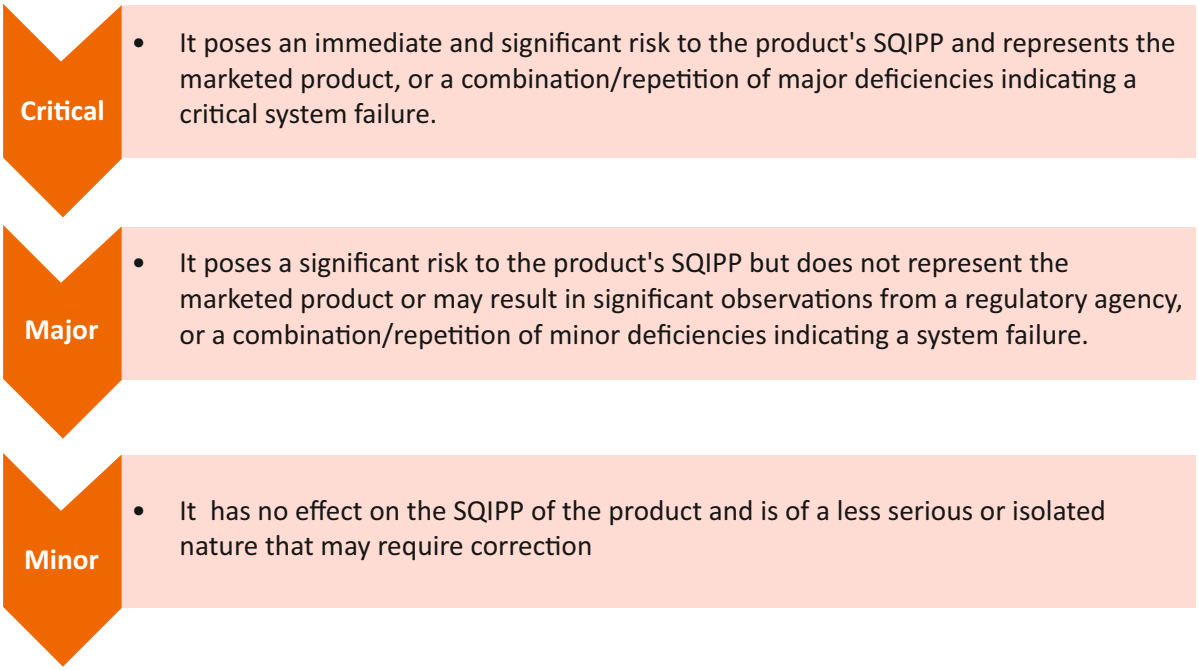


Fig 4.18 Risk Management for Deviation Risks

Depending on the scope and complexity of the deviation, a variety of formal root-cause-analysis tools can be employed. **Fishbone diagrams, 5-why analysis, fault tree analysis, and failure modes and effect analysis(FMEA)** are few examples of root-cause analysis tools that can be used in manufacturing process.

Notes

4.1.5 Analyse Components that Experience Problems at the Production Line

Numerous processing issues can arise during the production process, including **poor quality, long lead times, high on-hand inventory, supply chain interruptions**, and so on. All of these factors have an impact on the product you're putting out there, which in turn has an impact on the public's perception of the brand.

The most common problems tend to fit into four categories:

Quality problems	• High defect rate, high return rate and poor quality
Output problem	• Long lead time, unreasonable production schedule, high inventory rate, supply chain interruption
Cost problem	• Low efficiency, idle people or machines
Management problems	• Potential safety hazard, bad working conditions

Fig 4.19 Common Problems in Production Line

Solving production issues can be a difficult task. Quality managers must investigate what occurred and seek a permanent solution. However, as the digital revolution continues with the adoption of Industrial Internet of Things (IIoT) technology, these complex issues can be addressed by leveraging data's power. Furthermore, by capturing and analyzing data to visualize what is happening on the production floor, quality managers can develop tactical and strategic solutions for resolving current issues and preventing future ones. The steps to resolving common production issues are as follows:

Step 1: Identify Problems
- Through easily accurate, real-time data to understand where problems are occurring and the most egregious reasons for waste

Step 2: Dig into the Details
- Conduct a root cause analysis

Step 3: Develop a Plan to Solve the Issue
- Includes training, physical changes such as layout, standard work changes, material substitutions, or any number of steps alone or in combination to fix the problem

Fig 4.20 Steps to Resolve Common Problems in Production Line

4.1.6 Process of developing and providing an ICA plan to production line

The primary goal of the interim corrective action plan is to reduce risk as quickly as possible by implementing interim measures to control or minimize ongoing threats to production staff's health or the environment. Interim corrective actions are "first aid" measures that protect the customer from the problem until the root cause is identified and permanent corrective actions are implemented. It is the part of 8D methodology. **The Eight Disciplines of Problem Solving (8D)** is a systematic, holistic, and time-tested methodology for identifying the root cause of a problem, planning a quick fix, and implementing corrective and preventive actions to prevent its recurrence. The steps are as follows:

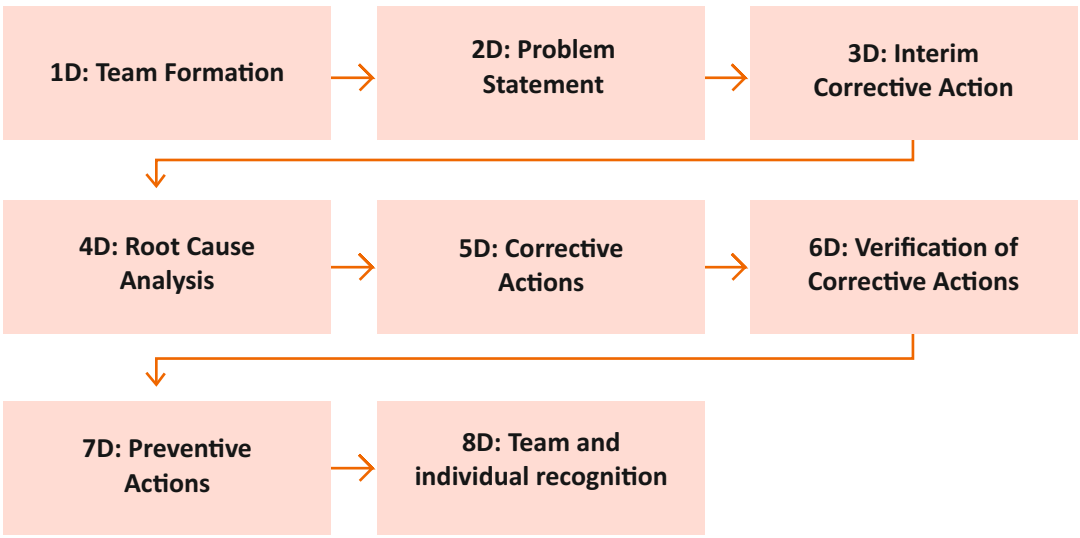


Fig 4.21 8D Methodology

The Interim Corrective Action is the 3rd discipline of 8D methodology for problem solving in production line. The staff involved in problem solving using the 8D Methodology should be aware that interim corrective action (ICA) can be used not only in step D3, but also in step D0, which is known as the Problem Statement.

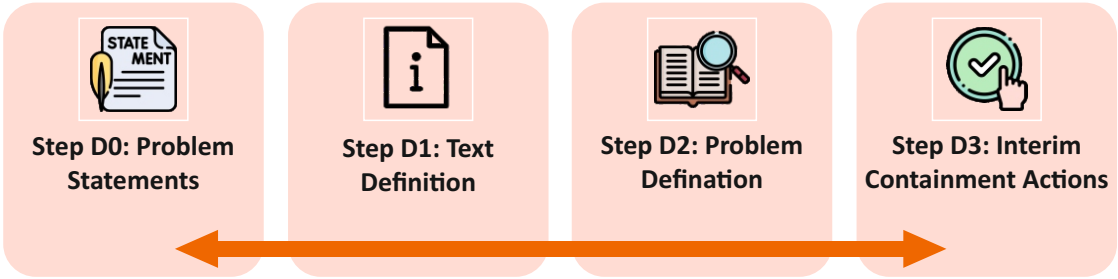


Fig 4.22 8D Methodology of ICA

In this, ICA can be initiated as a component of Emergency Response Actions (ERA), which are defined after determining whether the client's problem is related to safety or requires immediate resolution. It should be noted that ICA eliminates the problem symptom (exactly what the client reports) rather than

the Permanent Correction Actions defined in step D5, which eliminates the root cause and the problem symptom itself. During the interim containment actions plan process, the quality manager should ask the following questions:

- Are we still manufacturing defective goods?
- Do our control processes necessitate increased sampling frequency or a change in measurement method?
- Is it possible to notify the supplier of the problem?
- Do the actions we intend to take pose any additional risks?

The actions listed above must be taken immediately after determining the problem and must eliminate the effects caused by the defective product. Each ICA implementation should have a goal that is related to the impact limitation of the problem discovered by the final customer, the occurrence scale, and the final costs of poor quality.

Corrective and preventive action, or CAPA, are concepts within Good Manufacturing Practice (GMP) and Hazard Analysis and Critical Control Points/Hazard Analysis and Risk-Based Preventive Controls (HACCP/HARPC), both of which are commonly associated with the manufacturing process.

The main advantage of implementing ICA activities is ensuring the safety of the finished product and minimizing costs associated with the occurrence of a quality problem. It avoids the potential costs of:

1. Scrapping / repairing non-conforming final products
2. Special transports to customer factories
3. Start-up of additional production shifts
4. Final product selection in customer warehouses
5. Field recall campaigns

The following figure explains the of explains corrective action process:

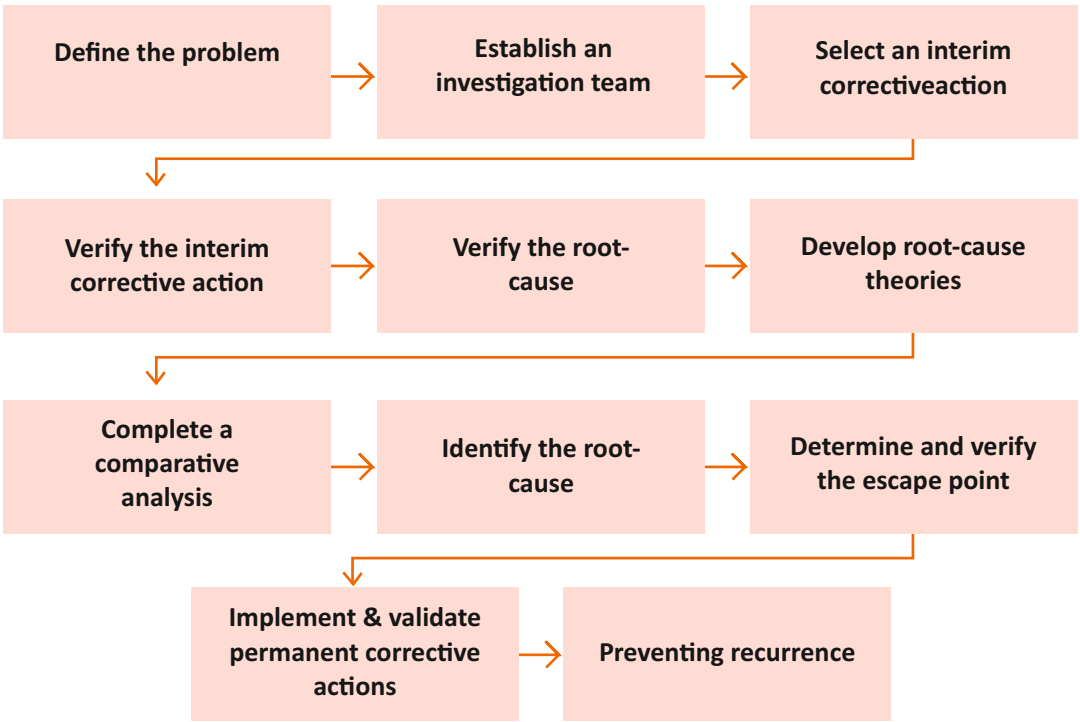


Fig 4.23 Corrective Action Process

4.1.7 Analyse the Causes of Breakdown of Tools, Equipment and Machineries

During the manufacturing process, equipment failure is quite frequent. Its consequences can range from minor to catastrophic, depending on factors such as repair costs, total downtime, health and safety implications, and impact on production and service delivery. There are several common causes of tool, equipment, and machinery breakdown, and understanding why the equipment is failing is the first line of defense against the serious consequences of unplanned downtime.

The following are the five most common causes of equipment failure with their respective solutions:

Cause #1: Improper operation

- Solutions:
  - Enough trained operators to allow for some flexibility and a contingency plan for staff shortage emergencies

Cause #2: Failure to perform preventive maintenance

- Solutions:
  - Effective preventive maintenance and identify small problems with inexpensive solutions before they become major, costly breakdowns

Cause #3: Too much preventive maintenance

- Solutions:
  - Strictly follow the manual and instructions before performing any maintenance of the equipment

Cause #4: Failure to continuously monitor equipment

- Solutions:
  - Continuous monitoring of the equipment with real time data

Cause #5: Bad reliability culture

- Solutions:
  - Trained operators, a solid PM schedule and a focus on reliability culture

Fig 4.24 Causes and Solutions for Machinery, Tools & Equipment Breakdown/Failure

4.1.8 7 Quality Control Tools

The seven essential quality tools (7 QC Tools) originated in Japan. These tools include simple graphical and statistical techniques that aid in the resolution of critical issues. These tools were frequently referred to as the 7 Basics Tools of Quality because they can be implemented by anyone with a basic understanding of statistics. These can be easily applied to complex quality-related problems. Seven quality control tools can be easily applied across any industry, from product development to delivery. The seven quality control tools are as follows:

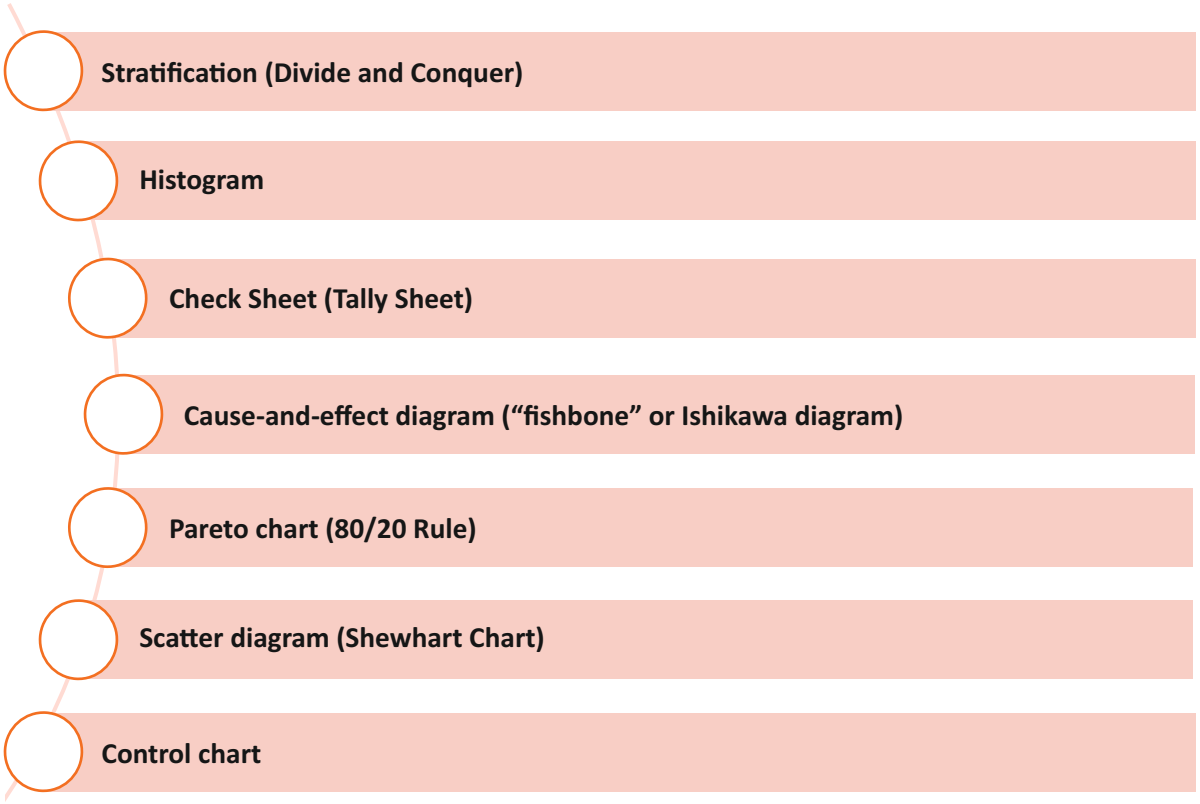


Fig. 4.25 Seven QC Tools

Purpose of Seven Quality Tools: Seven old quality control tools are a set of QC tools that can be used to improve the performance of production processes, from the first step of producing a product or service to the final stage of production. So, the overarching goal of this paper was to introduce these seven quality control tools. They can aid in understanding variation and determining the root cause of process errors. The seven fundamental tools are the most commonly used in lean manufacturing. All of the tools are graphical methods that do not necessitate a deep understanding of statistics.

Importance of Quality Tools: Quality management tools assist employees in identifying recurring problems as well as their root causes. Quality management tools are essential for increasing the quality of products and services.

1. **Stratification:**

It is a tool to divide the data into subcategories and classifying that data based on a group, division, class, or level. It helps in deriving meaningful information to understand an existing problem.

Un–stratified data: This is not properly arranged and hence provides no clear information.

For example: An employee reached late to the office on the following dates:

5-Jan, 12-Jan,13-Jan, 19-Jan, 21-Jan, 26-Jan,27-Jan

Stratified data: Data is classified systematically.

For example: Same data classified by day of the week

Day	Mon	Tues	Wed	Thu	Fri	Sat	Sun
Frequency – Late in Office	4	2	1	0	0	0	0

Fig 4.26 Stratification

2. **Histogram:**

A histogram is a bar graph representing the frequency distribution on each bar. The purpose of a Histogram is to study the density of data in any given distribution and understand the factors that repeat more frequently. The histogram helps in prioritizing factors and identifies which are the areas that need utmost attention immediately.

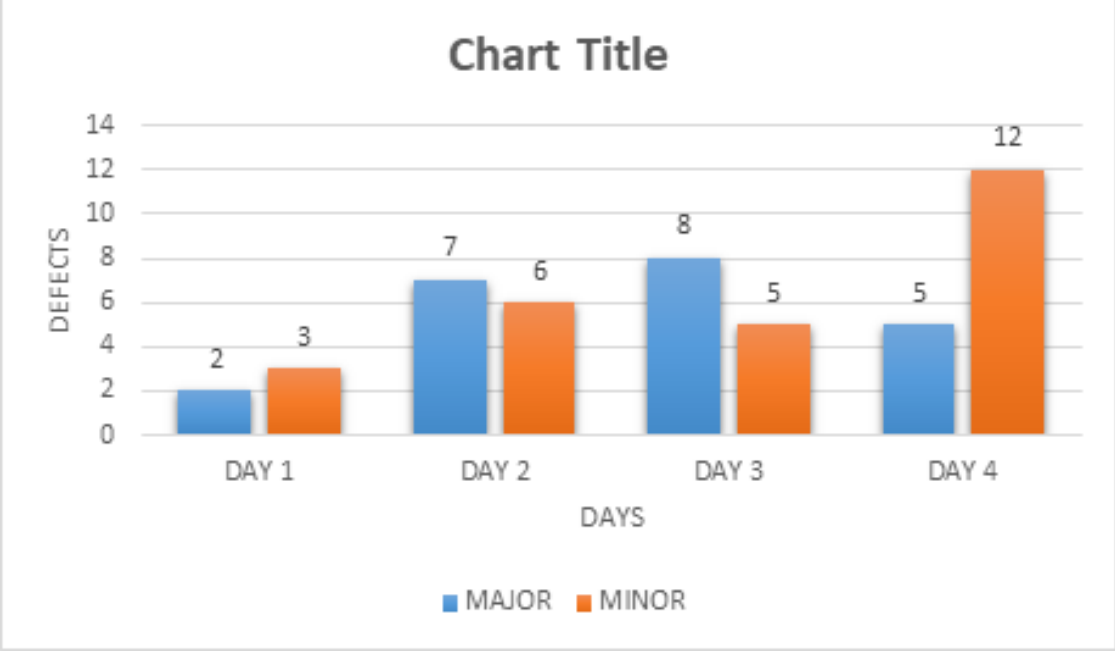


Fig 4.27 Histogram

Notes

3. **Check sheet (tally sheet):**

The check sheet is a form (document) that is used to collect data in real time at the source. When the collected information is quantitative, the check sheet can also be called a tally sheet. The purpose of the checklist is to list down the crucial checkpoints or events in a tabular format and keep on updating or marking the status on each occurrence. This helps in understanding the progress, defect patterns, and even causes for defects.

Defect Types? (Major/ Minor)	**Defects in Supplied items**							**Total Count**
	Sun	Mon	Tue	Wed	Thu	Fri	Sat	
Rusted Items		IIII	II		II	I		9
Items with Scratch	I							1
Dirty		I		III		II		6
Broken/ Cracks			II				I	3
Main Body Dent					III			3
Missing Components		II		II			I	5
Labeling Error					I	III		4
Damage in Packaging			II					2
Wrong item Issued					II		I	3
Film on Parts			IIII					4
Voids in Casting	I					I	II	4
Incorrect Dimension			II	I	II			5
Failed to Pass the Quality Test		II				I		8
Total Count	2	9	12	6	10	8	5	52

Fig 4.28 Check Sheet

4. **Cause and effect diagram:**

A Cause-and-Effect Relationship a diagram is a tool that assists in identifying, sorting, and displaying potential causes of a specific problem or quality characteristic. Once a quality-related problem is defined, the factors leading to the cause of the problem are identified. We further keep identifying the sub-factors leading to the causal of identified factors till we can determine the root-cause of the problem. This leads to a diagram with branches and sub-branches of causal factors resembling a fishbone diagram. In the manufacturing industry, to identify the source of variation, the causes are usually grouped into below significant categories:

1. People
1. Methods
3. Machines
4. Material
5. Measurements
6. Environment

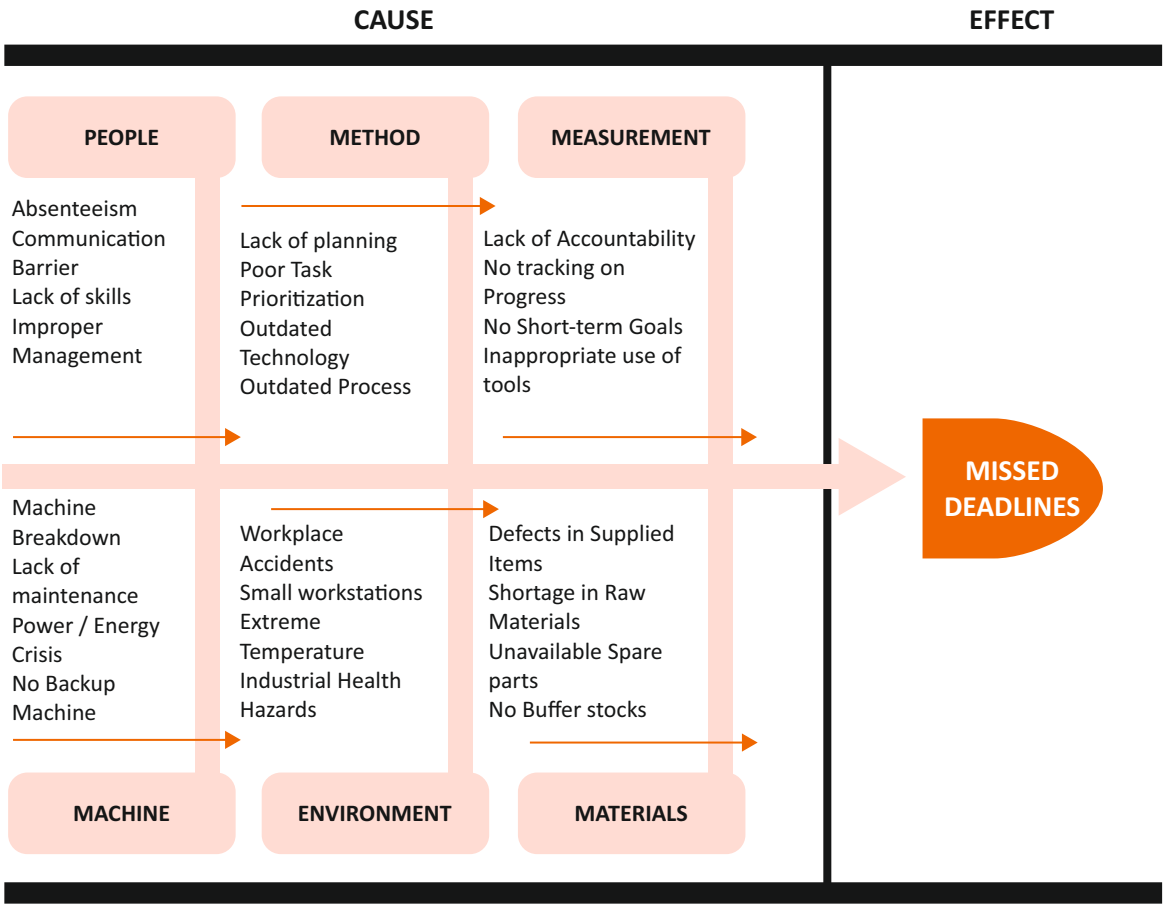


Fig 4.29 Fishbone Diagram

5. Pareto chart (80-20 rule):

The Pareto Principle, also known as the 80/20 Rule, The Law of the Vital Few, and The Principle of Factor Sparsely, states that 80% of effects result from 20% of the causes – or, in layman's terms, 20% of your actions/activities will account for 80% of your results/outcomes. The Pareto Chart's purpose is to highlight the critical factors that contribute to a major problem or failure. A pareto chart is made up of bar graphs and line graphs, with the bar graphs representing individual factors in descending order of impact and the line graph representing the total impact. Pareto charts help experts in the following ways:

a. Differentiate between vital few and trivial many

b. Determine relative importance of causes of a problem

c. Helps to focus on reasons that will have the most significant impact when solved

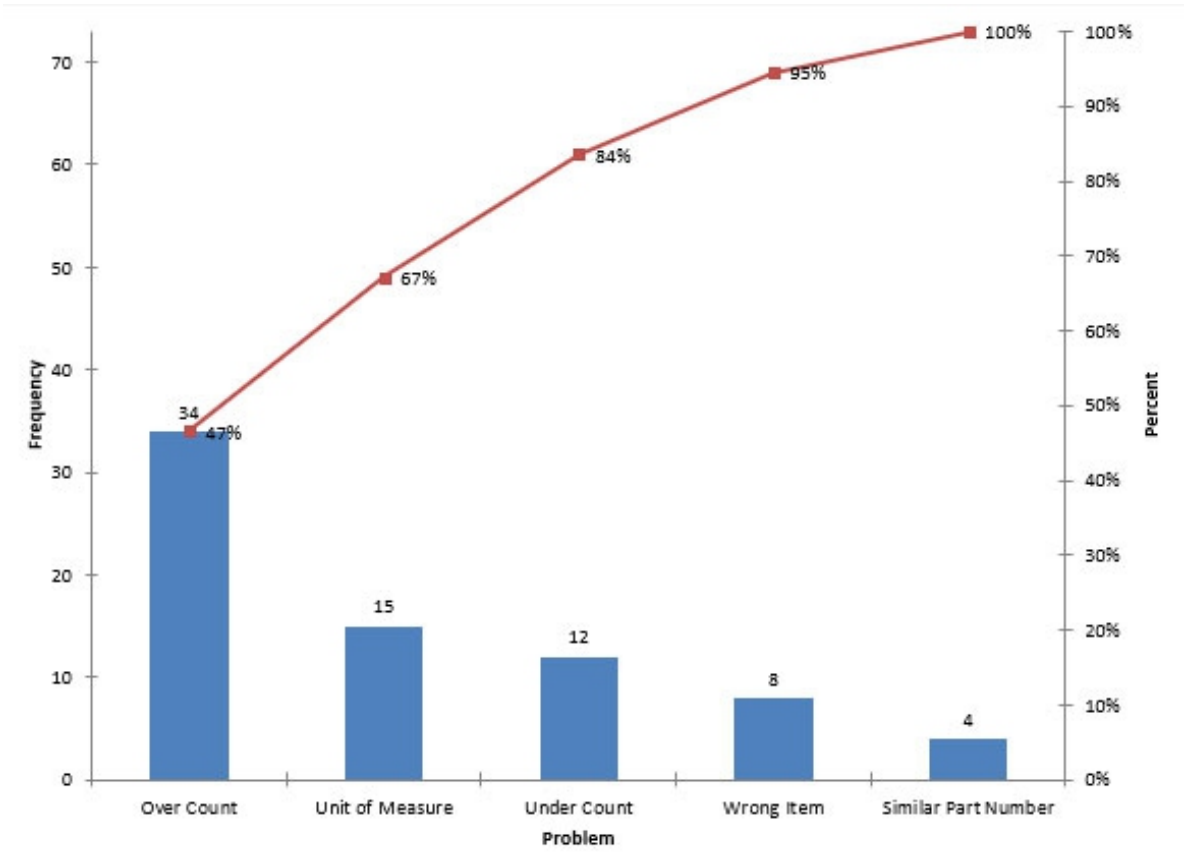


Fig 4.30 Pareto Chart

Scatter diagram: One of the Seven Basic Quality Tools is a scatter diagram. It compares two sets of observations; the horizontal axis represents one set of observations (independent variable), and the vertical axis represents the second set of observations (dependent variable). A scatter diagram/plot is a statistical tool that depicts dependent variables on Y-Axis and independent variables on X-axis plotted as dots on their common intersection points. Joining these dots can highlight any relationship between these variables or an equation in format:

$Y = F(X) + C$

Where, C is an arbitrary constant.

The aim of a scatter diagram is to establish a relationship between the problem (overall effect) and the causes that are affecting it. The relationship can be linear, curvilinear, exponential, quadratic, logarithmic, polynomial, etc. The stronger the correlation, the stronger the relationship will hold true.

The variables can be positively or negatively related, which is defined by the slope of the equation derived from the scatter diagram.

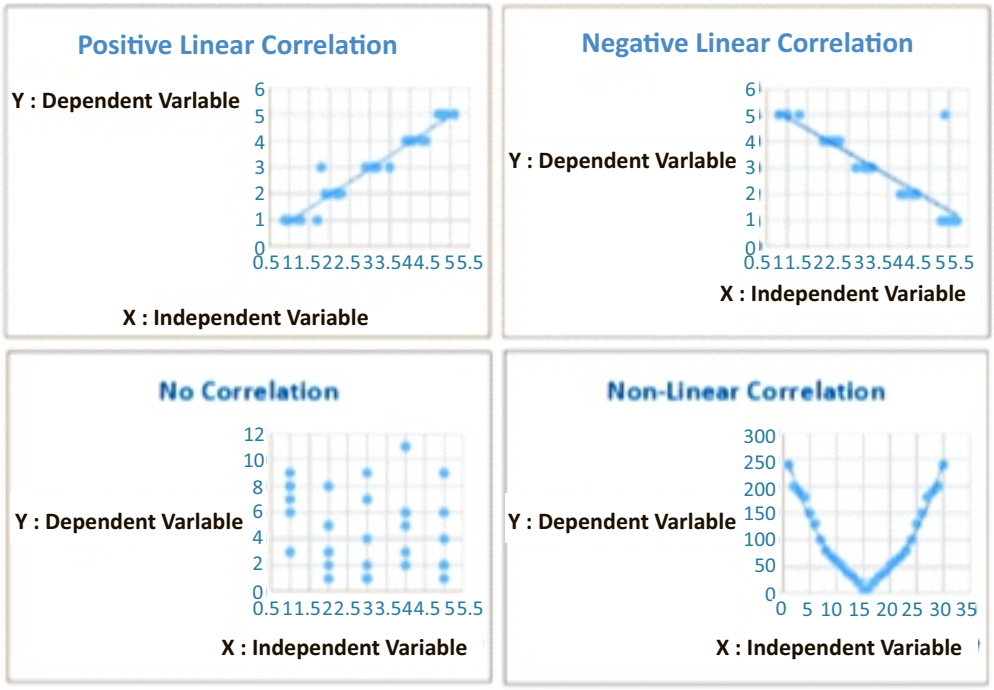


Fig 4.31 Scatter Diagram

Control chart (Shewhart chart): Shewhart chart, also known as a statistical process control chart. A control chart is a graph that is used to examine how a process changes over time. The data are plotted in chronological order. A control chart always includes a central line representing the average, an upper line representing the upper control limit, and a lower line representing the lower control limit. Control chart consists of:

- A central line: Average or mean
- An upper line: Upper control limit
- A lower line: Lower control limit.

These lines are determined from historical data. Comparing the current data to these lines, experts can conclude if the process variation is:

- Consistent
  a. In control, or
  b. Affected by common causes of variation
- Unpredictable
  a. Out of control, or
  b. Affected by special causes of variation.

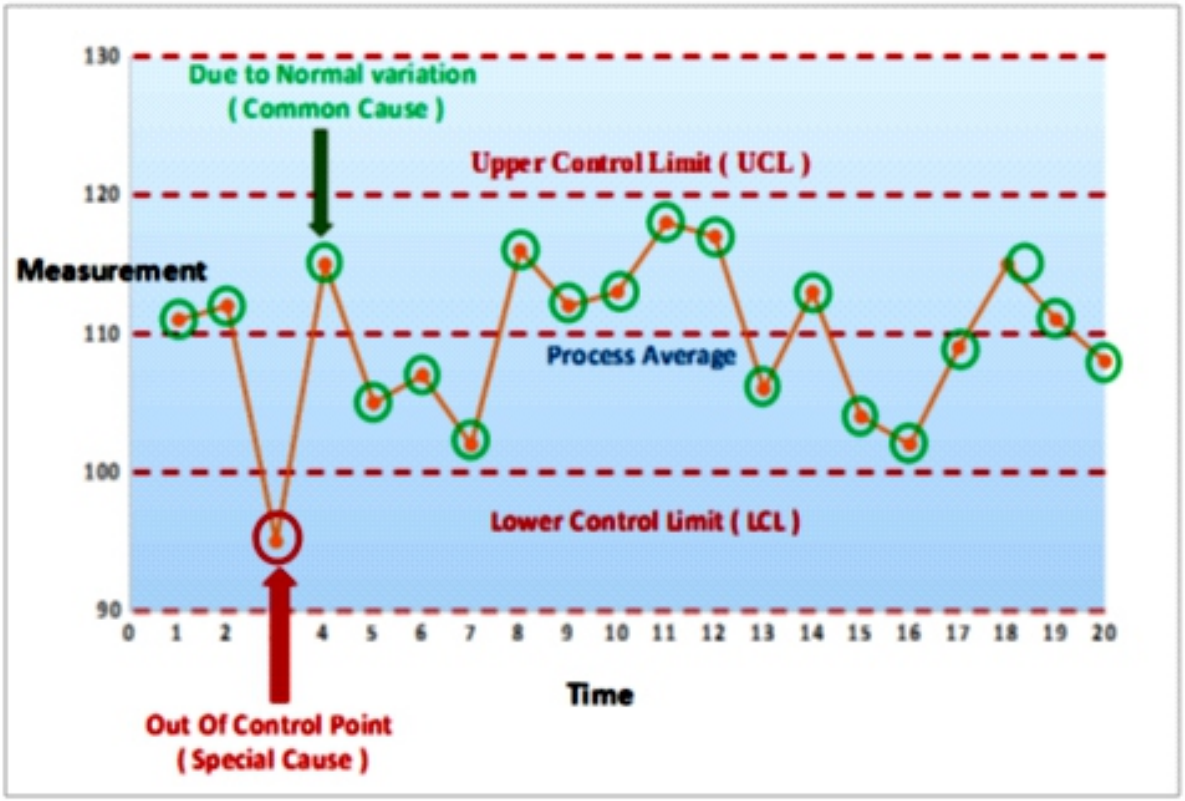


Fig 4.32 Control Chart

Notes

4.1.9 Process of Product Investigation Product and Quality- Related Key Solutions

In the quality management field, there is a tendency to confuse the root cause of a problem with the true cause of the problem. A root cause is objective proof of a quality issue. However, the actual finding or non-conformance is the true cause of a quality problem. Identifying root causes is not the same as identifying real causes of quality problems. Mistaking one for the other can result in the perpetuation of cycles like this:

1. After a change is made, a severe quality problem occurs at a manufacturing facility.
2. A group of stakeholders and possibly consultants gathers to investigate the issue.
3. A root cause is discovered.
4. A corrective/preventive action (CAPA) is carried out.
5. The issue has been resolved.
6. When another change occurs, the cycle begins again with a different but related problem.

The following are the six real causes of quality problems:

Lack of Organization	• Undetermined responsibilities and authorities • Undefined management systems • Inadequate communication
Lack of Training	• Personnel are not trained in the systems/methods in place, and they are not informed of who they are supposed to interact with. • Inadequate company training
Lack of Discipline	• Supervisors and managers set poor examples for their employees • Quality campaigns do not spread throughout the enterprise, resulting in frictions, demotivators, and disillusionment • Personal characteristics that prevent employees from adhering to the agreed-upon procedures • Systems that are rigid and stifle innovation, quick thinking, and human problem-solving creativity • Environments that is demotivating
Lack of Resources	• Management systems that are overly complex and drain valuable resources • Irresponsible behavior (i.e., resources are always completely used up in proportion with their allocation) • Uneven distribution • Estimates that are unrealistic • Inadequate reinvestment (for example, resource allocations are based on budgets from previous years without taking market changes into account) • Failure to modernize and explore new technology applications

Lack of time	• Excessively complex systems that waste time and/or create unnecessary tasks • Irresponsible behavior (e.g., personnel whose work always expands to fill the allotted time) • Unrealistic commitments made to customers without regard for the time required to properly deliver a quality product • Selfishness that adds pressures to the bottom line as a product nears completion • Workloads that is excessive
Lack of top management	• Motivation/attitude (i.e., a corporate culture that does not prioritize quality and assumes it is automatic) • Managers who have received insufficient training on the value of quality and how to achieve it • Time administration (e.g., quality managers spend more time fighting fires than proactively addressing quality, which typically results in a self-defeating cycle) • "Complacency Cancer" (i.e., the false belief that reputation and past performance will always outweigh any quality issues that may arise)

Table 4.1 Six Real Causes of Quality Problem

The following figure explains steps for determining quality problems in production line.

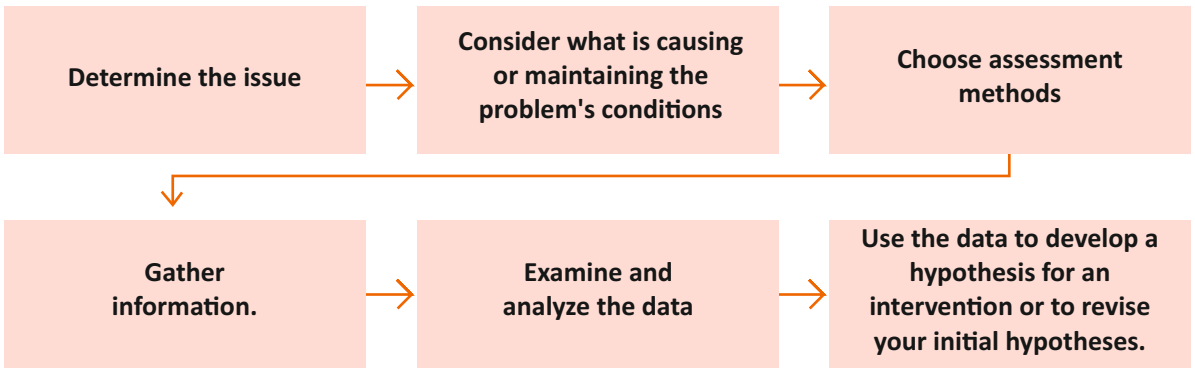


Fig 4.33 Steps for Solving Quality Problems

Notes

Notes

QR Code

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youtube.com/watch?v=xU8Rxnetsg8

4.1.1 Importance of Using of Relevant Tools, Equipment and PPE

youtube.com/watch?v=yuH35ottILU

4.1.8 7 Quality Control Tools

youtube.com/watch?v=zRYhEJBFsrc

4.1.9 Process of Product Investigation Product and Quality- Related Key Solutions

Exercise

Answer the following questions-

1. What PPE means?

_____
_____
_____

2. What are the categories of PPE?

_____
_____
_____

3. What is meant by PPE equipment?

_____
_____
_____

4. What is the role of quality control inspector?

_____
_____
_____

5. Why are 7 quality tools used for?

_____
_____
_____

MCQ-

1. Control Limits are the same are Specifications Limits.

- o True
- o False

2. Which of these quality gurus introduced the concept of Control Charts?

- o Juran
- o Crosby
- o Taguchi
- o Shewhart

3. Which of the following tools would be most appropriate for collecting data to study the symptoms of a problem?

- o Histogram
- o Checklist
- o Control Chart
- o Check Sheet

Unit 4.2 Evaluate the Quality of Output

Unit Objectives

At the end of the unit, the trainee will be able to:

1. Describe the process of preparing a check sheet based on the observations during testing and approving/ rejecting the output.

4.2.1 Process of Evaluating Quality of Output by Critical Tests

Testing is the fundamental activity for detecting and resolving technical issues in software source code, as well as evaluating the overall usability, performance, security, and compatibility of the product. It has a very narrow scope and is carried out by test engineers either concurrently with the development process or at a separate testing stage (depending on the methodological approach to the software development cycle). The concepts of quality assurance, quality control, and testing compared as:

	Testing	Quality Assurance	Quality Control
Purpose	Detecting and solving software errors and flaws	Setting up adequate processes, introducing the standards of quality to prevent the errors and flaws in the product	Making sure that the product corresponds to the requirements and specs before it is released
Focus	Source code and Design	Processes	Product as a whole
What	Detection	Prevention	Verification
Who	Test Engineers, Developers	The team including the stakeholders	The team
When	At the testing stage or along with the development process	Throughout the process	At the testing stage or along with the development process

Table 4.2 Comparison Between Quality Assurance, Quality control and Testing

The quality of any test is indicated by three measures:

1. **Reliability**
2. **Validity**
3. **Fairness**

The reliability measure indicates how much an examinee's test scores will not change if he or she takes the test again in a different version, on a different date, and so on. By comparing different versions of the same measurement, reliability can be calculated. Validity is more difficult to determine, but it can be estimated by comparing the findings to other relevant data or theory.

Different types of Testing –

Acceptance Testing - Acceptance testing ensures that the end-user (customers) can meet the objectives outlined in the business requirements, determining whether the product is ready for delivery. It is also referred to as user acceptance testing (UAT).

Black Box Testing - Black box testing involves running tests against a system in which the code and paths are hidden.

End to End Testing - End-to-end testing is a technique that tests the application's workflow from start to finish ensuring that everything works as expected.

Functional Testing - Functional testing checks production system to ensure it's doing exactly what it's supposed to be doing.

Interactive Testing - Interactive testing, also known as manual testing, allows testers to create and facilitate manual tests for those who do not use automation and collect results from external tests.

Integration Testing - Integration testing ensures that an integrated system as a whole meets a set of requirements. It is carried out in a combined hardware and software environment to ensure that the entire system works properly.

Non Functional Testing - Nonfunctional testing verifies a system's readiness based on nonfunctional parameters (performance, accessibility, UX, and so on) that are never addressed by functional testing.

Performance Testing - Performance testing examines a project's speed, stability, reliability, scalability, and resource usage under a specified workload.

Regression Testing - Regression testing is used to see if code changes break or waste resources in an application.

Security Testing - Security testing exposes the system's flaws in order to ensure that the software system and application are safe and secure. These tests are designed to identify any potential flaws or weaknesses in the production system that could result in a loss of data, revenue, or reputation among employees or outsiders.

Unit Testing - Unit testing is the process of checking small pieces of code to ensure that the individual parts of a program work properly on their own, reducing wasted tests and speeding up testing strategies.

White Box Testing - White box testing examines a product's underlying structure, architecture, and code in order to verify input-output flow and improve design, usability, and security.

Notes

Three Ways to Test –

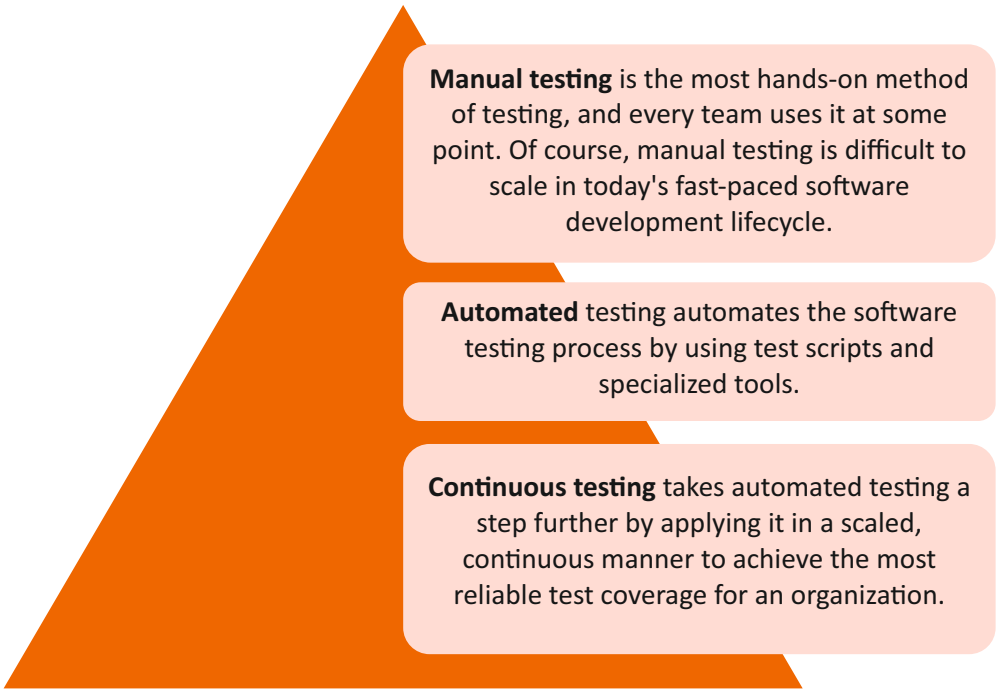

Fig 4.34 Three Common Methods of Product Testing

Product Quality - Product quality is the set of features and characteristics that determine a product's ability to meet the specifications of a standard or a customer. It is frequently defined as "the ability to meet the needs and expectations of the customer."

Importance of Quality Assurance - Quality assurance assists a company in developing products and services that meet customers' needs, expectations, and requirements. It results in high-quality product offerings that earn customers' trust and loyalty. A quality assurance program's standards and procedures help to prevent product defects before they occur.

Fig 4.35 Quality Assurance Checklist

4.2.2 Carrying Out Critical Tests

Product testing is the execution of any number of tests to assess a product's performance or properties. It can, for example, be used to ensure that a product works properly and is safe for consumers to use. Depending on the circumstances, manufacturers may test their own products or have them tested by an independent laboratory or government agency. Product testing is also a significant part of this process because it ensures product quality, smooth and timely delivery, and any subsequent servicing.

HALT/HASS (Highly Accelerated Life Test):

- Designed to identify flaws in the early stages of a product's life cycle
- Discover flaws that occur during the manufacturing and production processes

Vibration and Shock:

- Involve applying various frequencies of vibration to a product, whereas shock tests involve subjecting a product to sudden, short, and high levels of force
- Examine the product's response to these stimuli

ESS Testing:

- Refers to any of various tests that simulate the environmental conditions a product will be used in
- Includes extreme temperatures, corrosive environments, and persistent vibrations
- Includes thermal testing and electrodynamic vibration testing

Accelerated Weathering:

- Simulate the weather conditions that products used outdoors will be exposed to, such as sunlight, moisture, and extreme temperatures

Thermal and Humidity Testing:

- Refers to various environmental tests of a product’s resistance to humidity and temperature changes
- Include humidity cycling, high-temperature testing, and moisture-resistance testing
- Establish the temperature and moisture limits and uncover the causes of defects

Accelerated Life Cycle Testing:

- Stresses a product to uncover faults and failures
- Enables the manufacturer to predict the product's service life and maintenance requirements and offer appropriate guarantees and warranties

Mechanical Endurance Testing:

- Assess a product's reaction to repeated stress
- Measure the damage this stress will cause over a product's normal life using forces such as vibrations, shocks, and strains
- Establish the limits of an item's use and can help the manufacturer improve its durability

Fig 4.36 Types of Testing in Production

Notes

Exercise

Answer the following questions-

1. What is Quality Assurance?

   _____
   _____
   _____

2. Explain the process of evaluating quality of output by critical tests.

   _____
   _____
   _____

3. Explain different types of testing in production.

   _____
   _____
   _____

4. Explain common method of testing.

   _____
   _____
   _____

Fill in the Blanks -

1. Process development flow is another term for_____.
2. Tally Sheet is another term for_____.
3. The type of check Sheet used to collect information on process variability is called_____.
4. The type of Check Sheet which specifies the variety of defects with their frequency of occurrence is called_____.

Unit 4.3 Deal with Output's Quality-Related Problems

Unit Objectives

At the end of the unit, the trainee will be able to:

1. Describe the process of preparing a check sheet based on the observations during testing and approving/ rejecting the output.

4.3.1 Process of Preparing Check Sheet

A check sheet is a pre-structured form for gathering and analyzing data. One of the seven quality tools, it is a generic data collection and analysis tool that can be adapted for a wide range of purposes.

The check sheet can be used when:

1. When the same person or location can observe and collect data repeatedly.
2. When gathering information on the frequency or patterns of events, problems, defects, defect location, defect causes, or other similar issues.
3. When gathering data from a manufacturing process

Check sheet procedure –

1. Determine the event or problem for observation.
2. Establish operational definitions.
3. Determine when and for how long data will be collected.
4. Create the form.
5. Configure it so that data can be recorded simply by making check marks, xs, or other similar symbols, and that data does not need to be recopied for analysis.
6. Label every space on the form.
7. Test the check sheet for a short period of time to ensure that it collects the necessary data and is simple to use.
8. Record data on the check sheet each time the targeted event or problem occurs.

Check sheet example -

The figure below shows a check sheet used to collect data on telephone interruptions. The tick marks were added as data was collected over several weeks.

Telephone Interruptions

Reason	Day					
	Mon	Tues	Wed	Thurs	Fri	Total
Wrong number	𝍸	||	|	𝍸	𝍸 ||	20
Info request	||	||	||	||	||	10
Boss	𝍸	||	𝍸 ||	|	||||	19
Total	12	6	10	8	13	49

Fig 4.37 Check Sheet Example

A check sheet is useful for collecting data in the short term or when data cannot be collected automatically. As the accuracy of recorded data deteriorates, a long-running check sheet may become a burden or of little value.

Check Sheet Format –

A properly designed check sheet covers a variety of topics, such as the frequency and location of defect events, whether or not inspections have been completed, and so on. The following are some of the most common points that are usually included in the format of a check sheet:

a. Name of the employee

b. Type of the data being collected

c. A location where the data is being a collection

d. Schedule of data collection

E. Objective of data collection

Check Sheet is useful when:

a. The data can be continuously observed and collected at the same location by the same person.

b. The information is gathered to determine the frequency or patterns of problem events.

c. The data is gathered during the manufacturing process.

Replacement –

Check sheets have gradually become obsolete as various modern-day business process management software has gradually replaced them. These new pieces of software enable the automatic recording of more complex data, effectively removing the need for human intelligence and the dependability of check sheets. With a few mouse clicks, data can now be automatically recorded, organised, and presented in any way desired. In fact, some of the available business process management software generates output in a more user-friendly graphical format.

Benefits of Check Sheet –

1) Collects data with minimal effort

2) Convert raw data into useful information

3) Translate opinions of what is happening into what is actually happening

Advantages	Disadvantages
Effective way to of displaying data	Cannot reveal any changes overtime
Easy to use	Possibility of checks not entered by data collector
Can identify the root cause of a problem	Need to analyze several sheets arranged in chronological order to determine the trend
A first step in the construction of other graphic tools	Misinterpreting the data due to different influencing conditions are present
Provides a structure for uniform data	
Can be used to substantiate or refute allegations	

Table 4.3 Advantages and Disadvantages of Check Sheet

4.3.2 Identify and Implement Appropriate Corrective Measures

Corrective action is a quality management concept that aims to correct a task, process, product, or even a person's behaviour when any of these factors produces errors or deviates from an intended plan. Corrective actions are changes made to an organization in order to eliminate negative effects.

A correction is an immediate action taken to fix an issue discovered during an audit or while monitoring, and corrective action works to resolve the issue's root cause. A preventative action is one taken to avoid a future problem.

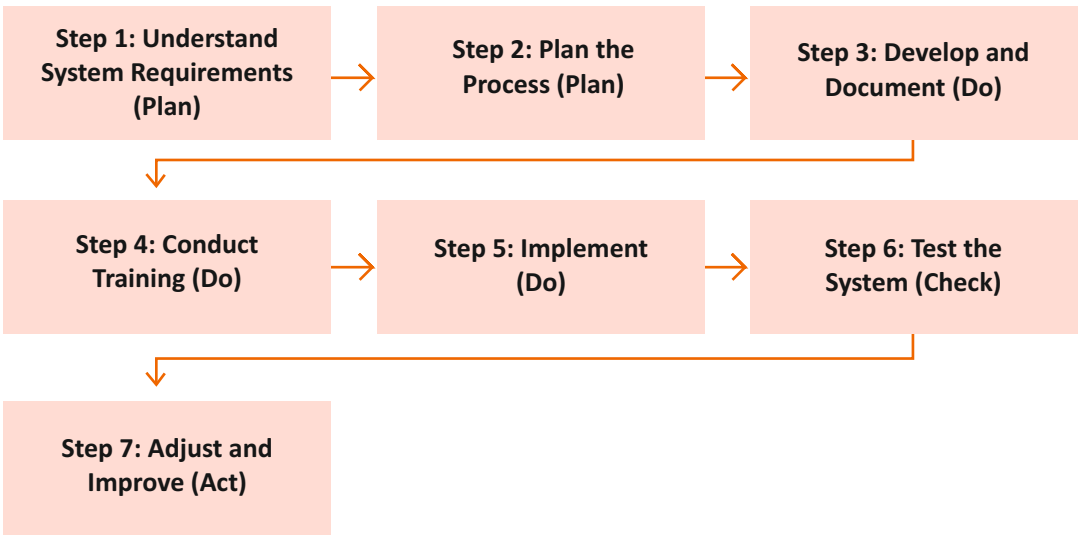

Fig 4.37 Seven Key Steps to Plan and Implement an Effective Corrective Action

All employees are expected to meet performance standards and behave appropriately in the workplace. Corrective action is the process of communicating with an employee in order to improve unacceptable behaviour or performance after other methods such as coaching and performance appraisal have failed.

Step 1: Understand System Requirements (Plan) –

The first step in developing an effective corrective action system is to seek understanding before acting. While quality standards outline the various requirements, it may be necessary to conduct additional research to determine exactly what must be done. In order to avoid implementation blunders, proper documentation and corrective action requirements must be accurately assessed.

Step 2: Plan the Process (Plan) –

Planning is the design phase in which decisions are made about the framework and mechanics of a corrective action system, as well as how the system will be integrated into current operations. Personnel duties for the corrective action process should also be addressed in the planning. Procedures

and conduits must be planned specifically for the completion of the following key tasks:

a. Identifying and evaluating created new triggers (customer complaints, audit findings, process parameters, etc.)

b. Identifying legal created a new and other issues

c. Identifying and incorporating issues into the corrective action process

d. Investigating and determining the source of a problem

e. Choosing and implementing solutions

f. Examining, testing, and confirming the effectiveness of a problem resolution

g. Using risk management protocols to prioritize major created a new

h. Creating personnel roles at various stages of the corrective action process

Step 3: Develop and Document (Do) –

During this stage of development, a well-planned cohesive corrective action system is created. Teams are formed, and the authority and responsibility for fully developing the program is delegated to them. Team responsibilities include ensuring that the corrective action system is properly structured, functional, and compatible with existing quality management elements that provide created new alerts.

Step 4: Conduct Training (Do) –

Any new system can significantly disrupt the status quo, causing anxiety among those affected by the change. Changes in management necessitate adequate training for something as large as a corrective action system that spans business operations. Training should include interactive learning events that are directly related to job duties and hands-on practice, such as on-the-job learning sessions, table top simulations, case studies, or a combination of all three.

Step 5: Implement (Do) –

Following training, the corrective action system should be implemented as soon as possible to reduce the time between training and actual use of new skills and knowledge. Corrective action procedures are activated in this step, and system mechanisms are fully operational. Instructions and methods are in place for designated personnel to manage corrective actions thoroughly.

Step 6: Test the System (Check) –

Following a full circle of corrective actions, the next feat is to ensure that the system performed as intended. The goal is to test functionality and usability. Auditing a sample of corrective actions from system input to investigation, resolution, and closure can be used to perform the check. Audit findings could help guide future corrective actions and changes. It is critical to notify and train affected personnel when changes are made.

Step 7: Adjust and Improve (Act) –

Everything goes according to plan in an ideal world. Glitches are likely in the real world. Adjustments are made in this step to improve the corrective action process. Actions are taken to fine-tune the system so that created new are reliably detected, evaluated, and resolved. Through continuous improvement, the goal is to make corrective action management a consistent and effective process.

Notes

QR Code

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youtube.com/watch?v=DSN1NAw3lJ0

4.3.1 Process of Preparing Check Sheet

youtube.com/watch?v=CH5J3e0K528

4.3.2 Identify and Implement Appropriate Corrective Measures

Exercise

Answer the following questions-

1. What is the significance of check sheet in business processes?

   _____
   _____
   _____

2. Explain seven key steps to plan and implement an effective corrective action.

   _____
   _____
   _____

3. Explain advantages and disadvantages of check sheet.

   _____
   _____
   _____

4. Explain the check sheet procedure.

   _____
   _____
   _____

Fill in the Blanks

1. A _____ is an immediate action taken to fix an issue discovered during an audit or while monitoring, and corrective action works to resolve the issue's root cause.
2. _____ have gradually become obsolete as various modern-day business process management software has gradually replaced them.
3. _____ is the design phase in which decisions are made about the framework and mechanics of a corrective action system, as well as how the system will be integrated into current operations.
4. A _____ is a pre-structured form for gathering and analyzing data.

Unit 4.4 Collect and analyse data

Unit Objectives

At the end of the unit, the trainee will be able to:

1. Explain the importance of engaging with customers to collect product feedback and analysing the product return data to identify trends and specific.

4.4.1 Collect Statistical Data with Respect to Performance of Production Line

Production data collection is the collection of data generated during the manufacturing process in a plant or factory, supported by information processing. In the manufacturing industry, data collection is especially crucial. In order to identify new opportunities and develop new ideas, businesses must collect and manage data. Data analysis can lead to discoveries that improve plant operations and increase productivity. Statistical knowledge allows you to collect data correctly, conduct appropriate analyses, and present the results effectively. Statistics is an essential component of how we make scientific discoveries, data-driven decisions, and predictions.

Data are discrete pieces of factual information that are collected and analyzed. The raw data is what is used to generate statistics. Statistics are the results of data analysis, which include interpretation and presentation. The process of gathering information from all relevant sources to solve a research problem is referred to as data collection in statistics.

It aids in determining the outcome of the problem. The methods of data collection allow a person to conclude the relevant question. There are numerous methods for gathering or obtaining data for statistical analysis. The following are three of the most popular methods:

A. Direct Observation

B. Experiments

C. Surveys

Fig 4.38 Converting Data into Information

A survey is a method of gathering information from people, such as Gallup polls, pre-election polls, and marketing surveys. A key survey parameter is the Response Rate (i.e., the proportion of all people chosen who complete the survey). For e.g.:

a. Personal Interview,

b. Telephone Interview, and

C. Self-Administered Questionnaire

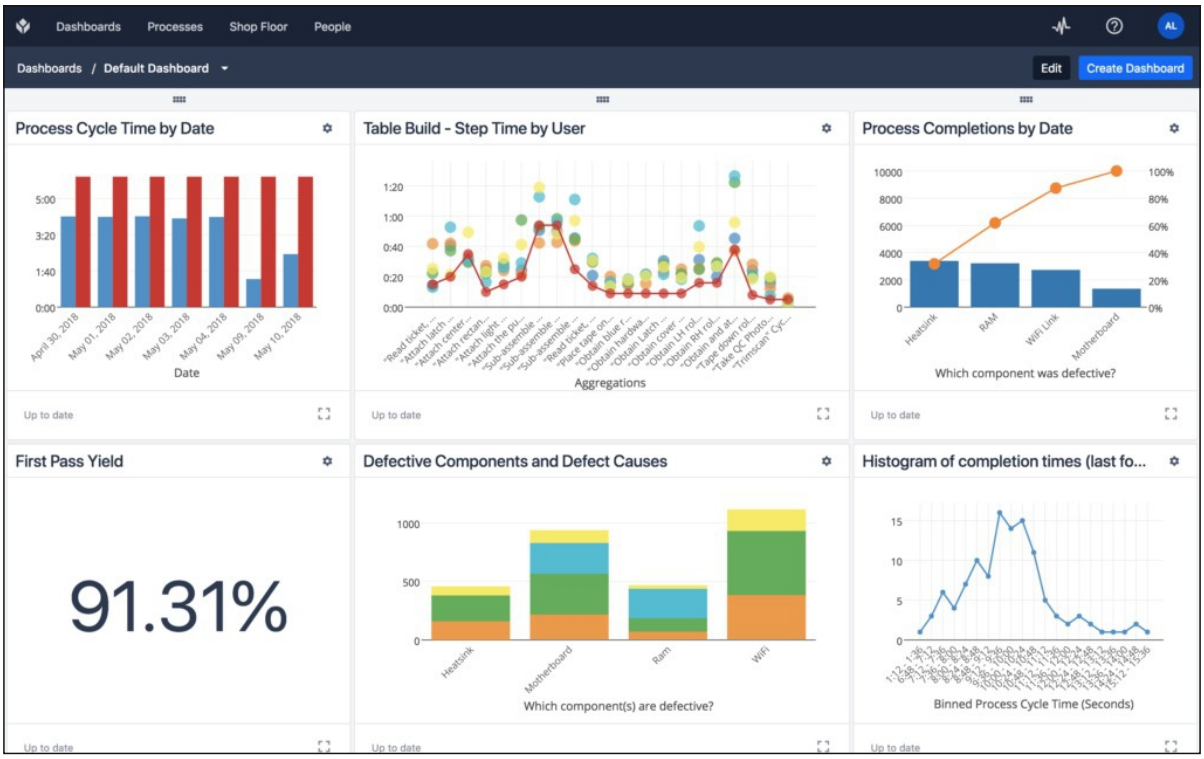

Fig 4.39 Statistical Data Collection

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youtube.com/watch?v=h4G5IFGuSTU

Unit 4.4 Collect and analyse data

4.4.2 Analyse Production's Line Statistical Data to Identify Quality Problems

Statistical quality control is the use of statistical methods to monitor and maintain the quality of products and services. Acceptance sampling is a technique used when deciding whether to accept or reject a group of parts or items based on the quality of a sample. The three categories of SQC are:

a. Traditional statistical tools

b. Acceptance sampling

c. Statistical process control (SPC)

Statistical methods are essential for quality control and improvement. They are the primary means of sampling, testing, and evaluating a product, and the information contained in those data is used to control and improve the process and the product.

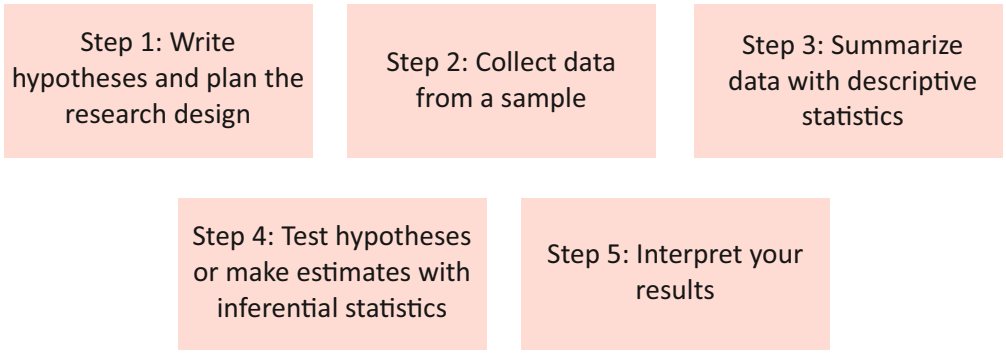

Fig 4.40 Steps to Analyse the Statistical Data

Step 1: Write hypotheses and plan research design –

To collect reliable data for statistical analysis, first define the hypotheses and then plan the research. The goal of research is to investigate a relationship between variables in a population by developing statistical hypotheses. Begin with a prediction, then use statistical analysis to test that prediction.

Fig 4.41 Graph Observation

A statistical hypothesis is a formal way of making a population prediction. Every research prediction is rewritten as a null and alternative hypothesis that can be tested with sample data.

Prepare research design

A research design is overall data collection and analysis strategy. It regulates which statistical tests you can use later to test your hypothesis.

Fig 4.41 Collecting Data

Step 2: Collect data from a sample –

In most cases, gathering data from everywhere is too difficult or expensive. Instead, gather information from a sample. Statistical analysis allows for the application of findings beyond the scope of the original sample, as long as appropriate sampling procedures are used.

Step 3: Summarize data with descriptive statistics –

After data collection, examine it and generate descriptive statistics that summarize it. There are several methods for inspecting the data, including the following:

Frequency distribution tables are used to organize data from each variable. A bar chart depicts the distribution of responses based on data from a key variable. A scatter plot explains the relationship between two variables. By visualizing the data in tables and graphs, you can determine whether the distribution is skewed and whether there are any outliers or missing data.

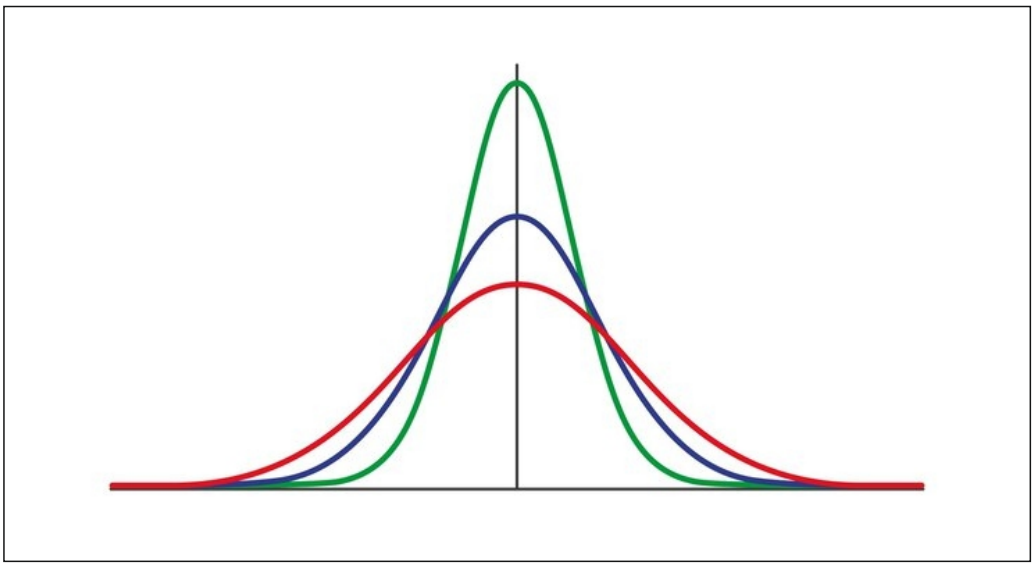

Fig 4.41 Standard Normal Distribution

Step 4: Test hypotheses or make estimates with inferential statistics –

A statistic is a numerical value that describes a sample, whereas a parameter is a numerical value that describes a population. Inferential statistics can be used to conclude population parameters based on sample statistics. Researchers frequently use two main methods to make statistical inferences (concurrently). The formal process of testing research predictions about the population using samples is known as hypothesis testing.

Step 5: Interpret your results –

The final step in statistical analysis is to interpret the findings. Statistical significance. In hypothesis testing, the primary criterion for concluding is statistical significance. To determine whether the results are statistically significant, compare the p-value to a predetermined significance level.

In data analysis, two main statistical methods are used: descriptive statistics, which uses indexes such as mean and median to summarize data, and inferential statistics, which uses statistical tests such as the student's t-test to conclude data.

4.4.3 Quality Documentation

A Quality Management System (QMS) is a formalized system that documents processes, procedures, and responsibilities for consistently delivering high-quality products and services to customers. A QMS assists in the coordination and direction of an organization's activities in order to meet customer and regulatory requirements while also continuously improving its effectiveness and efficiency. The structure, procedure, processes, and resources of the organization must be accurately and succinctly documented in the QMS documentation.

A well-designed documented system has numerous advantages: ensures that quality standards are met regularly to:

a. reduces the potential for error

b. reduces downtime when deviations occur due to the ability to quickly access relevant data

c. allows for easy monitoring of the processes so that process outputs can be analyzed and appropriate adjustments can be made

QMS documentation serves many functions, including information communication, evidence of conformity, and knowledge sharing; as a result, many different types and levels of documents, such as a quality manual, quality policy, documented procedures, and work instructions, are required. The **PDCA (Plan-Do-Check-Act)** cycle is used to create fit-for-purpose documentation, which can be completed in five steps:

Step 1: Identify documentation

Using a Process Map, identify all processes and their interactions; analysis of the processes should then be used to determine the amount of documentation required for the QMS. QMS standards will determine mandatory documents; for example, ISO13485:2016 lists the following as mandatory documentation: Quality Manual, Quality Policy, Quality Objectives, Quality Records, and six procedures:

1. Control of Documents
2. Control of Records
3. Internal Audit
4. Control of Nonconforming Product
5. Corrective Action
6. Preventive Action

Following that, procedures must be developed to cover each section of the standard that applies to the business, and the amount of documentation and level of detail required will be determined by the business's complexity.

Notes

Step 2: Identify structure of documentation

Fig 4.42 Structure Documentation

This structure is applicable to all organizations, regardless of size or complexity, and we recommend that it be implemented in the organization.

Step 3: Generate QMS documents-

QMS documents describe the structure, procedures, processes, and resources of the organization and, when followed, result in the consistent delivery of a quality product or service to the customer. Good documentation assesses employees' understanding of the processes, allowing them to incorporate and document them as quality records; thus, documents must be easy to read, have a natural logical order, use simple and clear language, and be concise. These characteristics will ensure that the message and content are understood. It will save time and effort later in document revision if time and effort are invested at this stage in getting the documents to the required standard. The quality procedures must be created first, with the document control procedure coming first. Prior to issuance, documents are reviewed and approved for adequacy. The first building block in the design of QMS documentation is the document control procedure, which describes the structure of all document types within the QMS. The document control procedure addresses the following issues:

a. Documents are reviewed, updated as needed, and re-approved.

b. Ensures that the correct revision status of documents and changes to documents are identified

c. Ensures that appropriate versions of relevant documents are available at points of use

d. Ensures that documents are legible and easily identifiable.

e. Ensures that documents of external origin are identified and distributed in a controlled manner.

f. Prevents document deterioration or loss.

g. Prevents the unintentional use of obsolete documents and the application of appropriate identification to them.

Step 4: Implement documentation system –

The document control process describes the existing documentation system and how it will be executed. The system in place must ensure that all documents are controlled, legible, easily identifiable, retrievable, and accessible at points of use, and that they are reviewed regularly for ongoing suitability throughout the product/service lifecycle. This procedure must be applied to all controlled documents. Documents detail the organization's structure, procedures, processes, and resources and are required as objective evidence for regulatory compliance and are auditable. Thus, document control procedures are critical because if they are not operating properly, they will quickly run into compliance issues and will have to apply costly resources to address problems.

Step 5: Maintenance and Improvement –

Documentation must be updated and improved on an ongoing basis. For the organization to comply with QMS and regulations, documentation must be kept per document control procedures. Documentation must be reviewed regularly, and data from QMS processes must be analyzed to determine any necessary changes. Process changes, non-conformance, audits, training, identified improvements, and standard changes all result in updates and improvements.

4.4.4 Instruct Quality Team to Engage with Customers

Customer feedback is an essential component of any business relationship. It contains thoughts, feelings, reactions, preferences, and complaints about the products or services. Customer feedback is useful because it informs a company about what its customers are thinking, feeling, or experiencing when they do business with it. The data can be used by the company to make more informed, customer-focused decisions. The stakes are very high. When used correctly, a strong customer feedback loop can:

1) Enhance products or services
2) Enhance internal processes that have an impact on the customer experience.
3) Assist in strengthening customer relationships

Customer feedback can be qualitative, such as a feedback form or information shared about a customer's experience with an agent or a sales representative. It can also be numerical, such as a customer satisfaction rating or a numerical review. Ways to Collect Customer Feedback:

- ☐ **Customer service feedback**
- ☐ **Surveys**
- ☐ **Reviews**
- ☐ **Sales or customer success feedback**
- ☐ **Social media posts**
- ☐ **Comments**
- ☐ **Support ticket spikes**
- ☐ **Returns**

Effective customer feedback methods

1. Conduct customer surveys

Customers can easily complete good customer surveys, which provide valuable business intelligence to the company.

- Lead surveys in relevant channels
- Keep them brief
- Offer incentives
- Ask a variety of questions
- Give your customers options
- Always follow up

2. Build a community forum

It serves as a central hub for customers to communicate with one another and share tips and tricks, as well as a great way to gather both direct and indirect customer feedbacks. The most common type of owned community forum is one in which the discussion occurs directly on the company's website.

3. Roll out a Voice of the Customer program –

A Voice of the Customer (VoC) program serves as a central hub for all customer feedback about a company. Implementing a Voice of Customer program is one way to ensure a streamlined process for managing customer feedback. All of the sources mentioned above, as well as others, can provide feedback, including:

a. Customer surveys

b. CSAT score

c. NPS, or net promoter score

d. Community

e. Advocacy teams—as frontline customer service representatives and as daily users of the product themselves

f. Advisory boards

g. 1:1 conversation with customer-facing teams and individuals

h. Sales—client feedback or insight from lost opportunities or deals

I. Product pilots and early access programs

4. Use customer feedback –

What should you do now that you've gathered feedback from customers? Bill Gates once said, "Your most unhappy customers are your greatest source of learning," and the truth is that customer feedback, good or bad, is only useful if it is used.

A. Listen and act

B. Share customer feedback widely

C. Correct the problem to avoid customer loss.

D. Identify and nurture champions

E. Celebrate success

5. Develop a customer feedback strategy –

A customer feedback strategy includes gathering as well as acting on feedback. Companies have numerous opportunities to receive feedback on their product, service, and overall customer experience via digital channels, but many lack the tools to act on it. Both steps must be completed for a successful customer feedback strategy.

Summary

- Every worker at a manufacturing facility is responsible for their safety as well as the safety of their coworkers.
- The quality manager ensures that all employees are aware of the importance of using the following personal protective equipment (PPE) during the manufacturing process.
- Employees face potential injury to hands and arms that cannot be eliminated through engineering and work practice controls. Potential hazards include skin absorption of harmful substances, chemical or thermal burns, electrical dangers, bruises, abrasions, cuts, punctures, fractures, and amputations.
- Proper PPE maintenance is required to ensure that the equipment continues to provide the level of protection for which it was designed.
- Quality managers supervise, guide, and oversee product development procedures daily to ensure that products meet quality and efficiency standards. The quality manager also collaborates with clients to ensure that the final products meet their needs and specifications.
- Monitoring is the periodic evaluation of the production process to determine whether or not it is proceeding as planned.
- Evaluation entails assessing the production process in terms of results, milestones, and the impact of the outcomes using performance indicators.
- A deviation can occur during the sampling and testing, raw material acceptance and manufacturing, and finished product acceptance and manufacturing processes. When manufacturing steps deviate from the established guidelines in some way, this is referred to as a "deviation".
- Solving production issues can be a difficult task. Quality managers must investigate what occurred and seek a permanent solution.
- The Eight Disciplines of Problem Solving (8D) is a systematic, holistic, and time-tested methodology for identifying the root cause of a problem, planning a quick fix, and implementing corrective and preventive actions to prevent its recurrence.

- Corrective and preventive action, or CAPA, are concepts within Good Manufacturing Practice (GMP) and Hazard Analysis and Critical Control Points/Hazard Analysis and Risk-Based Preventive Controls (HACCP/HARPC), both of which are commonly associated with the manufacturing process.
- During the manufacturing process, equipment failure is quite frequent. Its consequences can range from minor to catastrophic, depending on factors such as repair costs, total downtime, health and safety implications, and impact on production and service delivery. There are several common causes of tool, equipment, and machinery breakdown, and understanding why the equipment is failing is the first line of defense against the serious consequences of unplanned downtime.
- Seven old quality control tools are a set of QC tools that can be used to improve the performance of production processes, from the first step of producing a product or service to the final stage of production.
- The aim of a scatter diagram is to establish a relationship between the problem (overall effect) and the causes that are affecting it.
- Testing is the fundamental activity for detecting and resolving technical issues in software source code, as well as evaluating the overall usability, performance, security, and compatibility of the product.
- Product testing is the execution of any number of tests to assess a product's performance or properties. It can, for example, be used to ensure that a product works properly and is safe for consumers to use. Depending on the circumstances, manufacturers may test their own products or have them tested by an independent laboratory or government agency.
- A check sheet is a pre-structured form for gathering and analyzing data. One of the seven quality tools, it is a generic data collection and analysis tool that can be adapted for a wide range of purposes.
- Corrective action is a quality management concept that aims to correct a task, process, product, or even a person's behavior when any of these factors produces errors or deviates from an intended plan. Corrective actions are changes made to an organization in order to eliminate negative effects.
- Production data collection is the collection of data generated during the manufacturing process in a plant or factory, supported by information processing. In the manufacturing industry, data collection is especially crucial.
- Statistical quality control is the use of statistical methods to monitor and maintain the quality of products and services.
- A Quality Management System (QMS) is a formalized system that documents processes, procedures, and responsibilities for consistently delivering high-quality products and services to customers.

Notes

QR Code

Scan the QR Code to watch the related video

youtube.com/watch?v=47JZIHv1Q8w

4.4.2 Analyse Production's Line Statistical Data to Identify Quality Problems

youtube.com/watch?v=qTAyoSb_1qo

4.4.3 Quality Documentation

Exercise

Answer The Following Questions:

1. What is analyzing the data?

   _____
   _____
   _____

2. What are the 5 methods of collecting data?

   _____
   _____
   _____

3. What is the importance of understanding customers' wants and needs?

   _____
   _____
   _____

4. Why is customer feedback important to customer satisfaction?

   _____
   _____
   _____

5. What is the importance of responding to customers?

   _____
   _____
   _____

Choose the correct answer:

1. Data Analysis is a process of?
   A. inspecting data
   B. cleaning data
   C. transforming data
   D. All of the above
2. How many main statistical methodologies are used in data analysis?
   A. 2
   B. 3
   C. 4
   D. 5
3. Which of the following is true about hypothesis testing?
   A. answering yes/no questions about the data
   B. estimating numerical characteristics of the data
   C. describing associations within the data
   D. modeling relationships within the data

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Transforming the skill landscape

5. Process of Managing Recruitment, Training and Drive Quality Initiatives for Projects

ESSCI
Skilling India in Electronics

Unit 5.1 - Recruit the Quality Team Personnel

Unit 5.2 - Conduct Workshops and Training

Unit 5.3 - Drive Quality Initiatives

ELE/N7909

Key Learning Outcomes

At the end of this module, the trainee will be able to:

1. Describe the process of recruiting the quality team personnel.
2. Exhibit the process of conducting workshops and training.
3. Explain how to drive quality initiatives.

Unit 5.1 Recruit the Quality Team Personnel

Unit Objectives

At the end of the unit, the trainee will be able to:

1. Elaborate the process of collecting and analysing statistical data with respect to the performance of the production line on describe the applicable quality parameters
2. Describe the process of identifying problems and recommending appropriate changes in the production processes or quality controls
3. Describe the process of developing and monitoring continuous improvement programs to reduce the number of defects, manufacturing costs and improve the overall quality of the output

5.1.1 Process of Collecting & Analysing Statistical Data for Quality Performance

The practice of obtaining quantitative and qualitative data on certain factors in order to evaluate outcomes or gain actionable insights is known as data collection. To ensure that the data you collect is clean, consistent, and dependable, one must follow a certain procedure.

Primary data collection methods

a. **Qualitative data collection methods -** The format of data analysis can vary. The method used is determined by the research topic. Qualitative data collecting considers several criteria to provide a deeper understanding of raw data. Instead of counting responses or recording numeric data, qualitative approaches try to analyze aspects such as study participants' thoughts and feelings. With this enhanced view, researchers can:

   1) Explain the situation. Understanding where observations take place can give numbers more meaning.
   2) Categorize the participants in the study. This knowledge can inform the results if study is limited to a specific set of people, whether intentionally or due to demography or other circumstances.
   3) Describe the study's topic. Specific research activities and how study messages were given and received may occasionally reveal study facts.
   4) Interact with participants in the research. Interactions between respondents and researchers can provide important details about the outcomes.
   5) Keep an eye on the outside world. Unexpected circumstances can have an impact on study outcomes. Researchers can detect these events and weave them into their results narrative using qualitative data gathering methods, which is nearly impossible to do with a quantitative methodology.

Qualitative research methods

1. **Ethnography** influenced by Anthropology is the study of human civilizations and cultures. Researchers use this strategy to observe people in an undirected manner rather than asking specific and practical questions as traditional market researchers do. This method is intended to reveal actions from the subject's point of view rather than the researchers'.

2. The **grounded theory** arose from sociological scholars' desire to improve the validity of qualitative research by grounding it in reality rather than assumptions. Prior to this method, qualitative data analysis was done separately from the data collection and analysis process.
3. **Phenomenology** is the study of how people react to certain events or interactions. This method assesses responses to unusual events, therefore it's critical to comprehend the entire picture, not just the facts and data.

b. Quantitative data collection methods

The goal of quantitative analysis is to evaluate a numerical result. A survey, for example, asks questions to elicit responses that reveal trends, preferences, activities, opinions, and any other measurable factor. Because they are simple to use, quantitative data collection techniques are popular. These strategies are used by researchers to gather facts and numbers by asking questions. Quantitative data can be expressed numerically and is quantifiable.

Various quantitative research methods

1. **Descriptive** research uses observational data to explain the current state of a variable. Frequently, the researcher starts with no hypothesis and lets the data guide the investigation.
2. **Correlational** study aims to gather information that reveals connections between various events. A positive correlation occurs when two variables grow or decrease simultaneously. When one variable rises, another falls. This is known as a negative correlation. A zero-correlation result indicates that there is no meaningful association between two variables. Correlation aids in making predictions based on previous patterns and establishing a study's validity and dependability.
3. The scientific method is used to identify the cause-and-effect relationship between variables in **experimental research**, often known as "real experimentation." This strategy employs controls for all critical variables that may have an impact on the phenomena of interest. Researchers use the experimental method to allocate individuals to the control or treatment groups in a study.
4. **Quasi-experimental research**, also known as "causal-comparative" research, is similar to experimental research. Because it is often impossible or impractical to control all of the variables involved, quasi-experimental methods do not control for some variables but use the scientific technique to establish a cause-and-effect relationship. Independent variables get manipulated in both of these types of studies. However, experimental data collection methods use random assignment and sampling, whereas quasi-experimental data collection methods do not use random assignment, sampling, or both.

Secondary data collection methods

Surveys, questionnaires, direct observations, and focus groups are a few methods used in research to collect direct or primary data. While primary data collection methods are the most authoritative and accurate, secondary data collection methods can be helpful in a variety of situations. **Secondary data** can add value to a research project and is more efficient and cost-effective than collecting primary data. So, how does other people's research relate to your own? To answer this question, you must first understand how most modern research is conducted.

Data collection tools

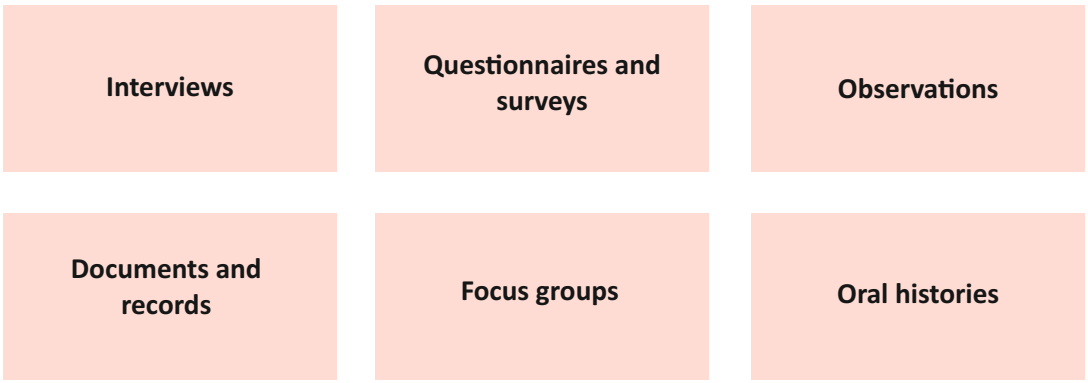

Fig. 5.1 Data Collection Tools

Statistical Process Control (SPC) - SPC can help a business measure and control quality by collecting data to monitor the manufacturing process. It enables factories to operate at maximum capacity and lays the groundwork for future growth.

Statistical methods for improving quality - Statistical approaches to quality improvement refer to the use of collected data and quality standards to develop new ways to improve products and services. They are a collection of predefined strategies for inferring the characteristics of a large set of data.

The use of statistical methods in quality improvement takes many forms, including:

Hypothesis Testing	• The alternative hypothesis (H1) and the null hypothesis (H0) are both tested (H1). • The null hypothesis is a "straw man" in statistical testing. The null hypothesis must be accepted or rejected.
Regression Analysis	• It generates a mathematical equation that expresses the functional relationship between one or more independent variables and one or more responses.
Statistical Process Control (SPC)	• Statistical methods are used to monitor, control, and improve processes. • SPC is used to identify when processes are out of control due to a unique cause variation (variation caused by special circumstances, not inherent to the process). • Following that, practitioners may seek strategies to remove variation from the process.
Design and Analysis of Experiments	• Controlled experiments are planned, carried out, analyzed, and interpreted to assess the factors that may influence a response variable.

Table 5.1 Forms of Statistical Data Testing

Methods for performing statistical analysis

1. **Mean:** The mean, also known as the average, is the first method used in statistical analysis. Add a set of integers together and divide the total by the number of items on the list to find the mean. This method allows for the determination of a data set's overall trend as well as a quick and concise evaluation of the data. This method has the added benefit of being simple and quick to calculate.

Calculating Mean for Statistical Data

To calculate the mean of the data, add the numbers together, then divide the total by the number of numbers in the dataset or list.

For Example: Let's find the mean of 6, 18, and 24

1. Add them all together i.e. 6 + 18 + 24 = 48
2. Then divide by the total number of numbers in the list.

   48 / 3 = 16
3. The average number is 16.

While the mean is helpful, it is advised not to be used as the sole statistical analysis method. This is because doing so may jeopardize the entire calculation, as it is also related to the mode (the value that occurs most frequently) and median (the middle) in some data sets. When dealing with a large number of data points, the mean does not provide the most accurate results in statistical analytics for a specific decision due to either a high number of outliers (a data point that differs significantly from others) or an inaccurate distribution of data.

2. **Standard deviation:** A standard deviation is a statistical tool used to calculate data spread around the mean. When the standard deviation is high, dealing with data is far from the mean. A low deviation, on the other hand, indicates that the majority of the data is in agreement with the mean and is also known as the set's expected value. The standard deviation is used to determine the dispersion of data points (whether or not they are clustered).

   The formula to calculate the standard deviation is:

   $\sigma 2 = \Sigma(x - \mu)2/n$

   In this formula:

   a. The symbol for standard deviation is σ

   b. Σ stands for the sum of the data

   c. x stands for the value of the dataset

   d. μ stands for the mean of the data

   e. σ2 stands for the variance

   f. n stands for the number of data points in the population

   To find the standard deviation:

   1) Find the mean of the numbers within the data set

   2) For each number within the data set, subtract the mean and square the result (which is this part

of the formula $(x - \mu)2$).

3) Find the mean of those squared differences

4) Take the square root of the final answer

5) If you used the same three numbers in our mean example, 6, 18, and 24, the standard deviation, or σ, would be 7.4833147735479.

3. **Regression:** It is the relationship between a dependent variable (the data you want to measure) and an independent variable in statistics (the data used to predict the dependent variable). It can also be explained in terms of how one variable influences another, or how changes in one variable produce changes in another, i.e. cause and effect. It suggests that one or more variables influence the outcome. In regression analysis graphs and charts, the line indicates whether the correlations between the variables are strong or weak, as well as displaying trends over time.

   Y = a + b(x)

   In this formula:

   a. A refers to the y-intercept, the value of y when x = 0

   b. X is the dependent variable

   c. Y is the independent variable

   d. B refers to the slope, or rise over run

4. **Hypothesis testing:** In statistical analysis, hypothesis testing, also known as "T Testing," can be used to test the two sets of random variables contained within a data collection. This method is used to analyse whether a particular argument or conclusion holds for the given data set. It allows data to be compared to various hypotheses and assumptions. It can also assist in predicting how business actions will impact the company. In statistics, a hypothesis test determines a quantity under a given assumption. The outcome of the test indicates whether or not the assumption is correct. This assumption is known as the null hypothesis, also known as hypothesis 0. The first hypothesis, also known as an alternate hypothesis, is any theory that contradicts hypothesis zero.

   Hypothesis testing formula

   a. The results of a statistical hypothesis test need to be interpreted to make a specific claim, which is referred to as the p-value.

   b. Let's say what you're looking to determine has a 50% chance of being correct.

   c. The formula for this hypothesis test is:

   d. H0: P = 0.5

   e. H1: P ≠ 0.5

5. **Sample size determination:** When it comes to statistical data analysis, the dataset can be too large, making proper data collection for each element difficult. When this occurs, most people choose sample size determination, which entails analyzing a smaller amount of data. To do this correctly, one must first determine the proper sample size. If the sample size is too small, it will not get valid results at the end of the analysis. To achieve this result, use one of several data sampling approaches. It is accomplished by distributing a survey to the customers and selecting respondents using a simple random sample method.

   Finding a sample size

   In contrast to the other four statistical analysis methods, there is no one-size-fits-all formula for calculating sample size. There are, however, some general guidelines to follow when calculating sample size:

   - Conduct a census when considering smaller sample size.
   - Use a sample size from a similar study to yours. For this, you might want to check through academic databases for a study that is similar to yours.
   - If you're performing a general study, you might be able to exploit an existing table to your advantage.
   - Consider using a sample size calculator.
   - Just because there isn't a single formula that works doesn't mean you won't be able to find one that does. There are numerous options available to you.

5.1.2 Applicable Quality Parameters

Quality standards are documents that specify rules, specifications, guidelines, or characteristics that can be consistently applied to ensure that materials, products, processes, and services are fit for their intended use. Organizations require standards to meet the expectations of their stakeholders because they provide a shared vision, understanding, procedures, and vocabulary. Because they provide accurate definitions and terminology, standards provide an objective and authoritative foundation for enterprises and consumers to interact and conduct business around the world.

The following figure explains the principles of quality standards in detail:

Customer focus

- Developing a strong client focus is a great approach to show your dedication to quality.
- Customer feedback, whether positive or negative, is critical in detecting non-conformities and improving processes.

Continued...

Leadership

- Strong leadership entails a clear vision for the future of your firm. By properly communicating this vision, you can ensure that everyone on your team is working toward the same goals, giving your company a sense of unity.

Engagement of people

- Management systems like ISO 9001 aren't just for top executives; everyone in your company contributes to the processes. If you want to get the most out of your quality management ISO, openly discussing problems and sharing information and experience with your team is crucial.

Process approach

- The ISO 9001 Standard's Plan, Do, Check, Act (PDCA) philosophy will assist you in creating a process-driven culture throughout your company. This is a tried-and-true method for effectively planning, resourcing, and managing your processes and interactions.

Improvement

- The ISO 9001 quality management system requires continuous improvement, which should be a top priority for your company. You'll be able to find ways to enhance and strengthen your firm by implementing procedures for identifying risks and opportunities, detecting and resolving non-conformities, and measuring and monitoring your efforts.

Evidence-based decision making

- For making informed judgments, you need accurate and trustworthy data. For example, the proper evidence is required to determine the underlying cause of a non-conformity. Ensure that information is accessible to those who require it and that communication channels remain open.

Relationship management

- Your suppliers can provide a competitive advantage, but this demands a trusting connection. Developing long-term partnerships with suppliers and other stakeholders requires balancing short-term financial rewards with long-term, mutually beneficial tactics.

Fig. 5.2 Principles of Quality Standards

Significance of quality standards

1. The bottom line of any company is determined by its standards. Successful businesses should enforce quality, safety, intellectual property, and environmental policies. Standardization provides benefits such as reduced redundancy, fewer errors or recalls, and a shorter time to market.
2. Businesses and organizations that adhere to quality standards assist products, services, and individuals in crossing international borders and ensuring that items manufactured in one country can be sold and used in another.
3. Several quality management standards protect customers, but standardization can also make life easier for consumers. A product or service that conforms to an international standard will be compatible with a greater number of products or services worldwide, increasing its marketability.

The table below displays various quality standards that are applicable globally.

Topic	Standard
Quality Management	ISO 9000 ISO 9001
Auditing	ISO 19011
Environmental Management	ISO 14000 ISO 14001
Risk Management	ISO 31011
Social Responsibility	ISO 26000
Sampling by Attributes	Z1.4
Food Safety	ISO 22000
Guidelines for performance improvement.	ISO 9004
Information technology- process assessment	ISO 15504-4: 2005
Quality function deployment, also known as the house of quality approach.	QFD
Continuous improvement	Kaizen
Statistical process control	Zero Defect Program
Statistical process control	Six Sigma
Total quality management	TQM
Inventive problem solving	TRIZ
Business process reengineering	BRP
Object-oriented Quality and Risk Management	OQRM
Leadership approaches to change	Top Down & Bottom Up Approaches

Table 5.2 Quality Standards

Total Quality Management (TQM)

TQM is an integrated management strategy for improving product and process quality over time:

Total		Quality		Management		TQM
• Quality Management involves everyone and all tasks and activities of a company.	+	• Degree to which the product (or service) fulfills customer requirements or was produced correctly.	+	• Quality must be managed by planning, organizing, leading and controlling.	=	• An integrative philosophy of management for continuously improving the quality of products and processes.

Fig. 5.3 Total Quality Management

TQM is based on the notion that preventing defects is less costly than dealing with the consequences of poor quality. In other words, when managers strive for zero flaws in the organization, total quality expenses are reduced. The four main types of quality expenses are prevention, appraisal, internal failure, and external failure. The costs incurred to eliminate poor quality are referred to as prevention costs. Quality procedures and improvements include:

1. Durable design of products
2. Training employees for better productivity
3. Certifying suppliers for quality products and services
4. Performing preventive maintenance on equipment
5. Documenting quality procedures and improvements

Prevention expenses are frequently the smallest percentage of total expenditures in a traditional organisation that does not use TQM.

Notes

5.1.3 Process of Identifying Problems and Recommended Solutions

A well-run business necessitates stringent quality control. A quality control programme ensures that the product, service, and customer experience of the small business are all consistent. Creating quality control methods allows the company to function without each other, making it easier to expand into new markets, delegate responsibilities, and eventually sell the company.

The steps for developing a quality control process in an organisation are as follows:

1. **Set quality standards:** In some industries, it requires to meet quality standards set by an outside body, such as an industry association, local safety inspector, or a government regulatory agency. There are no official quality standards, so organizations must establish their own. Each department in the company will have its quality control standards. They must, however, all be objectively measurable. For example, "sounding friendly on the phone" is not a measurable standard if you're developing quality control standards for your customer service team. Measurable standards could include the following:

    a. All customer calls must be answered by the second ring.

    b. All customer service emails must be answered within four hours.

    c. Customer service issues must be resolved in five minutes or less.

2. **Decide which quality standards to focus on:** Of course, to ensure that the operation is of the highest possible quality. Begin by focusing on the most crucial metrics, that have a huge impact on the revenue and customer satisfaction. It allows us to get results quickly while avoiding overwork for yourself and the team. For example, if you own a factory, keeping the facilities clean is essential—but not the most important. Completing the production process and meeting the deadline is a higher priority because it has a greater impact on the quality of the experience and customer satisfaction.

3. **Create operational processes to deliver quality:** The pioneer of modern quality control, W. Edwards Deming, felt that well-designed processes result in high-quality products and services. Your product or service will improve over time if you build good processes, measure the results of the procedures on a regular basis, and endeavor to continuously improve the process. Create step-by-step processes with benchmarks beginning with your important operations. For example, operational operations in a B2B company's accounting department can entail producing and issuing invoices within 24 hours of a work being done or a product being delivered. In a restaurant, operational procedures may demand servers to pick up food and deliver it to the customer's table within two minutes of its preparation.

4. **Review your results:** Most companies, from financial and accounting programs to customer relationship management and customer support software, allow you to personalize the data you collect and see it in dashboards. Examine the statistics on a regular basis to determine how well your organization is fulfilling its quality goals.

5. **Get feedback:** To acquire a more complete picture of product and service quality, use measurable feedback from external sources such as consumer surveys, internet ratings, reviews, and net promoter scores (NPS). Obtain regular feedback from staff as well. How effective are the operational processes at delivering quality? How could they be made better?
6. **Make improvements:** Don't stop there until you've met your quality control criteria. If you manage a domestic cleaning service and can reduce the time it takes your maids to clean the home by 25%, you'll be able to handle 25% more business without employing any extra personnel. That will significantly improve your bottom line.

Quality control illustrates that no matter how effectively your processes are operating, there's always space for improvement, and making tiny changes can pay off big time.

Elements of an Effective Change Management Process

Change Management has evolved throughout the years, with Change Management Models, Processes, and Plans established to help organisations cope with the impact of change. So, what are the differences between a Change Management Model, a Change Management Process, and a Change Management Plan?

a. Change Management Models were developed based on research and experience on how to best manage change in a business or in your personal life. Most Change Management Models include a process that you can use to help your company or yourself thrive.

b. Change Management Processes are a collection of steps or activities that guide a change from conception to completion.

c. Change Management Plans are developed to assist a project in implementing a change. It is typically developed during the planning stage of a Change Management Process.

Fig. 5.4 Features of Change Management

Tools and Components for Implementing Change Management Processes

Supporting activities and tools are essential for effective change management processes. These tools are frequently developed and managed internally by either the change management team or change management stakeholders. A product roadmap, for example, could be created by the product management team, whereas a post-mortem review would include everyone responsible for and affected by the change. These could include:

Product or Business Roadmaps	Readiness Assessments	Training Tutorials and Education Sessions
Stakeholder Feedback Forums	Post Mortem Review	Measurements and Analytics
Resistance Management	Continuous Improvement Plan	Business Case

Fig. 5.5 Components of Change Management

Quality Problems

A quality problem occurs when the desired quality attribute is not present or is not at the expected level. In other words, it is a failure to comply with standards or specifications. It is also referred to as the "Quality Gap."

1. **The attitude towards problems:** Problems should not be dismissed or ignored; instead, efforts should be taken to determine what problems exist and how serious they are. Each issue should be investigated further to see why it occurs and what can be done to prevent it.

2. **Problem identification:**

- Problem Identification via Statistical Quality Control
- Customer Complaints
- Employee Complaints
- Incident Reporting

3. The problem-solving cycle

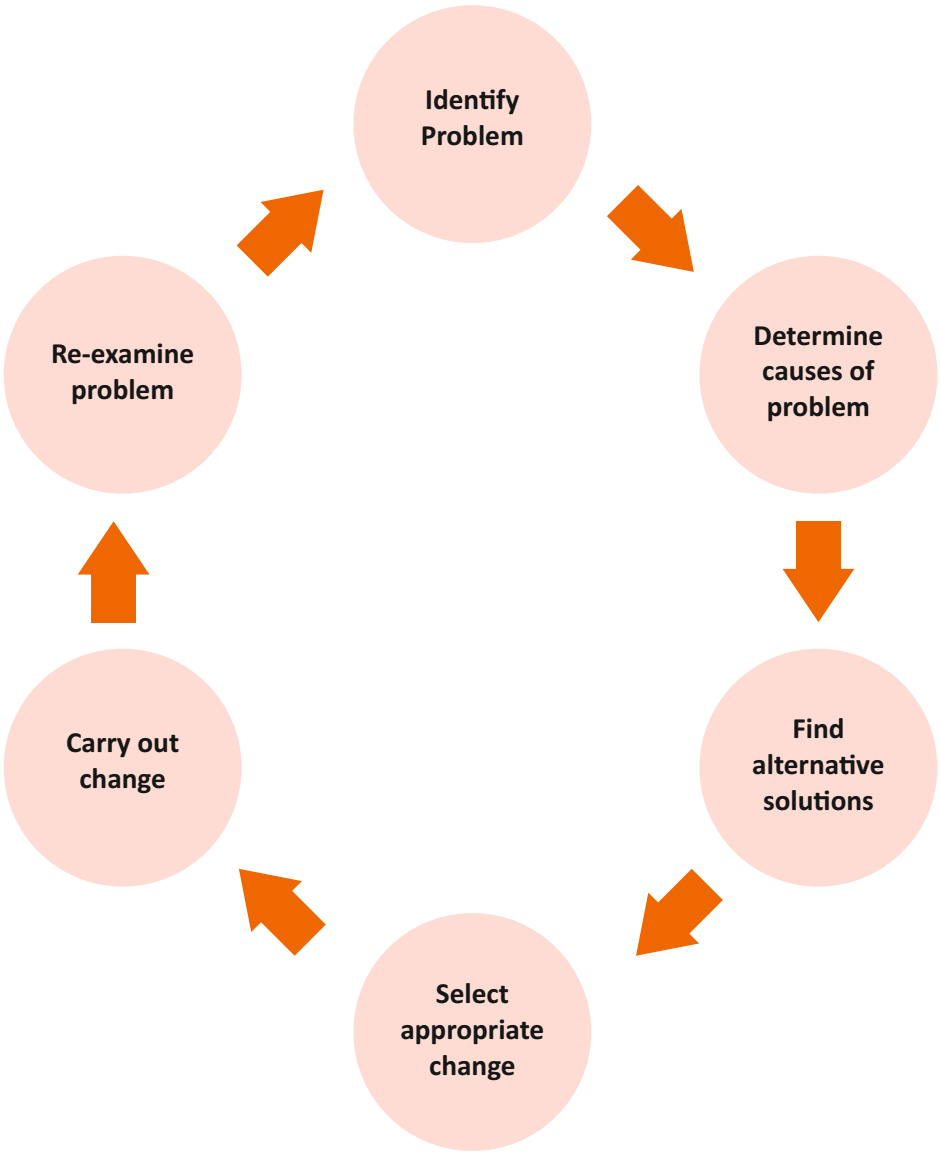

Fig. 5.6 Problem Solving Cycle

Notes

5.1.4 Selection of Quality Inspection Tools and Software for Inspection Team

Quality Assurance (QA) is described as the practice of observing software engineering methods and processes in order to ensure the quality of a delivered software system. It encompasses the entire SDLC – software development life cycle – and includes proper requirements management, software style, coding, testing, and management. The testing team also assures that products and services are of the highest quality. QA oversees and coordinates the management goals, processes, and policies aimed at meeting client needs and increasing customer satisfaction. As a result, the client may get the impression that they are receiving high-quality products that are always improving in the modern and dynamic technological period.

Flowchart

- A flowchart could be a diagram representing a workflow method, or a step by step method to connect by arrows and lines in several directions.
- In the flowchart, each step is an associate action and result of which produces an output which is again used as an input to the succeeding step.
- The method will then offer information or picture of what it looks like and will facilitate in identification of the issues related to quality. The straightforward structure of the flowchart is given below.

Histogram

- A histogram is a graphical illustration of a bar chart that shows pattern falls with totally different and typical method conditions.
- The examples to measure data in the histogram can be a number of new students joined, the number of new patients registered, etc. The basic structure of the histogram is given below.

Check Sheet

- A check sheet is a structured quality tool that is used to collect data. It is a type of prepared form for analyzing data and it can be adapted for a variety of purposes.
- It is also used during the review process, to ensure that all the required steps and necessary pre-requisites have been completed.

Continued...

Cause-Effect Diagram

- A Cause- and – Effect diagram, also known as the fish-bone diagram shows the many possible causes of a problem.
- Fish-bone captures all causes, ideas, and uses a brainstorming method to identify the strongest root cause. It also records the cause of specific problems to the processor system.
- To use this tool, you first need to identify and state the problem as a question. This will help in brainstorming as each question should have an answer. You can also simply start by writing it in the first headbox of the fish.

Pareto Chart

- A Pareto Chart is a bar graph of data that shows which factors are more significant.
- The main purpose of the Pareto chart is to highlight the most important factors that are the reason for the major cause of problem or failure.
- In Pareto Chart, bars in a graph represent the values in descending order where the left axis represents the frequency and right axis represents the percentage of the total number of occurrences.

Control Chart

- Control charts are used to plot data points over time and give a picture of the movement of that data.
- Control charts are used to compare current data to control limits which leads to conclusions on the consistency of process variation.

Scatter Diagram

- Scatter diagrams are the type of graphs that shows the relationship between the variables in which variables represent the causes and effect.
- The main purpose of the scatter diagram is to establish a relationship between the overall effect of the problem and the causes that are affecting it.

Fig. 5.7 Types of Quality Assurance Tools

5.1.5 Process of Developing and Monitoring Continuous Improvement Programs

A continuous improvement process (CI), also known as a continuous improvement process (CIP), is an ongoing effort to improve products, services, or processes. These initiatives can aim for "incremental" improvement over time or "breakthrough" improvement all at once. Continuous improvement is a well-known component of strong and well-planned manufacturing operations management. It is a key component of any manufacturer's operational excellence toolbox. A well-planned and executed continuous improvement process can provide the foundation for constructing a resilient manufacturing unit. One that can easily eliminate **waste processes, streamline operations, and ultimately produce** better products more quickly and at a lower cost. This has been successfully implemented by several Japanese manufacturers. Implementing a Continuous Improvement Process in an organization became a common practice. According to studies, the main advantages of a CIP are:

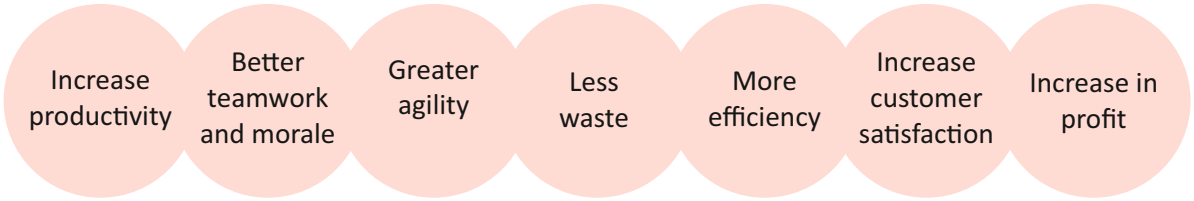

Fig. 5.8 Benefits of CIP

The CIP has four phases. The following phases are linked to the Shewhart Cycle:

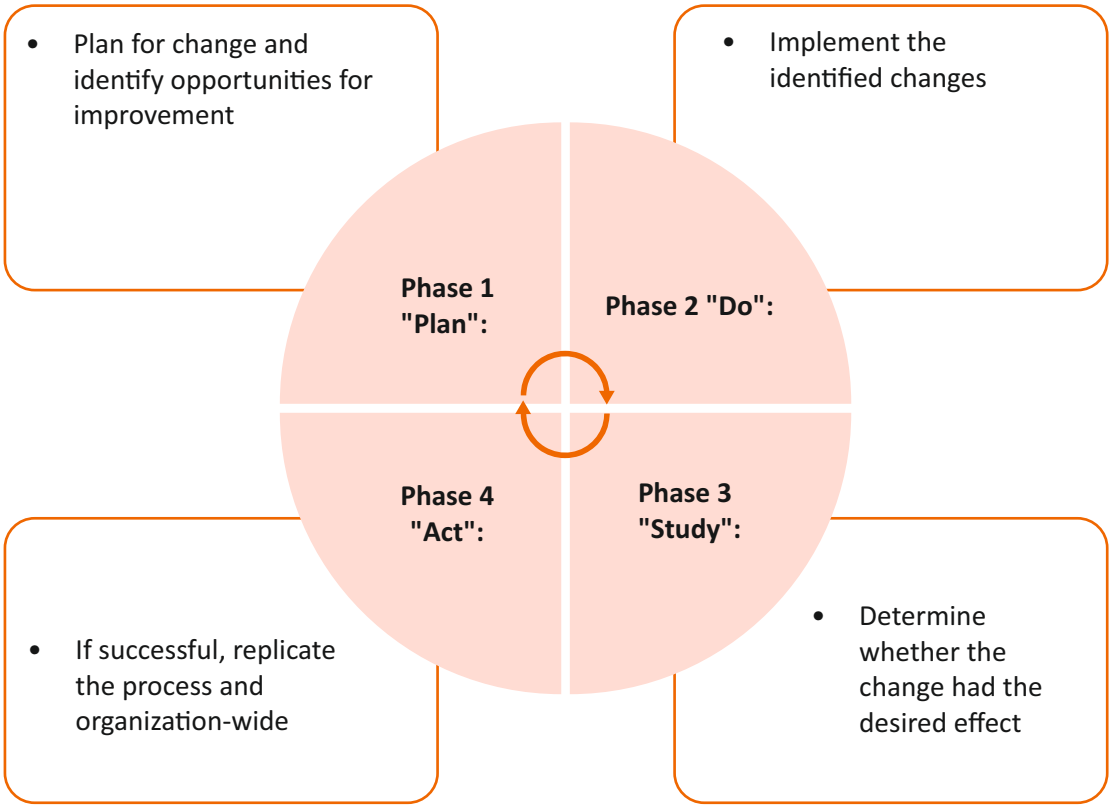

Fig. 5.9 Stages of CIP

The steps for the Continuous Improvement Process are as follows:

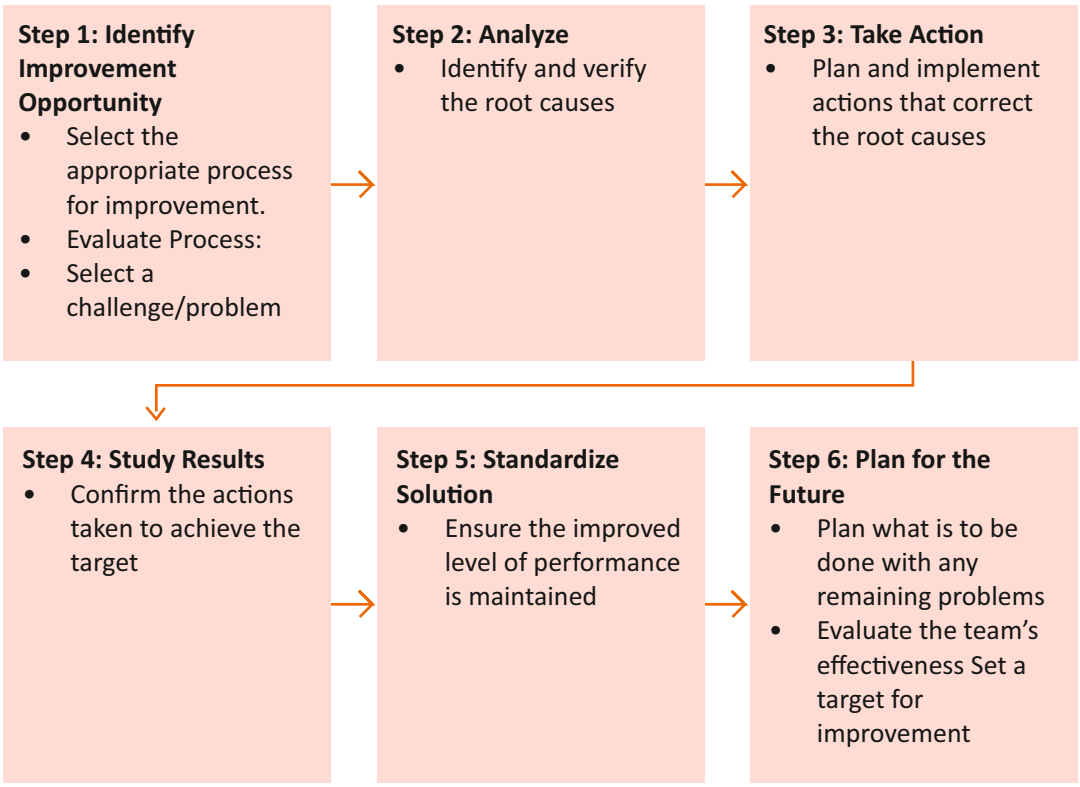

Fig. 5.10 CIP Process

Summary

- The practice of obtaining quantitative and qualitative data on certain factors in order to evaluate outcomes or gain actionable insights is known as data collection.
- Qualitative data collecting considers several criteria to provide a deeper understanding of raw data.
- The goal of quantitative analysis is to evaluate a numerical result. A survey, for example, asks questions to elicit responses that reveal trends, preferences, activities, opinions, and any other measurable factor.
- Secondary data can add value to a research project and is more efficient and cost-effective than collecting primary data.
- Statistical approaches to quality improvement refer to the use of collected data and quality standards to develop new ways to improve products and services. They are a collection of predefined strategies for inferring the characteristics of a large set of data.
- In statistical analysis, hypothesis testing, also known as "T Testing," can be used to test the two sets of random variables contained within a data collection.

- TQM is based on the notion that preventing defects is less costly than dealing with the consequences of poor quality.
- A quality control programme ensures that the product, service, and customer experience of the small business are all consistent. Creating quality control methods allows the company to function without each other, making it easier to expand into new markets, delegate responsibilities, and eventually sell the company.
- A quality problem occurs when the desired quality attribute is not present or is not at the expected level. In other words, it is a failure to comply with standards or specifications. It is also referred to as the "Quality Gap."
- Quality Assurance (QA) is described as the practice of observing software engineering methods and processes in order to ensure the quality of a delivered software system.
- Continuous improvement is a well-known component of strong and well-planned manufacturing operations management. It is a key component of any manufacturer's operational excellence toolbox.

Notes

_____
_____
_____

QR Code

Scan the QR Code to watch the related video

youtube.com/watch?v=h4G5IFGuSTU

5.1.1 Process of Collecting & Analysing Statistical Data for Quality Performance

youtube.com/watch?v=8d8U8Th9Ce8

5.1.2 Applicable Quality Parameters

youtube.com/watch?v=UnjwVYAN7Ns

5.1.5 Process of Developing and Monitoring Continuous Improvement Programs

Exercise

Answer the following questions-

1. What is secondary data collection method?

   _____
   _____
   _____

2. List down secondary data tools.

   _____
   _____
   _____

3. What is statistical process control?

   _____
   _____
   _____

4. Discuss the significance of quality standards in data collection.

   _____
   _____
   _____

5. What is quality gap?

   _____
   _____
   _____

6. Explain any two quality assurance tools.

   _____
   _____
   _____

7. Explain continuous improvement process.

   _____
   _____
   _____

Fill in the Blanks-

1. _____ considers several criteria to provide a deeper understanding of raw data.
2. _____ are a collection of predefined strategies for inferring the characteristics of a large set of data.
3. A _____ occurs when the desired quality attribute is not present or is not at the expected level.
4. _____ is based on the notion that preventing defects is less costly than dealing with the consequences of poor quality.
5. _____ is described as the practice of observing software engineering methods and processes in order to ensure the quality of a delivered software system.

Unit 5.2 Conduct Workshops and Training

Unit Objectives

At the end of the unit, the trainee will be able to:

1. Explain the importance of conducting research to identify ways to bridge the knowledge and skill gaps of the production and quality team personnel
2. Describe the process of preparing the required training modules
3. Describe the process of conducting workshop, classroom and shop floor training to ensure the quality and production team personnel are fully equipped to perform their duties

5.2.1 Significance of Conducting Research to Identify Ways to Bridge Knowledge & Skill Gaps

Knowledge gaps are a barrier to company success. These gaps can thwart progress, reduce performance, and reduce productivity. Many organizations are experiencing skill and knowledge gaps as they rapidly adopt new models and strategies to incorporate updated technology and address changing customer needs. These gaps are widening as more employees are being asked to perform tasks for which they were not hired or trained.

A knowledge problem happens when there is a huge discrepancy between what an employee knows and what the company requires them to know. Such gaps occur because of hiring inexperienced employees who are unsuitable for the job. Due to a staff shortage, businesses are frequently forced to hire employees who lack the necessary qualifications. Employee ambivalence and a lack of proper training exacerbate these gaps. These deficiencies are frequently caused by the changing nature of the market, which necessitates a business constantly revamp itself and upskilling and reskilling employees.

It is essential for a company to quickly identify and close these gaps in order to increase revenue and sales. A worker who lacks the necessary knowledge or skills may cost the company a potential client or customer. Such employees reduce overall workplace productivity, make it difficult to meet targets and goals, and drive business directly to competitors. Employees who do not understand how to do their job efficiently may become demotivated and quit. Critical thinking, attention to detail, communication skills, managing others, and advanced data analysis are some of the critical skills lacking in recent hires, according to Human Resources personnel and hiring managers. Each workplace is unique, and in order to succeed, we must identify the specific set of skills and knowledge that the employees lack. The following figure depicts the steps for identifying knowledge and skill gaps affecting an organization's performance.

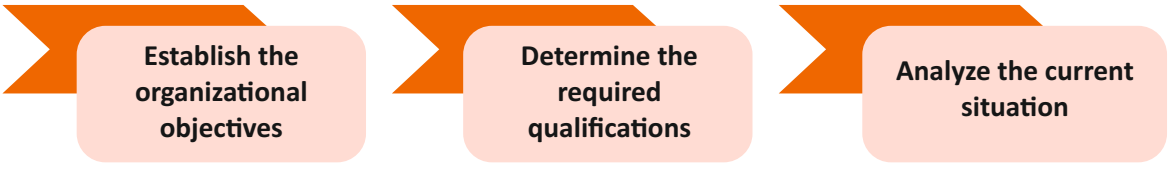

Fig. 5.11 Steps for Identifying Knowledge Gaps

After identifying the knowledge gaps existing in the workplace, the next step is to conduct a skill gap analysis. The following are the steps for skill gap analysis.

Step 1: Identify the Key Performance Indicators

- Key Performance Indicators (KPIs) are measurable values that highlight an organization's effectiveness.
- They can be quantitative, such as revenue or asset returns, or qualitative, such as customer satisfaction scores.
- Identifying the key performance indicators (KPIs) for the company or department is the first step toward accurately measuring employee performance.
- Keeping track of these indicators and metrics will show you where the company is falling short.

Step 2: Make employee assessment

- Along with tracking your employees' performance through KPIs, evaluate their skills through regular assessments and quizzes.
- This can aid in understanding the specific problems that each employee is experiencing to take corrective action.

Step 3: Observe the work environment

- However, assessments alone will not provide a complete picture of the employees' performance.
- As a result, keep an eye on them while they are performing their duties.
- It may help to identify issues that were missed during tests and provide additional information about their skill gaps.

Step 4: Take reviews from employees and customers

- Employee and customer feedback and reviews should be solicited regularly, as this may reveal previously overlooked issues.
- This is significant because it frequently aids in identifying a lack of soft skills such as communication and teamwork.

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- Employee and customer feedback and reviews should be solicited regularly, as this may reveal previously overlooked issues.
- This is significant because it frequently aids in identifying a lack of soft skills such as communication and teamwork.

Step 5: Identify the benchmark top performers

- Recognizing top performers within an organization serves as a model for other employees.
- Organizations can infer skill gaps in other employees by identifying what they are doing well.
- Their performance can be used to train other employees.
- After successfully identifying employee skill and knowledge gaps, determine how to best bridge these gaps.
- This could be accomplished through training, reskilling, or rehiring.
- It would be beneficial if organizations could also identify the root cause of these issues to best address them.

Fig. 5.12 Process for Skill Gap Analysis

Every company and business sector has knowledge and skill gaps. Identifying and closing these gaps, on the other hand, is what can help an organization succeed and increase sales. Identifying skill gaps provides insight into the business, allowing for a reevaluation of strategies and reorganization of the workforce to eliminate weak points. It can also help us improve our recruitment efforts and hire employees who are best suited to the organization. It will prevent losses caused by unsuitable and unqualified employees.

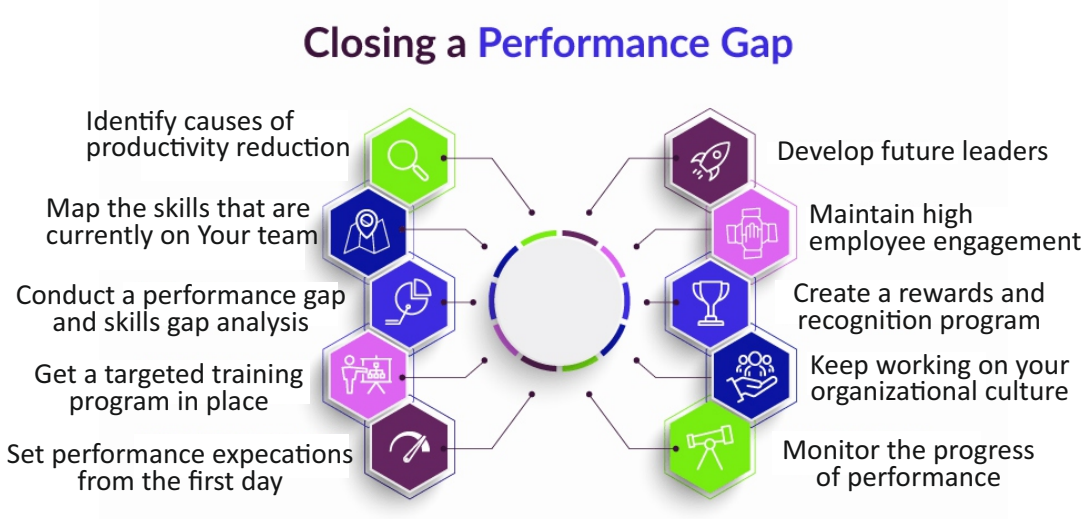

Fig. 5.13 Closing Performance Gap Analysis
(Source: https://www.aihr.com/wp-content/uploads/closing-a-performance-gap-1.png)

After identifying the gaps in the organization, the next step is to take is to close them with corrective measures. Following Gap analysing tools can be used to solve these gaps:

1. SWOT

SWOT analysis focuses on the internal environment's strengths and weaknesses, as well as the external environment's opportunities and threats. It assists in determining the organization's position within the industry or market.

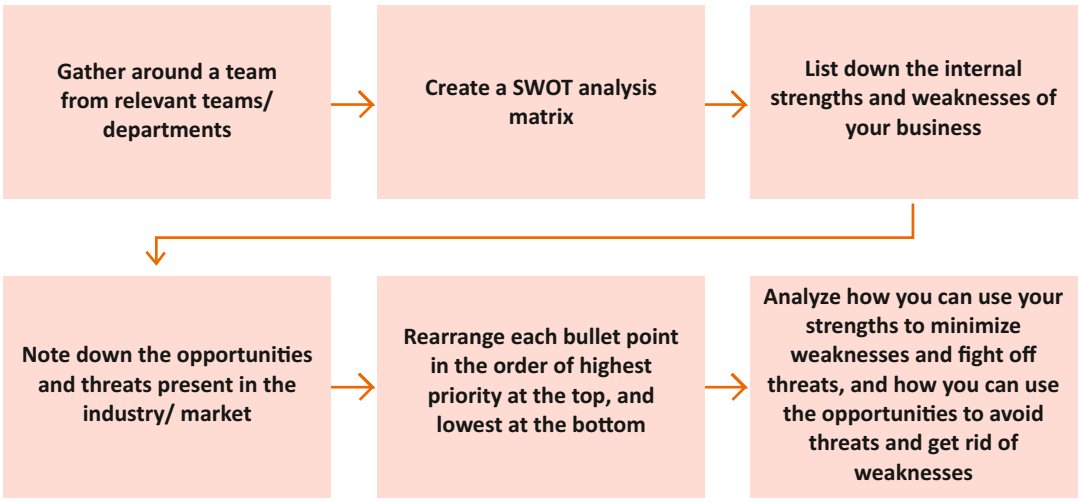

Fig. 5.14 SWOT Analysis Process

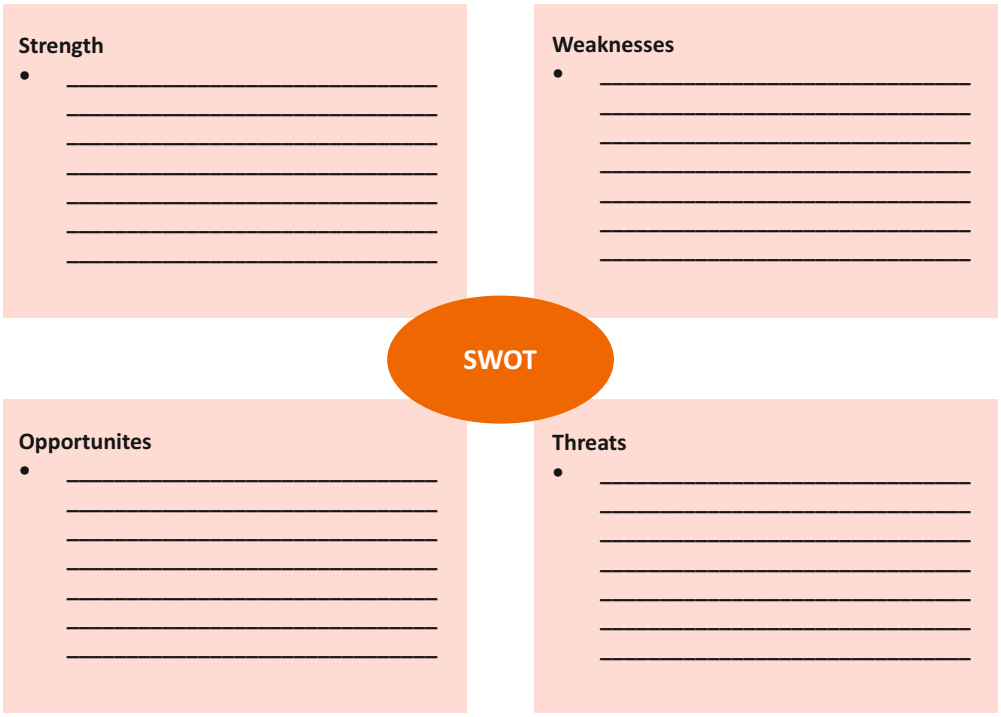

Fig.5.15 SWOT Analysis Template for Gap Analysis

2. McKinsey 7S

McKinsey 7S can assist with the following tasks:

a. To assist in understanding potential gaps in the business

b. Determine which areas should be optimized to improve business performance

c. During a merger or acquisition, align processes and departments

d. Examine the outcomes of future business changes

The 7s refer to key interrelated elements of an organization. They are as follow:

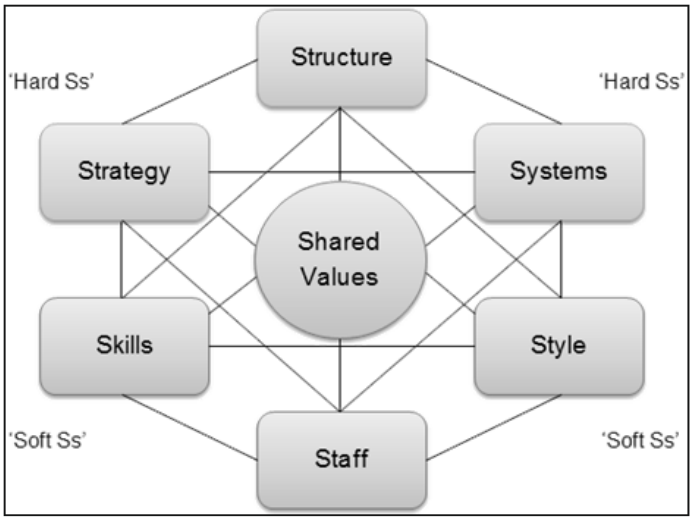

Fig.5.16 McKinsey 7S Model

These elements are classified into two types: hard elements, which are tangible and can be controlled, and soft elements, which are intangible and cannot be controlled.

Hard elements	Hard elements
• Strategy – the plan of actions that will help the organisation to gain a competitive advantage • Structure – the organizational structure • Systems – business and technical infrastructure employees use to do their daily tasks	• Shared values – a set of beliefs or traits the organization upholds • Style – the leadership style of the organization and the culture of interaction • Staff – the general staff • Skills – key skills of employees

Fig.5.17 Elements of McKinsey 7S Model

Steps

- Assemble a competent team
- Examine whether the elements are properly aligned with one another (look for gaps and weaknesses in the relationship between the elements)
- Define the state in which these elements are optimally aligned
- Create a plan of action to realign the elements
- Moving forward, implement the changes and continue to review the 7s

3. Nadler-Tushman's Congruence Model

It is built on the presumption that the performance of a business is determined by four factors: work, people, structure, and culture. The greater the compatibility between these elements, the better the performance.

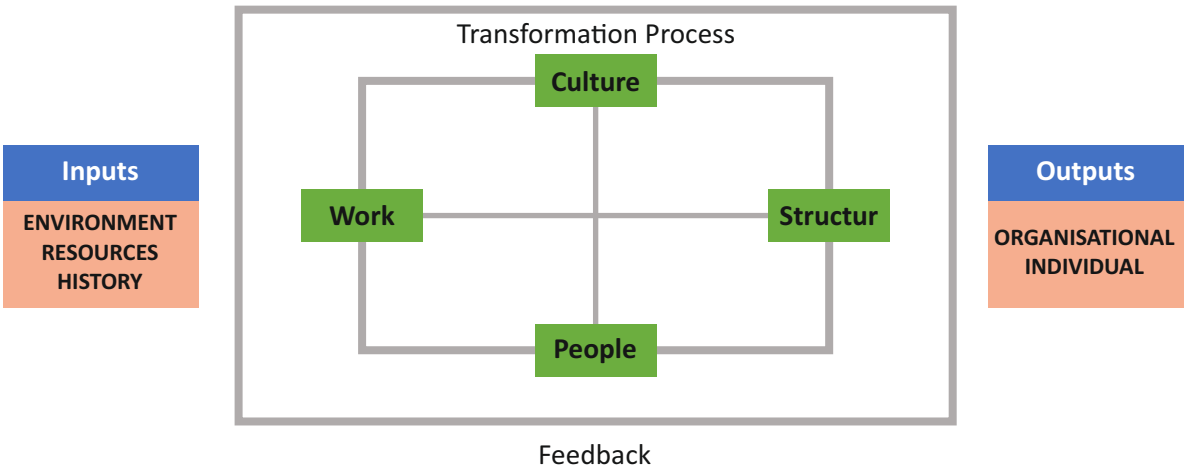

Fig.5.18 Nadler-Tushman's Congruence Model

Steps

- Collect all data that points to poor performance symptoms.
- Specify and analyse inputs such as the environment, resources, and history. Define your organization's strategy as well.
- Determine which outputs are required at the individual, group, and organizational levels to achieve the strategic goals.
- Assess the gaps between desired and actual output, as well as the problems associated with them (and mark down the costs associated with them as well)
- Collect data on and describe the fundamental nature of the organization's four major components.
- Determine the degree of similarity between these components.
- Evaluate the relation between poor congruence and output problems. Investigate whether the poor 'fit' of the four major components is related to the problems.
- Create a plan of action to address the root causes of the problem.

4. **Burke-Litwin Causal Model**

This tool assists you in understanding how the various components of an organisation interact with one another during a period of change. There are 12 interconnected components, which are as follows:

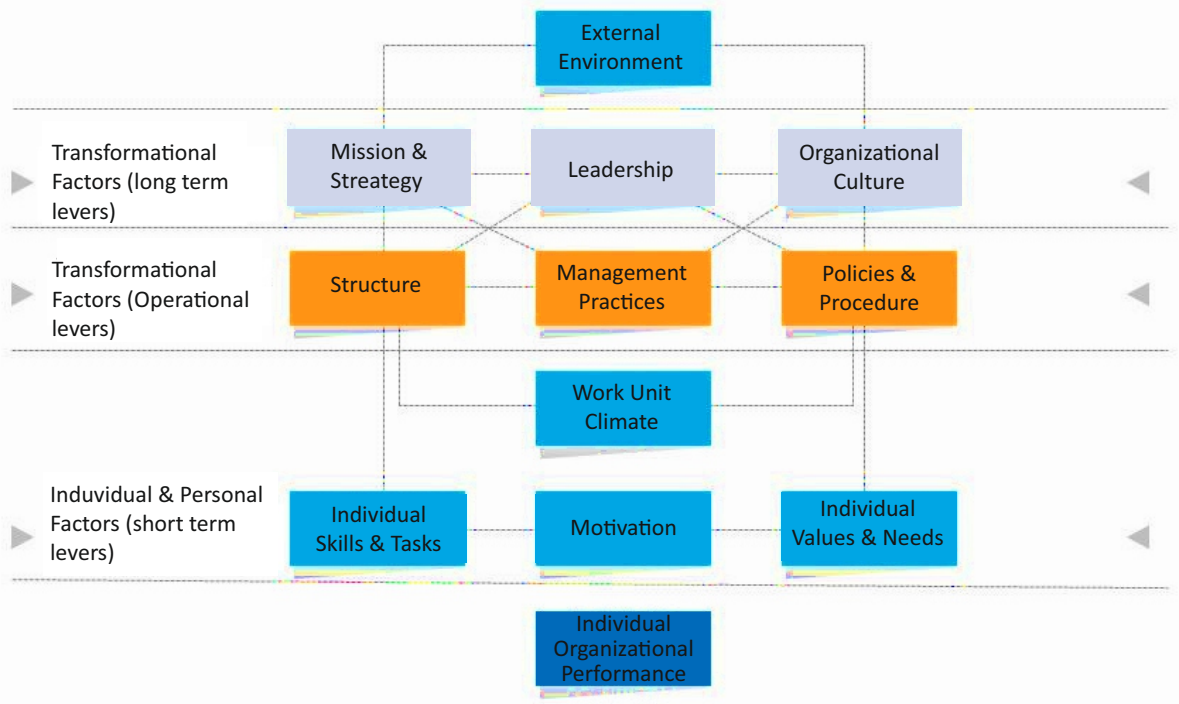

Fig.5.19 Burke-Litwin Diagram

Steps

- Determine where the need for change is coming from: the external environment, transformational factors, and so on.
- Determine which of the elements in each group is to blame for the situation.
- Examine the key element in conjunction with the other eleven elements. Pay close attention to those that are closely related to the identified element.
- Determine the changes that must be made to the main element as well as the few other elements that are closely related to it.

5.2.2 Process of Preparing Training Modules

A training module is a section of an innovative educational course that focuses on a specific topic or goal. Consider it as a book chapter. Each training module or chapter serves as a step in a learner's journey, bringing them closer to the end of the overall course. Overall, it comprises an entire layer of knowledge and tells a complete story. Each module of any complex course may include a number of lessons or learning objects that are even smaller elements of educational content.

A well-defined training module or guide provides a framework that managers can consistently implement with each employee in a specific position. It ensures that each employee has a comparable opportunity to learn the essential aspects of the job.

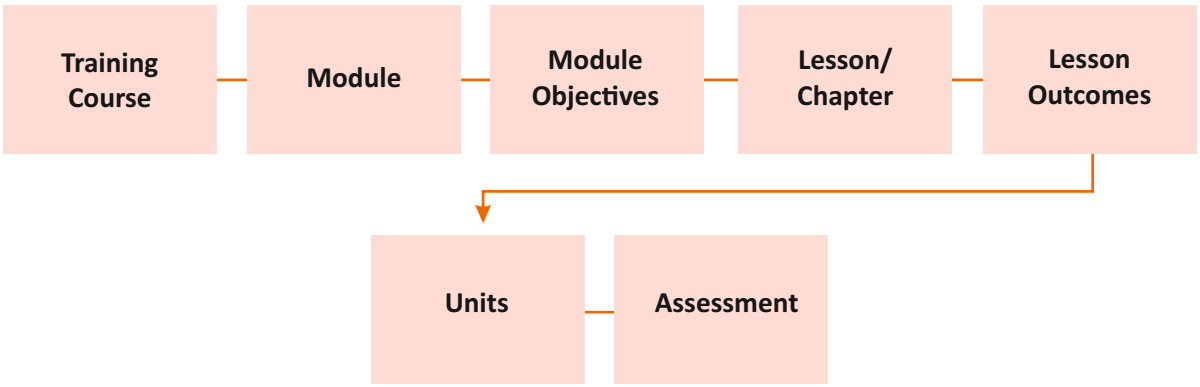

Fig. 5.20 Training Module Structure

Providing a diverse range of content types allows for a more comprehensive and robust training experience for all learners. Let's take a closer look at the various types of training modules to see which formats are the best fit for specific needs.

 Informational e-course	• An informational course is a common training format that consists of a series of slides with text, images, and "Next" buttons. This gives students information on a specific topic.
 Interactive assessment	• Interactive assessments are online quizzes that include a variety of question types, custom branching, and scenarios.

Continued...

 FAQ interaction	• An FAQ interaction is a training module that gives users one-click access to reference information and frequently asked questions.
 Video lecture and screencast	• A video lecture is a recorded instructional video that has been saved for later viewing.
 Dialogue simulation	• Dialogue simulations help the students improve their communication skills by having them engage in realistic conversations with colleagues and customers.
 Micro e-learning module	• A micro e-learning module is a short lesson that addresses a specific problem or question. At the point of need, such a training module can usually be completed in about five minutes. If it is too long, it is preferable to cut it into smaller pieces.
 Digital job aid	• A digital job aid is a document or presentation that is available virtually and that the learner can play, download, save, or print.

Table 5.3 Types of Training Modules

The following figure explains the process of preparing training module step by step:

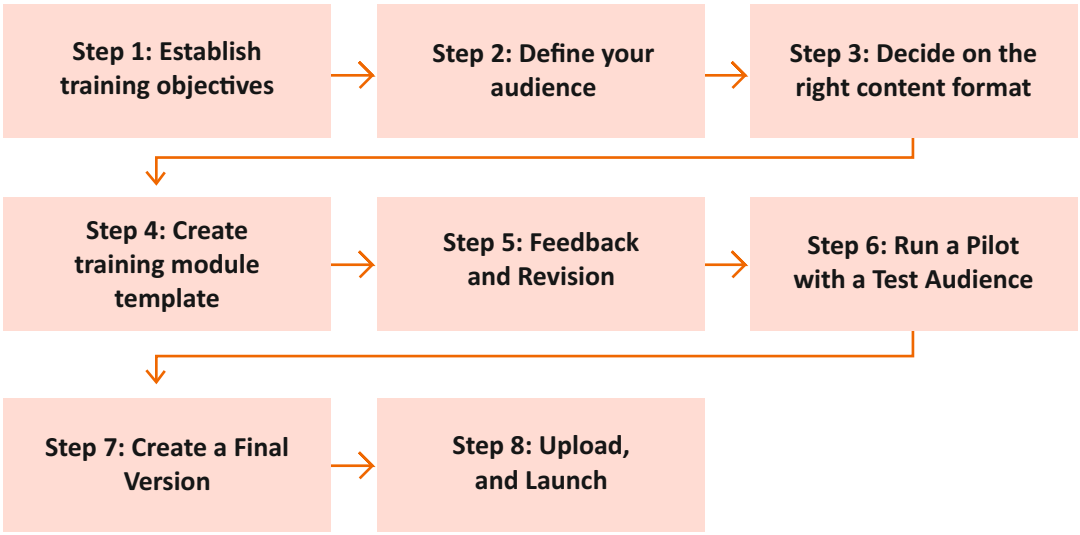

Fig. 5.21 Process for Creating Training Modules

5.2.3 Process of Conducting Workshop, Classroom and Shop Floor Training

Training is critical for organizational growth and success. It benefits both employers and employees of a company. If an employee is properly trained, he will become more efficient and productive. Employee training can lead to increased employee and production efficiencies for organizations.

Employees who receive comprehensive job-related training are less likely to make mistakes that reduce their efficiency and productivity. **Training and development programs** offer numerous advantages. They improve employee performance, productivity, and turnover while also improving company culture. By pursuing a career in human resources, one can learn about the importance of training and development programs for both employees and employers.

A **training workshop** is a type of interactive training in which participants/employee/staff engage in a variety of training activities rather than passively listening to a lecture. A training workshop can sometimes introduce a new concept, inspire participants to investigate it further on their own, or illustrate and promote actual process practice. It is an excellent method for teaching hands-on skills because it allows participants to experiment with new methods and fail in a safe environment.

Employee training workshops can be held for a variety of reasons. They teach essential skills that the employer believes employees must have in order to tackle a new stage of company development, a new project, or an existing problem in the company's work ethic.

A **workshop**, in general, is a single, brief educational program designed to teach or introduce participants to practical skills, techniques, or ideas that they can then apply in their work or daily lives. Most workshops share several characteristics:

1. They're typically small, with 6 to 15 participants, giving everyone personal attention and the opportunity to be heard.
2. They are frequently designed for people who work together or in the same field.
3. They are led by people who have firsthand knowledge of the topic at hand.

The following figure explains step by step instructions to conduct a good workshop.

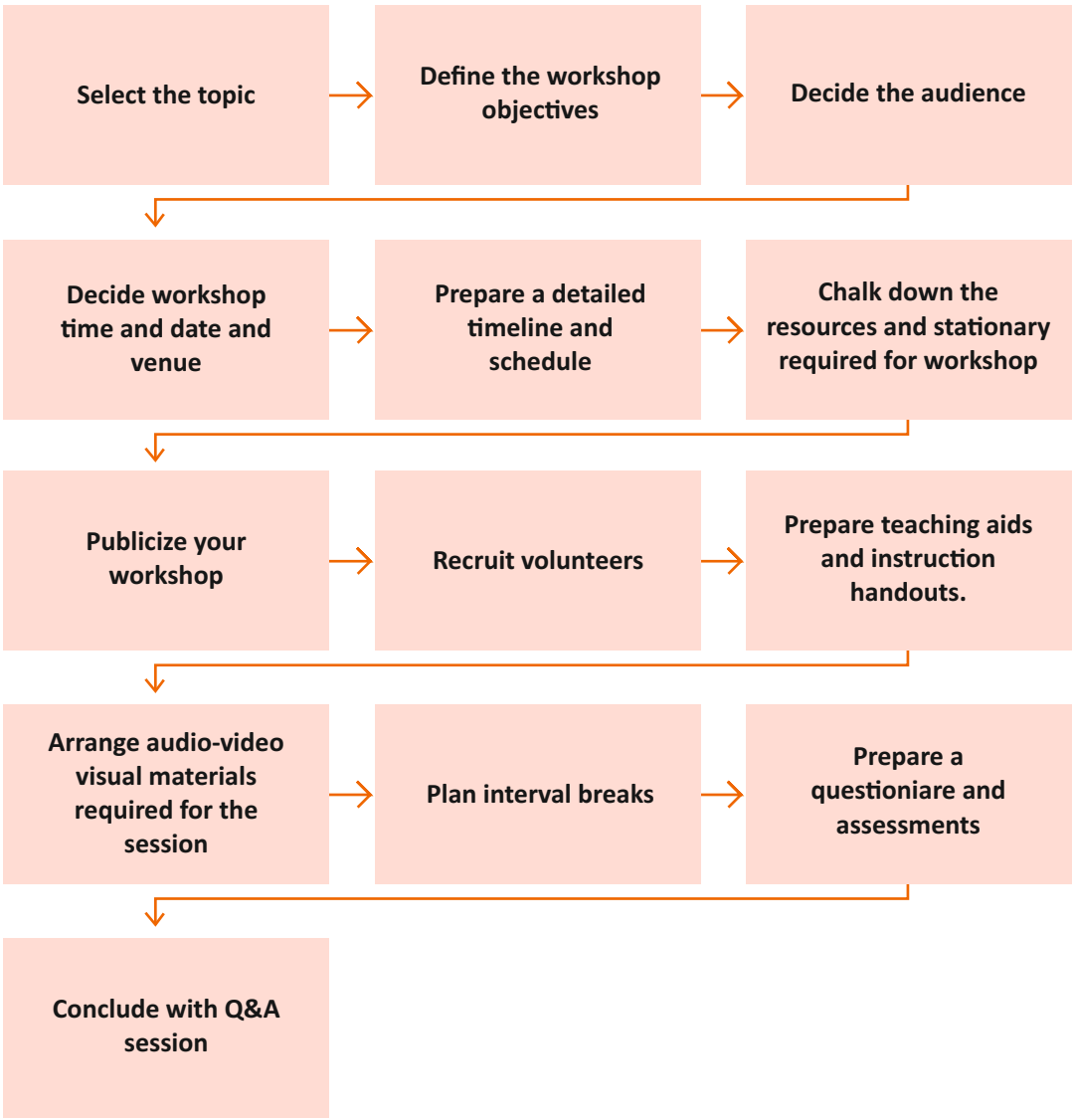

Fig. 5.22 Process for Conducting Training Modules

Summary

- A knowledge problem happens when there is a huge discrepancy between what an employee knows and what the company requires them to know. Such gaps occur because of hiring inexperienced employees who are unsuitable for the job.
- Identifying skill gaps provides insight into the business, allowing for a reevaluation of strategies and reorganization of the workforce to eliminate weak points. It can also help us improve our recruitment efforts and hire employees who are best suited to the organization.
- A well-defined training module or guide provides a framework that managers can consistently implement with each employee in a specific position. It ensures that each employee has a comparable opportunity to learn the essential aspects of the job.
- A training workshop is a type of interactive training in which participants/employee/staff engage in a variety of training activities rather than passively listening to a lecture. A training workshop can sometimes introduce a new concept.

Notes

Exercise

Answer the following questions-

1. What is skill gap?

_____
_____
_____

2. Explain the significance of conducting knowledge gap analysis.

_____
_____
_____

3. Write a short note on SWOT analysis.

_____
_____
_____

4. Explain any two types of training modules.

_____
_____
_____

5. Explain the process of conducting workshop.

_____
_____
_____

Fill in the Blanks-

1. _____ can be held for a variety of reasons.
2. _____ is a short lesson that addresses a specific problem or question.
3. _____ tool assists you in understanding how the various components of an organisation interact with one another during a period of change.
4. _____is built on the presumption that the performance of a business is determined by four factors: work, people, structure, and culture.
5. A worker who lacks the _____ may cost the company a potential client or customer.

Unit 5.3 Drive Quality Initiatives

Unit Objectives

At the end of the unit, the trainee will be able to:

1. Explain the use of the lean manufacturing method to identify ways to optimise the usage of manpower and materials
2. Elaborate the use of the six sigma methods to improve the business processes/ Standard Operating Procedures (SOPs)
3. Describe the process of reengineering the critical business processes to improve the quality of output and reduce production costs

5.3.1 Lean Manufacturing

Lean manufacturing is a production process that maximizes productivity while **minimizing waste** within a manufacturing operation. The lean principle sees waste as anything that adds value to the customers' willingness to pay for it. The benefits of lean manufacturing include **lower production costs, increased output quantity, and shorter production lead times.** The methodology is also known as lean production, the methodology is based on specific manufacturing principles that influence production systems across the world and various service industries. Following are the key benefits of Lean Manufacturing:

Reduce defects and unnecessary physical wastage, including excess use of raw material inputs, preventable defects, costs associated with reprocessing defective items

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Reduce defects and unnecessary physical wastage, including excess use of raw material inputs, preventable defects, costs associated with reprocessing defective items

Fig. 5.23 Benefits of Lean Manufacturing

Lean manufacturing is based on these five principles:

Value

- It is determined from the perspective of the customer and relates to how much they are willing to pay for products or services.
- This value is then created by the manufacturer or service provider who should seek to eliminate waste and costs to meet the optimal price for the customer while also maximising profits.

Map the Value Stream

- It involves analysing the materials and other resources required to produce a product or service with the aim of identifying waste and improvements.

Create Flow

- Creating flow is about removing functional barriers to improve lead times.
- This ensures that processes flow smoothly and can be undertaken with minimal delay or other waste.

Establish a Pull System

- Pull systems determine inventories in advance with production set to meet these sales or production forecasts.

Perfection

- Lean manufacturing requires ongoing assessment and improvement of processes and procedures to continually eliminate waste in an effort to find the perfect system for the value stream.

Fig. 5.24 Principles of Lean Manufacturing

The Lean Manufacturing model recognizes eight types of waste within an operation. Seven of the eight wastes are production process-oriented, while the eighth waste is directly related to management's ability to utilize personnel. Below are the ways to minimize these wastes.

Types of Waste	Remedial Methods
Unnecessary transportation	• Value stream mapping and partial or complete changes in factory layout can reduce transportation waste. • Complete documentation of all the phases of the production flow should be done and not just the mapping of a particular production process. • This will result in changes that will reduce or eliminate transportation waste.
Excess inventory	• Purchasing raw materials only when needed, reducing WIP, and eliminating or narrowing the definition of “safety stock” will reduce this type of waste.
Unnecessary movement of people, equipment, or machinery	• Process mapping should comprise facility layout and optimized workplace design. • It should include an analysis of the distance of motion within the space and the location of parts, supplies, and tools.
Waiting – either people or idle equipment	• Waiting is generally the result of poor process design and can be addressed through proper measurement of Takt time and creation of standard work.
Over-production of a product	• Lean manufacturing systems employ various tools to reduce overproduction. • To balance production rates amongst cells or departments, Takt time is used. • Measured and process-mapped jobs reduce setup time, allowing efficient small batch flow.
Over-processing or addition of unnecessary elements to a product	• Process mapping is a lean waste-elimination tool which helps in defining an optimized workflow that can eliminate over-processing.
Defects that require costly correction	Following are the effective ways to control defect waste: • Formalized document control • Checklists that have been audited to ensure proper adherence to the BOM • Proper design-change documentation • Thorough and documented quality methods in all production phases
Unused talent and ingenuity	• Involving non-utilized staff in the process development will provide them hands-on experience of the reality. Also, incorporating employees' ideas and providing training and growth opportunities will improve their possessed skills.

Table. 5.4 Ways to Reduce Production Wastage

5.3.2 Use of Six Sigma Methods to Improve SOPs

Six Sigma is an accumulation of management tools and strategies that aim to improve business by lowering the risk of errors. This improvement in performance and reduction in process variation aids in the reduction of defects while also increasing earnings, employee morale, and product or service quality. Six Sigma has a simple goal: to provide near-perfect goods and services for company transformation and maximum customer satisfaction. The following figure explains the steps of Six Sigma:

Define
- Describes a defective process to concentrate on, as determined by an examination of the company's goals and requirements.

Measure
- Statistical metrics help understand the process's benchmark performance by creating a list of potential inputs that could cause the problem.

Analyse
- The method involves isolating each input, or potential cause of failure, and testing it as the source of the issue. The team employs analytics to determine the source of process errors.

Improve
- The team works from there to improve system performance.

Control
- The group adds controls to the process to ensure it does not regress and become ineffective once again.

Fig. 5.25 Process of Six Sigma

The 5 Key Principles of Six Sigma

Focus on the customer

Measure the value stream and find your problem

Get rid of the junk

Keep the ball rolling

Ensure a flexible and responsive ecosystem

Fig. 5.26 Principles of Six Sigma

Lean Six Sigma is a data-driven, fact-based improvement strategy that emphasizes defect avoidance over defect discovery. It boosts customer satisfaction and bottom-line results by reducing variance, waste, and cycle time and encouraging work standardization and flow, resulting in a competitive advantage. It applies to any situation where there is a variety of waste, and it should involve every employee.

Implementation of Six Sigma

Six Sigma implementation strategies can differ significantly between organizations due to differences in culture and strategic business goals. An organization has two basic options after deciding to implement Six Sigma:

- **Implement a Six Sigma program or initiative**

Using this method, specific personnel (practitioners) are taught statistical tools regularly and instructed to apply them on the job as needed. If necessary, the practitioners may consult with a statistician. There may be accomplishments within an organization, but they do not build on one another to drive more and better use of the tools and overall technique.

When a company adopts Six Sigma as a program or effort, it often appears that they have simply added a few new tools to its toolkit on the fly through training classes. One extension of this technique is to use the tools as needed on assigned projects. But keep in mind that project selection, management, and execution are all handled by people.

- **Create a Six Sigma infrastructure**

Instead of focusing on individual tools, Six Sigma training should emphasize a process-oriented method that teaches practitioners how to choose the right tool for the right project at the right time. Six Sigma training for practitioners (Black Belts) typically consists of four weeks of instruction spread out over four months, with students working on their projects during the three weeks in between sessions.

Using Six Sigma as a business strategy rather than a tool is the most effective way to get the most out of your Six Sigma training.

Notes

Consider the following Six Sigma deployment benefits via projects that have executive management support:

Offers bigger impact through projects tied to bottom-line results	Utilizes the tools in a more focused and productive way	Provides a process/strategy for project management that can be studied and improved
Increases communications between management and practitioners via project presentations	Facilitates the detailed understanding of critical business processes	Gives employees and management views of how statistical tools can be of significant value to organizations
	Allows Black Belts to receive feedback on their project approach during training	

Fig. 5.27 Benefits of Six Sigma

Using Six Sigma with a closed-loop method, making time for auditing and incorporating lessons learned into an overall business strategy.

Standard Operating Procedure

A set of written instructions that explains the step-by-step process that must be followed to successfully accomplish a typical task is known as a standard operating procedure. To ensure that the organization remains consistent and in accordance with industry legislation and business standards, SOPs should be followed in the same manner every time.

Before creating the SOP, the author(s) should conduct a risk assessment of all the steps in the procedure to identify any potential obstacles and risks connected with those obstacles.

Key questions that should be answered in the standard operating procedure include:

- Who performs what role?
- What does each role do?
- What is the goal or outcome of each person's role?
- Has what needs to happen been explained clearly?

Organizations should develop a list of all their business processes to determine which operations may benefit from a SOP.

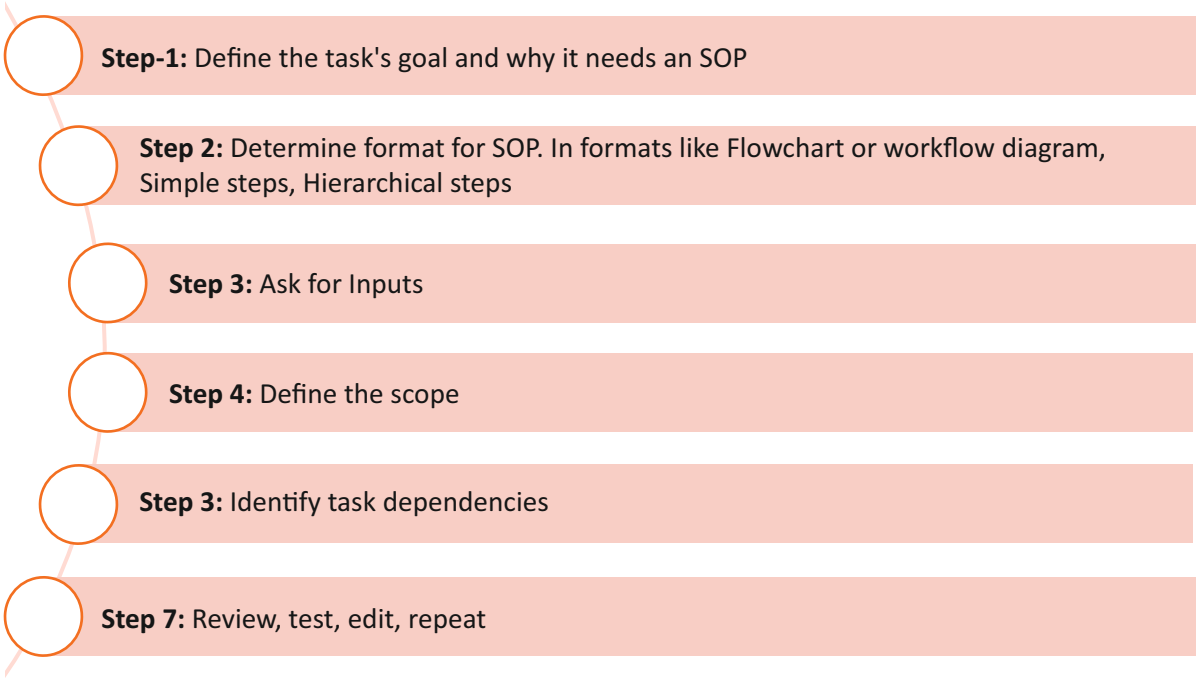

Fig. 5.28 Steps for Creating SOPs

Components of an SOP

Title Page: The procedure's title, specific function, department, team, or agency, its SOP identification number, and the names and signatures of the people who wrote and authorised the manual are all listed.

Table of contents: Provides easy access to the various sections in large SOPs.

A step-by-step list of the procedures: It contains explanations of the task's aim, roles and responsibilities, regulatory requirements, vocabulary, descriptions of what must be done to accomplish each phase, and a discussion of important decisions. This part will account for the majority of the SOP.

SOP best practices

- Establish a standard style and format for all SOPs in the company. Employees will understand the manual if it is written in plain, unambiguous language. Fonts, space, layout, and visuals should all be carefully selected.
- Employees should be able to quickly find information in the SOP. This can be accomplished by including a table of contents.
- Keeping all SOPs in one place is best accomplished by posting them online. This makes it easy to make any necessary modifications or updates, and it guarantees that staff knows where to get the information they require.
- Developing a routine for reviewing and maintaining the SOPs ensures that they remain current and error-free. SOPs should evolve and grow with the company. SOPs that are outdated are useless.
- Make a plan to distribute the SOP to staff and instruct them on how to follow it. Regular training, in addition to the initial orientation, are beneficial since they guarantee that all staff are aware of and understand the most current practices.

Uses of a standard operating procedure

Organization can better understand their business processes and find areas for improvement by using standard operating procedures. Use a SOP for the following reasons:

Fig. 5.29 Importance of using SOPs

Notes

5.3.3 Process of Reengineering to Improve the Quality Output & Reduce Costs

Business process re-engineering is the drastic rethinking of business processes to produce significant improvements in important factors such as quality, output, cost, service, and speed. Business process reengineering (BPR) aims to significantly reduce company costs and process redundancies.

Organizations reengineer two critical areas of their operations. First, they employ cutting-edge technology to improve data dissemination and decision-making processes. They then transform functional organizations into functional teams.

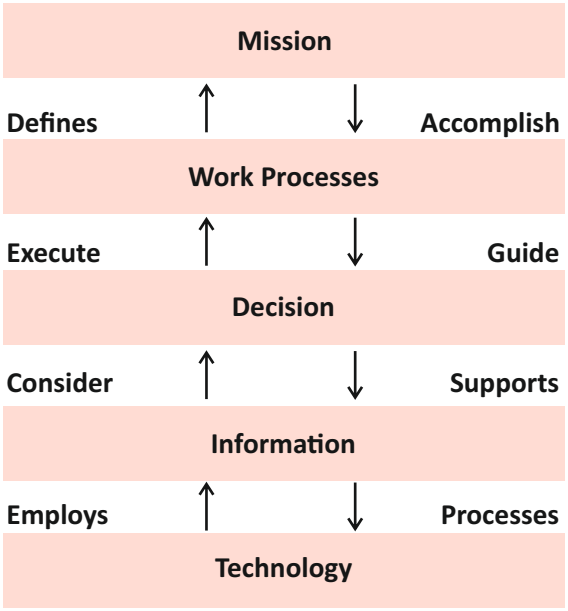

Fig. 5.30 Process-flow of Business Process Reengineering

Business Process Reengineering is a dramatic change initiative that contains five major steps that managers should take:

- Refocus company values on the demands of customers
- Redesign key processes, frequently with the help of information technology.
- Restructure a company into cross-functional teams that are responsible for the entire process.
- Consider fundamental organisational and personnel challenges.
- Streamline corporate operations across the board.

Fig. 5.31 Important Key notes for Manager in Business Process Reengineering

Uses Business Process Reengineering to:

Reduce costs and cycle times: Process management reduces costs and cycle times by eliminating inefficient operations and the personnel who perform them. Management layers are eliminated, information flows are accelerated, and errors and rework caused by multiple handoffs are eliminated.

Improve quality: Business Process Reengineering improves quality by eliminating task fragmentation and establishing clear ownership of processes. Workers take responsibility for their work and can evaluate their performance based on timely feedback.

The Six Key Steps of Business Process Reengineering

1. **Map the current state of your business processes:** Collect information from various sources, including software tools and stakeholders. Recognize how the process is currently performing.
2. **Analyze them and find any process gaps or disconnects:** Identify all mistakes and delays that prevent the process from running smoothly. Verify that all details are available in the appropriate steps for stakeholders to make rapid decisions.
3. **Look for improvement opportunities and validate them:** Check to see if all of the steps are required. Remove the step that just serves to inform the person and replace it with an automatic email trigger.
4. **Design a cutting-edge future-state process map:** Make a new procedure that addresses all of the issues you've discovered. Don't be hesitant to create a completely new method that you know will work. Every phase of the process should have its own set of KPIs.
5. **Implement future state changes and be mindful of dependencies:** Notify all stakeholders of the revised procedure. Proceed only after everyone is on board and well-informed about the new procedure. Constantly monitor the KPIs.

5.3.4 Use of New Advanced Tools & Technology to Improve Business Processes

Technology's role in business cannot be overstated. Emerging technologies are being used by businesses all over the world to increase their competitive edge and drive strategy and growth. We can no longer imagine doing business without the Internet, video conferencing, project management software, and other technological advances. In reality, the importance of technology in business will only grow. This fact necessitates, if you haven't already, introducing technology into your procedures. It, now is the time to learn about technology, and here are some tips on how to do so.

Few reasons why technology is important for businesses:

1. Communication	Interactions within your team, with clients, potential customers, investors, or the general public are all examples. Video conferencing technology such as Skype and Zoom enable meetings to take place across geographical boundaries. Within your company, a software like Slack or Asana can help you streamline communication.
2. Security	With the rise of cyber-crime and data breaches, all businesses must prioritize security. Today, the majority of company assets are kept in the cloud or on endpoints. As a result, businesses must take extra precautions to protect their own and their customers' data.
3. Efficiency	Technology aids in the improvement of system, product, and service efficiency. It aids in the tracking and streamlining of procedures, as well as the management of contacts and staff records. In fact, increasing operational efficiency helps the company save money while also allowing it to expand quickly.
4. Employee assistance	The majority of employees feel compelled to use the most up-to-date technologies in order to offer the greatest results. To improve results, businesses must think about the cost-output connection and deploy appropriate technology.
5. Time and money	There's no denying that technology allows organisations to accomplish more in less time without sacrificing product or service quality. In reality, technology is currently taking over duties that were formerly undertaken by humans. This helps by lowering personnel costs or directing them to areas where they are most required.

Table 5.5 Importance of Technology in Businesses

To get the most out of technical tools, businesses must have a thorough understanding of them. Companies can use management information systems to keep track of their data, sales, productivity levels, and expenses. Data can also be used to identify areas for improvement as well as growth potential.

Tools and technologies to aid evolve business growth:

Emerging technology is exciting, especially when it gives a field unexplored promise. Companies who recognize this are investigating how this technology can benefit them. Business development leaders must create and implement solutions that will lead to workplace evolution.

1. **Automation and Multi-Experience Interfaces:** Automation and the emergence of multi-experience interfaces will pave the way for increased democratization of technology capabilities and human enhancement. These developments, on the other hand, promote dependency and a more intrusive integration of technology into people's life. This raises problems about digital ethics, privacy, and trust.
2. **Augmented Reality Sales Tools:** Internal efficiencies, reduced contact time, improved customer experience, and more consumer confidence are all benefits of using such solutions. Users of a developing augmented reality sales tool can insert customized films in emails, keeping person-to-person interactions even when they take place digitally.
3. **Voice Search:** Companies that understand customer preferences and how technology advances will be successful. The rise of voice search via tools like Siri and Alexa is a fantastic example. People search in a different way when they speak rather than type.
4. **Virtual Experience Tools:** To create a healthy work atmosphere, the capacity to recreate face-to-face interactions is critical. Organizations may create that face-to-face experience with platforms like Zoom, and Slack provides a more informal environment for pinging a colleague than the more traditional manner of emailing. Organizations should implement similar technology in light of Covid-19's uncertain future.
5. **Customer Segmentation Workflow:** Customers must be segmented using workflows. The tools being created for sales professionals can help you figure out where you should spend your time by using patterns to identify likely potential clients.
6. **Intent Intelligence Platforms:** Business development professionals must separate the wheat from the chaff, therefore utilizing a new intent intelligence platform can help them do so. This occurs not only because time is money, but also because a business development expert will be more relevant, personable, and helpful if they understand a customer's needs or objectives.
7. **Collaborative Work Management Software:** Collaboration work management software (CWM) like Asana, Wrike, and others is an emerging technology for establishing a business. With the rise of remote working and cross-functional teams, you'll need simple, adaptable solutions to coordinate and track work throughout the organization. CWM improves visibility and reduces meetings.
8. **Data Catalogs:** The goal of business development is to connect the dots across an organisation. Data silos within departments obstruct having a complete picture of the business. Data catalogues are a new category of solutions that can help you properly break down silos by preserving sensitive data while still connecting diverse data sets and roles.

Notes

Advanced Technology Examples to Improve Your Business

Robotic Process Automation (RPA)

- RPA is an excellent example of an advanced technology solution for SMBs.
- Bots are bits of software that have been programmed to execute certain activities such as data entry, supply chain management, and data collection.
- Bots can perform these difficult activities without assistance 24 hours a day, seven days a week, and make fewer errors than humans.

Document Data Extraction

- Automated document data extraction signficantly reduce time spet on processing
- Productivity is improved, with employees freed up to focus on other tasks
- Greater accurancy and faster results compared to performing the same taks manually
- Operational and labor costs are reduced meaning much improved cost effectiveness
- Employees can save numerous hours of time by extracting data from documents.
- Purchase orders, client documents, customer records, and invoices may all be scanned quickly and accurately for information, enhancing data validation.
- DocuWare, for example, is increasingly able to supply these functions to SMBs in their entirety while keeping costs low.

Workflow Tools

- Workflow tools, particularly cloud-based solutions, are great for organising work processes and projects inside groups.
- These solutions also support management best practises including approval routing, data validation, and guaranteeing data integrity before it enters your ERP system.

AI Assistants

- People are using chatbots for customer support in greater numbers than ever before, and businesses are increasingly using them.

Low-Code Applications

- Low-code development refers to app-building technologies that can handle or optimise difficult and specific tasks—as it's simple as dragging and dropping and takes a fraction of the time of traditional development.

Fig. 5.32 List of Advanced Technology Tools for Businesses

Summary

- Lean manufacturing is a production process that maximizes productivity while minimizing waste within a manufacturing operation. The lean principle sees waste as anything that adds value to the customers' willingness to pay for it.
- The Lean Manufacturing model recognizes eight types of waste within an operation. Seven of the eight wastes are production process-oriented, while the eighth waste is directly related to management's ability to utilize personnel.
- Six Sigma is an accumulation of management tools and strategies that aim to improve business by lowering the risk of errors.
- A set of written instructions that explains the step-by-step process that must be followed to successfully accomplish a typical task is known as a standard operating procedure. To ensure that the organization remains consistent and in accordance with industry legislation and business standards, SOPs should be followed in the same manner every time.
- Business process reengineering (BPR) aims to significantly reduce company costs and process redundancies.
- Business Process Reengineering improves quality by eliminating task fragmentation and establishing clear ownership of processes. Workers take responsibility for their work and can evaluate their performance based on timely feedback.
- We can no longer imagine doing business without the Internet, video conferencing, project management software, and other technological advances. In reality, the importance of technology in business will only grow.
- Emerging technology is exciting, especially when it gives a field unexplored promise. Companies who recognize this are investigating how this technology can benefit them. Business development leaders must create and implement solutions that will lead to workplace evolution.

Notes

Notes

QR Code

Scan the QR Code to watch the related video

youtube.com/watch?v=gixa9MHNPaM

5.3.1 Lean Manufacturing

youtube.com/watch?v=4EDYfSl-fmc

5.3.2 Use of Six Sigma Methods to Improve SOPs

youtube.com/watch?v=_2K-txcDteU

5.3.4 Use of New Advanced Tools &
Technology to Improve Business Processes

Exercise

Answer the following questions-

1. What is lean manufacturing?

2. Explain Six sigma methods and its process in detail.

3. What is reengineering in business processes?

4. Explain the principles of lean manufacturing.

5. Explain the process of creating SOPs in an organization.

6. Explain the importance of using SOPs.

7. Why technology is important in businesses?

8. Explain any two advanced technology tools used in various businesses.

Skill India
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National
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Transforming the skill landscape

ESSCI
Skilling India in Electronics

6. Soft Skills and Work Ethics

Unit 6.1 - Work and Communicate effectively at workplace

Unit 6.2 - Work in a disciplined and ethical manner

Unit 6.3 - Uphold social diversity at the workplace

ELE/N9905

Key Learning Outcomes

At the end of this module, the trainee will be able to:

1. Work effectively at the workplace
2. Implement the practices related to gender and PwD sensitization

Unit 6.1 Work and Communicate Effectively at Workplace

Unit Objectives

At the end of the unit, the trainee will be able to:

1. State the importance of effective communication and interpersonal skills
2. Explain the importance of conveying information/instructions as per defined protocols to the authorized persons/team members
3. Discuss ways of dealing with heightened emotions of self and others
4. Explain the importance of working as per the workflow of the organisation to receive instructions and report problems

6.1.1 Significance of Effective Communication & Interpersonal skills

Effective communication is required for all employees in the organization to perform basic management functions and carry out their jobs and responsibilities. The ability to communicate effectively at work is essential regardless of industry. Effective communication entails more than just exchanging information; it also encompasses the emotion and intentions behind the facts and conveying a message. Therefore, communicating more clearly and effectively requires learning some essential skills. Learning these skills can assist employees in developing stronger bonds, gaining more trust and respect, improving teamwork, problem-solving, and overall social and emotional health. As a result, we can state that "effective communication is a foundational component of successful organizations."

Build strong professional relationships with co-workers and clients	Helps to express thoughts and convey clear message	Manage and assist the team where required
Motivate and boost teamwork and lead to better project collaboration	Enhance leadership and negotiation skills	Bridge gaps between clients, colleagues, and partners
Recognize each others' good work and give constructive feedback	Resolves issues and conflicts	Improve productivity by sharing information and ideas

Fig. 6.1 Importance of Effective Communication and Interpersonal Skills

It is extremely difficult for Quality Managers to manage their teams and coordinate efforts for successfully completion of a project without strong interpersonal communication skills. A project cannot be successful if there is no communication. Without effective communication skills, dealing with all of the intricate details, dependencies, decisions, and approvals that a project entails would be impossible. The Quality Manager must possess following interpersonal communication skills.

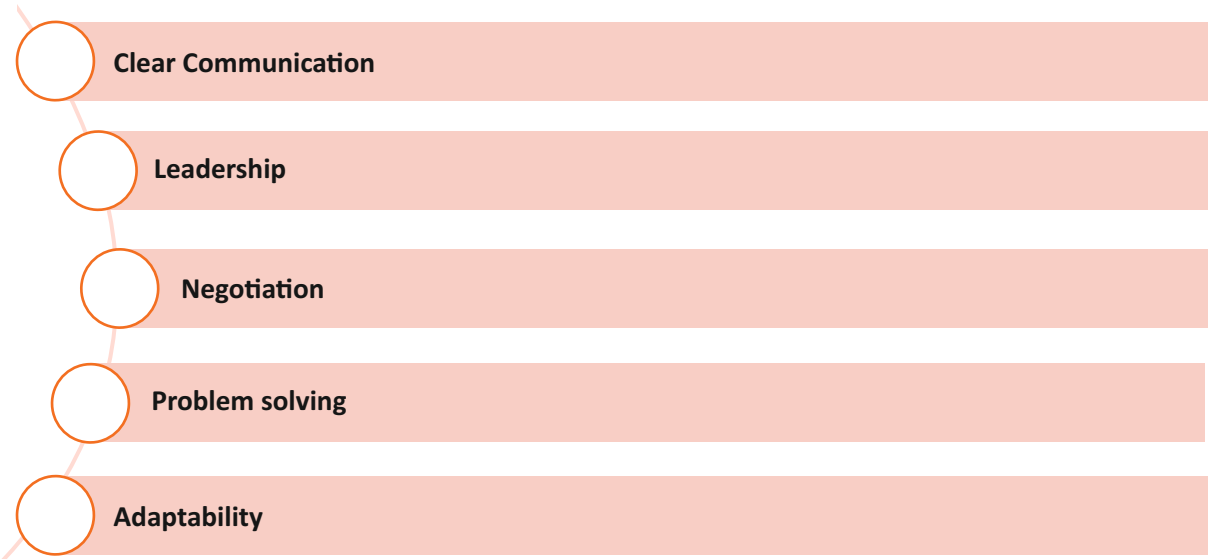


Fig. 6.2 Interpersonal Communication Skills of Quality Manager

6.1.2 Communication Process

The process of communication is a dynamic structure that explains how a message is transmitted between a sender and a receiver via various communication channels. Its purpose is to ensure that the receiver accurately decodes the message and can provide feedback with precision and convenience.

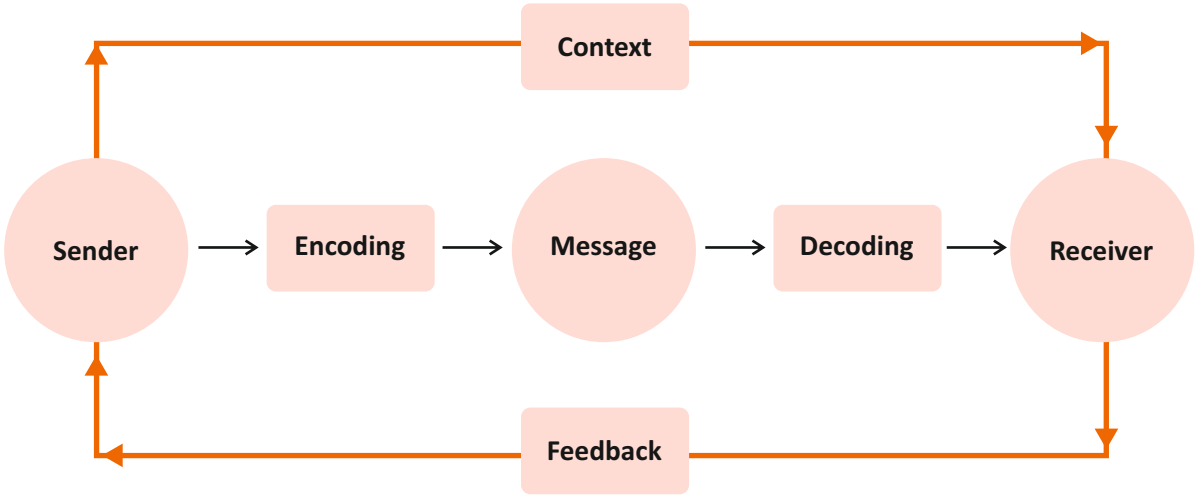


Fig. 6.3 Process of Communication

As demonstrated in the exhibit above, there are 8 elements of communication:

Sender
Who sends the message or is the source of the message.

Encoding
Transferring the message into a format that can be shared. It includes the language or tone chosen.

Message
The idea being communicated by the sender.

Channel
The mode chosen for communicating. Example- phone, oral, text, gestures, or writing.

Decoding
It means how the sender comprehends and understands the message that sender has communicated

Receiver
The idea being communicated by the sender

Feedback
The revert or the response communicated by the receiver to the source/sender after having decoded the message

Context
The environment, situation, or the circumstances in which the communication is happening

Fig. 6.4 Elements of Effective Communication

4.1.3 Communication Barriers

All of the elements depicted above can also act as a barrier to communication. Communication barriers are factors that prevent a message from being received in the way the sender sent it. People frequently face the problem of the message being received in an assumed manner when communicating. As a result, it leads to miscommunication and misunderstandings. Let us look at the table below to understand four significant barriers to communication.

Communication Barriers	
	**Physical or Environmental Barriers** • The barriers in the surroundings or in the environment are the physical barriers. • Example- Noise in the surroundings, the physical distance between the sender & receiver, defects in the communication system like network problems, poor signal, etc.

Continued...

Communication Barriers	
	**Language Barriers** • This barrier arises due to the different language or differences in the language of the sender and receiver. • This problem often occurs because of the different meanings perceived in the same word, or the receiver does not understand the jargon used in the message. The language barrier is not limited to spoken language. It also includes body language. • The same message is perceived differently by the receiver said with different body language.
	**Psychological Barriers** • Barriers or problems arising due to the differences in perception, ego clashes, prejudices, state of mind, poor past experiences, behaviors, attitudes, moods, and value systems are psychological barriers. • These barriers are generally exceedingly difficult to overcome.
	**Socio-Cultural Barriers** • Sometimes the differences in social or cultural norms cause communication problems. • These include how the people generally speak, wear, follow customs, behave, or eat is not completely understood by the receivers who are not accustomed to the differences. • For example, some communities are louder and more extravagant than others.

Table. 6.1 Potential Barriers in Communication

6.1.3 Significance of Effective Communication with Team members

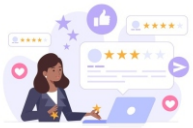
It is significant to convey information as per defined protocols to the authorized person's/team members, as it reduces communication gaps, strengthens alignment with all levels of leadership, and ensures that employees receive consistent messages. The Communication Protocol specifies the types of information to be communicated to the organization, as well as the person(s) in charge of communicating specific topics. The audience, frequency, and suggested communication vehicles are also discussed. The Protocol, which is prominently displayed in all common areas such as lobbies and conferences, and is distributed to all new hires, ensures that communications align with the company's key strategic priorities.

Effective communication with the supervisor is essential for professional development and advancement. Refer to the exhibit below for tips on communicating with the supervisor effectively.

Listen to your supervisor carefully and understand the goals and requirements

Report the facts and problems and ask for possible solutions if necessary

In case of an unsuccessful attempts, highlight it to the supervisor rather than covering it up



Stay open to feedback and keep a positive attitude

Inform immediately about any situation that needs attention

Follow the code of conduct that has been established by the organization

Igreet the supervisor with a smiling face

Don't argue with the supervisor in front of other employees

Concisely put your point of view, concerns, and requests in a polite and respectful manner

A loud voice tone suggesting impatience, sarcasm or taunt, is not acceptable by anyone

I Avoid words and topics which may offend someone

Communicate regularly with your supervisor to develop and maintain a successful professional relationship

Fig. 6.5 Effective Communication with Superior

Following proper communication, rules are critical to keeping a **healthy relationship with colleagues and co-workers.** The quality of the relationship with colleagues and co-workers will depend on the behavior you demonstrate while interacting with them. A relationship built on trust, excellent, clear communication, polite language, and appropriate behavior helps you succeed at work.

Greet everyone with a smile and positive body language.	**Listen actively and avoid jumping to conclusions**	**Offer help to a new colleague in your crew**
Show courtesy and respect to colleagues	**Speak in a polite and respectful tone**	**Make an eye contact while you speak**
Use positive words and body language	**Appreciate each other's work**	**Learn from your team members and collaborate with them**
Keep commitments made to your colleagues or team members	**Inform your colleagues in case of delay in the work**	**Do not be a grump. Leave your bad mood out of the worksite**
Do not engage in any kind of gossip	**Do not disturb others when they are working**	**Do not waste your time and others' time by holding conversations which are not related to work**
Do not interrupt when the other person is speaking. Wait for them to complete	**Avoid controversial conversations**	

Fig. 6.6 Effective Communication with Colleagues

6.1.4 Organizational Communication

Organizational communication can be divided into two categories: formal and informal communication.

1. **Formal communications** are those that are official and are part of a recognized communication system that is involved in the organization's operation. These communications can be either verbal or written.

   a. It can take place between a superior and a subordinate, or between a subordinate and a superior, administratively or externally.

   b. It can happen outside of the organization, i.e. with suppliers, clients, unions, government agencies, and community groups.

   c. It can sometimes be obligatory, indicative, or informative. Mandatory communication implies an order or command to be followed and is known by various euphemisms such as instructions, briefing, and so on.

   D. This type of communication is mostly vertical and usually one-way from top to bottom. Indicative or explanatory communication can occur at any level and may be vertical or horizontal.

2. **Informal communications** emerge from the social interactions of coworkers. These are bound by conventions, customs, and culture rather than any chart on the wall. In the form of grapevine, such communication provides useful information for upcoming events.

Any communication style is only effective if the listener actively listens, observes, and empathizes. In an organization, four major types of communication are used on a daily basis:

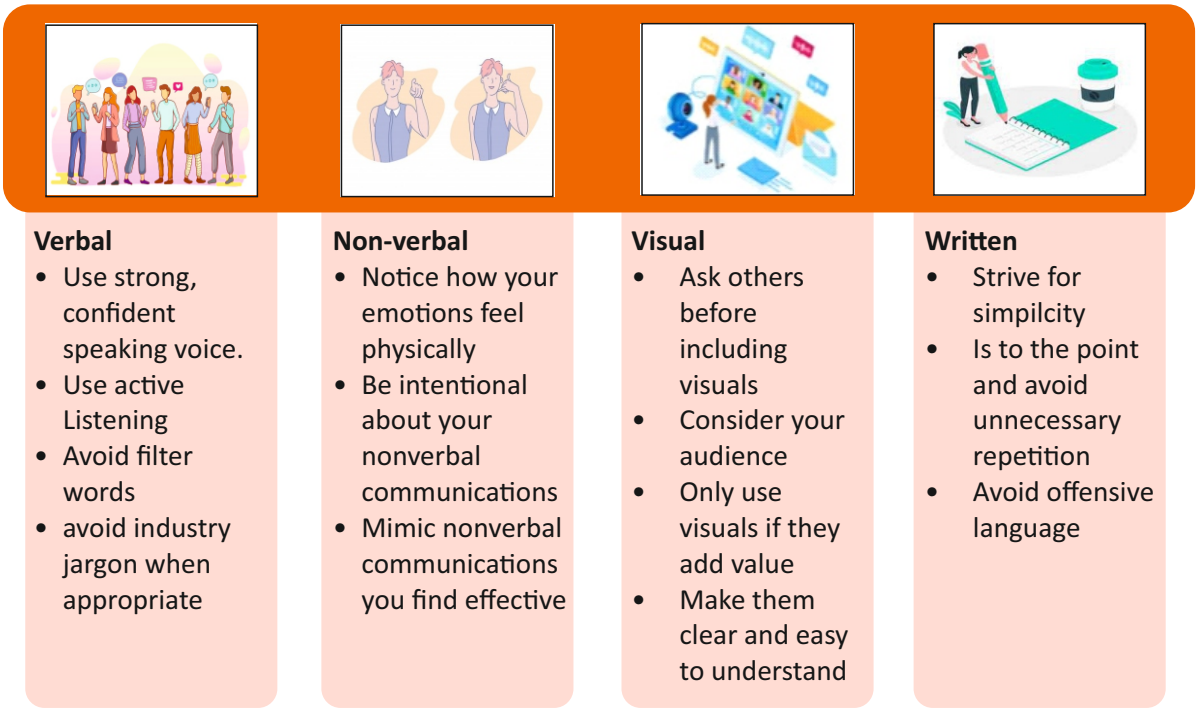


Fig. 6.7 Types of Communication and Ways to Use Them

6.1.5 Managing Emotions at Work

Humans are emotional beings. It is difficult for us not to be emotional. While it is generally beneficial to be in touch with our emotions and not suppress them, there are some situations in which we must manage our emotions especially well. This is especially true at work. Emotional outbursts at work could be caused by work-related issues or by stressors from our personal lives spilling over into our work lives. Handling our emotions (especially negative ones) at work is frequently regarded as a test of our professionalism. Although, it is never good to repress or suppress emotions, whether positive or negative. However, in order to function in a variety of situations, we must manage our emotions. The following are some coping strategies to deal with heightened emotions at work.

Fig. 6.8 Strategies for Coping with Heightened Emotions at Work

6.1.6 Organizational Structure

An organizational structure is a system that defines how specific activities are directed in order to achieve an organization's goals. These activities may include rules, roles, and responsibilities. The organizational structure also governs how information flows within the company. There are numerous types of organizational reporting structures, each with its own set of benefits and drawbacks. The reporting structure is chosen based on the organizational requirements. The following are the top organizational reporting structures.

Hierarchical organizational structure

- It is a pyramid-like top-down management structure.

Functional organizational structure

- It is a business structure that divides a company into departments based on areas of expertise.

Divisional or product organizational structure

- In a product-based structure (also known as a divisional structure), employees are assigned to self-contained divisions based on the -market, product line and geography.

Line-and-staff organizational structure

- In this structure, authorities (e.g., managers) establish goals and directives that are then carried out by employees and other workers.

Flat organizational structure

- A flat organizational structure means that there are few (if any) levels of management between the workforce and the highest-level managers.

Matrix organizational structure

- A matrix organization is a work structure in which team members report to multiple leaders.

Network organization structure

- It is a type of internal structure that prioritizes communication and relationship goals over hierarchy.

Fig. 6.9 Types of Organizational Structure

6.1.6 Importance of Working as per the Organization's Workflow

Workflow, in a broad sense, is the set of tasks—grouped chronologically into processes—and the set of people or resources required to complete those tasks to achieve a specific goal. The workflow of an organization consists of the processes that must be completed, the people or other resources that are available to perform those processes, and the interactions between them.

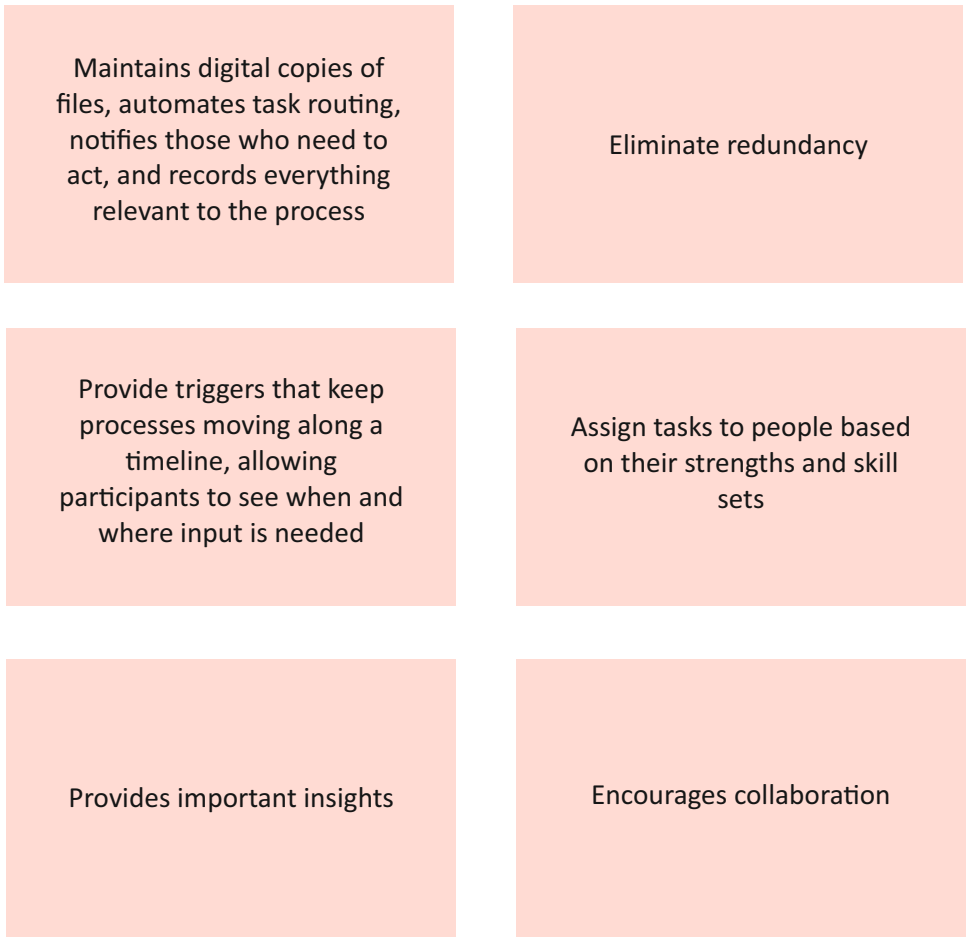


Fig 6.10 Importance of Working as per the Organization's Workflow

Notes

6.1.7 Organizational Communication Policies and Procedures

Communication is a vital management component of any organization. Effective communication is a critical issue for effective management, whether the purpose is to update employees on new policies, prepare for a natural disaster, ensure safety throughout the organization, or listen to employees' attitudes. To attain success, organizations should have comprehensive policies for communicating with their, employees, stakeholders, and the community at large. With a formal, defined and comprehensive communication strategy, organizations can make sure that they:

1. Communicate consistent messages
2. Establish a distinguishable brand
3. Deliver messages that are congruent with the organization's mission, vision, and culture

Communication policies of an organization establish expectations and manage the flow of communications within and outside the organization. As a result, it facilitates meaningful and necessary communication for employee productivity and morale without restricting employees' feeling intimidated and powerless. In addition, good communication policy, reduces conflicts and misunderstandings.

An organization has many channels for communication, running internally and externally. It is imperative to regulate these channels for the sake of business interests. Therefore, communication policy and procedures need to be written out in clear, straightforward language for all the employees. When outlining these communication policies and procedures, it is essential to consider existing policies and regulations that must comply with the organization. It is important for a workplace where employees need to understand proper lines of communication and behavior with one another. Communication policy and procedures guide the employees for handling information, either outgoing or incoming, that pertains to the organization. It focuses on spreading important news and information to other co-workers, customers and stakeholders. Creating clear rules avoids liability issues and embarrassing or damaging situations in the organization.

1. **Procedures for verbal communication -** It is essential to communicate well verbally to understand what others are saying to you. Following are the key points when communicating verbally in an organization:

a. Employees should speak clearly and listen carefully when communicating with each other. If it is not clear, ask the person to repeat it or explain what they mean.

b. Speak clearly and slowly to deliver the correct message. Avoid speaking quickly or in a mumbling tone. Repeat the message to make sure it is right.

c. Pass on the urgent messages as soon as possible. If the person is busy, then then wait for your chance to speak. On the other hand, if the message is very urgent, inform them politely.

2. **Procedures for written communication -** Most workplaces have standard writing methods. They have special forms or layouts to use. These are sometimes called 'templates'. Using these is part of the organizational procedure. Each employee must use these standard layouts for written communication. For example, writing e-mails, letters, memos, faxes and messages and other office tasks. Below are the key points when using written communication in an organization:

a. Keep it simple. Make your sentences, paragraphs, and the overall document as short and concise as possible.

b. Strive for clarity

c. Keep it in a structured form

d. Use appropriate tone

e. Give the right amount of detail

f. Give copies to everyone concerned

6.1.8 Sharing Information with Team Members

In the workplace, information drives communication, and communication, in turn, allows all members of the organization, from entry-level employees to the CEO, to work together to achieve the company's goals and maximize productivity. Transparently sharing data and information ensures that everyone is in the loop and aware of any potential issues with the business, product, or service that can be addressed collaboratively. Employees might have lots of knowledge that is crucial for the organization and other employees. **Sharing information helps them connect, perform better, and become more vital as professionals.** The following chart explains the importance of sharing information with team members in an organization:

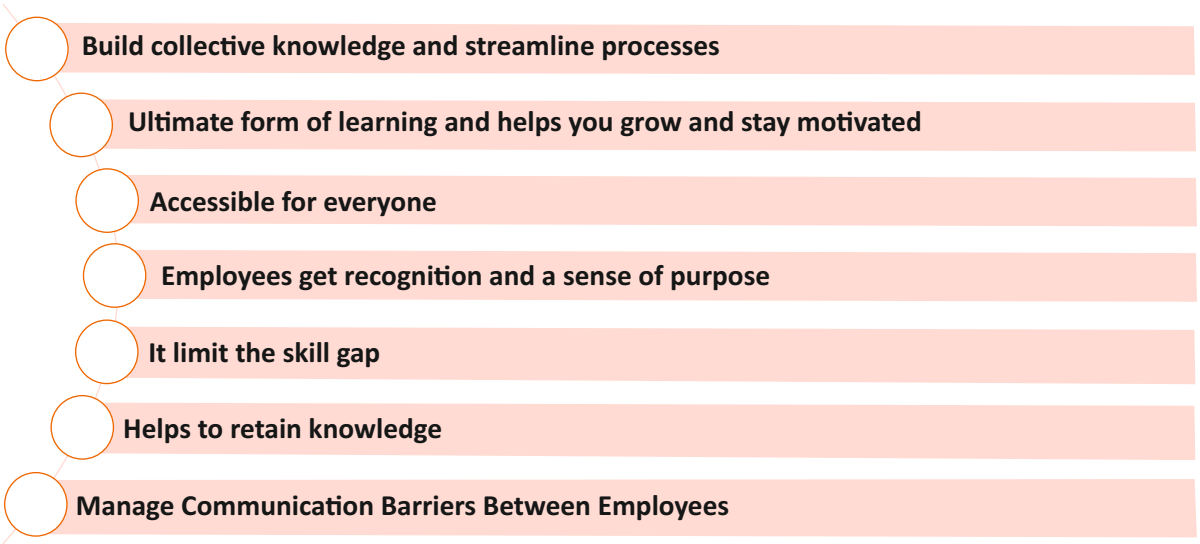


Fig. 6.11 Importance of Sharing information with team members

Notes

6.1.9 Individual and Team goals

Goal setting is undoubtedly one of the most effective motivational tools in the organization. Almost every organization requires employees to set goals regularly. Even when times change, continuously updating and setting goals is necessary to keep your business on track. Goals in each organization should be **S.M.A.R.T: specific, measurable, actionable, realistic, and timely.** It helps you and your team feel a stronger sense of purpose and direction. In addition, setting goals in place will help you and your team feel productive with each bit of accomplishment and ensure that more significant production stays on track.

Individual goals are significant because they give direction to the employees. While team goals are great for the overall guidance, personal goals will allow your team members to take distinct paths to digest the larger plan and turn it into action.

Team goals are necessary to guide the entire organization. It includes broad objectives that can be broken down into team projects and initiatives with individual key results. In addition to helping the organizations achieve their objectives, setting team goals also **boost employee engagement, productivity and retention by ensuring that every team member has a complete understanding of their role in the overall approach.** This also **saves time and improve efficiency.** In addition, setting team goals also offers organizations the following benefits:

Fig. 6.12 Benefits of Team Goals in an Organisation

6.1.10 Performance Measurement

Team performance evaluation is a key factor in inspiring teams, improving the quality of work, and keeping them motivated. It is the best channel to understand how the team is performing and an effective measure to get feedback about how production is going, whether the employees are working positively towards achieving goals, and what can be done to improve employees' engagement. It also provides a foundation to determine increments and succession plans for the team and the development of an organization.

A comprehensive team performance evaluation process often consists of different evaluation methods to help judge a team's performance. Using multiple techniques can help in getting a broader perspective of the areas where a team needs to improve and the steps you can take to support the team's growth.

The following chart explains the need for employee performance measurement methods:

Fig 6.13 Importance of Performance Measurement

Performance evaluation methods include the following:

1. **Peer review:** This is one of the strategies that many organizations and employee evaluation software use to enhance the traditional evaluation process. The peer-review process consists of anonymous feedback from shift managers, colleagues, teammates, and peers on specific aspects of team members' performance.

    a. It provides a unique prospect to study the team member's skills and capabilities and help identify individuals' networking, leadership, occupational, and collaboration skills within an organization.

    b. This process provides a unique chance to determine each team member's strengths and weaknesses and use this valuable data to decide succession planning, building teams, and shift rotations.

2. **Self-evaluation:** Self-evaluation is a vital activity to help make the evaluation process more efficient. When done correctly, it can provide several critical inputs to the organization. In addition, this method offers a chance for the team to play an active role in their evaluation process. Thus, the employees are given a voice rather than simply receiving the management's feedback.

   This directly links their jobs and the evaluation process and thus, fosters better communication between the staff and the management. With active participation, employees tend to experience better engagement with the overall review process, while managers can better understand the individual's performance and their perception of their performance.

3. **Quantitative evaluation:** It is based on statistics and utilizes various standards to track the productivity. The process begins with the formulation of organizational standards against which employee data can be measured. Different industries have different ways to articulate their quantitative output. For example, the number of units produced in traditional manufacturing is generally a reliable quantitative metric. Similar metrics are still used in modern organizations.

4. **360-degree feedback:** This is another tool to evaluate employee's performance. To assess an employee's score, his managers, peers, subordinates, and customers are asked to provide feedback for specific areas. This feedback often gives an accurate and multi-perspective view of the employee's performance, skill level, and improvement points.

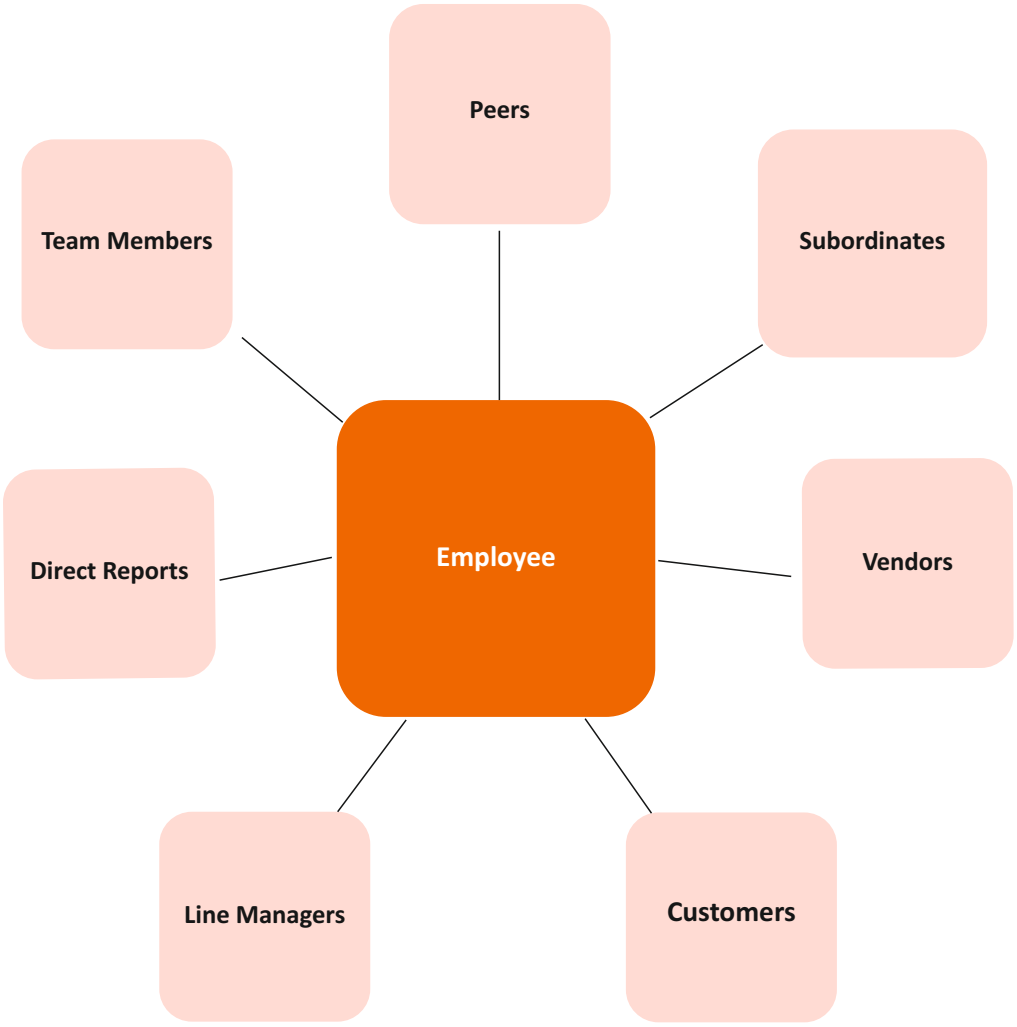


Fig.6.14 360-degree Feedback Method

5. **Competency on a scale:** This is among the most frequently used employee performance evaluation techniques. In this method, the employee's performance in various job duties is rated on a defined scale. A wide range of criteria, including productivity, quality of work, concern for safety, customer service, teamwork etc., are evaluated. This method can be achieved with letters or numbers, and it usually consists of a range, unsatisfactory to outstanding. This method also allows employers to evaluate several employees simultaneously.
6. **Subjective appraisal by the manager:** In most organizations, performance is assessed several times a year during (bi-)annual performance reviews. Employees are evaluated on various criteria, the job-quality being the most common.
7. **Human Capital ROI:** It is a metric that assesses the human capital value (i.e., knowledge, habits, and social and personal attributes). Human Capital ROI can be determined by calculating the company's revenue (minus benefit-cost and operating expenses and compensation) and dividing this by the total compensation and benefit-cost that the company pays for its employees.
8. **Absenteeism Rate:** Absenteeism and performance are highly correlated constructs. Highly motivated and engaged employees generally take fewer sick days. Additionally, absent employees are less productive, and high absenteeism rates throughout an organization are a key indicator of lower performance.
9. **Overtime per Employee:**

Overtime per FTE = Total hours of overtime / FTE

The average overtime per FTE (full-time equivalent) is a final employee performance metric. Employees, eager to put in the extra effort are generally highly motivated and tends to produce more (in terms of work quantity).

Notes

Notes

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youtube.com/watch?v=erdLGyEliEg

Unit 6.1 Work and Communicate Effectively at Workplace

youtube.com/watch?v=JyLez4xZ16Q

6.1.2 Communication Process

youtube.com/watch?v=NNVZxTkiX1Y

6.1.3 Communication Barriers

Exercise

1. Fill in the Blanks:

a) _____is a building block of successful organizations.

b) A healthy relationship with colleagues is built on _____, _____ and_____.

c) _____ is a part of your organization's duties to its community and stakeholders.

d) Sharing information helps employees to limit the _____ gap.

e) _____ is a mechanism or strategy that enables different entities to work together.

f) _____ facilitates meaningful and necessary communication for employee _____and manage the communication flow within and outside the organization.

g) Fill in the Blanks-

h) _____ is a set of rules indicating the proper and polite way to behave at work.

i) _____include how the people generally speak, wear, follow customs, behave by the receivers who are not accustomed to the differences.

j) _____ is the response communicated by the receiver to the source/sender after having decoded the message.

k) The quality of the relationship with colleagues and co-workers will depend on the _____ demonstrate while interacting with them.

2. Goals in each organization should be:

   a) Specific, monthly, adjustable, realistic, and timely

   b) Smart, measurable, actionable, realistic, and timely

   c) Specific, measurable, actionable, realistic, and timely

3. The following are the types of communication at workplace, except:

   a) Employer – employee

   b) Colleagues

   c) Stakeholders

   d) Customer – friend

4. Which one is not the correct way of verbal and written communication?

   a) Short

   b) Irrelevant

   c) Simple

   d) Direct

5. Differentiate between team goals and individual goals.

_____
_____
_____

6. What is effective communication?

_____
_____
_____

7. How language barriers create gaps in workplace?

_____
_____
_____

8. List any two tips for communicating effectively with superiors.

_____
_____
_____

Unit 6.2 Work in a Disciplined and Ethical Manner

Unit Objectives

At the end of the unit, the trainee will be able to:

1. Explain the importance of work ethics and workplace etiquette
2. Explain ways to maintain discipline at the workplace
3. Discuss the importance of following organisational guidelines for dress code, time schedules, language usage and other behavioural aspects
4. Discuss the common reasons for interpersonal conflict and ways of managing them effectively
5. Explain the common workplace guidelines and legal requirements on non-disclosure and confidentiality of business-sensitive information

6.2.1 Importance of Work Ethics and Workplace Etiquette

A professional code of ethics establishes an organization's ethical guidelines and best practices for maintaining honesty, integrity, and professionalism. Violations of the code of ethics can result in sanctions, including termination, for members of an organization. The following figure explains the standard practices and professional code of ethics follow in every organization.

Fig.6.15 Professional Code of Ethics

Work ethics are the morals or principles that govern a person's or group's behavior, whereas etiquette is a set of rules indicating the proper and polite way to behave at work. Both contributes positive energy and influence to the growth of an organization. Workplace etiquettes inspire healthy and interactive communication among employees and promote honesty, integrity, and respect for each other in the organization.

Fig.6.16 Workplace Etiquettes

Notes

6.2.2 Managing Conflicts at Workplace

Dealing with conflict at the workplace is inevitable. The ability to recognize conflict with your colleagues, understand its nature, and try to bring a quick and fair resolution to the conflict is critical to anyone who works in a team. **Conflict management** is a crucial skill that enables an individual to handle confrontations tactfully and constructively. It aims to yield a positive result from disputes and disagreements that occur between people in the workplace and resolve the conflict in a way that respects everyone's wants and needs. At some point, we need skills for managing conflict in the workplace. The following tips can help us resolve the conflict or a disagreement in that situation.

Stay calm during a conflict	**Control your anger by staying conscious of the situation and swaying with the flow**	**Do not try to assume others' perspectives. Give them the opportunity to speak and one must listen**
Leave the site for a time-being, if the situation is heating up	**Sometimes it is not necessary to argue. Letting the moment pass shall avoid the conflict**	**Keep an open mind and compromise where necessary**
Mind your language if you enter an argument. Never say something which you may need to regret later	**Remember, everyone is different and can have a different point of view to yours**	**Try to look at the situation from others' point of view**
Determine the way in which both the parties could be mutually benefitted	**Do not try to overpower your intent**	**If the conflict intensifes, let a common lead help resolve the conflict**

Fig. 6.17 Tips for Managing Conflicts

6.2.3 Maintaining Discipline at Workplace

Employee discipline isn't about power or punishment. It is about making the workplace safe and enjoyable for both employees and management. Discipline is most effective when there is mutual trust between managers and employees. It all begins with clear communication and continues with consistency. Discipline assists employees in correcting any shortcomings to become valuable, contributing members of the workforce. Documentation created as a result of the disciplinary process can also help an employer protect itself if termination or other adverse employment decision is required. Here are the ways to maintain workplace discipline in the organization while maintaining employee respect:

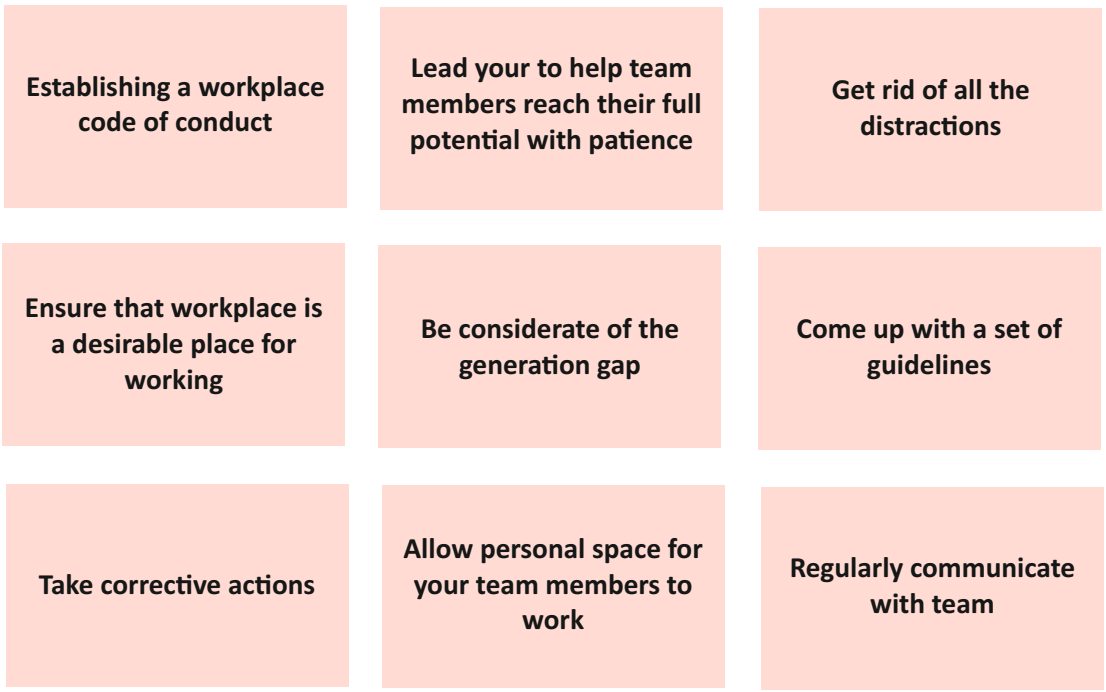

Fig. 6.18 Tips for Maintaining Discipline at Workplace

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youtube.com/watch?v=I-1Fa7aTYXA

Unit 6.2 Work in a Disciplined and Ethical Manner

6.2.4 Confidentiality in the Workplace

Confidentiality, or not disclosing specific information, is essential in a variety of jobs. Confidentiality is important for legal and reputational reasons, but it is also important because future employment may be contingent on it. Some information, such as personally identifiable information and 'business secrets,' is legally protected in several countries. As a result, it is crucial to understand the nature of confidentiality and how to ensure that employees follow legal or ethical guidelines. Confidentiality refers to the state of keeping information secret or not disclosing it. Following are the type of information that comes under the non-disclosure and confidentiality of business-sensitive information.

Employee Information
- Includes the private information of employees such as name, address, maiden name and so on

Managerial Information
- Includes both information about individuals, such as disciplinary action, and also about broad management actions such as planned redundancies or employee relations issues

Organisational Information
- Also known as business information or 'trade secrets'

Customer or Contact Information
- Partially covered by 'trade secrets'

Professional Information
- Information about individuals or organisations through their professional position.

Fig. 6.18 Types of Confidential Information

Exercise

Answer the following questions:

1. Write a short note on work ethics and workplace etiquette.

   _____

   _____

   _____

2. List any 3 ways of maintaining discipline at the workplace.

   _____

   _____

   _____

3. What is conflict management?

   _____

   _____

   _____

4. Explain confidentiality in the workplace.

   _____

   _____

   _____

5. How language barriers create gaps in workplace?

   _____

   _____

   _____

Unit 6.3 Uphold social diversity at the workplace

Unit Objectives

At the end of the unit, the trainee will be able to:

1. Describe the process of reporting grievances and unethical conduct such as data breaches, sexual harassment at the workplace, etc.
2. Explain the concept and importance of gender sensitivity and equality.
3. Discuss ways to create sensitivity for different genders and Persons with Disabilities (PwD).

6.3.1 Maintaining Discipline at Workplace

Grievances results in collective disputes when they are not resolved timely. Also, this lowers the morale and efficiency of the employees. Frustration, employee dissatisfaction, low productivity, lack of interest in work, high absenteeism, etc. might be a result of unattended grievances. In short, grievance arises when the organization does not fulfill employees' expectations, resulting in a feeling of discontentment and dissatisfaction. This dissatisfaction must have cropped up from employment issues and not from the personal issues.

A grievance may result from the following factors-

a) **Working Conditions and Safety:** These consists of any complaint or grievance that directly addresses the employees' work environment. These can include everything from unsafe working conditions to difficult and indifferent managers.

b) **Unreasonable Management Policies:** If employees believe that a particular policy is unfair or unreasonable, they will want their concerns addressed. Such policies can include a gap in production standards or overtime regulation compliance.

c) **Violations of Rules and Policies:** These are related to any organizational rules which the employees feel are being violated by other workers and/or middle or senior management.

The Quality Manager should immediately identify all grievances and take appropriate actions to eliminate the causes of such grievances to achieve employee's loyalty and commitment to their work. Thus, effective grievance management is an essential part of personnel management.

For Addressing Grievance, Quality Manager should adopt the following approach to manage grievance effectively:

1. **Complaint:** As soon as the grievance arises, it should be identified and resolved. This lowers the detrimental effects of grievance on the employees and their performance.
2. **Acknowledging grievance:** Acknowledge the grievance put forward by the employee as a manifestation of true and genuine feelings of the employees. Acknowledgment implies that you are eager to look into the complaint impartially and without bias. This creates a conducive work environment with instances of grievance reduced.

3. **Gathering facts:** Gather relevant and adequate facts that explains the nature of the grievance. These facts must be recorded to be used at a later stage of grievance redressal.
4. **Examining the causes of grievance:** The actual cause of resentment should be identified. Consequently, remedial actions should be taken to prevent the repetition of the grievance.
5. **Decisioning:** After identifying the causes of grievance, an alternative course of action should be suggested to manage the grievance. The effect of each action on the existing and future management policies and procedures should be analyzed, and accordingly, the manager should take a decision.
6. **Execution and review:** The manager should implement the decision quickly, ignoring the fact that it may or may not hurt the concerned employees. After implementing the decision, a follow-up must ensure that the grievance has been resolved completely and adequately.

An effective grievance procedure ensures a pleasant work environment because it redresses the grievance to the mutual satisfaction of the employees and the supervisors.

Fig 6.19 Grievance Addressing Process

6.3.2 Sensitivity for Person-With-Disability (PwD)

Disabled workers are a part of the diversity in today's workforce. However, being disabled does not imply that the individual is incompetent or unable to do his/her job. In fact, being disabled simply means the person has an impairment, which can be anything ranging from physical to psychological. Disabled co-workers and employees are not any different in that they are there to earn a living, advance their career, and better the organization through their contributions.

Listed below are some tips for interacting and communicating with people with disabilities.

Fig. 6.20 Communicating and Interacting with PWD

The RPWD Act, 2016 provides that "the appropriate Government shall ensure that the PwD enjoy the right to equality, life with dignity, and respect for his or her own integrity equally with others." The Government is to take steps to utilize the capacity of the PwD by providing appropriate environment.

Gender inequality in an organization's is a complex phenomenon that can be seen in organizational structures, processes, and practices. Following chart explains gender based issues in workplace:

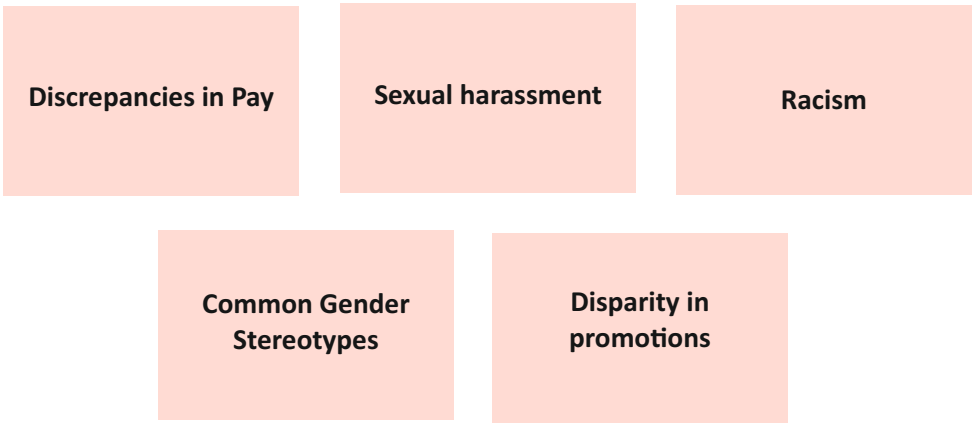

Fig. 6.21 Gender based Issues at Workplace

Females with disabilities are subjected to multiple layers of discrimination. Based on their gender and disability status, they often face double discrimination. They often face disproportionately high rates of gender-based **violence, sexual abuse, neglect, maltreatment and exploitation.** The exclusion experienced by women and girls with disabilities is a social issue that requires active participation of everyone.

It is important to follow organizational standards related to PwD at workplace because, it:

1. Protects them from any physical harm or any accidents
2. Provides them equal rights
3. Protects them from any kind of discrimination and racism
4. Provides security from any kind of violence and harassments
5. Protects their respect and dignity
6. Provides equal opportunities to deserving candidates

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Unit 6.3 Uphold social diversity at the workplace

6.3.3 Rights and Duties at Workplace concerning PwD

The following chart explains the rights and duties at the workplace with respect to PwD:

Rights	Duties
• To an accessible workplace free of hazards and risks • To complete information about the job • To information, education, training and safely equipment that reduces risks and hazards • To equal access to benifits, conditions of employement and promotional opportunities • To special safety procedures and considerations that may relate to one's disability in case of emergency • To be treated with dignity and respect • To special tools and services that be needed to accomodate a disability on the job or in the community	• To provide complete and honest information as it relates to the job • To request reasonable accomodation or assistance if needed • To practice safely procedures and use equipment to reduce risks to self and others • To report illness or injury promptly • To cooporate and work with rehabitation professionals and employes in good faith regarding return to work. • To use the access and services provided to be fully productive • to advocate, educate and collaborate with legel, service and other systems to meet needs and resolve conflicts

Fig. 6.22 Rights and Duties at Workplace with Respect to PwD

Summary

- Effective communication is required for all employees in the organization to perform basic management functions and carry out their jobs and responsibilities.
- It is extremely difficult for Quality Managers to manage their teams and coordinate efforts for successfully completion of a project without strong interpersonal communication skills. A project cannot be successful if there is no communication.
- The process of communication is a dynamic structure that explains how a message is transmitted between a sender and a receiver via various communication channels. Its purpose is to ensure that the receiver accurately decodes the message and can provide feedback with precision and convenience.
- Communication barriers are factors that prevent a message from being received in the way the sender sent it. People frequently face the problem of the message being received in an assumed manner when communicating.

- Effective communication with your supervisor is crucial to your professional development and career advancement. Refer to the exhibit below for tips on communicating with the supervisor effectively.
- Following proper communication, rules are critical to keeping a healthy relationship with colleagues and co-workers. The quality of the relationship with colleagues and co-workers will depend on the behavior you demonstrate while interacting with them.
- Transparently sharing data and information ensures that everyone is in the loop and aware of any potential issues with the business, product, or service that can be addressed collaboratively. Employees might have lots of knowledge that is crucial for the organization and other employees. Sharing information helps them connect, perform better, and become more vital as professionals.
- Organizational communication can be divided into two categories: formal and informal communication.
- Emotional outbursts at work could be caused by work-related issues or by stressors from our personal lives spilling over into our work lives. Handling our emotions (especially negative ones) at work is frequently regarded as a test of our professionalism.
- An organizational structure is a system that defines how specific activities are directed in order to achieve an organization's goals.
- The workflow of an organization consists of the processes that must be completed, the people or other resources that are available to perform those processes, and the interactions between them.
- Communication policies of an organization establish expectations and manage the flow of communications within and outside the organization. As a result, it facilitates meaningful and necessary communication for employee productivity and morale without restricting employees' feeling intimidated and powerless.
- Goals in each organization should be S.M.A.R.T: specific, measurable, actionable, realistic, and timely. It helps you and your team feel a stronger sense of purpose and direction. In addition, setting goals in place will help you and your team feel productive with each bit of accomplishment and ensure that more significant production stays on track.
- Team performance evaluation is a key factor in inspiring teams, improving the quality of work, and keeping them motivated. It is the best channel to understand how the team is performing and an effective measure to get feedback about how production is going, whether the employees are working positively towards achieving goals, and what can be done to improve employees' engagement.
- A professional code of ethics establishes an organization's ethical guidelines and best practices for maintaining honesty, integrity, and professionalism. Violations of the code of ethics can result in sanctions, including termination, for members of an organization.
- Work ethics are the morals or principles that govern a person's or group's behavior, whereas etiquette is a set of rules indicating the proper and polite way to behave at work.
- Dealing with conflict at the workplace is inevitable. The ability to recognize conflict with your colleagues, understand its nature, and try to bring a quick and fair resolution to the conflict is critical to anyone who works in a team.

- Discipline is most effective when there is mutual trust between managers and employees. It all begins with clear communication and continues with consistency. Discipline assists employees in correcting any shortcomings to become valuable, contributing members of the workforce.
- Confidentiality is important for legal and reputational reasons, but it is also important because future employment may be contingent on it.
- Disabled co-workers and employees are not any different in that they are there to earn a living, advance their career, and better the organization through their contributions.
- The RPWD Act, 2016 provides that "the appropriate Government shall ensure that the PwD enjoy the right to equality, life with dignity, and respect for his or her own integrity equally with others." The Government is to take steps to utilize the capacity of the PwD by providing appropriate environment.
- Gender inequality in an organization's is a complex phenomenon that can be seen in organizational structures, processes, and practices.
- Females with disabilities are subjected to multiple layers of discrimination. Based on their gender and disability status, they often face double discrimination.
- For a healthy performance-oriented culture, organizations need the correct mix of talent which is not bound by any gender.
- Use respectful language while communicating with each other. Do not reinforce gender stereotypes.
- Gender sensitivity is not about fighting women against men. On the contrary, gender-sensitive education, benefits members of all genders. It helps the individuals determine what assumptions are valid and which are stereotyped generalizations in matters of gender.

Notes

Exercise

1. Write a short note on:
   a. Grievance Management

   _____
   _____
   _____

   b. Rights and duties of PwD at the workplace

   _____
   _____
   _____

   c. Gender based issues at workplace

   _____
   _____
   _____

   d. Best practices for gender sensitivity

   _____
   _____
   _____

   e. List down the steps for addressing grievance.

   _____
   _____
   _____

2. Match the following.

Column A	Column B
Gender inequality	Gender-specific social groups
Listen attentively	Equal access to benefits
Rights at Workplace concerning PwD	With hearing disability person to get his attention
Tap a person on shoulder	Disparity in promotions
Do not promote	While talking with people having difficulty speaking

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7. Basic Health and Safety Practice

Unit 7.1 - Dealing with Workplace Hazards & Risks

Unit 7.2 - Fire Safety Practices

Unit 7.3 - Emergency, Rescue and First-aid Practices

Unit 7.4 - Effective Waste Management Practices

ELE/N1002

Key Learning Outcomes

At the end of this module, the trainee will be able to:

1. Apply health and safety practices at the workplace

Unit 7.1 Dealing with Workplace Hazards & Risks

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Discuss job-site hazards, risks and accidents
2. Explain the organizational safety procedures for maintaining electrical safety, handling tools and hazardous materials
3. Describe the importance of maintaining appropriate postures while lifting heavy objects
4. Explain various warning and safety signs
5. Describe how to interpret warning signs while accessing sensitive work areas
6. Elaborate on electronic waste disposal procedures
7. List the name and location of concerned people, documents and equipment for maintaining health and safety in the workplace
8. Explain the importance of good housekeeping

7.1.1 Workplace Safety

Workplace safety is one of the key aspects of any manufacturing business or facility. Getting it right can boost overall operation performance and lead to growth. On the other hand, putting safety at risk can lead to lost time, money, occupational injuries, and even reputational damage. Although every employer is required by law to adhere to workplace safety standards established by governments in order to ensure the safety of its employees and workers, it must be understood that safety is everyone's responsibility. Nobody wants to be hurt at work. As a result, employees/workers must be aware of and strictly follow the safety procedures in place.

Quality Managers are in a unique position because, as Quality leaders and coordinators, they indirectly influence health and safety. As safety is an integral part of the workplace, Quality Managers should not turn a blind eye and, if necessary, issue instructions. Quality Managers discuss health and safety during the following stages:

1. Planning because of its impact on accessibility and work methods

2. Initial workplace inspections due to the project's immediate environmental impact

3. Onsite meetings if the contractor or subcontractors are not addressing it

4. Site inspections and discussions as most important aspect of the worksite is health and safety

It is everyone's responsibility, whether the Quality Manager or team member, to keep the workplace clean, healthy, and safe. Everyone in the workplace must be extremely cautious and adhere to the established safety guidelines. The following are the standard practices to ensure health and safety in an organization.

Fig. 7.1 Health and Safety Guidelines

7.1.2 Safety Hazards, Risks and Accidents

A hazard or risk is something or someone that has the possibility of causing, serious harm, damage, or negative health effects. It has the potential to cause human injury or illness, property damage, environmental damage, or a combination of these effects. The figure below depicts the most common on-site hazards, risks, and accidents:

Notes

Fig. 7.2 Hazards and Risks at Workplace

The safety hazards and risks in the electronics industry vary depending on the various sub-sectors:

1. Various chemical hazards in the semiconductor and fabrication industries include exotic and dangerous chemicals such as arsine, phosphine, and silane
2. Noise, ionizing and non-ionizing radiation used for testing, quality control, and curing operations are all physical hazards in electronic work
3. Repetitive assembly line work or manual handling results in cumulative trauma disorders, backache, and musculoskeletal strains
4. Low humidity in clean room work, causing dermatological symptoms
5. Prolonged visual inspection work, especially when using a microscope, frequently causes eyestrain
6. Biological hazards are uncommon in electronics work, but communicable diseases can easily spread to other workers
7. Negative psychosocial factors such as the fast and constant pace of work, the monotonous nature of work, and rotating shifts

It is significant to ensure a high level of safety that no machine tool should be used unless the risk management process outlined below is understood and applied by the user:

1. Determine the potential hazard(s) that the machine tool may produce.
2. Using the Risk Assessment Matrix, determine the likelihood and severity of the hazard(s). The following individuals have risk acceptance decision authority for the risk levels
   a. very high
   b. very high
   c. moderate and low
3. Determine the risk-control measures that will eliminate or reduce the hazard(s). Then, implement risk control measures before and during machine tool operation to eliminate threats or mitigate their risks.
4. Monitor and evaluate the process. Enforce the established standards and risk management procedures. Evaluate the effectiveness of the control measures and make any necessary adjustments/updates.

7.1.3 Organizational Safety Procedures

An organizational safety procedure is a step-by-step instruction manual for carrying out a work procedure. It is used when a deviation from the procedure could result in injury or an accident.

When working with machinery, tools and equipment, employees are exposed to a variety of hazards and risks that can result in a variety of injuries. The following are the most common hazards in handling tools, hazardous materials and machining work:

Risk of injuries from moving parts of machinery (e.g. entanglement, friction,abrasion, cutting, crushing, shearing etc.)

Accidents and injuries from poor illumination

Fire/explosion caused by gas leaks, backfires and flashbacks

Risk of elctrocution due to faulty electrical components

Prolong exposure of excessive loud noise by machines can cause noise-induced deafness(NID)

Fig. 7.3 Machine Hazards

Therefore, when working with tools and equipment in the workplace, specific safety procedures must be followed to prevent these hazards and accidents:

1. SOPs (Standard Operating Procedures) must be followed and maintained for all machinery in the manufacturing unit.
2. SOPs must be based on manufacturer recommendations and must include specific hazards associated with the machine as well as safe use recommendations.
3. SOPs (standard operating procedures) must be accessible at or near the machine.

Electricity is widely recognized as a serious workplace hazard that can cause electric shock, burns, fires, and explosions. Every year, many employees suffer pain, injuries, and even death as a result of electric shocks. To keep yourself and others safe, it is critical to adhere to electrical safety-related work practices.

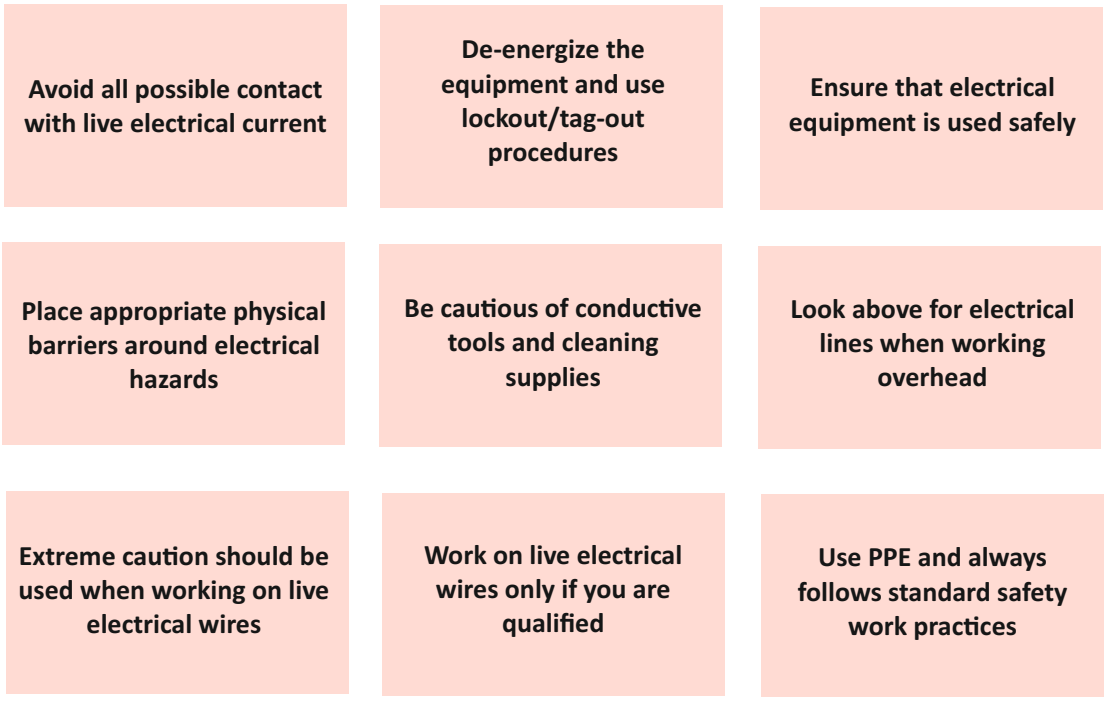


Fig. 7.4 Standard Procedures for Electrical Safety at Workplace

Notes

The following are some basic rules who work with or near hazardous materials should know and follow:

1. Pay close attention while working with or around hazardous materials.
2. Always wear the appropriate PPE.
3. Ensure that all containers are properly labeled and that hazardous materials are stored in an appropriate container.
4. Report damaged containers or illegible labels to your supervisor as soon as possible.
5. Read labels and the Safety Data Sheets (SDSs) before using any material to make sure you understand hazards and precautions Use hazardous materials solely for their intended purpose.
6. Never eat or drink while working with hazardous materials.
7. Store all hazardous materials properly, separate incompatibles, and keep them in well-ventilated, dry, and cool locations.
8. After handling any hazardous material, employees must keep themselves and the work area clean.
9. Gain knowledge about first-aid, emergency procedures, and evacuation procedures for dealing with fires or spills/leaks.
10. It also entails knowing what to do if a coworker is injured or poisoned by chemicals.

7.1.4 Significance of Maintaining Appropriate Postures While Lifting Heavy Objects

Lifting heavy objects is one of the leading causes of workplace injury. The main causes of these injuries were overexertion and cumulative trauma. Bending is the most frequently cited movement that resulted in back injuries, followed by twisting and turning.

Lifting loads incorrectly or carrying loads that are either too large or too heavy are common hazards associated with manually moving materials. Employees who use safe lifting techniques are less likely to sustain back sprains, muscle pulls, wrist injuries, elbow injuries, spinal injuries, and other injuries as a result of lifting heavy objects. The following figure explains on safe lifting and material handling at workplace.

Fig. 7.5 Tips for Maintaining Appropriate Postures While Lifting Heavy Objects

7.1.5 Warning and Safety Signages

Workplace safety signage evolved with the Industrial Revolution when workplace safety became a major concern. The purpose of a workplace safety sign is to identify and warn employees who may be exposed to various hazards. Safety signs help to communicate important instructions, reinforce safety messages, and provide emergency instructions. Workplaces that lack the necessary safety signs not only violate safety regulations but may also face hefty fines and regulatory action if they are audited by legal authorities. If an accident occurs and it is determined that proper safety signs were not present, the employer or other responsible parties could face legal consequences. It is essential to know the meaning of safety signs. Such signs warn us of danger and allow us to take precautions to keep safe. There are four main types of safety signs:

1. Prohibition signs
2. Mandatory signs
3. Warning signs
4. Information signs
5. Fire Safety signs
6. Danger Signs

The following table represents the various signages related to health and safety measures:

S. No.	Signage	Message
1.		Basic floor sign to stop moving ahead
2.		Stop Look Out for Forklifts
3.		Eye safety warnings
4.		Fire exit sign
5.		Authorized personnel only
6.		Fire hose notification
7.		Caution signage

S. No.	Signage	Message
8.		Caution signage
9.		Wet floor warning
10.		Watching out for step
11.		Water-saving signage

Table. 7.1 Safety & Warning Signages

7.1.6 Electronic Waste Disposal Procedures

E-waste is an abbreviation for electronic waste. That is, waste produced by broken, obsolete, or surplus electronic devices. It is also referred to as e-scraps. These electronics frequently contain toxic chemicals and hazardous materials. And if it is not disposed of properly, it can result in the release of toxic substances into our environment. The reprocessing and re-use of these electronic wastes are referred to as e-waste recycling. It is straightforward. It is a method of recovering material from electronic waste. This allows you to incorporate them into new electronic products. These electronic wastes can take the form of household appliances such as air conditioners, televisions, electric cookers, air conditioners, heaters, DVDs, fans, microwaves, and radios. They can also take the form of information technology equipment such as computers, laptops, mobile phones, batteries, hard discs, circuit boards, and monitors. E-waste recycling is one of the most discussed issues in the world today due to its potential to reduce environmental hazards and pollution. It can also protect our lives as humans and other life forms in our world. E-waste recycling is the reuse and reprocessing of any type of discarded or obsolete electrical and electronic equipment.

Recycling electronics can be a difficult task. This is due to the fact that e-scraps are typically sophisticated and made from a variety of materials such as metals, plastics, and glass. While this process frequently varies, the following figure explains the standard process of electronic waste disposal.

Step 1: Collection and Transportation

- This is the first stage of e-waste recycling. Recyclers set up take-back booths or collection bins in specific locations. When these bins are full, recyclers transport the e-waste to recycling centers and plants.

Step 2: Shredding and Sorting

- After collecting and transporting the e-waste, the next step is to shred and sort it. Shredding is the process of breaking down e-waste into smaller pieces for proper sorting. These tiny prices are sorted by hand and then manually dismantled. This is typically labor-intensive because waste items are separated at this stage to retrieve different parts.

Step 3: Dust Removal

- The tiny waste particles are evenly distributed on the conveyor belt by a shaking process. The uniformly distributed e-waste is then further broken down. The dust is extracted and disposed of in an environmentally responsible manner at this point. There is no environmental degradation in this manner.

Step 4: Magnetic Separation

- Following that, a powerful overhead magnet aids in the separation of steel and iron from other wastes. It has successfully recycled the steel from the waste stream in this manner.

Step 5: Water Separation

- Water separation technology is used to separate the glass from the plastic.

Step 6: Purification of Waste Stream

- The next step is to locate and extract leftover metals from plastics to further purify the waste stream.

Step 7: Preparing Recycled Materials For Sale

- The last step is to prepare recycled materials for sale. The materials are separated here for sale as raw materials to manufacture new electronics.

Fig. 7.6 Standard Process of Electronic Waste Disposal

7.1.7 List of Concerned Authorities, Documents and Equipment for Workplace Health and Safety

It is simply a huge task for a single person to be solely responsible for workplace health and safety. As a result, the **health and safety executive (HSE), legal bodies, business owners, managers and supervisors, contractors, and employees at all levels in a company all share equal responsibility**. However, this does not imply that responsibilities are distributed evenly. Staff in various roles will have varying health and safety responsibilities. **Employers**, for example, bear more responsibility than their employees because they are held accountable for their employee's safety and well-being. They are required by law to protect their employees and anyone else who may be harmed by their business, including customers, visitors to the workplace, temporary workers, and contractors. Employers must perform the following duties in order to meet their health and safety obligations:

Fig. 7.7 Roles and Responsibilities of Employers for Workplace Health & Safety

Procedure for Reporting Workplace Health & Safety Issues to Concern Person

1. To raise a workplace health & safety issue with the concerned authorities, constructive steps should be taken immediately to resolve the problem. These steps may include:
2. Reporting the issue to your supervisor or manager
3. Reporting the issue through the workplace's hazard reporting procedures
4. Raising the issue with the health and safety representative
5. Raising the issue with management through union representative

Issues can be related to:

1. Personal hygiene
2. Handling of food and beverages
3. Storage and Work area
4. Suitable dress and personal protective equipment and clothing
5. Cross-contamination
6. Machinery, tools, and equipment
7. Inappropriate handling and disposal of garbage
8. Cleaning and sanitizing

List of documents for maintaining workplace health and safety

Health and safety documents assist in controlling risks and communicating safe working procedures. Many health and safety documents, such as risk assessments and health and safety policies, are also required by law.

1. **Method Statements -** Method statements include information such as project start and end dates, a project description, and all potential hazards associated with the project. Emergency procedures and guidelines for monitoring are also included.
2. **Risk Assessment –** Risk assessment documents serve as a strategic tool for planning for and responding to specific workplace risks. These documents help to raise awareness of hazards, identify specific people who may be at risk and note ways to eliminate or control that risk.
3. **Near Miss Reports -** A near-miss report is a document that details a problem or issue that occurred at work that had the potential to injure or harm someone. This usually happens when a break in a chain of events prevents harm or damage from occurring. This type of safety document is similar to an accident/incident investigation report in which the accident did not occur but could have.
4. **Equipment and Machinery Inspection Reports -** These reports detail when specific equipment or machinery was inspected, who inspected it, and what they discovered. Regular inspection reports also help to ensure that employees are using up-to-date and safe equipment.
5. **Emergency Action Plan -** These plans provide clear, detailed instructions on how people in a building should behave in the event of a specific disaster. Emergency action plans provide a comprehensive overview of all potential disasters, including fires, tornadoes, earthquakes, floods, and explosions.
6. **Personal Protection Equipment Manual -** This manual assists both employers and employees in doing the following:
    a. Understand the various types of PPE.
    b. Understand the fundamentals of conducting a "hazard assessment."

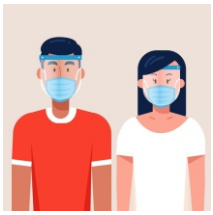
Personal Protective Equipment

Every worker at workplace is responsible for their safety as well as the safety of their coworkers. A person must take different precautions for different situations to avoid accidents and hazards. To begin, everyone on the job site must wear Personal Protective Equipment (PPE) for their safety.

Fig. 7.8 PPE

PPE refers to the clothing or equipment designed to protect the workers/employees from shop floor hazards. It includes items such as hard hats, safety boots, coveralls, gloves, safety glasses and goggles, earplugs, high visibility vests, lifejackets, fall protection, and respirators.

Common types of PPE include the following:



Eye and Face Protection

Hand Protection

Head Protection

Hearing protection

Foot Protection

Body Protection

Fall Protection

Respiratory protection

Fig. 7.9 Types of Personal Protective Equipment

7.1.8 Significance of Good Housekeeping at Workplace

Effective housekeeping assists in the control or elimination of workplace hazards. Poor housekeeping practices frequently contribute to incidents. If the presence of paper, debris, clutter, and spills is accepted as normal, other, more serious hazards may be overlooked. Cleaning is only one aspect of housekeeping. It entails keeping work areas neat and orderly, keeping halls and floors free of slip and trip hazards, and removing waste materials (such as paper and cardboard) and other fire hazards from work areas. It also necessitates paying close attention to details such as the overall layout of the workplace, aisle marking, the adequacy of storage facilities, and maintenance. Good housekeeping is also a fundamental component of incident and fire prevention. Effective housekeeping is a continuous process, not a one-time event. Effective housekeeping is a continuous process; it is not a one-time or sporadic clean-up. Periodic "panic" clean-ups are both costly and ineffective in terms of incident reduction.

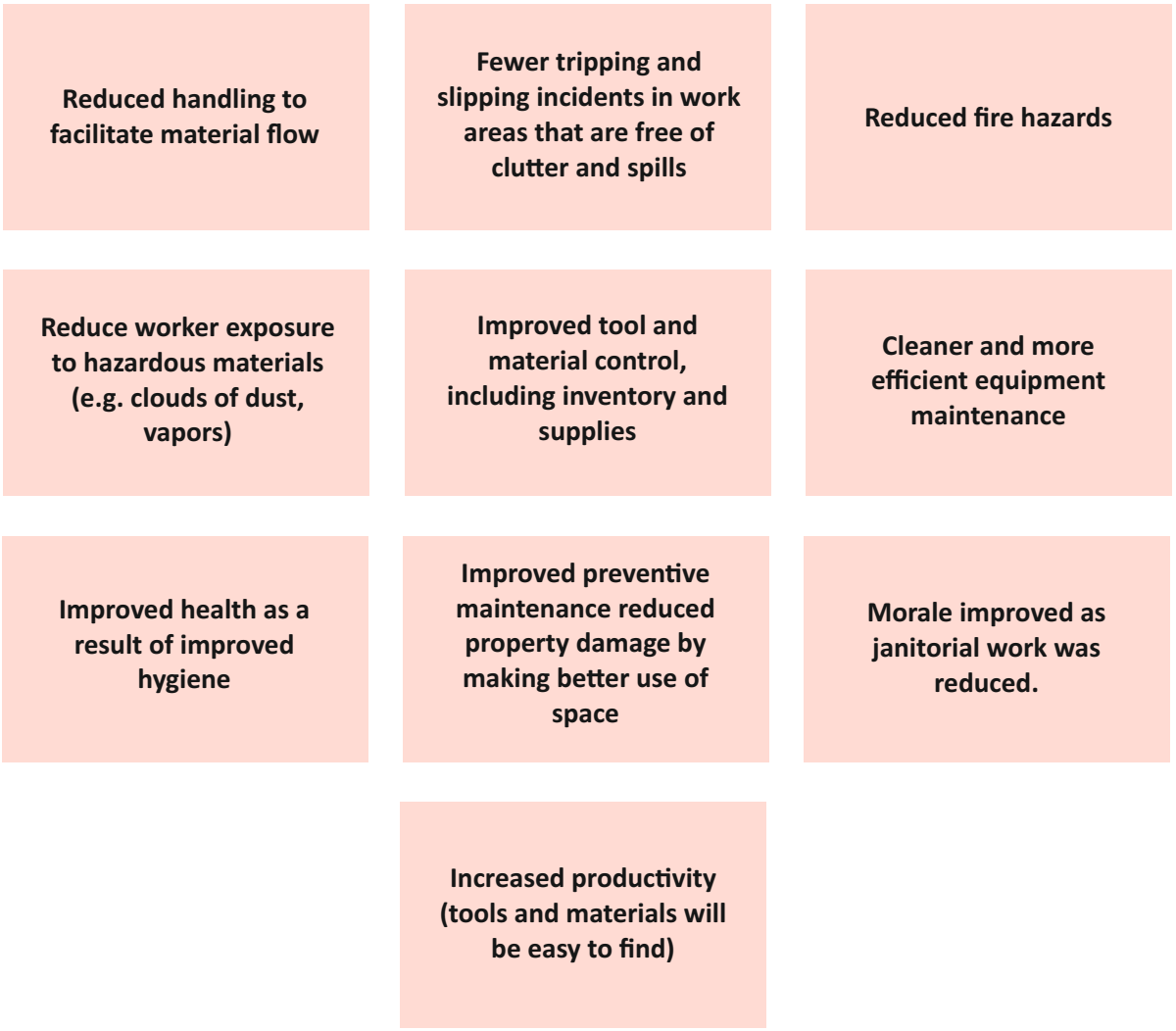


Fig. 7.10 Significance of Good Housekeeping at Workplace

7.1.9 5S

5S is intended to be a visually-oriented system of cleanliness, organization, and arrangement to attain greater productivity. It engages all employees and is a foundation for more self-discipline on the job for better work and better products. Along with engaging employees, it also builds a strong and positive culture of self-discipline at the workplace for better work and quality outcomes.

5S, sometimes referred to as 5s or Five S, refers to five Japanese terms used to describe the steps of the 5S system of quality management. Each term starts with an S. In Japanese, the five S's are **Seiri, Seiton, Seiso, Seiketsu, and Shitsuke**. The five S's are translated as Sort, Set in Order, Shine, Standardize, and Sustain in English**.**

S.No.	Japanese Words		English Translation	Definition
1	Seiri		Sort	Sorting means keeping only the essential items required in the workplace and removing all the nonessential items.
2	Seiton		Set in order	Ensures that all the items are organized and placed logically to make the task easier and convenient for the worker.
3	Seiso		Shine	Efforts to keep the orderly workplace area clean and maintain routine tasks are involved, like dusting, mopping, and maintenance of machinery, tools, and other equipment.
4	Seiketsu		Standardize	Create a set of standards for organization and processes where rules are made for how 3S will be maintained and when these tasks will be performed.
5	Shitsuke		Sustain	Sustain new practices and conduct audits to maintain discipline. Th2is means the previous four S's must be continued over time. This is achieved by developing a sense of self-discipline in employees who will participate in 5S.

Table. 7.2 5S

The guiding principles underlying the 5S technique involve organization, cleanliness, and standardization. Overall workplace cleanliness, created by removing waste from the work area, promotes internal organization and enhances visual communication. By reducing wasted time and materials, productivity is increased along with safety, and costs are reduced. The system as a whole minimizes waste and improves efficiency by ensuring that employees are spending time doing productive tasks rather than looking for misplaced items, sorting unnecessary through stacks of waste material, or rearranging the work environment at the change of shifts.

Advantages of Implementing 5S Principle

1. **Sort**: It helps better allocate valuable resources, as additional space becomes available once the unnecessary items are removed from the area. Furthermore, the process forces inspection of the items, thereby recognizing the need to repair or eliminate any obsolete equipment and also preventing the equipment from being misplaced.
2. **Systemize**: A systematic work area also supports the efficiency of work. When kept at a fixed location, each object remains there until it is taken away while in use and is immediately kept back at the same place after use. Labeling and other identifying methods are also a part of this step. In addition, systematically storing and arranging things prevents a lot of time wasted searching for items. Overall, if each team member arranges things in an orderly fashion, it leads to the success of the whole organization.
3. **Shine**: It provides qualitative and quantitative results and improvises employee's pride and morale while working in a clutter-free pleasant work area. A clean area also results in a safe and healthy workplace.
4. **Standardize**: Following the standardized procedures helps achieve efficiency, improve workplace safety, and reduce workplace injuries.
5. **Sustain**: Maintenance of any system is essential as it increases its sustainability. Thus, maintaining the system is necessary; otherwise, the cost and effort spent on developing the system will go to waste.

Notes

Notes

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youtube.com/watch?v=WW0U6o1XNec

7.1.1 Workplace Safety

youtube.com/watch?v=aH495epWeAE

7.1.2 Safety Hazards, Risks and Accidents

youtube.com/watch?v=UKhGD3UbXH4

7.1.9 5S

Exercise

Answer the following questions:

1. Explain potential risks and hazards at the workplace.

   _____

   _____

2. Explain the benefits of 5S principles.

   _____

   _____

3. Explain any two types of Personal Protective Equipment.

   _____

   _____

4. List the ways for maintaining appropriate postures while lifting heavy objects.

   _____

   _____

5. Discuss the importance of good housekeeping at workplace.

   _____

   _____

6. List of documents for maintaining workplace health and safety.

   _____

   _____

7. What is PPE?

   _____

   _____

8. Write a short note on organizational safety procedures.

   _____

   _____

Fill in the blanks:

1. To raise a _____ with the concerned authorities, constructive steps should be taken immediately to resolve the problem.
2. _____ is one of the key aspects of any manufacturing business or facility. Getting it right can boost overall operation performance and lead to growth.
3. As safety is an integral part of the workplace, _____ should not turn a blind eye and, if necessary, issue instructions.
4. _____ has the potential to cause human injury or illness, property damage, environmental damage, or a combination of these effects.

1. An _____ is a step-by-step instruction manual for carrying out a work procedure.
2. Lifting heavy objects is one of the leading causes of _____.
3. The purpose of _____ is to identify and warn employees who may be exposed to various hazards.
4. _____ is one of the most discussed issues in the world today due to its potential to reduce environmental hazards and pollution.
5. _____ bear more responsibility than their employees because they are held accountable for their employee's safety and well-being.
6. _____ documents assist in controlling risks and communicating safe working procedures.

1. Choose the correct answers (MCQ)

a) The way of protecting individuals' well-being of health is classified as:

   1. Safety
   2. Health
   3. Adverse Situation
   4. Security

b) What are the most common risks in the workplace?

   1. Risk of electrocution
   2. Risk of injuries from faulty equipment
   3. Being hit by falling objects
   4. All of the above

Unit 7.2 Fire Safety Practices

Unit Objectives

At the end of this unit, the trainee will be able to:

1. List the types of fire and fire extinguishers

7.2.1 Fire Safety

Fire safety refers to a set of practices designed to reduce the devastation caused by fire. Fire safety measures include those used to prevent the ignition of an uncontrolled fire as well as those used to limit the development and effects of a fire once it has begun. Following are the standard practices for fire safety at workplace.

1. **Follow the emergency instruction in case of fire**
   a. Activate the ALARM.
   b. Evacuate the area.
   c. Call the fire department.
   d. Stay Calm
2. **Fight the fire only if:**
   a. You know-how.
   b. The fire is small.
   c. You are confined to the area where it started.
   d. You have a way out.
   e. You can work with your back to the exit.
   f. You have the right type of extinguisher.
   g. You feel confident that you can operate it effectively.
3. **Do not fight the fire if:**
   a. You have any doubts about fighting it.
   b. It is spreading beyond the area where it started.
   c. It could block your escape route.

4. Precautions to be taken during the fire:

Following precautions are to be taken in case of fire –

a. Switch off the main switch.

b. Snuff the fire by throwing dry sand on it.

c. Make sure that the fire extinguisher is operational and not expired.

d. Do not use water to extinguish an electrical fire.

e. Know the location of emergency exits and procedures.

Fire can be prevented by following these do's and don'ts at the workplace

Do's	Don'ts
Keep the work area clean.	Do not wear inflammable materials like nylon etc.
If empty containers contain inflammable materials, fill them with water.	Do not use inflammable materials near electrical lines.
Report any unsafe situation that may cause a fire.	Never weld near combustible materials.
Watch where the sparks and metals are falling from your work.	Never leave any cable without insulation.

Table. 7.3 Do's and Don'ts of Preventing Fire

Notes

7.2.2 Fire Extinguishers

Electrical fires are different from regular fires. They cannot be extinguished with water. Also, using water to put out an electrical fire is very dangerous and could lead to electrocution. To put out an electrical fire, the right type of fire extinguisher must be used. The following figure represents the different classes of fires:

Class of Fire - A

- Type of Fire - Ordinary Combustible : wood, paper, rubber, fabrics and many plastics.
- Type of Extinguisher- Water, dry powder, halon

Class of Fire - B

- Type of Fire - Flammable liquids and Gases: Gasoline, Oils, paint, lacquer and tar.
- Type of Extinguisher- Carbon Dioxide, dry powder, halon

Class of Fire - C

- Type of Fire - Fires involves live electrical equipment .
- Type of Extinguisher- Carbon Dioxide, dry powder, halon

Class of Fire - D

- Type of Fire -Combustible metals or combustible metal alloys
- Type of Extinguisher- Special Agents

Class of Fire - K

- Type of Fire - Fires in cooking appliances that involve combustible cooking media: vegetable or animal oils and fats.
- Type of Extinguisher - Wet Chemical

Fig. 7.11 Types of Fire

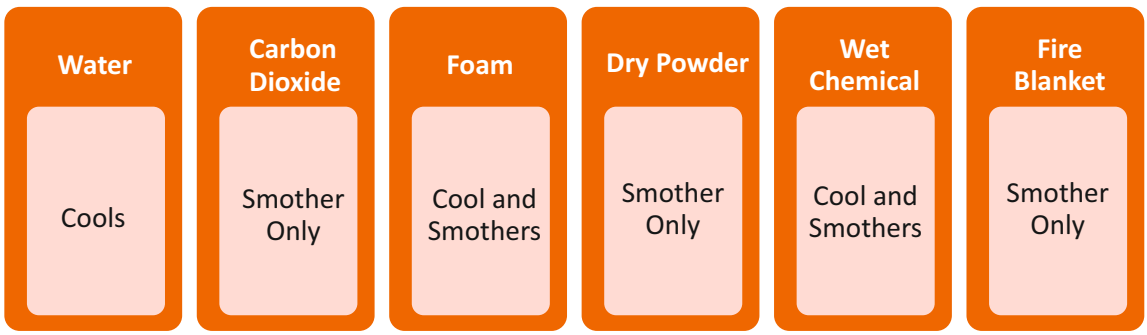

Fig. 7.12 Types of Fire Extinguishers

Fig. 7.13 Using a Fire Extinguishers

Notes

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youtube.com/watch?v=ReL-DM9xhpI

Unit 7.2 Fire Safety Practices

Exercise

Fill in the blanks:

a) _____cannot be extinguished with water.
b) Safety is _____ responsibility.
c) _____ in case of fire.
d) Do not fight the fire if_____.

Answer the following questions:

1. Explain various types of fire and fire extinguishers.

_____
_____
_____

2. Write a short not fire safety.

_____
_____
_____

3. Explain do's and don'ts of preventing fire.

_____
_____
_____

4. List the precautions to be taken during the fire.

_____
_____
_____

Unit 7.3 Emergency, Rescues and First-aid Practices

Unit Objectives

At the end of this unit, the trainee will be able to:

1. Describe different ways of preventing accidents at the workplace

7.3.1 Different Ways of Preventing Accidents/Hazards at the Workplace

ISO 45001 is an international standard for health and safety at work developed by national and international standards committees of government. An Occupational Health and Safety Management System (OHSMS) is a fundamental part of an organization's risk management strategy.

Implementing an OHSMS enables an organization to:

a. Protect its workforce and others under its control

b. Comply with legal requirements

c. Facilitate continual improvement

The following figure explains different ways/methods to control hazards and prevent accidents at the workplace:

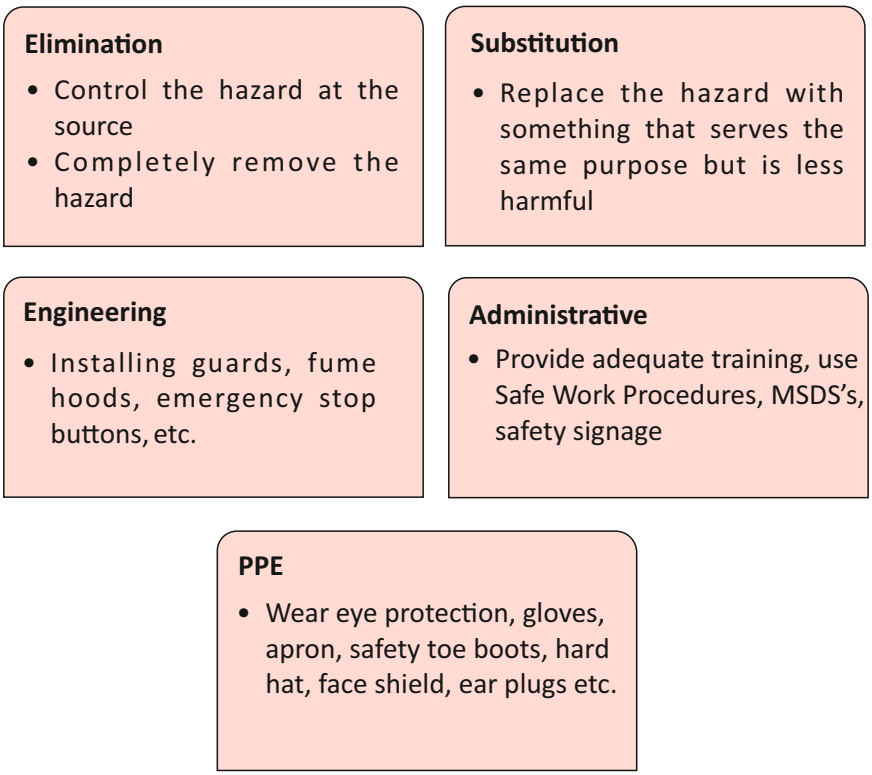

Fig 7.14 Steps to Control Hazards and Prevent Accidents

7.3.2 Emergency Procedures to Deal with Electric Shock and Accidents

When a person somehow comes in contact with the live wire and gets shocked and faints, the following are the steps to be undertaken immediately as a first aid to save his/her life:

Responsibilities	Descriptions
Recognize the symptoms	• Common shock signs and symptoms include the following: o Pale, cold, clammy skin. It may appear grayish, the lips and fingernails may look blue. o The pulse and breathing are rapid. o The person is exhibiting disorientation or giddiness. o Nausea or vomiting may occur. o The person seems weak, with vacant eyes.
Call local emergency services number	• It's crucial to have paramedics on the way while you administer the treatment since the shock is a severe condition that will require hospitalization. • Stay on the line with the emergency services dispatcher in case of any need and provide the proper first aid. • In India, the Ambulance Emergency number is – 102
Make the person lie down	• Be extremely gentle since any sudden movements could injure the person. If the person is not in pain, place his or her legs on a pillow to elevate them about 12 inches above the head. • Do not move the person's head. • Keep the person flat and still after he or she is lying down.
Check for signs of breathing	• Observe the person's chest to see if it rises and falls, and place your cheek next to his or her mouth to check for breath. If the person is not breathing, perform CPR. Check the breathing every 5 minutes until the emergency services arrive.
Make the person comfortable	• Loosen the collars and unbutton or cutaway tight clothing. Unbuckle the person's belt, loosen the shoes and remove all tight jewelry on the person's wrists or neck. Cover the person with a blanket. • Do not give the person food or water. • Reassure and comfort the person; try to keep him or her calm until help arrives.

Responsibilities	Descriptions
Check for vomiting and bleeding from the mouth	• If you observe vomit or blood coming from the mouth or nose, turn the person on his or her side to prevent him or her from choking. Help to prop the person up with pillows.
Administer treatment for injuries or blood loss	• If the person sustained a trauma, you might need to stop blood flow from a wound or provide first aid for a broken bone. • Seek further instructions from the emergency personnel over the phone.

Table. 7.4 Emergency Procedures to deal with Accidents

7.3.3 Safety Mock Drills

Safety is a priority to provide a safe working environment. Efforts should be taken to reduce the scale & probability of hazards. However careful we can be, hazards may still occur. Effective action has been possible in the emergency. In dealing with such emergencies, effective action is likely a pre-planned and practiced procedures for dealing with such emergencies.

What is a Mock Drill?

Mock Drill is a situation in which a fake emergency is announced, and workmen are asked to follow an emergency evacuation plan. This allows the workman to get familiarized with the emergency and act according to plan. Mock drills for chemical accidents and firefighting drills should be organized at regular intervals at the sites.

At the time of emergency evacuation, one must:

1. Raise the alert by crushing the glass cover of the closest break-glass alarm unit.
2. Be calm and composed.
3. Switch off all electrical apparatus except lights.
4. If possible, shut doors around the fire area to stop it from spreading.
5. Leave the building/site area immediately.
6. Follow the evacuation queue.
7. Give first preference to the physically disabled, expectant mothers, and the elderly
8. If it's dark and smoky, get down on your hands and knees and crawl to the nearest exit by counting the number of doors. If manageable, cover your nose with a wet towel or handkerchief.
9. Be acquainted with the hot exit door and pay attention to the thick smoke in the staircase. If the stairs are free from smoke, follow the directional signs and handrails.
10. Gather at the designated assembly point.
11. Do not re-enter the building until the signal is given
12. Max. time for evacuation should be 2.5 to 3.0 minutes.

7.3.4 Procedure for Reporting Accidents and Hazards

The essential responsibilities of an individual for reporting hazards and accidents are:

1. The people responsible for health and safety at the workplace;
2. The name, designation, and location of the person responsible to contact at the time of emergency

Additionally, an individual should also be adept in writing accident reports. An accident report needs to include all the essential information about the incident or near-miss. The report-writing process begins with facts and ends with recommendations for preventing future accidents.

An accident report involves four steps:

Gathering Facts: Collect and note all the facts, including –

- Date, time, and location of the accident
- Names, job titles, workers, and immediate supervisors involved
- Events leading up to the accident
- Job that the worker was handling at the time of the accident
- Names of employee who witnessed the accident
- Surrounding conditions (e.g., greasy floor, insufficient lighting, noise, etc.)
- Circumstances at the time of the accident (including tasks, equipment, tools, materials, etc.)
- PPE worn by the worker at the time of the accident
- Injuries that occurred (name of the injured body part and characteristics and extent of injuries)
- Type of treatment for injuries (first aid, if given)
- Damage to equipment, materials that the worker was working on or any other equipment or material around it.

Determining the Sequence: Describe the sequence of events after gathering the facts –

- **Events leading up to the accident:** Task the employee was performing at the time of the accident. For example: bending over, climbing, lifting operating machinery, using a tool, handling hazardous materials, etc.
- **Events involved in the accident:** Was the employee struck/caught in the machine or caught in the fire? Did the worker fall on the same level or from a height? Did he inhale hazardous fumes or get splashed with a hazardous chemical?
- **Events immediately following the accident:** What did the employee do: started bleeding? The body caught fire? Complain about back pain? Put a hand over a bleeding wound? Response from other workers/supervisors. Did they call for help, administer first aid, shut down equipment, move the victim to another place, etc.?
- The accident should be described in the report in sufficient detail that any reader can picture what happened.

Analysing: Analyse the causes of the accident. Causes include:

- Primary cause (e.g., a slip and fall from a ladder)
- Secondary causes (e.g., an employee not wearing appropriate goggles or helmet)
- Other contributing factors (e.g., poor ventilation).

Recommending: Recommendations for corrective action might include immediate as well as long-term corrective actions such as:-

- Training on safe work practices
- Preventive maintenance exercises that keep equipment in excellent working condition.
- Assessment of job techniques with a proposal for changes.
- Conducting a job hazard analysis to evaluate the task for any other hazards and then train employees on these hazards.
- Engineering changes that make the task safer or administrative changes that might include changing the way the job is performed.

Fig. 7.15 Accident Report Procedure

Exercise

Answer the following questions:

1. What are the different ways/methods to control hazards and prevent accidents at the workplace?

_____
_____
_____

2. Explain emergency procedures to deal with electric shock and accidents.

_____
_____
_____

3. Write a short note on safety mock drills.

_____
_____
_____

4. Discuss the process of reporting accidents and hazards.

_____
_____
_____

Unit 7.4 Effective Waste Management Practices

Unit Objectives

At the end of this unit, the trainee will be able to:

1. List the common sources of pollution and ways to minimize it
2. Describe the concept of waste management and methods of disposing hazardous waste
3. Explain the importance of efficient utilization of water, electricity and other resources
4. Describe the process of disposal of hazardous waste

7.4.1 Workplace Pollution

Workplace pollution is defined as the presence of hazardous materials or noises within a workplace that may affect employees while they are performing their duties. Such workplace pollutants can harm workers' health, especially if they are exposed for extended periods, even at low levels. The most common type of exposure is workplace air pollution. This includes workplace hazards from airborne pollution or the presence of hazardous substances in the workplace indoor air as gases (fumes) or as particulate matter (tiny particles - dust) dispersed in the air. Other modes of exposure include skin contact, ingestion, and/or injection.

Good Air Ventilation	**Identifying and avoiding direct contact with corrosive or toxic materials,**	**Not eating or drinking the presence of toxic or hazardous materials,**
Wearing protective gear as and when required).	**Effective Waste management practices at workplace**	**Effective cleaning and hygiene practices among the employees**
Re-use and Recycle	**No to plastic bags**	**Carpool or using public transport**

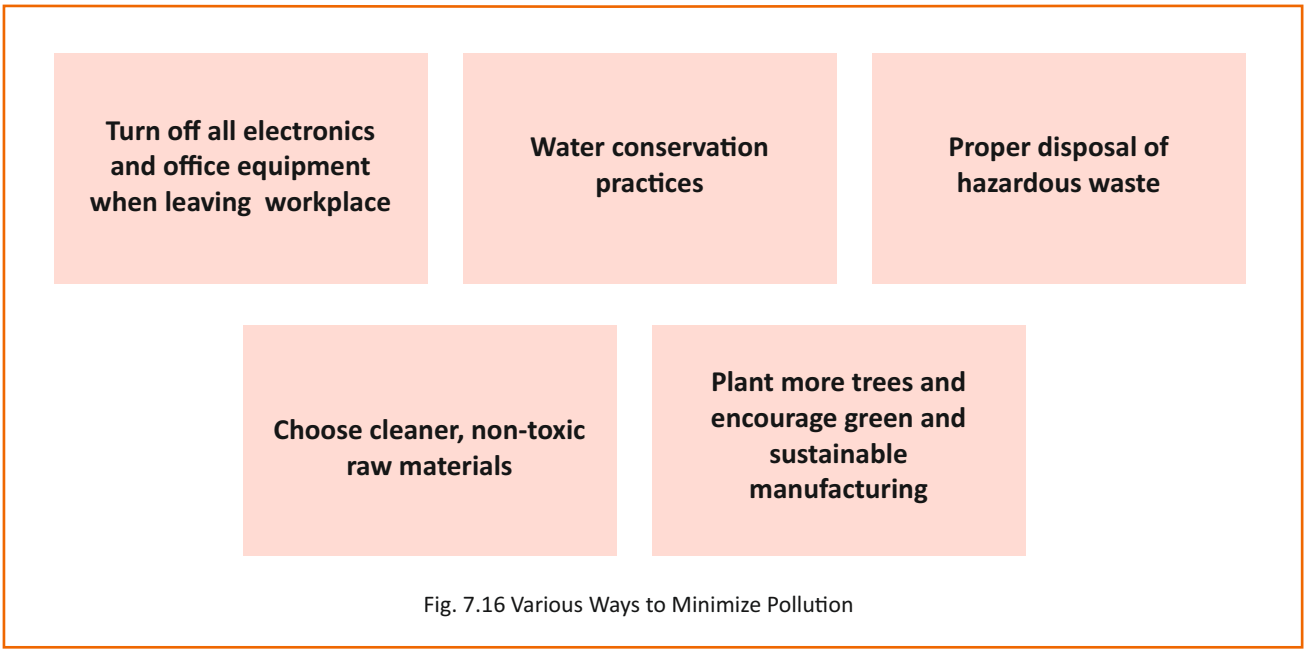

Fig. 7.16 Various Ways to Minimize Pollution

Notes

7.4.2 Effective Waste Management

Waste management refers to the activities and actions required to manage waste from its inception to its disposal. This includes the collection, transport, treatment, and disposal of waste and monitoring and regulation of the waste management process.

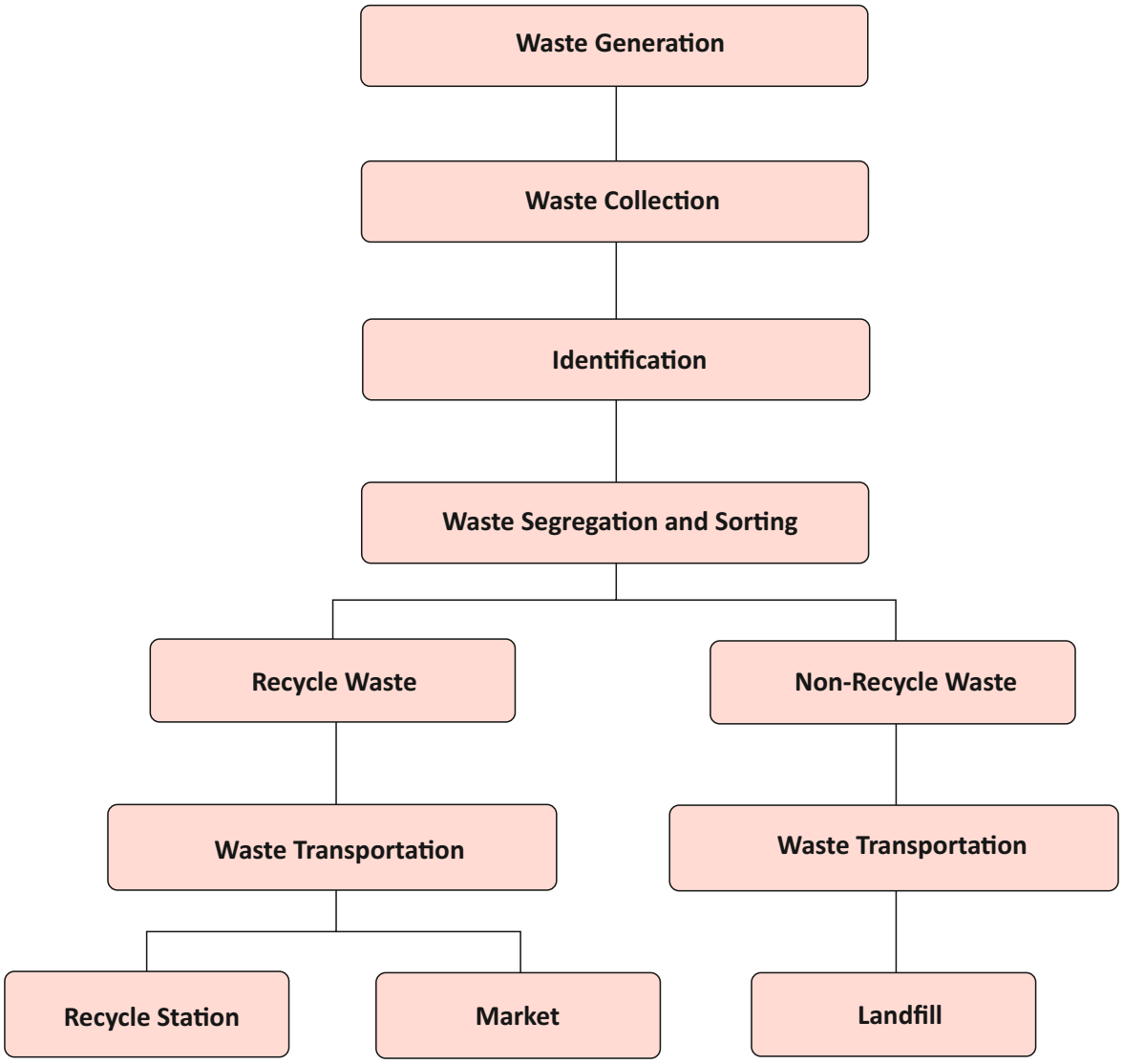

Fig 7.17 Waste Management Process

Waste elimination is one of the utmost effective ways to escalate the profitability of any trade or business. To eliminate waste, it is essential to understand exactly what waste is and where it exists. While products significantly differ between places, the typical wastes found in electronic manufacturing environments are pretty similar.

There is a strategy to decrease or eliminate its effect on a company for each waste, thereby refining overall performance and quality. Everything that is done in an organization is divided into two groups: value-adding and waste. Usually speaking, value-adding is something the consumer pays for, and waste

is anything the consumer does not care about. All non-value-added activities belong to waste.

Specifically, waste metal is often difficult for businesses to manage in the electronic industries. Often exceptionally heavy and problematic to store, proper scrap metal disposal is a continuous challenge for businesses that produce large amounts of metal waste.

That is where the concept of waste mineralization becomes a must for every employee to understand. There are many ways to define waste mineralization. However, in its broadest sense, waste mineralization includes all practices including waste prevention, reuse, and recycling that reduce the amount of waste entering the environment.

Fig 7.18 Waste Minimization

Waste Segregation

In general, waste is segregated as dry and wet waste. Dry waste includes wood, paper, plastic, glass, etc., related products that can be recycled, and wet waste refers to organic and biodegradable waste. The waste can be segregated using color-coded dustbins.

Fig 7.19 Waste Segregation

1. Green Bin

The green-colored bin is used to dump biodegradable waste, for example, wet/organic material, including cooked or leftover food, vegetable and fruit rinds, eggshell, rotten eggs, chicken/fish bones, tea or coffee grinds, coconut shells, and garden waste, including fallen leaves/twigs or the worship flowers/garlands.

2. Blue bin

The blue-colored bin is used for segregating dry or recyclable left over. This category includes waste like plastic covers, bottles, boxes, cups, toffee wrappers, soap or chocolate wrappers, and paper waste, including magazines, newspapers, tetra packs, cardboard cartons, pizza boxes, or paper cups/plates, metallic items like tins/cans, foil paper, and containers.

Fig 7.20 Dry &Wet Waste Bins

Recyclable Waste	Non-Recyclable Waste
Recyclable waste is renewable. The waste material can be reused or converted into new products or raw material, like paper, corrugated cardboard, glass, plastics container and bags, hard plastic, metal, wood products, e-waste, textile, etc.	Non-recyclable waste commonly includes materials that can be easily degraded in nature. For example, fruit shells, vegetable leaves, food leftovers, flowers and leaves, etc. it also includes cigarette end, muck, coal, cinder, construction waste, and paint waste which do not have big value after being discarded.

Table 7.5 Recyclable and Non-Recyclable Waste

The most commonly used methods of waste disposal are:

Landfill

It is a man-made method of disposing of solid and hazardous waste on land.

Incineration

It is a waste treatment method that involves the combustion of organic substances found in waste materials.

Waste Compaction

It is the process of compacting waste in order to reduce its size.

Biogas Generation

It is a renewable fuel that is created through the breakdown of organic matter. It can be used for vehicle fuel, heating, and electricity generation.

Composting

It is the natural process of decomposing and recycling organic material into a humus-rich soil amendment.

Vermicomposting

It is the process by which worms are used to convert organic materials (usually wastes) into a humus-like material known as vermin-compost.

Fig 7.21 Methods of Waste Disposal

QR Code

Scan the QR Code to watch the related video

youtube.com/watch?v=cqJ-ZM4UZNk

Unit 7.4 Effective Waste Management Practice

7.4.3 Hazardous Waste Management

Hazardous waste is defined as waste that poses significant or potential risks to public health or the environment. Characteristic hazardous wastes are materials that have been proven or tested to have one or more of the following hazardous properties:

1. Ignitability
2. Reactivity
3. Corrosively

Following are the impact of various hazardous material on the manufacturing process:

Increase risk and contamination	**Substandard quality and defective products**	**Certain hazardous substances also have the potential to explode or cause a fire**
Possible injuries and illness among the workers	**Possible damage of equipment and machinery**	**Low productivity**
Material and resources wastage	**Loss of time, money and goodwill**	**Economic consequences of recall and outbreak**

Fig 7.22 Impact of Hazardous Material in Production Process

There are several options for hazardous-waste management. The most desirable option is to reduce waste at its source or to recycle the materials for another productive use. Nonetheless, while reduction and recycling are desirable options, they are not regarded as the final solution to the hazardous-waste disposal problem. There will always be a need for hazardous waste treatment, storage, or disposal.

1. **Chemical Treatment -** Chemical treatment processes include ion exchange, precipitation, oxidation and reduction, and neutralization.
2. **Thermal Treatment -** Thermal methods include high-temperature incineration, which can not only detoxify but also destroy certain organic wastes. Thermal equipment of specialized design is used to burn waste in solid, liquid, or sludge form. Fluidized-bed incinerators, multiple-hearth furnaces, rotary kilns, and liquid-injection incinerators are some examples of thermal treatment.

1. **Biological Treatment -** The waste is carefully mixed with surface soil on a suitable plot of land in this technique. Microbes that can metabolize waste, as well as nutrients, may be added.

2. **Surface storage and land disposal -** Hazardous wastes that cannot be destroyed by incineration or other chemical processes must be properly disposed of. Land disposal is the ultimate destination for the majority of such wastes, though it is not an appealing practice due to the inherent environmental risks involved. Landfilling of hazardous solid or containerized waste is subject to stricter regulations than municipal solid waste landfilling. Hazardous wastes must be disposed of in so-called secure landfills, which must have at least 3 meters (10 feet) of space between the landfill's bottom and the underlying bedrock or groundwater table. Two impermeable liners and leachate collection systems are required for a secure hazardous-waste landfill.

Manufacturers of hazardous substances must provide warning labels and safety guidelines with their products. Employers must ensure that the safety guidelines for each hazardous substance used in the workplace are available to employees and warning labels on hazardous substances should feature:

- Hazard Pictograms
- Signal Words (e.g. Danger and Warning)
- Hazard Statements (e.g. Fatal If Swallowed)
- Precautionary Statements (e.g. Wear Protective Gloves).

The Safety guidelines must include important information on handling the product safely, including:

- Potential Health Effects
- Precautions for Use
- Safe Storage Suggestions
- Emergency First Aid Instructions
- Contact Numbers for Further Information.

7.4.4 Material Utilization

Material efficiency means producing the same result with reduced amounts or lower grades of raw materials. Material efficiency measures seek to decrease the number of natural resources required to produce a certain output level and recycle post-consumption waste material back in the manufacturing process.

The reuse of wear parts and components is also part of material efficiency, extending the lifetime of machinery, components, and spare parts through reconditioning. Material efficiency includes new product innovations to replace previous products that consume greater amounts of raw materials.

7.4.5 Energy Conservation Practices

In general terms, energy conservation refers to the simple practices that we follow in our day-to-day life to preserve energy. Manufacturing facilities are among the largest consumers of energy. Therefore, efforts to improve energy efficiency are an increasing concern for many manufacturing facilities. This can be accomplished by evaluating energy end uses e.g., lighting, processing equipment, and heating, air conditioning, and ventilation, HVAC systems, and by implementing measures to reduce the total amount of energy consumed for one or more of the end uses. The following exhibit suggests a few steps which can be followed for achieving energy efficiency and consumption.

Switching off lights remains one of the easiest ways to save on energy but it's surprising how often lights are kept on, even when no one is in the lit area. This problem is compounded in when employees go in and out of various buildings and work areas as they go about their duties.

Ensure you shut off machinery and equipment when not in use. Walking through your plant after-hours and ensuring equipment is powered down when not in use can result in significant savings over time.

Regular cleaning and planned maintenance of the electrical and mechanical equipment will go a long way towards optimising its performance and lifespan, which can translate to energy efficiency savings.

Newer heating and cooling systems will be far more efficient than old ones, so it may be worth getting systems more than 10 years old replaced.

Insulation acts as a barrier against temperature shifts. By installing insulation in the roof, and walls of your workspace, you can reduce the amount of energy needed to maintain room temperature during heat loss and heat gain.

Use fixed or adjustable shading, plant trees and vegetation or install sun filters on the windows and walls of the workplace— especially industrial sheds— to protect from acute heat during summers.

Use LED lights which are more energy efficient.

Continued...

Use natural airflow where possible to avoid usage of cooling systems.

Optimise the energy consumption settings of the appliances being used in the unit, like refrigerator and AC can be made to run by a couple of degrees higher.

Create awareness on importance of energy consumption among the employees

Fig 7.23 Energy Conservation Practices

7.4.3 Water Conservation Practices

Water conservation is the practice of using water efficiently to reduce unnecessary water usage. It is essential because fresh clean water is a limited resource and a costly one. We are already well aware of the financial costs of inefficient water use. Conservation of this natural resource is critical for the environment — and our wallets.

Fig 7.24 Water Conservation Practices

Summary

- Workplace safety is one of the most significant concerns for any manufacturing company or facility. Getting it right can improve the overall performance of the operation and lead to growth.
- It is the responsibility of everyone, whether employer or employee, to keep the workplace clean, healthy, and safe.
- As safety is an integral part of the workplace, Quality Managers should not turn a blind eye and, if necessary, issue instructions.
- A hazard is something or someone that has the potential to cause damage, harm, or adverse health effects.
- An organizational safety procedure is a step-by-step instruction manual for carrying out a work procedure. It is used when a deviation from the procedure could result in injury or an accident.
- Electricity is widely recognized as a serious workplace hazard that can cause electric shock, burns, fires, and explosions. Every year, many employees suffer pain, injuries, and even death as a result of electric shocks. To keep yourself and others safe, it is critical to adhere to electrical safety-related work practices.
- Lifting heavy objects is one of the leading causes of workplace injury. The main causes of these injuries were overexertion and cumulative trauma. Bending is the most frequently cited movement that resulted in back injuries, followed by twisting and turning.
- Workplace safety signage evolved with the Industrial Revolution when workplace safety became a major concern. The purpose of a workplace safety sign is to identify and warn employees who may be exposed to various hazards.
- Electronic-waste recycling is one of the most discussed issues in the world today due to its potential to reduce environmental hazards and pollution. It can also protect our lives as humans and other life forms in our world. E-waste recycling is the reuse and reprocessing of any type of discarded or obsolete electrical and electronic equipment.
- Recycling electronics can be a difficult task. This is due to the fact that e-scraps are typically sophisticated and made from a variety of materials such as metals, plastics, and glass.
- Employers bear more responsibility than their employees because they are held accountable for their employee's safety and well-being.
- Health and safety documents assist in controlling risks and communicating safe working procedures. Many health and safety documents, such as risk assessments and health and safety policies, are also required by law.
- PPE refers to the clothing or equipment designed to protect the workers/employees from shop floor hazards. It includes items such as hard hats, safety boots, coveralls, gloves, safety glasses and goggles, earplugs, high visibility vests, lifejackets, fall protection, and respirators.
- Effective housekeeping assists in the control or elimination of workplace hazards. Poor housekeeping practices frequently contribute to incidents.
- 5S is intended to be a visually-oriented system of cleanliness, organization, and arrangement to attain greater productivity. It engages all employees and is a foundation for more self-discipline on the job for better work and better products.

- Fire safety refers to a set of practices designed to reduce the devastation caused by fire. Fire safety measures include those used to prevent the ignition of an uncontrolled fire as well as those used to limit the development and effects of a fire once it has begun.
- Electrical fires are different from regular fires. They cannot be extinguished with water. Also, using water to put out an electrical fire is very dangerous and could lead to electrocution. To put out an electrical fire, the right type of fire extinguisher must be used.
- If you observe vomit or blood coming from the mouth or nose, turn the person on his or her side to prevent him or her from choking. Help to prop the person up with pillows.
- A mock Drill is a scenario in which a fake emergency is declared and employees are instructed to follow an emergency evacuation plan. This allows the worker to become acquainted with the emergency and act accordingly.
- Workplace pollution is defined as the presence of hazardous materials or noises within a workplace that may affect employees while they are performing their duties. Such workplace pollutants can harm workers' health, especially if they are exposed for extended periods, even at low levels.
- Waste management refers to the activities and actions required to manage waste from its inception to its disposal. This includes the collection, transport, treatment, and disposal of waste and monitoring and regulation of the waste management process.
- Waste elimination is one of the utmost effective ways to escalate the profitability of any trade or business. To eliminate waste, it is essential to understand exactly what waste is and where it exists. While products significantly differ between places, the typical wastes found in electronic manufacturing environments are pretty similar.
- In general, waste is segregated as dry and wet waste. Dry waste includes wood, paper, plastic, glass, etc., related products that can be recycled, and wet waste refers to organic and biodegradable waste. The waste can be segregated using color-coded dustbins.
- Recyclable waste is renewable. Non-recyclable waste commonly includes materials that can be easily degraded in nature.
- Hazardous waste is defined as waste that poses significant or potential risks to public health or the environment.
- Material efficiency means producing the same result with reduced amounts or lower grades of raw materials. Material efficiency measures seek to decrease the number of natural resources required to produce a certain output level and recycle post-consumption waste material back in the manufacturing process.
- In general terms, energy conservation refers to the simple practices that we follow in our day-to-day life to preserve energy. Manufacturing facilities are among the largest consumers of energy. Therefore, efforts to improve energy efficiency are an increasing concern for many manufacturing facilities.
- Water conservation is the practice of using water efficiently to reduce unnecessary water usage. It is essential because fresh clean water is a limited resource and a costly one.

Exercise

Fill in the blanks:

a) Dry waste includes _____, _____ and _____ etc.

b) _____ can be reused or converted into new products or raw material.

c) The waste can be segregated using _____ dustbins.

Answer the following questions:

1. Differentiate between recycle and non-recycle waste.

_____

_____

_____

2. Explain waste elimination.

_____

_____

_____

3. Name any methods of waste disposal.

_____

_____

_____

4. List various ways to minimize pollution at workplace

_____

_____

_____

Match the following:

Column A	Column B
Energy Conservation Practices	Strains and sprains from lifting loads
Water Conservation Practices	Reuse of wear parts
Potential injuries occurs during moving of materials manually	Shut off machinery when not in use
Material efficiency	Turn off the tap when it is not necessary

ANNEXURE - QR Codes

Chapter No.	Unit No.	Topic Name	Page No.	QR code(s)	URL
Chapter - 1 Introduction to Role of a Quality Manager (Bridge Module)	Unit 1.1 Introduction to Electronic Industry	1.1.1 Roles and Responsibilities of Quality Manager	8		youtube.com/watch?v=7EhkenV4T7g
Chapter 2 Process of Managing Quality in the Product Design Process	Unit 2.1 Identify the Customer Needs and Concerns	2.1.1 Various Methods for Connecting with Target Customers	14		youtube.com/watch?v=h5-LpwwQJ6M
		2.1.2 Analysing and Collecting Data Regarding Customer Expectations and Concern			youtube.com/watch?v=yOU_s0xzc-Y
	Unit 2.2 Carry out Advanced Product Quality Planning (APQP)	2.2.1 Importance and Process of Carrying out Advanced Product Quality Planning	36		youtube.com/watch?v=jIE23969kH8
		2.2.2 Product Program Planning as Per Customer Needs and Expectations			youtube.com/watch?v=xkHW6ak3xf8

ANNEXURE - QR Codes

Chapter No.	Unit No.	Topic Name	Page No.	QR code(s)	URL
		2.2.5 Process of carrying out Design Failure Mode and Effect Analysis (DFMEA)	36		youtube.com/watch?v=N_HiqvF7U5I
		2.2.7 Product Design and Production Process Development			youtube.com/watch?v=w2m5eU8XDVI
		2.2.10 Competitive Benchmarking			youtube.com/watch?v=JC4CaksviQY
		2.2.12 Importance and Process of Identifying Issues and Corrective Actions			youtube.com/watch?v=RfCkkcVuBfg
		2.2.13 Relevant Legal and Safety Standards			youtube.com/watch?v=MIssDGB7pJc

ANNEXURE - QR Codes

Chapter No.	Unit No.	Topic Name	Page No.	QR code(s)	URL
Chapter 3 Process of Managing the Supplier Relationship and Receipt Inspection Process	Unit 3.1 Manage the Supplier Relationship	3.1.1 Importance of Quality standards and Compliance Monitoring Process	55		youtube.com/watch?v=XSAzVS3fvXA
Chapter 4 Process of Managing Quality in the Production Process and Final Output	Unit 4.1 Manage Quality in Production Process	4.1.1 Importance of Using of Relevant Tools, Equipment and PP	95		youtube.com/watch?v=xU8Rxnetsg8
		4.1.8 7 Quality Control Tools			youtube.com/watch?v=yuH35ottILU
		4.1.9 Process of Product Investigation Product and Quality-Related Key Solutions			youtube.com/watch?v=zRYhEJBFsrc
	Unit 4.3 Deal with Output's Quality-Related Problems	4.3.1 Process of Preparing Check Sheet	107		youtube.com/watch?v=DSN1NAw3lJ0

ANNEXURE - QR Codes

Chapter No.	Unit No.	Topic Name	Page No.	QR code(s)	URL
		4.3.2 Identify and Implement Appropriate Corrective Measures	107		youtube.com/watch?v=CH5J3e0K528
	Unit 4.4 Collect and analyse data	Unit 4.4 Collect and analyse data	110		youtube.com/watch?v=h4G5IFGuSTU
		4.4.2 Analyse Production's Line Statistical Data to Identify Quality Problems	119		youtube.com/watch?v=47JZIHv1Q8w
		4.4.3 Quality Documentation			youtube.com/watch?v=qTAyoSb_1qo
Chapter 5 Process of Managing Recruitment, Training and Drive Quality Initiatives for Projects	Unit 5.1 Recruit the quality team personnel	5.1.1 Process of Collecting & Analysing Statistical Data for Quality Performance	140		youtube.com/watch?v=h4G5IFGuSTU
		5.1.2 Applicable Quality Parameters			youtube.com/watch?v=8d8U8Th9Ce8

ANNEXURE - QR Codes

Chapter No.	Unit No.	Topic Name	Page No.	QR code(s)	URL
		5.1.5 Process of Developing and Monitoring Continuous Improvement Programs	140		youtube.com/watch?v=UnjwVYAN7Ns
	Unit 5.3 Drive Quality Initiatives	5.3.1 Lean Manufacturing	169		youtube.com/watch?v=gixa9MHNPaM
		5.3.2 Use of Six Sigma Methods to Improve SOPs			youtube.com/watch?v=4EDYfSl-fmc
		5.3.4 Use of New Advanced Tools & Technology to Improve Business Processes			youtube.com/watch?v=_2K-txcDteU
Chapter 6 Soft Skills and Work Ethics	Unit 6.1 Work and Communicate Effectively at Workplace	Unit 6.1 Work and Communicate Effectively at Workplace	189		youtube.com/watch?v=erdLGyEIiEg
		6.1.2 Communication Process			youtube.com/watch?v=JyLez4xZ16Q

ANNEXURE - QR Codes

Chapter No.	Unit No.	Topic Name	Page No.	QR code(s)	URL
		6.1.3 Communication Barriers	189		youtube.com/watch?v=NNVZxTkiX1Y
	Unit 6.2 Work in a Disciplined and Ethical Manner	Unit 6.2 Work in a Disciplined and Ethical Manner	195		youtube.com/watch?v=I-1Fa7aTYXA
	Unit 6.3 Uphold social diversity at the workplace	Unit 6.3 Uphold social diversity at the workplace	201		youtube.com/watch?v=uHYuDDHvU64
Chapter 7 Basic Health and Safety Practice	Unit 7.1 Dealing with Workplace Hazards & Risks	7.1.1 Workplace Safety	224		youtube.com/watch?v=WW0U6o1XNec
		7.1.2 Safety Hazards, Risks and Accidents			youtube.com/watch?v=aH495epWeAE
		7.1.9 5S			youtube.com/watch?v=UKhGD3UbXH4

ANNEXURE - QR Codes

Chapter No.	Unit No.	Topic Name	Page No.	QR code(s)	URL
	Unit 7.2 Fire Safety Practices	Unit 7.2 Fire Safety Practices	230		youtube.com/watch?v=ReL-DM9xhpI
	Unit 7.4 Effective Waste Management Practices	Unit 7.4 Effective Waste Management Practices	242		youtube.com/watch?v=I-1Fa7aTYXA

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