

## 1.1 DIMENSIONS OF PRODUCT AND SERVICE QUALITY IN TQM

Product and service quality are multi-dimensional concepts, meaning they can be assessed and evaluated across various attributes or dimensions. These dimensions provide a comprehensive understanding of what constitutes quality from both the perspective of the consumer and the organization delivering the product or service.

### Dimensions of Product Quality

#### 1. Performance

- Refers to how well the product performs its intended function. This could include speed, accuracy, reliability, and efficiency.
- Example: For a smartphone, performance might refer to how fast it operates, how well it runs applications, or how strong the signal reception is.

#### 2. Features

- The characteristics or attributes of the product that enhance its utility or appeal. It's often the "extras" beyond basic functionality.
- Example: For a car, features might include GPS navigation, heated seats, or an advanced audio system.

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#### 3. Reliability

- Refers to the consistency of the product's performance over time. A reliable product performs consistently without failure.
- Example: A washing machine that consistently works without breakdowns over a long period.

#### 4. Durability

- The product's ability to withstand wear, pressure, or damage over time.
- Example: A pair of hiking boots that remain intact and effective after multiple rough outings.

#### 5. Conformance to Specifications

- This dimension measures how well the product meets predetermined standards or specifications, ensuring consistency in quality.
- Example: A batch of smartphones that all have the same screen size, camera quality, and operating system version.

#### 6. Aesthetics

- The sensory characteristics of the product that influence its appeal, such as design, style, color, and overall look and feel.

- Example: A designer watch with a sleek, modern look that appeals to fashion-conscious consumers.

### 7. **Serviceability**

- The ease with which a product can be repaired, maintained, or upgraded.
- Example: A laptop with a removable battery that is easy to replace when it deteriorates.

### 8. **Perceived Quality**

- This dimension relates to how customers perceive the overall quality of the product, which may be influenced by branding, reputation, and past experiences.
- Example: Apple products are often perceived as higher quality due to their brand image and consistent consumer experiences.

## **Dimensions of Service Quality**

### 1. **Tangibles**

- Refers to the physical evidence of the service, such as the appearance of the facilities, equipment, personnel, and communication materials.
- Example: In a restaurant, the cleanliness of the restaurant, the uniforms of staff, and the presentation of food.

### 2. **Reliability**

- The ability to consistently perform the promised service dependably and accurately. It's the cornerstone of service quality.
- Example: An airline that consistently departs and arrives on time.

### 3. **Responsiveness**

- The willingness and ability of service personnel to help customers promptly and address their needs.
- Example: A hotel receptionist who quickly provides extra towels when requested.

### 4. **Assurance**

- The service provider's ability to inspire confidence and trust. It encompasses the competence, courtesy, and professionalism of staff.
- Example: A doctor who is knowledgeable, reassuring, and communicates effectively with patients.

### 5. **Empathy**

- The service provider's ability to understand and care for the individual needs of customers, offering personalized attention.
- Example: A customer service representative who listens attentively to a complaint and offers a solution that suits the specific circumstances.

## 6. Access

- The ease with which customers can contact or approach the service provider, which may include location, availability of communication channels, and convenience.
- Example: An online retail company with a user-friendly website and a 24/7 customer support hotline.

## 7. Communication

- The clarity and effectiveness of communication with the customer, including how well the service provider explains the service, offers updates, or addresses concerns.
- Example: A telecom provider sending clear and timely notifications about network outages or plan changes.

## 8. Consistency

- The ability to provide the same level of service quality over time, ensuring that each customer has a similar experience.
- Example: A fast-food chain that delivers the same quality of food and service regardless of the location or time of day.

### SUMMARY COMPARISON

Dimension	Product Quality	Service Quality
<b>Performance</b>	How well the product works	Not directly applicable (services are process-oriented)
<b>Features</b>	Additional functionalities	Not typically applicable
<b>Reliability</b>	Consistency of performance	Ability to consistently deliver promised services
<b>Durability</b>	How long the product lasts	Not directly applicable (except in recurring services)
<b>Conformance to Specifications</b>	Meets specific design or manufacturing standards	Consistency in service delivery
<b>Aesthetics</b>	Product design and appearance	Appearance of service delivery (staff, environment)
<b>Serviceability</b>	Ease of repair or upgrade	Responsiveness to service issues or complaints
<b>Perceived Quality</b>	Consumer perception of overall quality	Reputation and brand image of service provider

<b>Dimension</b>	<b>Product Quality</b>	<b>Service Quality</b>
<b>Tangibles</b>	Not applicable	Physical evidence of service delivery (e.g., cleanliness)
<b>Responsiveness</b>	Not typically applicable	Willingness to help and address customer concerns
<b>Assurance</b>	Not directly applicable	Knowledge, competence, and trust of service personnel
<b>Empathy</b>	Not directly applicable	Personalized attention and understanding of customer needs
<b>Access</b>	Not applicable	Ease of access to the service provider
<b>Communication</b>	Not applicable	Clarity and transparency in communication with customers
<b>Consistency</b>	Not applicable	Providing the same quality of service across interactions

Understanding both product and service quality across these dimensions can help businesses assess and improve their offerings, ensuring they meet or exceed customer expectations.

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## 1.2 BASIC CONCEPTS OF TQM

**Total Quality Management (TQM)** is a comprehensive approach to improving organizational processes, products, and services through continuous improvement, customer satisfaction, and employee involvement. It is a philosophy and set of practices aimed at creating a culture of quality throughout the entire organization. Below are the **basic concepts of TQM**:

### 1. Customer Focus

- **Core Idea:** The ultimate goal of any organization is to satisfy the needs and expectations of its customers. Quality is defined by what the customer values, and success is measured by customer satisfaction.
- **Key Principles:**
  - Understand customer needs and expectations.
  - Deliver products and services that consistently meet or exceed those expectations.
  - Customer feedback is critical for continuous improvement.

### 2. Continuous Improvement (Kaizen)

- **Core Idea:** TQM emphasizes a continuous and ongoing effort to improve processes, products, and services. This involves making small, incremental improvements rather than focusing solely on radical changes.
- **Key Principles:**
  - Regularly assess performance and identify opportunities for improvement.
  - Foster a culture where employees are encouraged to suggest and implement improvements.
  - Use tools like Plan-Do-Check-Act (PDCA) cycles to guide improvements.

### 3. Employee Involvement

- **Core Idea:** Every employee, from top management to frontline workers, is involved in the pursuit of quality. Their participation is crucial in identifying problems, suggesting solutions, and implementing improvements.
- **Key Principles:**
  - Empower employees to take responsibility for quality in their areas.
  - Provide training and resources to help employees contribute effectively.
  - Encourage teamwork and collaboration across departments to achieve common goals.

#### 4. Process-Centered Approach

- **Core Idea:** TQM focuses on improving processes rather than just managing results. The quality of output depends on the quality of the underlying processes.
- **Key Principles:**
  - Identify, map, and optimize critical processes to reduce variability and improve efficiency.
  - Standardize processes to ensure consistency and reduce errors.
  - Use tools like flowcharts, cause-and-effect diagrams, and process maps to analyze and improve processes.

#### 5. Integrated System

- **Core Idea:** TQM requires a holistic approach, where all parts of the organization are aligned toward common quality goals. It integrates various quality management practices across departments.
- **Key Principles:**
  - Departments and functions must work together to ensure quality is built into every aspect of the organization.
  - Ensure that quality is a strategic priority from top management down to individual contributors.
  - Use systems thinking to understand how different processes and activities interrelate and impact overall performance.

#### 6. Fact-Based Decision Making

- **Core Idea:** TQM emphasizes the use of data and facts to make decisions. Rather than relying on intuition or assumptions, decisions should be based on objective, verifiable information.
- **Key Principles:**
  - Collect and analyze data to identify problems, track performance, and make informed decisions.
  - Use statistical methods and quality tools (e.g., control charts, Pareto analysis) to evaluate and improve processes.
  - Measure performance against clear metrics to assess the effectiveness of improvements.

## 7. Communication

- **Core Idea:** Open, transparent, and effective communication is essential to the success of TQM. All members of the organization need to be informed and engaged in quality improvement efforts.
- **Key Principles:**
  - Ensure clear communication about quality goals, objectives, and expectations.
  - Foster an environment of trust and transparency, where employees can freely share ideas, concerns, and feedback.
  - Provide regular updates on the progress of quality improvement initiatives.

## 8. Leadership Commitment

- **Core Idea:** Strong leadership is critical to the success of TQM. Leaders must be committed to quality at all levels of the organization and actively drive the cultural change necessary for TQM to succeed.
- **Key Principles:**
  - Top management should lead by example and demonstrate a strong commitment to quality improvement.
  - Set clear quality goals and provide the resources, training, and support necessary to achieve them.
  - Create a vision of quality that aligns with the organization's mission and values.

## 9. Supplier Quality Management

- **Core Idea:** TQM recognizes that quality does not just happen within the organization—it extends to the entire supply chain. Suppliers should be treated as partners in quality improvement.
- **Key Principles:**
  - Develop long-term, mutually beneficial relationships with suppliers.
  - Work with suppliers to ensure that their processes and products meet quality standards.
  - Use supplier audits, performance reviews, and collaboration to continuously improve quality across the supply chain.

## 10. Strategic Quality Planning

- **Core Idea:** TQM is not just a set of isolated activities; it requires alignment with the organization's long-term strategy. Quality objectives should be integrated into the overall strategic planning process.
- **Key Principles:**
  - Define quality objectives that support the organization's mission and vision.
  - Regularly review and align quality initiatives with changing customer needs and business goals.
  - Make quality a part of the organization's strategic priorities and allocate resources accordingly

### Summary of the Key Concepts of TQM:

1. **Customer Focus:** Understand and meet customer needs.
2. **Continuous Improvement (Kaizen):** Constantly improve processes and products.
3. **Employee Involvement:** Engage all employees in the process of quality improvement.
4. **Process-Centered Approach:** Improve processes to ensure consistent and reliable quality.
5. **Integrated System:** Align all parts of the organization towards quality goals.
6. **Fact-Based Decision Making:** Use data and analysis for informed decision-making.
7. **Communication:** Maintain open, transparent communication throughout the organization.
8. **Leadership Commitment:** Leadership must actively support and promote quality.
9. **Supplier Quality Management:** Work collaboratively with suppliers to ensure quality.
10. **Strategic Quality Planning:** Integrate quality initiatives into the overall business strategy.

These principles, when effectively implemented, contribute to creating a culture of quality that supports long-term success and customer satisfaction. TQM is not just a set of tools, but a philosophy that permeates every aspect of an organization.



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## 1.3 TQM FRAMEWORK

The **Total Quality Management (TQM)** framework is a structured approach that organizations use to continuously improve their processes, products, and services, aiming to meet or exceed customer expectations while achieving long-term success. The framework encompasses various principles, practices, and tools that work together to ensure a commitment to quality at every level of the organization.

The TQM framework can be understood in terms of the **key elements** that drive the process, often grouped into categories such as leadership, customer focus, process management, and continuous improvement. Below is an overview of the **core components of the TQM framework**.

### 1. Key Principles of TQM Framework

#### 1. Customer Focus

- **Definition:** The primary focus of TQM is to meet or exceed customer expectations. All activities in the organization are aligned with delivering high-quality products and services that satisfy customer needs.
- **Actions:**
  - Identify and understand customer needs through regular feedback.
  - Ensure customer satisfaction by delivering quality in every aspect of the service/product.
  - Use customer feedback to continuously improve processes.

#### 2. Leadership Commitment

- **Definition:** Effective leadership is crucial for the successful implementation of TQM. Leaders must define the quality vision and create an environment that fosters a culture of quality.
- **Actions:**
  - Senior management must be fully committed to TQM and lead by example.
  - Establish clear quality goals and ensure alignment with business strategies.
  - Provide necessary resources (training, tools, time) for quality initiatives.
  - Encourage and motivate employees to embrace quality practices.

#### 3. Employee Involvement

- **Definition:** TQM requires active participation from all employees at all levels. Everyone in the organization must be empowered to contribute to quality improvement efforts.

- **Actions:**
  - Empower employees to make decisions and take responsibility for quality in their areas.
  - Create teams to identify problems, analyze data, and implement solutions.
  - Provide continuous training and support for employees to enhance their skills and knowledge in quality management.

#### 4. Continuous Improvement (Kaizen)

- **Definition:** TQM is based on the philosophy of **continuous improvement**—always striving for better performance, quality, and efficiency.
- **Actions:**
  - Regularly review processes and identify areas for improvement.
  - Implement incremental improvements that add up to significant gains over time.
  - Use methodologies like **Plan-Do-Check-Act (PDCA)** cycles, Six Sigma, or Lean to drive improvement.

#### 5. Process Management

- **Definition:** In TQM, quality is embedded in every process within the organization. The focus is on managing and improving processes to reduce variation and ensure consistency in product or service delivery.
- **Actions:**
  - Map out and understand all key business processes.
  - Identify bottlenecks, inefficiencies, and areas of waste.
  - Standardize processes to ensure consistency and minimize errors.
  - Continuously measure and monitor process performance.

#### 6. Data-Driven Decision Making

- **Definition:** TQM encourages decisions to be based on accurate data and facts, rather than assumptions or gut feeling. Data helps to identify root causes of problems and measure improvements.
- **Actions:**
  - Collect and analyze data on process performance, customer satisfaction, and quality metrics.
  - Use statistical tools (e.g., control charts, Pareto analysis) to track trends and detect variations.
  - Foster a culture where data is seen as a key tool for decision-making and problem-solving.

## 7. Integrated System

- **Definition:** The TQM framework requires that all parts of the organization—people, processes, systems—work together toward common quality goals. A holistic approach is taken to integrate quality management into every aspect of the organization.
- **Actions:**
  - Align quality initiatives with organizational strategies, goals, and resources.
  - Create cross-functional teams that work together on quality issues.
  - Integrate quality standards into every department and operation.

## 8. Supplier Quality Management

- **Definition:** TQM recognizes that an organization's quality is influenced not only by internal processes but also by the quality of inputs from external suppliers. Quality must extend to the entire supply chain.
- **Actions:**
  - Build long-term, collaborative relationships with suppliers.
  - Set clear quality expectations and performance standards for suppliers.
  - Regularly assess and provide feedback to suppliers to help them improve.

## 9. Customer Satisfaction Measurement

- **Definition:** TQM relies on regular assessments of customer satisfaction to gauge the effectiveness of quality efforts and identify areas for improvement.
- **Actions:**
  - Use surveys, focus groups, and direct feedback to understand customer perceptions.
  - Regularly monitor satisfaction metrics such as Net Promoter Score (NPS) or Customer Satisfaction Score (CSAT).
  - Use customer feedback to prioritize improvements.

## 2. TQM Framework Components

A typical **TQM framework** is built around several key **components** that support and drive the above principles:

### A. Enablers of TQM

1. **Top Management Commitment:** Without strong leadership and clear direction, TQM cannot be successful. Top management must set the tone for a quality culture.
2. **Strategic Planning:** Quality management strategies should be integrated into the organization's strategic planning process.

3. **Quality Culture:** A culture where quality is everyone's responsibility, and quality improvement is an ongoing process.
4. **Training and Education:** Continuous learning and skill development are vital for building a knowledgeable and empowered workforce.
5. **Clear Vision and Goals:** Clearly defined quality objectives that align with business goals.
6. **Employee Involvement:** Encouraging employees to participate in decision-making and problem-solving related to quality.

## B. Tools and Techniques for TQM

- **Statistical Process Control (SPC):** Monitoring and controlling processes through statistical methods.
- **Root Cause Analysis (RCA):** Identifying the fundamental cause of problems to prevent recurrence.
- **Flowcharts:** Visualizing processes to identify inefficiencies and areas for improvement.
- **Pareto Analysis:** Using the 80/20 rule to identify the most significant issues that should be prioritized.
- **Fishbone Diagram (Ishikawa):** Identifying the potential causes of problems or defects in a process.
- **Benchmarking:** Comparing an organization's performance with industry best practices to identify gaps.

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## C. Results/Outcomes of TQM

1. **Improved Product/Service Quality:** The end goal is to consistently meet customer expectations and deliver superior products and services.
2. **Operational Efficiency:** Optimizing processes to reduce waste, cost, and time, improving overall efficiency.
3. **Employee Satisfaction:** By involving employees and fostering a quality culture, employee engagement and morale improve.
4. **Customer Satisfaction:** Meeting or exceeding customer expectations leads to increased customer loyalty and market competitiveness.
5. **Continuous Growth:** Organizations adopting TQM enjoy continuous improvement, better innovation, and sustained business growth.

### 3. Key TQM Models and Frameworks

Several popular TQM models provide structure and guidance to organizations pursuing quality improvement:

1. **The Deming Wheel (PDCA Cycle):** A four-step cycle (Plan, Do, Check, Act) for continuous improvement.
2. **The Malcolm Baldrige National Quality Award (MBNQA):** A model that provides a framework for performance excellence, focusing on leadership, strategy, customers, and results.
3. **ISO 9000 Series:** A set of international standards for quality management systems that guide organizations toward effective quality practices.
4. **Six Sigma:** A data-driven approach focused on reducing process variation and defects to improve quality.

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## 1.4 BARRIERS TO TQM

Total Quality Management (TQM) is a holistic approach aimed at continuous improvement in organizational processes and customer satisfaction. However, implementing TQM is not without its challenges. Below are some common **barriers to TQM**:

### 1. Lack of Top Management Commitment

- **Explanation:** TQM requires a strategic shift and sustained effort, which must be driven from the top. If leadership is not fully committed, employees may perceive TQM as unimportant, and necessary resources may not be allocated.

### 2. Resistance to Change

- **Explanation:** TQM often involves modifying established processes, roles, and responsibilities. Employees may resist these changes due to fear of job loss, increased workload, or skepticism about the benefits of the new system.

### 3. Insufficient Training and Education

- **Explanation:** TQM tools and techniques, such as statistical process control or root cause analysis, require specific skills. Without proper training, employees may lack the competence to implement and sustain TQM practices.

### 4. Poor Communication

- **Explanation:** Ineffective communication between departments, management, and employees can lead to misunderstandings, misaligned goals, and lack of clarity about TQM's purpose and benefits.

### 5. Inadequate Resources

- **Explanation:** TQM requires financial investment, time, and human resources. Limited budgets, overworked employees, or insufficient tools can hamper the implementation process.

### 6. Short-term Focus

- **Explanation:** Organizations prioritizing immediate profits or results often overlook the long-term benefits of TQM. This mindset can lead to a lack of sustained effort toward quality improvement.

## 7. Inconsistent Objectives

- **Explanation:** When organizational departments have conflicting goals (e.g., sales prioritizing volume while production focuses on cost-cutting), it creates silos that undermine TQM's holistic approach.

## 8. Lack of Customer Focus

- **Explanation:** TQM is customer-centric. If an organization does not actively incorporate customer feedback into its processes, it fails to align its improvements with customer needs and expectations.

## 9. Inadequate Measurement and Feedback Systems

- **Explanation:** TQM relies on continuous monitoring and feedback to identify areas of improvement. Without robust metrics and systems, it is difficult to evaluate progress and make informed decisions.

## 10. Cultural Barriers

- **Explanation:** An organizational culture that does not value teamwork, innovation, or employee participation can resist the collaborative spirit essential to TQM.

## 11. Overemphasis on Tools

- **Explanation:** TQM involves cultural and systemic changes, but some organizations focus excessively on tools and techniques without fostering the mindset and behaviors needed for sustained improvement.

## 12. Lack of Employee Empowerment

- **Explanation:** Employees are at the frontline of processes and often have valuable insights. If they are not empowered to make decisions or suggest improvements, the full potential of TQM remains unrealized.



### 13. Failure to Benchmark

- **Explanation:** Benchmarking helps organizations set realistic quality goals based on industry best practices. Without this, companies may set unachievable targets or miss opportunities for improvement.

### 14. External Constraints

- **Explanation:** Regulatory requirements, economic downturns, or supply chain disruptions can divert focus and resources away from TQM initiatives.

#### Addressing These Barriers:

To overcome these barriers:

- Gain active support from top management.
- Foster open communication about TQM benefits and changes.
- Provide regular training and empower employees at all levels.
- Ensure alignment of organizational goals with customer satisfaction.
- Develop effective feedback and measurement systems.
- Create a culture that values continuous improvement and collaboration.

## 1.5 BENEFITS OF TQM

Total Quality Management (TQM) is a holistic approach to long-term success through customer satisfaction. It involves continuous improvement of organizational processes, focusing on quality as a core element of every operation. Below are detailed benefits of implementing TQM:

### 1. Enhanced Customer Satisfaction

- **Focus on Quality:** TQM ensures that products or services meet or exceed customer expectations by maintaining high-quality standards.
- **Consistency:** By reducing variability in processes, customers consistently receive the promised value.
- **Customer Feedback Integration:** Continuous feedback loops improve responsiveness to customer needs and preferences.

### 2. Improved Employee Engagement

- **Empowerment:** TQM encourages employee involvement in decision-making and problem-solving, fostering ownership of tasks.
- **Training & Development:** Employees receive training to improve their skills, leading to higher job satisfaction and productivity.
- **Teamwork:** Collaborative culture under TQM boosts morale and cohesion among employees.

### 3. Operational Efficiency

- **Reduction in Waste:** Streamlining processes and eliminating non-value-added activities minimize waste and reduce costs.
- **Process Optimization:** Standardization and refinement of workflows improve operational efficiency and resource utilization.
- **Reduced Rework:** High-quality standards prevent defects, saving time and material costs.

### 4. Cost Savings

- **Lower Quality Costs:** By emphasizing defect prevention, TQM reduces costs associated with inspection, rework, and warranty claims.
- **Energy and Resource Efficiency:** Leaner processes result in cost-effective use of resources, including energy and raw materials.

### 5. Stronger Competitive Position

- **Market Differentiation:** Superior quality can be a competitive advantage, improving brand reputation and customer loyalty.
- **Increased Market Share:** Satisfied customers are more likely to recommend the organization, leading to organic growth.
- **Adaptability:** Continuous improvement processes allow organizations to adapt quickly to market changes.

### 6. Enhanced Organizational Culture

- **Commitment to Excellence:** TQM fosters a culture of quality that permeates every level of the organization.
- **Continuous Improvement:** The mindset of constant progress becomes ingrained, driving innovation and long-term success.
- **Shared Vision:** TQM aligns employees, departments, and stakeholders with common goals.

## 7. Regulatory and Compliance Advantages

- **Adherence to Standards:** TQM practices often align with industry standards (e.g., ISO 9001), easing compliance efforts.
- **Risk Management:** Proactive identification and mitigation of risks reduce legal and operational vulnerabilities.

## 8. Higher Financial Performance

- **Revenue Growth:** Consistently high-quality products or services can command premium pricing.
- **Investor Confidence:** Companies with strong TQM systems are more attractive to investors due to reduced risks and stable operations.

## 9. Increased Innovation

- **Encouragement of Ideas:** Employee-driven improvements and customer feedback under TQM foster innovation.
- **Better R&D Outcomes:** High-quality data from TQM processes enhance decision-making in research and development.

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## 10. Sustainability

- **Environmental Benefits:** By minimizing waste and optimizing resources, TQM contributes to sustainable practices.
- **Long-Term Viability:** A quality-focused organization is better equipped to maintain relevance and success over time.

TQM is a transformative strategy that improves every aspect of an organization, from customer relations to internal processes and overall profitability. While its implementation requires commitment, the long-term benefits often outweigh the initial investment.

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W. Edwards Deming was a renowned statistician, professor, author, and consultant who is best known for his work in the field of quality management. His philosophy, often referred to as the "Deming Philosophy," emphasizes continuous improvement, statistical thinking, and systems management. It had a profound impact on manufacturing, particularly in post-World War II Japan, where his ideas contributed to the rise of Japanese industry as a global leader in quality and efficiency. Deming's principles were later widely adopted in other countries and industries.

Here are the key elements of Deming's philosophy:

### 1. Systematic Thinking and the System of Profound Knowledge

Deming stressed the importance of seeing organizations as systems, where all parts are interconnected. He argued that improving one part of a system without considering the entire system often leads to suboptimal results. He introduced the **System of Profound Knowledge**, which is a framework for understanding and improving organizations. This system consists of four components:

- **Appreciation for a system:** Understanding that an organization is a system made up of interrelated parts that need to work together.
- **Knowledge of variation:** Recognizing that variability exists in all processes, and it's important to understand the sources of variation to improve quality.
- **Theory of knowledge:** A belief in continuous learning and understanding the theory behind how things work. Knowledge is gained through observation and experimentation.
- **Psychology:** Understanding human behavior and motivation. Deming believed that effective management must take into account the needs and motivations of people within the system.

### 2. The Plan-Do-Check-Act (PDCA) Cycle

Deming popularized the **Plan-Do-Check-Act (PDCA)** cycle, also known as the Deming Cycle. This is a method for continuous improvement that consists of four stages:

- **Plan:** Identify a problem, plan a solution, and predict the outcome.
- **Do:** Implement the plan on a small scale to test its effectiveness.
- **Check:** Evaluate the results of the implementation to see if the problem is being solved.
- **Act:** If the solution works, standardize the change and scale it. If not, make adjustments and repeat the cycle.

This iterative process encourages constant learning and refinement, which helps organizations gradually improve their products, services, and operations.

### 3. 14 Points for Management

In his 1986 book *Out of the Crisis*, Deming outlined his famous **14 Points for Management**, which serve as guidelines for transforming organizational culture and improving quality. Key points include:

- **Create constancy of purpose:** Organizations should have a clear, long-term vision, focusing on continuous improvement rather than short-term profits.
- **Adopt the new philosophy:** Management should embrace quality and continuous improvement as core values.
- **Cease dependence on inspection:** Rather than relying on inspections to catch defects, Deming advocated for building quality into the process from the start.
- **Improve every process:** Continuously work on improving processes to reduce waste and increase efficiency.
- **Institute training:** Provide employees with the necessary skills to perform their work effectively.
- **Drive out fear:** Create a culture where employees feel safe to express ideas, report problems, and contribute to improvements.
- **Eliminate barriers between departments:** Promote collaboration across departments rather than focusing on internal competition.

### 4. Focus on Quality, Not Just Cost Reduction

Deming emphasized that organizations should focus on improving quality rather than just cutting costs. High quality leads to customer satisfaction, which ultimately drives profitability. He also argued that focusing too much on cost reduction often leads to poor quality, which harms the business in the long run.

### 5. The Role of Leadership

Deming believed that leadership was the key to transforming organizations. He argued that it was the responsibility of managers and executives to provide direction, remove obstacles, and foster a culture of collaboration and continuous improvement. Leadership should empower employees, provide them with the tools and training they need, and create an environment where innovation and problem-solving are encouraged.

## 6. Intrinsic Motivation and Employee Involvement

Deming emphasized the importance of intrinsic motivation — the idea that employees should be motivated by the work itself, not just by external rewards or punishments. He believed that when employees are involved in decision-making, feel valued, and are empowered to contribute to improvement efforts, they will naturally perform better and contribute to the success of the organization.

## 7. Reduce Fear and Encourage Open Communication

One of Deming's core principles was the need to eliminate fear in the workplace. He argued that fear stifles creativity and innovation, preventing employees from speaking up about problems or suggesting improvements. A culture of open communication and trust allows for more effective problem-solving and continuous improvement.

## 8. The Importance of Data and Statistical Control

Deming championed the use of data, statistical analysis, and control charts to monitor and improve processes. He introduced the concept of **statistical process control (SPC)**, which involves using data to understand process variation and make informed decisions to improve quality. By focusing on data rather than intuition or assumptions, organizations can make more effective, evidence-based decisions.

## 9. Focus on the Customer

Deming believed that quality should always be defined in terms of customer needs and expectations. By understanding customer requirements and continuously striving to meet or exceed them, organizations can create long-term success.

## 10. Continuous Improvement (Kaizen)

Deming advocated for the philosophy of **continuous improvement**, which is a never-ending process of making incremental improvements to products, services, and processes. This mind-set aligns closely with the concept of **Kaizen**, which is a Japanese term meaning "change for better." For Deming, quality was never "finished" — it was always a journey of improvement.

## Legacy and Impact

Deming's philosophy has had a lasting impact, especially on the fields of quality management, manufacturing, and leadership. His principles formed the foundation of several well-known quality

frameworks, including Total Quality Management (TQM), Six Sigma, and Lean Manufacturing. His ideas also helped shape the **ISO 9000** standards for quality management systems.

In Japan, Deming's work was instrumental in the transformation of the country's manufacturing sector after World War II. He is credited with helping Japanese companies, such as Toyota, to develop world-class products that set new standards for quality.

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**Customer satisfaction** is at the heart of **Total Quality Management (TQM)**, a management philosophy that aims to continuously improve the quality of products, services, and processes across an organization to meet or exceed customer expectations. In TQM, customer satisfaction is seen as the ultimate measure of success, and it drives the organization's improvement efforts.

### Key Aspects of Customer Satisfaction in TQM

#### 1. Understanding Customer Needs and Expectations

- TQM emphasizes that organizations must understand and anticipate customer needs, preferences, and expectations. This understanding is crucial for designing products, services, and processes that align with customer desires.
- **Customer feedback** is essential. Organizations should continuously gather and analyze feedback through surveys, focus groups, reviews, complaints, and direct interactions to stay attuned to customer requirements.
- TQM encourages **proactive engagement** with customers, not just reactive responses to problems. Companies that can anticipate needs and deliver on them consistently tend to build better relationships with their customers.

#### 2. Customer Focus as the Core Principle

- A fundamental principle of TQM is that the **customer is always the focus**. All activities in the organization should be geared toward creating value for customers.
- Every employee, from top management to frontline workers, should understand the organization's commitment to customer satisfaction and their role in delivering that satisfaction.
- TQM encourages organizations to shift from a product-centric mindset to a **customer-centric approach**. This means that even in product development or service design, the primary goal is to meet or exceed customer expectations rather than focusing solely on internal processes or technical specifications.

#### 3. Quality as Defined by the Customer

- In TQM, **quality** is not defined by the organization's internal standards or specifications, but by what the customer perceives as quality. The organization's products or services should meet the functional and emotional needs of customers.
- The concept of **fitness for use** — meaning that a product or service performs as expected and delivers the benefits the customer seeks — is crucial. The focus is not just on meeting technical standards, but on delivering value and satisfaction to the customer.

#### 4. Customer Satisfaction as the Ultimate Measure

- TQM posits that **customer satisfaction** is the ultimate measure of quality. High levels of satisfaction lead to repeat business, customer loyalty, and positive word-of-mouth, while poor satisfaction can result in lost customers, negative feedback, and damage to the brand's reputation.
- Regular **customer satisfaction measurement** helps the organization understand how well it is meeting customer expectations. This could involve tracking metrics like customer loyalty, Net Promoter Score (NPS), or Customer Satisfaction (CSAT) scores.
- **Customer retention** is a key indicator of sustained satisfaction. The more satisfied customers are with the product or service, the more likely they are to remain loyal to the company and continue purchasing over time.

#### 5. Continuous Improvement (Kaizen) for Better Customer Experience

- A key concept in TQM is **continuous improvement**, also known as **Kaizen**. It involves constantly refining and improving processes to deliver better quality and enhance the customer experience.
- The TQM philosophy believes that through small, incremental improvements, organizations can continually enhance the value they offer to customers.
- Regular process evaluation and data-driven decision-making allow businesses to identify areas of improvement and make the necessary adjustments to further satisfy customer needs.
- For example, if customer feedback indicates that a product feature is difficult to use, the organization will make design or usability improvements to meet customer expectations.

#### 6. Cross-Functional Teams and Collaboration

- Achieving customer satisfaction through TQM requires a **cross-functional approach** to quality. Different departments within the organization—such as marketing, production, quality control, and customer service—must collaborate to create products and services that fulfill customer needs.
- Quality isn't just the responsibility of the quality department; it's a **company-wide commitment**. Every employee in every department must be involved in understanding customer expectations and contributing to quality improvement efforts.

#### 7. Eliminating Waste and Reducing Variation

- In TQM, reducing variation in processes (through **statistical process control** or **Six Sigma**) helps ensure that products or services consistently meet customer expectations.
- The goal is to eliminate **defects** and **waste** that detract from the customer experience. This could involve refining manufacturing processes to prevent defects, reducing waiting

times for customers, or streamlining customer service procedures to provide faster and more accurate responses.

- By maintaining **consistent quality**, organizations can ensure that customers receive reliable, high-quality products or services every time they engage with the company.

## 8. Customer Involvement in the Quality Process

- TQM encourages **customer involvement** in the quality process, particularly when designing new products or improving existing ones. Engaging customers early on can provide valuable insights into their needs, preferences, and pain points.
- Companies that implement co-creation or collaborative development models can gain valuable feedback, making it easier to tailor their offerings to customer expectations.
- Regular interaction with customers (such as through surveys, focus groups, and social media engagement) ensures that customer perspectives are integrated into decision-making and process improvements.

## 9. Leadership Commitment to Customer Satisfaction

- Leadership plays a crucial role in fostering a customer-centric culture. In TQM, senior management must demonstrate a strong commitment to customer satisfaction by setting clear expectations, providing resources for improvement, and ensuring that all employees understand the importance of customer satisfaction.
- Leadership should also establish the **vision and values** that prioritize customer needs, embedding these principles into the organization's mission and everyday practices.
- By aligning organizational goals with customer satisfaction, leaders help ensure that the entire organization is focused on delivering value to customers

## Benefits of Prioritizing Customer Satisfaction in TQM

### 1. Increased Customer Loyalty and Retention

- When customers are consistently satisfied with the products, services, and overall experience, they are more likely to remain loyal to the brand, reducing churn and ensuring repeat business.

### 2. Improved Reputation and Brand Image

- Satisfied customers are more likely to recommend the company to others, leading to positive word-of-mouth and an enhanced reputation in the market.

### 3. **Competitive Advantage**

- Organizations that focus on customer satisfaction often differentiate themselves from competitors. A reputation for delivering high-quality products or exceptional customer service can be a significant competitive advantage.

### 4. **Higher Profitability**

- Satisfied customers tend to spend more and are less price-sensitive. They may also be willing to pay a premium for products and services they perceive as high-quality. This can result in higher revenues and profitability over time.

### 5. **Employee Satisfaction and Engagement**

- When employees see that their efforts to improve quality and serve customers are making a positive impact, it boosts morale, engagement, and motivation. A customer-focused culture can create a sense of pride and purpose among employees.

In **Total Quality Management**, customer satisfaction is the ultimate goal and a key indicator of organizational success. By understanding customer needs, continuously improving processes, and embedding a culture of quality across all departments, TQM ensures that customer satisfaction is not a one-time achievement but an ongoing, sustainable outcome. Organizations that prioritize customer satisfaction in their TQM initiatives are more likely to foster loyalty, maintain a competitive edge, and achieve long-term success.

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## 2.3 TEAMS AND TEAMWORK

In **Total Quality Management (TQM)**, **teams** and **teamwork** are essential components for achieving continuous improvement and delivering high-quality products and services. TQM emphasizes collaboration, cross-functional teams, and collective responsibility to improve processes, solve problems, and enhance customer satisfaction. Teams are seen as a vital mechanism for driving the culture of quality across the organization.

### Key Concepts of Team and Teamwork in TQM

#### 1. Cross-Functional Teams

- **Cross-functional teams** in TQM are groups of individuals from different departments or areas of expertise who come together to solve problems or work on projects. These teams often include people from areas like production, marketing, quality control, customer service, and design, among others.
- The idea behind cross-functional teams is that **quality is everyone's responsibility**, not just the responsibility of the quality department. By involving people with diverse skills and perspectives, the team can tackle issues from multiple angles and come up with more comprehensive solutions. [www.EnggTree.com](http://www.EnggTree.com)
- For example, if a company wants to improve customer satisfaction with a product, a cross-functional team might include product designers, engineers, customer service representatives, and marketing experts. Each member brings a different viewpoint to the problem.

#### 2. Team-Based Problem Solving

- **Problem-solving** is at the heart of TQM, and **teams** are often the most effective way to address challenges. In TQM, teams use structured problem-solving methods, such as the **Plan-Do-Check-Act (PDCA) cycle**, **root cause analysis**, and **brainstorming**.
- Teams may work together to identify issues in quality, analyze the root causes, develop improvement plans, and implement solutions. This collaborative approach ensures that all perspectives are considered and that solutions are practical, effective, and sustainable.
- A well-known problem-solving tool used by TQM teams is the **Fishbone diagram (Ishikawa diagram)**, which helps teams analyze the potential causes of a problem in a systematic way.

### 3. Continuous Improvement (Kaizen) through Teamwork

- **Kaizen**, a Japanese term for "continuous improvement," is a fundamental philosophy in TQM, and teamwork is crucial to its implementation. Teams in TQM are formed to drive ongoing improvement in processes, products, and services.
- Teams are expected to work on **incremental improvements** over time, addressing small issues that, when solved, accumulate to significant enhancements in quality. By continuously improving processes, teams help organizations meet customer expectations more effectively and efficiently.
- Team members are encouraged to look for ways to eliminate waste, reduce variation, and optimize performance in every aspect of their work.

### 4. Empowerment of Teams

- In TQM, teams are not just problem-solvers; they are empowered to make decisions. This empowerment is central to fostering a culture of responsibility and accountability.
- Teams are given the **authority** to make changes to processes, suggest improvements, and implement solutions. This autonomy enables quicker decision-making and helps drive change from within the team itself, which increases employee engagement and commitment to quality.
- Empowering teams can also increase job satisfaction, as employees feel that their input is valued and that they have an active role in improving the organization's performance.

### 5. Communication and Collaboration

- Effective **communication** and **collaboration** are essential for successful teamwork in TQM. Teams rely on clear, open communication channels to share ideas, align goals, and discuss issues.
- Regular team meetings, status updates, and collaborative tools (such as shared documents or software platforms) help maintain focus and ensure that all team members are on the same page.
- Teams in TQM are encouraged to share feedback openly, as this helps identify potential problems early on and fosters an environment of trust and mutual respect.

### 6. Team Leadership and Roles

- Every team in TQM requires a **team leader** who is responsible for guiding the team, setting clear objectives, and ensuring that the team stays focused on its goals. The leader facilitates communication, resolves conflicts, and helps members collaborate effectively.

- In addition to the leader, each team member has specific roles and responsibilities based on their expertise. A team might include:
  - A **facilitator**, who ensures smooth communication and helps the team stay organized.
  - A **note-taker**, who records the discussions and decisions made during meetings.
  - **Subject matter experts**, who provide deep knowledge in specific areas.
  - **Team members**, who contribute ideas, feedback, and action items to achieve the team's objectives.
- The most effective teams in TQM are those where leadership is collaborative, with the leader guiding the process while encouraging input and participation from all members.

## 7. Team-Based Training and Development

- **Training** is a critical component of TQM, and teams are often provided with ongoing training to develop their skills and knowledge. Training might include topics like quality improvement tools, problem-solving techniques, communication skills, and process management.
- Teams need to be well-equipped with the necessary **skills and tools** to tackle challenges effectively. Regular training ensures that team members are up to date with the latest methodologies and can contribute to the organization's quality improvement efforts.

## 8. Recognition and Reward Systems for Teams

- Recognizing and rewarding teams for their achievements is an important part of TQM. When teams accomplish goals, solve problems, or contribute to significant improvements, they should be celebrated and rewarded.
- Recognition helps reinforce the importance of teamwork and motivates employees to continue collaborating toward quality goals. This could include formal awards, team celebrations, or even just public acknowledgment of the team's contributions during company meetings.
- Recognition also fosters a sense of pride and ownership, which encourages team members to continue working hard and striving for excellence.

## 9. Teamwork and Organizational Culture

- TQM requires a cultural shift where **teamwork** is a core value across the entire organization. This shift is supported by leadership, which sets the tone for collaboration and encourages a shared commitment to quality.
- Teams are an integral part of the **organizational culture** in TQM, and their success is seen as essential to the company's overall success. A collaborative culture, where teams work together

toward common goals, leads to better communication, more innovative solutions, and more effective problem-solving.

### ***Benefits of Teamwork in TQM***

#### **1. Improved Problem Solving**

- Teams bring diverse perspectives and ideas, which often leads to better problem-solving. Different viewpoints can help identify root causes of issues and generate more creative solutions.

#### **2. Increased Efficiency**

- When teams work well together, tasks can be completed faster, and resources can be used more efficiently. Teams in TQM often improve processes by streamlining workflows and eliminating unnecessary steps.

#### **3. Enhanced Communication**

- Cross-functional teams foster better communication between departments, breaking down silos and ensuring that everyone is aligned in their efforts to meet customer needs.

#### **4. Higher Employee Engagement**

- Empowering employees to take ownership of quality improvement initiatives increases job satisfaction and commitment to the organization's goals. When employees feel valued as part of a team, they are more likely to contribute their best efforts.

#### **5. Sustained Quality Improvements**

- Because TQM emphasizes continuous improvement, teams are responsible for making incremental changes that add up over time. Teams ensure that quality improvements are not one-time events but a sustained process.

In **Total Quality Management (TQM)**, teams and teamwork play a vital role in driving continuous improvement and delivering high-quality products and services. Through cross-functional collaboration, problem-solving, empowerment, and ongoing training, teams contribute to organizational success by ensuring that quality is ingrained in every aspect of the company. By working together toward common goals, teams can effectively address challenges, enhance customer satisfaction, and maintain a culture of excellence and improvement.



## 2.4 SUPPLIER PARTNERSHIP

In **Total Quality Management (TQM)**, managing relationships with suppliers is a crucial element for ensuring that an organization's products or services meet high-quality standards. Suppliers contribute significantly to the quality of the final product, so **supplier partnership** and **collaborative relationships** are central to the TQM philosophy. The goal is to build long-term, mutually beneficial relationships with suppliers, which will result in improved quality, reduced costs, and greater customer satisfaction.

TQM focuses on working closely with suppliers to integrate them into the quality improvement process, making them active participants in an organization's pursuit of excellence. The following elements—**partnering, supplier selection, supplier rating, and relationship development**—are key aspects of managing supplier partnerships in TQM.

### 1. Supplier Partnering

Supplier **partnering** in TQM refers to the practice of developing long-term, collaborative relationships with suppliers rather than treating them as just transactional entities. TQM encourages organizations to view suppliers as integral parts of their value chain and key contributors to quality improvement.

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- **Mutual Trust and Communication:** Establishing a partnership requires **open, transparent communication** and **trust**. Organizations and suppliers must be willing to share information, collaborate on solving problems, and work together to improve quality and performance. This includes sharing production schedules, quality expectations, and performance data.
- **Shared Goals:** In a true partnership, both the supplier and the organization share common goals, such as **improving quality, reducing costs, and enhancing customer satisfaction**. Partners work together to address quality issues and find solutions to challenges in the supply chain.
- **Joint Problem Solving:** Instead of blaming each other when issues arise, partners in TQM work together to identify the root cause of problems and develop solutions. This collaborative approach helps to **prevent defects** and improve the quality of both products and processes.
- **Continuous Improvement:** Suppliers should be treated as part of the continuous improvement process. Through **Kaizen** (continuous improvement) and the **PDCA cycle**, suppliers can contribute ideas and innovations that improve product quality, reduce costs, and enhance efficiency.

#### Benefits of Supplier Partnering:

- Reduced defects and rework.

- More consistent supply of high-quality materials.
- Greater innovation through shared knowledge and expertise.
- Reduced lead times and more flexible supply chains.
- Enhanced problem-solving capabilities.

## 2. Supplier Selection

Supplier selection is a critical process in TQM because the quality of the materials or components provided by suppliers directly impacts the final product quality. TQM emphasizes the need for a **systematic, rigorous approach** to selecting suppliers to ensure that they meet the required quality standards.

- **Quality Criteria:** In TQM, suppliers are selected based on their ability to consistently meet or exceed the organization's quality standards. This includes factors like:
  - **Consistency in delivering defect-free products.**
  - Ability to meet **delivery deadlines.**
  - **Compliance with environmental and ethical standards.**
  - **Technical capabilities**, such as capacity to innovate and improve processes.
- **Cost Considerations:** While cost is a factor in supplier selection, TQM stresses that **quality and long-term relationships** are more important. The goal is to select suppliers who can deliver high-quality products at competitive prices, rather than opting for the cheapest option without regard for quality.
- **Financial Stability:** Suppliers should have the financial stability to continue providing quality products and support the organization's long-term needs.
- **Reputation and Experience:** A supplier's reputation in the industry, as well as their **experience and track record** in delivering quality products or services, plays a significant role in selection.
- **Capacity for Innovation:** Suppliers should be able to contribute to product and process innovations. This could include **design improvements, new technologies**, or more efficient manufacturing methods.

### Key Supplier Selection Criteria in TQM:

- Quality systems in place (e.g., ISO 9001 certification).
- On-time delivery performance.
- Competitive pricing without sacrificing quality.
- Capability for continuous improvement.
- Ethical practices and compliance with regulatory standards.

- Ability to provide support services, such as training or technical assistance.

### 3. Supplier Rating

Supplier **rating** or **performance evaluation** is an ongoing process in TQM, used to assess the performance of suppliers over time. This ensures that suppliers continue to meet quality standards and that the relationship remains beneficial to both parties. Supplier ratings are based on objective criteria and provide valuable data for improving supplier relationships.

- **Key Performance Indicators (KPIs):** Supplier performance is typically measured using KPIs, such as:
  - **Quality:** The number of defects, returns, or customer complaints related to the supplier's products.
  - **Delivery Performance:** On-time delivery rate and adherence to schedules.
  - **Cost Control:** How well the supplier meets cost targets while maintaining product quality.
  - **Flexibility and Responsiveness:** The supplier's ability to accommodate changes in demand, respond to urgent requests, or resolve issues quickly.
  - **Service and Support:** The level of customer service and support the supplier provides, such as technical assistance, training, or after-sales support.
- **Rating Systems:** Various rating systems are used to evaluate suppliers. Some companies use a numerical score (e.g., 1–5 scale or percentage rating), while others use **Balanced Scorecards** or **Supplier Scorecards**, which include multiple criteria (quality, cost, delivery, etc.) and give a comprehensive view of supplier performance.
- **Regular Reviews:** Supplier performance should be reviewed regularly (e.g., quarterly or annually) to assess how well the supplier is meeting quality and performance expectations.
- **Feedback and Communication:** After evaluations, feedback should be provided to the supplier, highlighting areas of strength and areas for improvement. Suppliers who consistently perform well should be recognized, and those who need improvement should be given the opportunity to address deficiencies.

#### Supplier Rating Benefits:

- Helps identify areas for improvement.
- Enables data-driven decision-making when choosing suppliers or renewing contracts.
- Enhances supplier accountability.
- Encourages suppliers to improve performance and align with quality standards.

#### 4. Supplier Relationship Development

Developing and nurturing **supplier relationships** is crucial in TQM, as long-term, stable relationships with suppliers contribute to consistent quality, reliability, and mutual success. TQM emphasizes collaboration, shared goals, and continuous improvement as part of the relationship development process.

- **Building Trust:** Building trust is the foundation of any strong supplier relationship. This involves consistent, honest communication, and ensuring that both parties fulfill their commitments. Trust ensures that the supplier feels confident in the partnership, which makes them more willing to invest in quality improvements and innovation.
- **Joint Development and Innovation:** Supplier relationships in TQM should go beyond transactional exchanges. Suppliers should be treated as partners in **innovation** and **product development**. Companies often collaborate with suppliers to improve products or design new solutions together. This joint effort can lead to cost reductions, better quality, and more competitive products.
- **Shared Risk and Rewards:** TQM promotes the idea of shared responsibility for success and failure. When a supplier experiences a setback, it can be helpful to provide support or work together to find solutions, rather than penalizing them immediately. Conversely, when both parties succeed, the rewards should be shared.
- **Regular Communication and Feedback:** Open lines of communication are essential for building strong relationships. Regular meetings, performance reviews, and informal conversations can help both parties stay aligned on quality expectations, delivery schedules, and any issues that arise.
- **Long-Term Commitment:** Supplier relationships in TQM are meant to be long-term. Companies often engage in **strategic partnerships** with their suppliers, which are more collaborative and less transactional. Long-term relationships create stability in the supply chain and allow both parties to plan and invest in continuous improvement over time.

##### **Benefits of Supplier Relationship Development:**

- Improved collaboration leads to better problem-solving and quality improvements.
- Long-term relationships help ensure stability and consistency in supply and pricing.
- Suppliers are more likely to innovate and improve if they feel like a valued partner.
- Reduced risks in the supply chain, as both parties work together to address challenges.
- More flexible supply chains that can adapt to changes in demand or requirements.

In **Total Quality Management (TQM)**, effective management of supplier relationships is fundamental to ensuring high product quality and operational efficiency. **Supplier partnerships, selection, rating, and relationship development** play a vital role in building a robust, collaborative supply chain that supports the organization's commitment to quality and continuous improvement.

By carefully selecting suppliers, evaluating their performance regularly, and developing long-term, mutually beneficial relationships, organizations can create a supply chain that contributes to consistent product quality, cost reductions, and enhanced customer satisfaction. TQM emphasizes that suppliers are not just vendors but partners in achieving quality excellence, and fostering strong, cooperative relationships is essential for long-term success.

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## 2.5 JURAN TRILOGY

The **Juran Trilogy** is a fundamental concept in Total Quality Management (TQM), developed by **Dr. Joseph M. Juran**, one of the key figures in quality management. The Juran Trilogy consists of three critical components: **Quality Planning**, **Quality Control**, and **Quality Improvement**. These components provide a systematic approach for organizations to manage and improve quality at all levels.

Juran's approach is designed to ensure that quality is built into processes from the beginning, maintained throughout operations, and continuously improved. Each part of the trilogy addresses a specific aspect of quality management and complements the others.

### 1. Quality Planning

Quality Planning is the first phase of the Juran Trilogy. It involves **identifying customer needs and developing the processes necessary to meet those needs**. In TQM, quality planning is a proactive approach that sets the stage for quality in the product or service before production even begins. This phase ensures that quality is "designed in" rather than inspected out.

#### Key Steps in Quality Planning:

- **Identify Customers and Their Needs:** The first step in quality planning is to understand who the customers are (both external and internal) and what their expectations are. This involves gathering feedback from customers, market research, and analyzing customer requirements.
- **Determine the Requirements for Product or Service:** Once customer needs are understood, the next step is to determine what specific characteristics (features, functions, etc.) the product or service must have to meet those needs.
- **Develop the Process to Meet Requirements:** Quality planning involves designing processes that will reliably produce products that meet the defined customer requirements. This includes developing systems, selecting suppliers, creating training programs, and establishing quality standards.
- **Set Quality Targets:** Establishing clear and measurable **quality objectives** (such as defect rates, delivery times, customer satisfaction levels) helps ensure that quality goals are clearly defined and achievable.
- **Risk Assessment and Control Plans:** Planning for potential problems is crucial, and quality planning involves designing control mechanisms to monitor performance and prevent defects before they occur.

**Outcome of Quality Planning:**

- A **well-defined process** that delivers products or services that meet customer needs.
- Clear **quality objectives** aligned with customer expectations.
- A roadmap for ensuring that quality is maintained throughout the production or service delivery process.

**2. Quality Control**

Quality Control focuses on **monitoring and measuring ongoing processes to ensure they are producing products or services that meet the desired standards**. It involves establishing control measures to track performance, detect issues early, and take corrective actions when required.

**Key Components of Quality Control:**

- **Performance Monitoring:** This involves **measuring performance** against predefined standards or targets. In TQM, this could mean monitoring process variables, product attributes, or service outcomes (such as defect rates or response times).
- **Statistical Process Control (SPC):** Juran emphasizes using **statistical tools** to measure process variations and determine whether processes are stable and predictable. Statistical techniques like control charts and Pareto analysis are often used to identify areas for improvement.
- **Defect Detection:** Quality control ensures that **defects or deviations** from standards are identified and addressed quickly. This includes inspecting products during production or post-production, or reviewing service processes.
- **Corrective Actions:** When variations or defects are identified, immediate corrective actions are taken to prevent them from affecting the final output. This could include process adjustments, repairs, or revising procedures.

**Key Concepts in Quality Control:**

- **Preventive Action:** Quality control focuses on not just detecting defects, but also preventing them from occurring in the first place. This is achieved by controlling process variations and maintaining consistency.
- **Continuous Monitoring:** Ongoing monitoring of processes to ensure they remain stable and capable of producing high-quality results.

**Outcome of Quality Control:**

- Ongoing assurance that processes are operating within defined limits and producing the desired quality levels.
- **Reduced defects**, fewer errors, and better consistency in products or services.
- **Identification of root causes** of defects and corrective action plans.

**3. Quality Improvement**

Quality Improvement is the third phase of the Juran Trilogy, focusing on **making continuous improvements** to processes and systems to achieve higher levels of performance. This phase is about making incremental or breakthrough improvements that help an organization improve its quality over time.

**Key Elements of Quality Improvement:**

- **Continuous Improvement:** Quality improvement is an ongoing process. It's about constantly striving to eliminate inefficiencies, reduce defects, and increase value to the customer. This involves adopting a **Kaizen** mindset (small, incremental improvements) or sometimes pursuing **breakthrough improvement** (larger, transformative changes).
- **Problem-Solving:** Teams or individuals within the organization are tasked with identifying problems, analyzing their root causes, and implementing solutions. Tools such as the **Pareto Principle**, **Fishbone diagrams**, and **Root Cause Analysis (RCA)** help teams address issues systematically.
- **Involvement of Employees:** In TQM, **employees at all levels** are encouraged to participate in quality improvement efforts. This is typically done through **cross-functional teams**, where individuals from different departments work together to solve problems and improve processes.
- **Use of Tools and Techniques:** A variety of quality tools and methodologies (e.g., Six Sigma, Lean, **DMAIC** — Define, Measure, Analyze, Improve, Control) are employed to drive process improvements, eliminate waste, and enhance performance.
- **Innovation and Creativity:** Quality improvement requires creativity and innovation in solving problems. Juran emphasizes the importance of looking beyond immediate symptoms and addressing underlying causes.

**Outcome of Quality Improvement:**

- **Enhanced Process Efficiency:** More effective and efficient processes that minimize waste, reduce variation, and improve throughput.

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- **Higher Customer Satisfaction:** Through continuous improvements, organizations are better able to meet or exceed customer expectations, driving loyalty and satisfaction.
- **Sustained Competitive Advantage:** Organizations that continuously improve their processes are better positioned to maintain a competitive edge in the marketplace.

### The Interconnection of the Juran Trilogy

- **Quality Planning** sets the foundation by defining the **what and how** — what customers need and how the organization will deliver it.
- **Quality Control** ensures that processes are maintained within standards and that quality is consistently met throughout production or service delivery.
- **Quality Improvement** helps organizations take it to the next level by continuously enhancing processes to achieve higher levels of performance and meet changing customer expectations.

The **three components** of the Juran Trilogy are interdependent:

- **Planning** ensures that the processes are designed to meet customer needs from the outset.
- **Control** ensures that quality is consistently maintained during operations.
- **Improvement** ensures that quality is continually enhanced and that the organization adapts to evolving demands and opportunities.

### Juran's "Quality is Everyone's Responsibility"

A key principle from Dr. Juran's philosophy is that **quality is not just the responsibility of the quality control department**; it is a **shared responsibility** across the entire organization. From top management to frontline employees, everyone must contribute to quality planning, control, and improvement. The **Juran Trilogy** provides a roadmap for how different functions and roles within an organization can collaborate to ensure quality in products, services, and processes.

### Benefits of the Juran Trilogy in TQM

- **Systematic Approach:** The Juran Trilogy provides a clear and structured approach for managing quality, making it easier for organizations to align efforts and achieve quality goals.
- **Prevention Over Inspection:** By emphasizing quality planning and continuous improvement, the Trilogy promotes a **preventive approach** to quality, reducing the need for inspection and rework.
- **Customer Focus:** The Trilogy's emphasis on understanding customer needs ensures that quality efforts are always aligned with customer expectations, leading to higher satisfaction and loyalty.

- **Employee Engagement:** By involving all employees in quality efforts and improvement initiatives, organizations create a culture of quality that permeates every level of the organization.
- **Sustained Improvement:** The focus on ongoing quality improvement ensures that the organization does not become complacent and continues to adapt to changing market conditions.

The **Juran Trilogy** is a comprehensive framework for managing and improving quality in an organization. By focusing on **quality planning**, **quality control**, and **quality improvement**, organizations can ensure that they consistently meet customer expectations, continuously improve their processes, and maintain high standards of quality over time. The Trilogy provides a roadmap for integrating quality into every aspect of the business, making quality everyone's responsibility and helping organizations achieve long-term success in competitive markets.

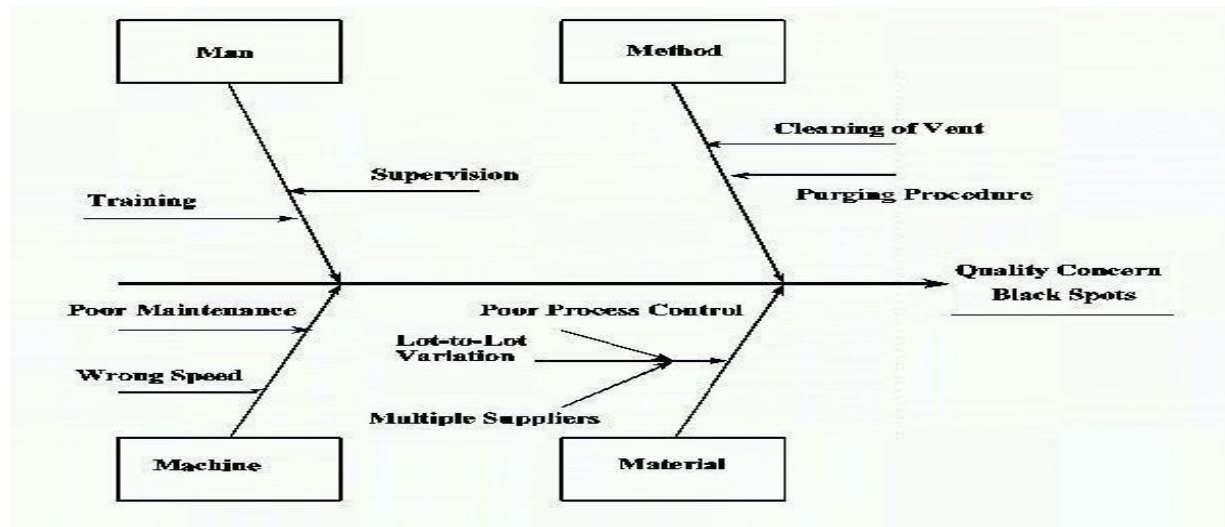
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### 3.1 SEVEN TOOLS OF QUALITY

1. Cause-and-effect diagram (also called Ishikawa or fishbone diagrams): Identifies many possible causes for an effect or problem and sorts ideas into useful categories.

Cause-and-Effect Diagrams - 1943 by Mr. Kaoru Ishikawa at the University of Tokyo

Purpose: One important part of process improvement is continuously striving to obtain more information about the process and its output. Cause-and-effect diagrams allow us to do not just that, but also can lead us to the root cause, or causes, of problems.



Constructing the Cause-and-Effect Diagram:

Step 1: Select the team members and a leader. Team members knowledgeable about the quality. Team members focus on the problem under investigation.

Step 2: Write the problem statement on the right hand side of the page, and draw a box around it with an arrow running to it. This quality concern is now the effect.

Step 3: Brain-storming. The team members generate ideas as to what is causing the effect.

Step 4: This step could be combined with step 3. Identify, for each main cause, its related sub-causes that might affect our quality concern or problem (our Effect). Always check to see if all the factors contributing to the problem have been identified. Start by asking why the problem exists.

Step 5: Focus on one or two causes for which an improvement action(s) can be developed using other quality tools such as Pareto charts, check sheets, and other gathering and analysis tools.

Check sheet: A structured, prepared form for collecting and analyzing data; a generic tool that can be adapted for a wide variety of purposes.

The check sheet is a simple document that is used for collecting data in real-time and at the location where the data is generated. The document is typically a blank form that is designed for the quick, easy, and efficient recording of the desired information, which can be either quantitative or qualitative. When the information is quantitative, the check sheet is sometimes called a tally sheet.

Defect Types? Event occurrence	Events							Total
	Sun	Mon	Tue	Wed	Thur	Fri	Sat	
Supplied parts rusted		✓✓✓ ✓✓✓ ✓✓	✓✓✓✓	✓✓✓✓	✓✓			19
Misaligned Weld			✓✓✓			✓✓		5
Improper Test Procedure		✓		✓✓				3
Wrong Part Issued					✓✓			2
Film on Parts				✓✓✓✓		✓✓		6
Voids in Casting								0
Incorrect Dimensions								0
Adhesive Failure					✓			1
Masking Insufficient								0
Spray Failure				✓✓✓✓				4
<i>Total</i>		9	8	14	5	4	0	40

A defining characteristic of a check sheet is that data is recorded by making marks (“checks”) on it. A typical check sheet is divided into regions, and marks made in different regions have different significance. Data is read by observing the location and number of marks on the sheet. 5 Basic types of Check Sheets:

*Classification:* A trait such as a defect or failure mode must be classified into a category.

*Location:* The physical location of a trait is indicated on a picture of a part or item being evaluated.

*Frequency:* The presence or absence of a trait or combination of traits is indicated. Also number of occurrences of a trait on a part can be indicated.

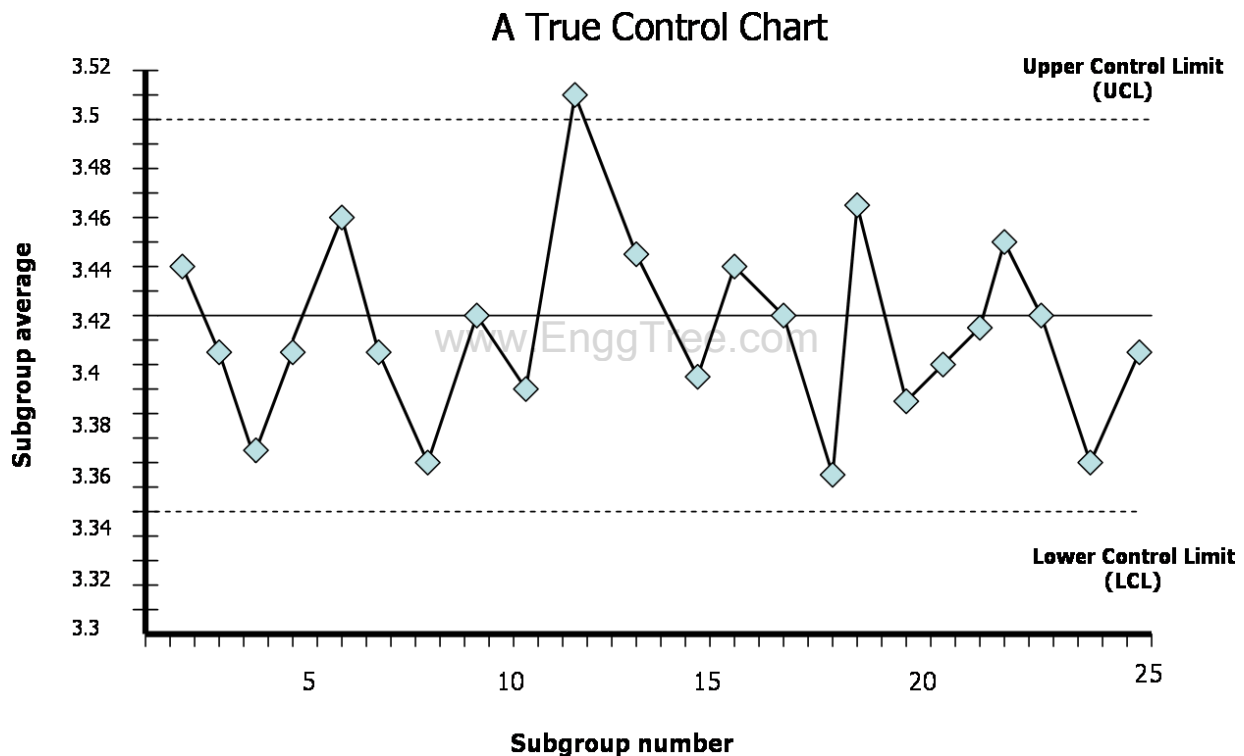
*Measurement Scale:* A measurement scale is divided into intervals, and measurements are indicated by checking an appropriate interval.

*Check List:* The items to be performed for a task are listed so that, as each is accomplished, it can be indicated as having been completed.

**Control chart:** Graph used to study how a process changes over time. Comparing current

data to historical control limits leads to conclusions about whether the process variation is consistent (in control) or is unpredictable (out of control, affected by special causes of variation). Control charts have long been used in manufacturing, stock trading algorithms, and process improvement methodologies like Six Sigma and Total Quality Management (TQM). The purpose of a control chart is to set upper and lower bounds of acceptable performance given normal variation. In other words, they provide a great way to monitor any sort of process you have in place so you can learn how to improve your poor performance and continue with your successes.

The control chart serves to “sound the alarm” when a process shifts (for instance, a machine suddenly breaking on a factory floor) or if someone has a breakthrough that needs to be documented and standardized across the larger organization. Simply put (without taking



anomalies into consideration).

**Histogram:** The most commonly used graph for showing frequency distributions, or how often each different value in a set of data occurs.

Error Causes	Total		Serious		Moderate		Minor	
	No.	%	No	%	No	%	No.	%
IES	205	22%	34	27%	68	18%	103	24%
MCC	156	17%	12	9%	68	18%	76	17%
IDS	48	5%	1	1%	24	6%	23	5%
VPS	25	3%	0	0%	15	4%	10	2%
EDR	130	14%	26	20%	68	18%	36	8%
ICI	58	6%	9	7%	18	5%	31	7%
EDL	45	5%	14	11%	12	3%	19	4%
IET	95	10%	12	9%	35	9%	48	11%
IID	36	4%	2	2%	20	5%	14	3%
PLT	60	6%	15	12%	19	5%	26	6%
HCI	28	3%	3	2%	17	4%	8	2%
MIS	56	6%	0	0%	15	4%	41	9%
<b>Total</b>	<b>942</b>	<b>100%</b>	<b>128</b>	<b>100%</b>	<b>379</b>	<b>100%</b>	<b>435</b>	<b>100%</b>

Let's see usage of Histogram in context of "Plan Quality Management" and "Control Quality" for your The Project Management Professional (PMP examination.

In "Plan Quality Management" a Histogram serves as a preventive approach to improve processes. We use historical data to identify categories of causes effecting most. Based on effecting most categories, we select processes to improve. For example due to higher frequencies in IES, MCC and EDR, we may select improvements in "Collect Requirement", and "Define Scope" processes.

Using "Control Quality" we identify causes of poor performance help in improving processes and their work products. In this way, causes of poor performance analysis make Histogram a powerful tool to take corrective actions.

Pareto chart: A bar graph that shows which factors are more significant.

Pareto analysis is a technique for recording and analysing information relating to a problem or cause, which easily enables the most significant aspects to be identified.

A Pareto diagram is a special form of vertical bar chart, or column chart, which allows the information to be visually displayed.

When to use it

Separating the 'vital few' from the 'useful many' problems, (80/20 rule).

Selecting major problem areas

Identifying major effects and causes

What does it achieve?

"First things first" is the thought behind the Pareto diagram; the properly constructed diagram

should suggest on which error or activity resources should be used first to make the best improvement. Very often the simple process of arranging data may suggest something of importance that would otherwise have gone unnoticed. Selecting classifications, tabulating data, ordering data, and constructing the Pareto diagram have often served a useful purpose in problem investigation. The communication process between people takes on many forms, and Pareto diagrams are a form of language using a display in a commonly understood format. The continued use of the Pareto diagram enhances communication between members of staff and through all levels of management.

#### Key steps

List the activities to be analyzed

Calculate totals

Order totals

Draw the Pareto diagram

Interpret results

Pareto Diagram example

#### Difference between Pareto Chart and Histogram:

Histogram	Pareto Chart
The Histogram is a kind of bar chart showing a distribution of variables or causes of problems.	A Pareto chart is a specific type of histogram that represents the causes of problems by their influence. It is a useful tool to prioritize corrective action as errors with the greatest impact displayed in descending order of frequency.
A histogram represents cause of a problem as a column and the frequency of each cause of problem as the height of the column.	In Pareto chat, an arc representing the cumulative percentage of frequencies of causes also included.

Scatter diagram: Graphs pairs of numerical data, one variable on each axis, to look for a relationship.

Also called: scatter plot, X-Y graph

The scatter diagram graphs pairs of numerical data, with one variable on each axis, to look for a relationship between them. If the variables are correlated, the points will fall along a line or curve. The better the correlation, the tighter the points will hug the line. This cause analysis tool is considered one of the seven basic quality tools.

### **WHEN TO USE A SCATTER DIAGRAM**

When you have paired numerical data

When your dependent variable may have multiple values for each value of your independent variable

When trying to determine whether the two variables are related, such as:

When trying to identify potential root causes of problems

After brainstorming causes and effects using a fishbone diagram to determine objectively whether a particular cause and effect are related

When determining whether two effects that appear to be related both occur with the same cause

When testing for autocorrelation before constructing a control chart

### **SCATTER DIAGRAM PROCEDURE**

Collect pairs of data where a relationship is suspected.

Draw a graph with the independent variable on the horizontal axis and the dependent variable on the vertical axis. For each pair of data, put a dot or a symbol where the x-axis value intersects the y-axis value. (If two dots fall together, put them side by side, touching, so that you can see both.)

Look at the pattern of points to see if a relationship is obvious. If the data clearly form a line or a curve, you may stop because variables are correlated. You may wish to use regression or correlation analysis now. Otherwise, complete steps 4 through 7.

Divide points on the graph into four quadrants. If there are  $X$  points on the graph:

Count  $X/2$  points from top to bottom and draw a horizontal line.

Count  $X/2$  points from left to right and draw a vertical line.

If number of points is odd, draw the line through the middle point.

Count the points in each quadrant. Do not count points on a line.

Add the diagonally opposite quadrants. Find the smaller sum and the total of points in all quadrants.



$A = \text{points in upper left} + \text{points in lower right}$   
 $B = \text{points in upper right} + \text{points in lower left}$   
 $Q = \text{the smaller of } A \text{ and } B$

$$N = A + B$$

If  $Q$  is less than the limit, the two variables are related.

If  $Q$  is greater than or equal to the limit, the pattern could have occurred from random chance.

Stratification (also known as Flow Chart and/or Run Chart)

A technique that separates data gathered from a variety of sources so that patterns can be seen (some lists replace "stratification" with "flowchart" or "run chart").

Stratification is a way to organize data, and in particular of separating data into meaningful groups. Stratification is also known as a flow chart or run chart.

In stratification, you should include each data point in only one group, and you should leave no data point(s) out.

Below is an example of stratification.

### **WHEN TO USE STRATIFICATION?**

Before collecting data

When data come from several sources or conditions, such as shifts, days of the week, suppliers, or population groups

When data analysis may require separating different sources or conditions Here are examples of different sources that might require data to be stratified:

Equipment

Shifts

Departments

Materials

Suppliers

Day of the week

Time of day

Products

### **STRATIFICATION PROCEDURE**

Before collecting data, consider which information about the sources of the data might have an effect on the results. Set up the data collection so that you collect that information as well.

When plotting or graphing the collected data on a scatter diagram, control chart, histogram, or other analysis tool, use different marks or colors to distinguish data from various sources. Data that are distinguished in this way are said to be "stratified."

Analyze the subsets of stratified data separately.

For example, on a scatter diagram where data are stratified into data from source 1 and data from source 2, draw quadrants, count points, and determine the critical value only for the data from source 1, then only for the data from source 2.

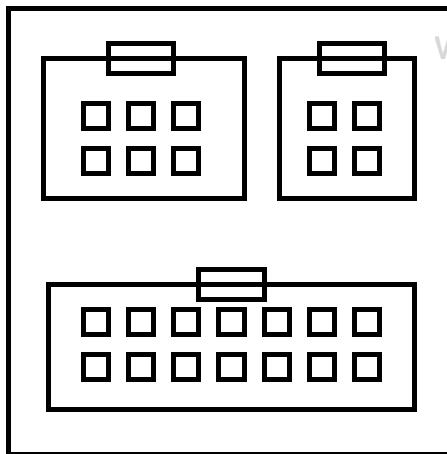
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### 3.2 NEW MANAGEMENT TOOLS

The seven management and planning tools have their roots in operations research work done after World War II and the Japanese total quality control (TQC) research.

1. Affinity Diagram [KJ method]
2. Interrelationship diagram
3. Tree diagram
4. Prioritization matrix
5. Matrix diagram or quality table
6. Process decision program chart
7. Activity network diagram

#### 1. Affinity Diagram [KJ method]

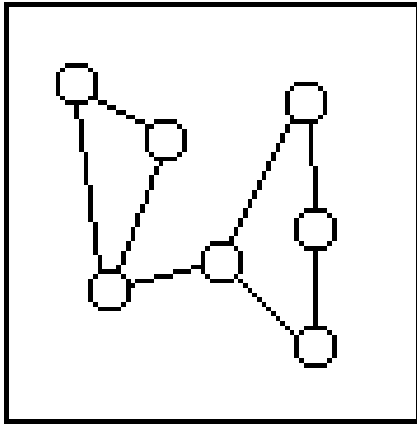


Affinity diagrams are a special kind of brainstorming tool that organize large amount of disorganized data and information into groupings based on natural relationships.

It was created in the 1960s by the Japanese anthropologist Jiro Kawakita. It is also known as KJ diagram, after Jiro Kawakita. An affinity diagram is used when:

1. You are confronted with many facts or ideas in apparent chaos.
2. Issues seem too large and complex to grasp.

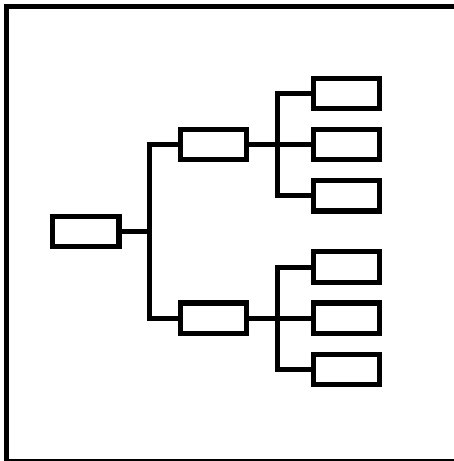
## 2. Interrelationship diagram



Interrelationship diagrams (IDs) displays all the interrelated cause-and- effect relationships and factors involved in a complex problem and describes desired outcomes. The process of creating an interrelationship diagram helps a group analyze the natural links between different aspects of a complex situation.

## 3. Tree diagram

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This tool is used to break down broad categories into finer and finer levels of detail. It can map levels of details of tasks that are required to accomplish a goal or solution or task. Developing a tree diagram directs concentration from generalities to specifics.

#### 4. Prioritization matrix

	a	b	c	d	e	f
1						
2						
3						
4						
5						
6						

This tool is used to prioritize items and describe them in terms of weighted criteria. It uses a combination of tree and matrix diagramming techniques to do a pair-wise evaluation of items and to narrow down options to the most desired or most effective. Popular applications for the prioritization matrix include return on investment (ROI) or cost-benefit analysis (investment vs. return), time management matrix (urgency vs. importance), etc.

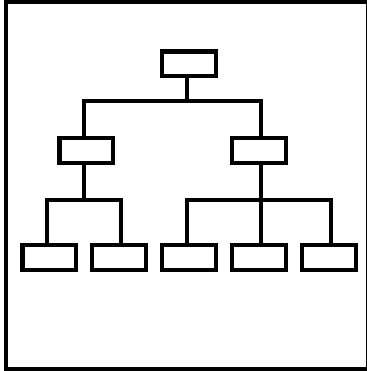
#### 5. Matrix diagram or quality table

	a	b	c	d	e	f
1						
2						
3						
4						
5						
6						

This tool shows the relationship between two or more sets of elements. At each intersection, a relationship is either absent or present. It then gives information about the relationship, such as its strength, the roles played by various individuals or measurements. The matrix diagram enables you to analyze relatively complex

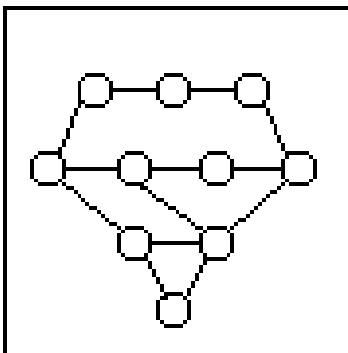
situations by exposing interactions and dependencies between things. Six differently shaped matrices are possible: L, T, Y, X, C, R and roof-shaped, depending on how many groups must be compared.

#### 6. Process decision program chart



A useful way of planning is to break down tasks into a hierarchy, using a tree diagram. The process decision program chart (PDPC) extends the tree diagram a couple of levels to identify risks and countermeasures for the bottom level tasks. Different shaped boxes are used to highlight risks and identify possible countermeasures (often shown as "clouds" to indicate their uncertain nature). The PDPC is similar to the failure modes and effects analysis (FMEA) in that both identify risks, consequences of failure, and contingency actions; the FMEA also rates relative risk levels for each potential failure point.

#### 7. Activity network diagram



This tool is used to plan the appropriate sequence or schedule for a set of tasks and related subtasks. It is used when subtasks must occur in parallel. The diagram

helps in determining the critical path (longest sequence of tasks). The purpose is to help people sequentially define, organize, and manage a complex set of activities.

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### 3.3 SIX SIGMA

Six Sigma is a quality management methodology used to help businesses improve current processes, products, or services by discovering and eliminating defects. The goal is to streamline quality control in manufacturing or business processes so there is little to no variance throughout.

Six Sigma is a set of techniques and tools for process improvement. Six Sigma is a quality management methodology used to help businesses improve current processes, products or services by discovering and eliminating defects. The goal is to streamline quality control in manufacturing or business processes so there is little to no variance throughout.

It was introduced by American engineer Bill Smith while working at Motorola in 1980. Six Sigma was trademarked by Motorola in 1993, but it references the Greek letter sigma, which is a statistical symbol that represents a standard deviation. Motorola used the term because a Six Sigma process is expected to be defect-free 99.99966 percent of the time — allowing for 3.4 defective features for every million opportunities. Motorola initially set this goal for its own manufacturing operations, but it quickly became a buzzword and widely adopted standard.

#### **Six Sigma principles**

The goal in any Six Sigma project is to identify and eliminate any defects that are causing variations in quality by defining a sequence of steps around a certain target. The most common examples you'll find use the targets “smaller is better, larger is better or nominal is best.”

Smaller is Better creates an “upper specification limit,” such as having a target of zero for defects or rejected parts. Larger is Better involves a “lower specification limit,” such as test scores — where the target is 100 percent.

Nominal is Best looks at the middle ground — a customer service rep needs to spend enough time on the phone to troubleshoot a problem, but not so long that they lose productivity.

The process aims to bring data and statistics into the mesh to help objectively identify errors and defects that will impact quality. It's designed to fit a variety of business goals, allowing organizations to define objectives around specific industry



needs.

### **Six Sigma DMAIC**

The Six Sigma DMAIC project methodology includes five phases, each represented as a letter in the DMAIC acronym. These include:

- ❖ **Define** the problem, the customer, the project requirements and the ultimate goals and expectations of the customer.
- ❖ **Measure** performance of the current process by establishing a data collection plan to determine defects and gather metrics.
- ❖ **Analyze** the process to establish root cause of variations and defects to identify issues with the current strategy that stand in the way of the end goal.
- ❖ **Improve** the process by eliminating the root causes of defects through innovative solutions.
- ❖ **Control** the new process to avoid falling into old habits and to ensure it stays on track.

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### **Six Sigma DMADV**

The Six Sigma DMADV, also known as the Design For Six Sigma (DFSS), includes five stages:

- ❖ **Define** realistic goals that suit the customer's requirements or the business strategy.
- ❖ **Measure** and identify the customer's critical to quality (CTQ) requirements and translate them into clear project goals.
  - ❖ Analyze multiple options and alternatives for the customer along with the estimated total life cycle of the project.
- ❖ **Design** the process at a high level before moving onto a more detailed version that will become the prototype to identify errors and make modifications.
- ❖ **Verify** that the final iteration of the product or process is approved by all customers and clients — whether internal or external.

### **Six Sigma implementation roles**

**Executive leadership:** This includes the CEO and other executive management

who are charged with developing the vision for Six Sigma implementation. Leaders should also be responsible for encouraging new ideas and supplying the resources to act on innovation.

**Champions:** Typically found in upper management, Champions are the people responsible for acting on executive leadership's vision and acting as mentors to black belts.

**Master Black Belts:** These workers spend all their time on Six Sigma methodology, either by guiding Black or Green Belts or helping Champions. They're picked out by Champions and are tasked with ensuring consistency in the Six Sigma strategy.

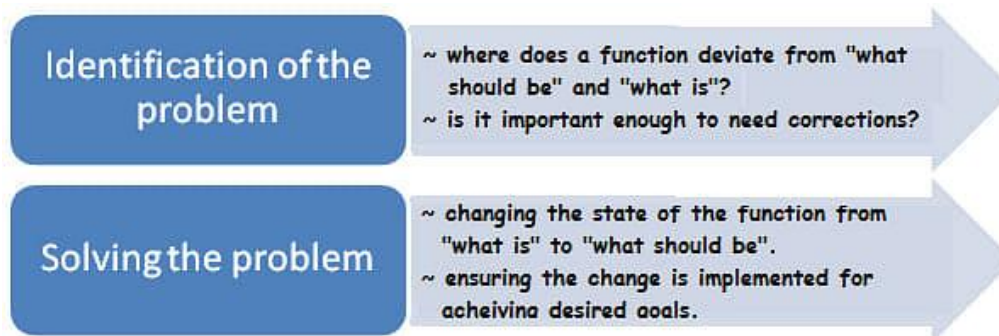
**Black Belts:** Working below Master Black Belts, Black Belts are responsible for executing on the Six Sigma strategy and typically act as leaders for specific tasks.

**Green Belts:** Guided by Black Belts, Green Belts are new to the Six Sigma methodology and start learning it while maintaining their other job responsibilities.

### The 5 Key Principles of Six Sigma

The concept of Six Sigma has a simple goal – delivering near-perfect goods and services for business transformation for optimal customer satisfaction (CX).

Goals are achieved through a two-pronged approach:



**Six Sigma has its foundations in five key principles:**

#### 1. Focus on the Customer

This is based on the popular belief that the "customer is the king." The primary goal is to bring maximum benefit to the customer. For this, a business needs to understand its customers, their needs, and what drives sales or loyalty. This requires establishing the standard of quality as defined by what the customer or market demands.

## **2. Measure the Value Stream and Find Your Problem**

Map the steps in a given process to determine areas of waste. Gather data to discover the specific problem area that is to be addressed or transformed. Have clearly defined goals for data collection, including defining the data to be collected, the reason for the data gathering, insights expected, ensuring the accuracy of measurements, and establishing a standardized data collection system. Ascertain if the data is helping to achieve the goals, whether or not the data needs to be refined, or additional information collected. Identify the problem. Ask questions and find the root cause.

## **3. Get Rid of the Junk**

Once the problem is identified, make changes to the process to eliminate variation, thus removing defects. Remove the activities in the process that do not add to the customer value. If the value stream doesn't reveal where the problem lies, tools are used to help discover the outliers and problem areas. Streamline functions to achieve quality control and efficiency. In the end, by taking out the above-mentioned junk, bottlenecks in the process are removed.

## **4. Keep the Ball Rolling**

Involve all stakeholders. Adopt a structured process where your team contributes and collaborates their varied expertise for problem-solving.

Six Sigma processes can have a great impact on an organization, so the team has to be proficient in the principles and methodologies used. Hence, specialized training and knowledge are required to reduce the risk of project or re-design failures and ensure that the process performs optimally.

## **5. Ensure a Flexible and Responsive Ecosystem**

The essence of Six Sigma is business transformation and change. When a faulty or inefficient process is removed, it calls for a change in the work practice and employee approach. A robust culture of flexibility and responsiveness to changes in procedures can ensure

streamlined project implementation. The people and departments involved should be able to adapt to change with ease, so to facilitate this, processes should be designed for quick and seamless adoption. Ultimately, the company that has an eye fixed on the data examines the bottom line periodically and adjusts its processes where necessary, can gain a competitive edge.

### **The Six Sigma Methodology**

The two main Six Sigma methodologies are DMAIC and DMADV. Each has its own set of recommended procedures to be implemented for business transformation.

**DMAIC** is a data-driven method used to improve existing products or services for better customer satisfaction. It is the acronym for the five phases: D – Define, M – Measure, A – Analyse, I – Improve, C – Control. DMAIC is applied in the manufacturing of a product or delivery of a service.

**DMADV** is a part of the Design for Six Sigma (DFSS) process used to design or re-design different processes of product manufacturing or service delivery. The five phases of DMADV are: D – Define, M – Measure, A – Analyse, D – Design, V – Validate. DMADV is employed when existing processes do not meet customer conditions, even after optimization, or when it is required to develop new methods. It is executed by Six Sigma Green Belts and Six Sigma Black Belts and under the supervision of Six Sigma Master Black Belts. We'll get to the belts later. The two methodologies are used in different business settings, and professionals seeking to master these methods and application scenarios would do well to take an online certificate program taught by industry experts.

### **Brainstorming**

Brainstorming is the key process of any problem-solving method and is often utilized in the "improve" phase of the DMAIC methodology. It is a necessary process before anyone starts using any tools. Brainstorming involves bouncing ideas and generating creative ways to approach a problem through intensive freewheeling group discussions. A facilitator, who is typically the lead Black Belt or Green Belt, moderates the open session among a group of participants.



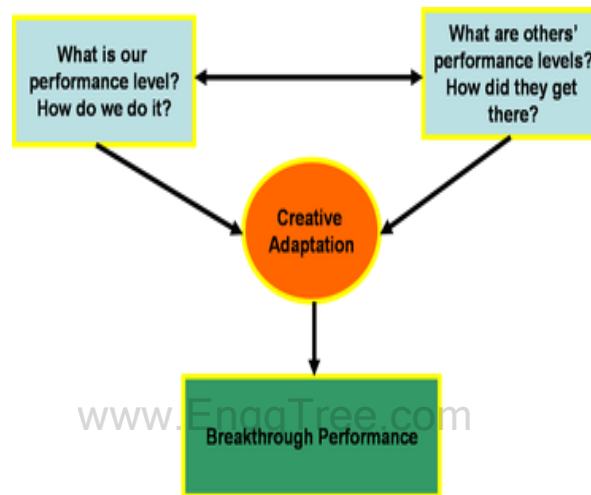
### 3.4 BENCH MARKING

Benchmarking is a way to go backstage and watch another company's performance from the wings, where all stage tricks and hurried realignments are visible.

#### Levels of Benchmarking

There are three levels of benchmarking:

1. Internal benchmarking (within the company)
2. Competitive or strategic benchmarking (Industry and competitors)
3. Benchmarking outside the industry.



#### TYPES OF BENCHMARKING

##### PROCEDURE OF BENCHMARKING:

The following is an example of a typical shorter version of the methodology:

##### 1. Identify your problem areas:

Because benchmarking can be applied to any business process or function, a range of research techniques may be required. They include: informal conversations with customers, employees, or suppliers; exploratory research techniques such as focus groups; or in-depth marketing research, quantitative research, surveys, questionnaires, re-engineering analysis, process mapping, quality control variance reports, or financial ratio analysis. Before embarking on comparison with other organizations it is essential that you know your own organization's function, processes; base lining performance provides a point against which improvement effort can be measured.

**2. Identify other industries that have similar processes:**

For instance if one were interested in improving hand offs in addiction treatment he/she would try to identify other fields that also have hand off challenges. These could include air traffic control, cell phone switching between towers, transfer of patients from surgery to recovery rooms.

**3. Identify organizations that are leaders in these areas:**

Look for the very best in any industry and in any country. Consult customers, suppliers, financial analysts, trade associations, and magazines to determine which companies are worthy of study.

**4. Survey companies for measures and practices:**

Companies target specific business processes using detailed surveys of measures and practices used to identify business process alternatives and leading companies. Surveys are typically masked to protect confidential data by neutral associations and consultants.

**5. Visit the “best practice” companies to identify leading edge practices:**

Companies typically agree to mutually exchange information beneficial to all parties in a benchmarking group and share the results within the group.

**6. Implement new and improved business practices:**

Take the leading edge practices and develop implementation plans which include identification of specific opportunities, funding the project and selling the ideas to the organization for the purpose of gaining demonstrated value from the process.

**REASONS TO BENCHMARK:**

Benchmarking in Total Quality Management (TQM) can help businesses in a number of ways, including: **Evaluating performance**

Benchmarking can help businesses compare their performance to competitors and identify areas for improvement.

**Improving performance**

Benchmarking can provide insights into how leading companies achieve their results, which can help businesses match or exceed their performance.

**Identifying best practices**

Benchmarking can help businesses identify where they fall short of current best practice and determine what action is needed to either match or exceed best practice.

### **Strategic planning**

Smaller businesses with limited budgets can learn a lot about how to plan strategically by following their competitors' activities on social media or checking their websites for product and pricing data. Benchmarking is an important performance evaluation tool, but it should never be the primary strategy for improvement. To make meaningful comparisons, it is essential to conduct this process accurately and with appropriate data sources.

### **PROCESS BENCHMARKING:**

The initiating firm focuses its observation and investigation of business processes with a goal of identifying and observing the best practices from one or more benchmark firms. Activity analysis will be required where the objective is to benchmark cost and efficiency; increasingly applied to back-office processes where outsourcing may be a consideration.

### **Financial benchmarking**

Performing a financial analysis and comparing the results in an effort to assess your overall competitiveness.

### **Performance benchmarking**

Allows the initiator firm to assess their competitive position by comparing products and services with those of target firms.

### **Product benchmarking**

The process of designing new products or upgrades to current ones. This process can sometimes involve reverse engineering which is taking apart competitors products to find strengths and weaknesses.

### **Strategic benchmarking**

Involves observing how others compete. This type is usually not industry specific meaning it is best to look at other industries.

### **Functional benchmarking**

A company will focus its benchmarking on a single function in order to improve the operation of that particular function. Complex functions such as Human Resources, Finance and Accounting and Information and Communication.



Technology are unlikely to be directly comparable in cost and efficiency terms and may need to be disaggregated into processes to make valid comparison.

## **PITFALLS AND CRITICISMS OF BENCHMARKING**

Some pitfalls and criticisms of benchmarking in Total Quality Management (TQM) include:

### **Lack of context**

Benchmark data may be presented without its short-term and long-term context, making it difficult to identify areas for improvement.

### **Outdated or inconsistent data**

Data that is outdated, inconsistent, or unavailable can make findings inaccurate.

### **Focusing too much on the competition**

Benchmarking can lead to a focus on the competition at the expense of a company's own strengths and capabilities.

### **Aiming to match the industry leader**

Benchmarking can lead to complacency if the goal is to match the industry leader instead of surpassing them.

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### **Cost and time**

Benchmarking can be time-consuming and costly because it requires gathering and analyzing data from external sources.

### **Other pitfalls**

Other pitfalls include:

Skipping clear objectives

Choosing the wrong benchmarks

Benchmarking too many KPIs

Assuming that numbers and performance stay stable for long periods

Benchmarking is a tool that compares a company's processes, products, and outcomes with those of the best performers in its industry.

**4.1 QUALITY CIRCLE:**

A quality circle is a group of employees who meet regularly to identify, analyze, and solve problems related to quality and production. Quality circles are a key component of Total Quality Management (TQM) and are designed to improve organizational processes by using the collective knowledge of employees.

Here are some characteristics of quality circles:

**Size**

Typically 6–12 members, which allows for effective communication and collaboration while keeping the group small enough for active participation

**Membership**

Voluntary

**Structure**

A supervisor or other appointed leader runs the meetings, which are organized and documented with minutes

**Objectives**

To promote a culture of continuous improvement, increase employee engagement, and develop problem-solving, communication, and teamwork skills

**Benefits**

Can increase productivity and competitiveness, improve customer satisfaction, and raise awareness of quality control

The concept of quality circles originated in Japan after World War II and was influenced by the work of W. Edwards Deming and Kaoru Ishikawa. The first quality circle in the United States was registered at Lockheed Missile and Space Company in 1974.

Some challenges to implementing quality circles include: Lack of management support, Inconsistent meeting structure, Unclear goals and expectations, Insufficient training, and Limited resources.

**QUALITY EDUCATION**

Total Quality Management is a management approach that was instigated in the 1950s and has gradually become popular since the early 1980s. The term ‘quality’ is at the core of this philosophy. While defining total quality management, scholars took the opportunity to present their perceptions regarding this term in numerous ways; as a result, a good number of definitions appear before us with different connotations. Crosby states that quality management is a methodical way of ensuring that organized activities happen the way they are planned. Short & Rahim define TQM is a proactive approach, to confirm quality into the product, service and

design of the process and then to continually improve it.

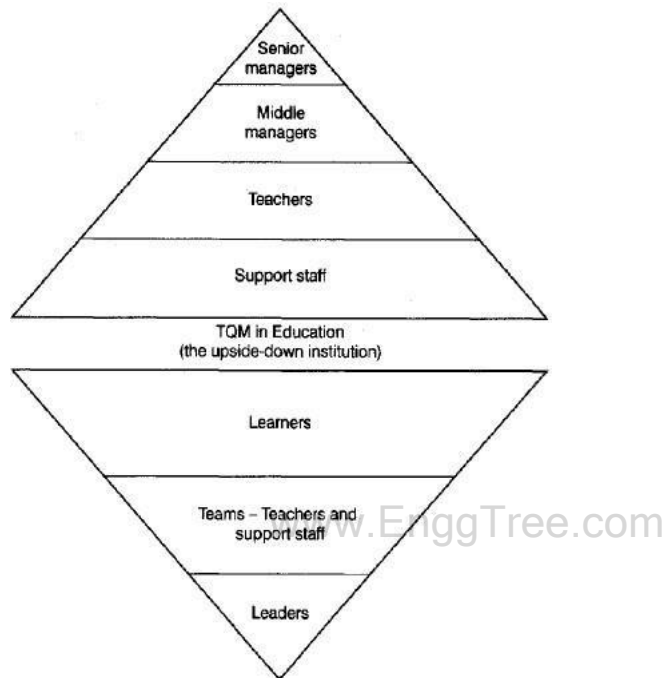
According to these definitions, TQM is a plan, a systematic approach to ensure quality and continuous improvement. Deming describes TQM is a never-ending cycle of progress in the system of production should change into gaining better performance and quality standards for the product. Yang perceives TQM is a set of practices that focuses on the systematic improvement, satisfying the customers' needs, and decreasing rework. TQM is a system and set of practices which are aimed at relentless quality improvement and better business performance. TQM views an organization as a collection of interrelated processes. It (TQM) is a method by which management and employees are involved in continuous improvement of the production of goods and services. Goetsch and Davis opine that TQM consists of relentless improvement activities, involving everybody in the business in a totally integrated effort towards improving performance at every level. Vinni comments TQM creates such environment in which all the assets are used ingeniously and effectively in order to provide quality service the institution needs to adapt in this fast paced world.

According to Witcher, TQM is the combination of three terms—Total: meaning that one is involved, including customer and suppliers; Quality: indicating that customer needs are met exactly; and Management: indicating that senior executives are committed. Oakland expresses TQM as an approach involving the whole organization for understanding each activity of each individual at each management layer. TQM strives to integrate all organizational functions (marketing, finance, design, engineering, and production, customer service, etc.) to focus on meeting customer needs and organizational objectives. Escrig considers TQM as a strategic action that focuses on managing the total organization to provide products or services that fulfill their customer requirements by utilizing all resources. TQM is the holistic management approach that incorporates all the organizational activities to satisfy customers' needs and achieving overall organizational objectives as outlined by Kumar et al.

### **Quality Education process with Education**

Michael et al. comment that TQM can be defined as a general management philosophy and a set of tools which allow an institution to pursue a definition of quality and a means for achieving quality, with quality being a continuous improvement as determined by customers' satisfaction with the services they have received. It indicates the flexible aspect of TQM, i.e. it is applicable to any organization and subject to adjustment as per merit of the situation. With the help of TQM, an

academic institution would be able to develop its own definition of quality, benchmark, and quality improvement practices in the light of customers' requirement. Meirovich and Romar observe that the findings of the literature on the usefulness of TQM in education are differing. There are some authors who are very much confident about the applicability of TQM in education. According to Srivanci, they believe that the values of TQM are similarly appropriate in higher education.



The next level is teaching quality to students. Students are recognized as both customer and workers in the educational system. Administrators need to involve students in their own education by training them to evaluate the learning process and accept responsibility for their learning. Robert and Robert (1998) addressed the most influential factor in success or failure of a TQM implementation effort is universal endorsement. If management is not completely sold on TQM, it is unlikely that an implementation effort will be successful. Endorsing TQM represents a fundamental change in the way. Less than full support by anyone in the chain of authority essentially condemns the effort to failure.

TQM is usually accomplished by a series of small-scale incremental projects. The philosophy of TQM is large-scale, inspirational and all-embracing, but its practical implementation is small-scale, highly practical and incremental. Solid and lasting change is based on a long series of small and achievable projects (Edward 3rd, 2002). TQM requires the change entirely for organization.

Change of culture is notoriously difficult to bring about and takes into implement. It requires a change of attitudes and working methods. Two things are required for staff to produce quality. First, staff needs a suitable environment in which to work. The tools of trade, system and procedures should aid them in doing their jobs. The environment that surrounds staff has a profound effect on their ability to do their job properly and effectively. Second, encouragement and recognition of success and achievement should be deserved from leaders who can appreciate their achievement and coach them to greater success.

### **EARLIER EFFORTS OF IMPLEMENTATION OF TQM IN EDUCATION**

TQM in education surfaced in 1988 at Mt. Edgcombe High School in Sitka, Alaska. When David Langford, the school's technology teacher/coordinator, applied total quality concepts in his classes. TQM has become increasingly popular in education, as evidenced by the plethora of books and journal articles since 1990. TQM has also spread into the mainstream of educational organizations. The Association for Supervision and Curriculum Development, for example, devoted its entire November, 1992 issue of its Journal, "Educational Leadership" to quality movement in education. In support of the TQM initiatives in education, Crawford and Shutler (1999) applied Crosby's model to suggest a practical strategy for using TQM principles in education.

Their strategy focused on the quality of the teaching system used rather than on students' examination results. They argue that examinations are a diagnostic tool for assuring the quality of the teaching system. To satisfy the educational needs of students, continuous improvement efforts need to be directed to curriculum and delivery services. From such a perspective, various root causes of quality system failure in education have been identified. These include poor inputs, poor delivery services, lack of attention paid to performance standards and measurements, unmotivated staff and neglect of students' skills, Ali and Zairi (2005).

### **REASONS TO APPLY TQM IN EDUCATION**

A lot of literature available points to a growing interest in applying TQM in education for a wide variety of reasons, Thakkar et al. (2006). Some of the reasons include pressures from industry for continuous upgrading of academic standards with changing technology; government schemes with allocation of funds, which encourage research and teaching in the field of quality; increasing competition between various private and government academic institutions and reduction in the pool

of funds for research and teaching, implying that only reputable institutions will have a likely chance of giving access to various funds. According to Crosby (1984) unless strategy is focused on the quality of the teaching system and improvement, goal of TQM cannot be fulfilled. TQM in education cannot be accomplished without everyone in the organization from top to bottom being committed to achieve results a passion for quality and decisions based on performance data, Kaufman, (1992). According to Corrigam (1995), unless an organization builds a customer driven, learning organization dedicated to total customer satisfaction TQM cannot be successful. “A set of fundamental core values forming building blocks of proposed TQM framework is leadership and quality cultures continuous improvement and innovation in educational process; employee participation; and development; fast response and management of information customer-driven quality and partnership development; both internally externally”, Juran and Gryna (1980).

### **FOR SUCCESSFUL IMPLIMENTATION IN EDUCATION**

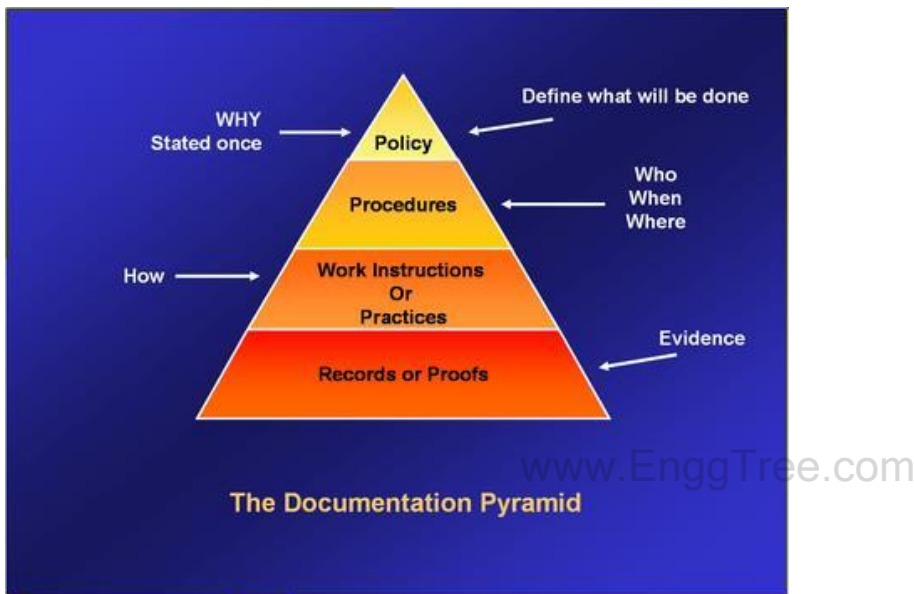
For the successful implementation of TQM in education quality circles are to be formed. A quality circle consists of small groups of people that meet on a regular basis to discuss problems to seek solutions and to cooperate with management in the implementation of those solutions. Quality circles utilize organized approaches to problem solving, operate on the principle that employee participation in decision making and problem solving improves the quality of work. In education quality deals with monitoring and identifying the areas that affect the levels of teachings. The past few decades were considered pioneering work on educational leadership, Bensimon and Neuman (1993), the leadership component deal with examining senior management personal of leadership and involvement in creating and sustaining a customer focus, clear goals, high expectations and a leadership system that would perform excellently.

It also examines leadership system and policies internally that would impact staff and students and public responsibilities establishing partnerships with industry parents and general community externally. Improvements in leadership effectiveness could be achieved through a participative management style that includes inputs from a comprehensive 360 degree feedback system from these internal and external stakeholders. The strategic planning of this element would examine how the institution sets strategic directions and how it determines key plan requirements with a primary focus on students satisfaction. This element examines the key aspects of process management including learner focused education design, education delivery services and business operations. It examines how key processes are innovatively and continuously improved. The performance results

of this element would examine student performance and improvement using key measures and indicators. This element examines how staff development and training is aligned along the objectives of the institution.

## QUALITY OBJECTIVES AND QUALITY POLICY

A quality system is the method used to ensure that the quality level of a product or service is maintained. The system documentation can be viewed as a hierarchy containing four tiers, as shown in the following illustrations:



### Define the term strategy?

In order to understand the concept of strategic management, first we need to understand the literal meaning of the word “strategy”. The definition is mentioned below:

1. The science and art of using all the forces of a nation to execute approved plans as effectively as possible during peace or war. The science and art of military command as applied to the overall planning and conduct of large-scale combat operations.
2. A plan of action resulting from strategy or intended to accomplish a specific goal.
3. The art or skill of using stratagems in endeavors such as politics and business

What is the relation of Strategic Planning and Total Quality Management?

When an organization chooses to make quality a major competitive edge (differentiation), it becomes the central issue in strategic planning. This is especially reflected in vision, mission and policy guidelines of an organization.

An essential idea behind strategic quality planning is that the product is customer value rather than a physical product or service. This feat cannot be achieved unless an organization creates a culture of quality and no strategy and plan can be worthwhile unless it is carefully implemented.

There are three types of quality statements:

1. Vision statement
2. Mission statement
3. Quality policy statement

The utilization of these statements varies from organization to organization. Small organization may use only the quality policy statement

**1. Vision Statement:** The vision statement is a short declaration what an organization aspires to be tomorrow. A vision statement, on the other hand, describes how the future will look if the organization achieves its mission.

Successful visions are timeless, inspirational, and become deeply shared within the organization, such as:

- ❖ IBM's Service
- ❖ Apple's Computing for the masses
- ❖ Disney theme park's the happiest place on the earth, and
- ❖ Polaroid's instant photography

**2. Mission Statement:** A mission statement concerns what an organization is all about. The statement answers the questions such as: who we are, who are our customers, what do we do and how do we do it. This statement is usually one paragraph or less in length, easy to understand, and describes the function of the organization. It provides clear statement of purpose for employees, customers, and suppliers.

An example of mission statement is:

Ford Motor Company is a worldwide leader in automatic and automotive related products and services as well as the newer industries such as aerospace, communications, and financial services. Our mission is to improve continually our products and services to meet our customers' needs, allowing us to prosper as a business and to provide a reasonable return on to our shareholders, the owners of our business.



**3. Quality Policy Statement:** The quality policy is a guide for everyone in the organization as to how they should provide products and services to the customers. It should be written by the CEO with feedback from the workforce and be approved by the quality council. A quality policy is a requirement of ISO 9000.

A simple quality policy is:

Xerox is a quality company. Quality is the basic business principle for Xerox. Quality means providing our external and internal customers with innovative products and services that fully satisfy their requirements. Quality is the job of every employee.

## **QUALITY INFORMATION FEEDBACK**

### **Customer Feedback:**

Should be continually solicited and monitored: Customer Feedback should be continuously solicited as customer preferences keep on changing. Let us remember those days when the original red Lifebuoy was selling like hot cake. Now people's preferences have changed. The organization has come up with many variations of Lifebuoy. The basic USP remains the same, 'health and hygiene' but concepts of, beauty and healthy skin is thrown in to satisfy the changed customer needs.

### **Customer complaints (feedback)**

Customer feedback must be continuously solicited and monitored to reduce the dissatisfied customers as much as possible.

### **Purpose of Feedback:**

**Discover Customer Dissatisfaction:** The feedback helps to know how satisfied or dissatisfied the customer is. A customer who does not complain and switches to another brand is more dangerous than a customer who complains. Customer dissatisfaction can be a big eye opener and help discover what more needs to be done for a product or service.

**Discover Relative Priorities of Quality:** Certain parameters of quality are more important than others. Whenever planning for a quality goal the organization should prioritize its goals.

## HOW TO WRITE A QUALITY PLAN

Quality Assurance or Quality Control plans evaluate and/or modify an organization's procedures to help ensure they provide the desired results. Quality control plans are often viewed as a set of instructions that should be followed. They document the planning, implementation, and assessment procedures for a project, as well as any QA or QC activities.

Some areas may be more detailed than others, based on the project, process, or organization's needs. It is important to note that each plan is unique based on the organization's needs and their Quality Management System (QMS). However, quality control plans should always have a structure that permits improvements to the plan. This allows employees to offer input on how to improve efficiency and quality. In addition, the plan should be reviewed by others periodically, including stakeholders, to ensure the plan is comprehensive.



Quality control plans generally include detailed information on:

- An overview or introduction of the project or process detailing the background, need, scope, activities, and important dates or deadlines
- The organizational structure or org chart detailing necessary team members, including external vendors
- Each team member's responsibilities and qualifications necessary to fulfill stated duties
- Work verification (e.g., who is responsible for carrying out a task, as well as who is responsible for checking the work)
- Supplier standards (e.g., specify the standards the prospective suppliers must meet before they can bid on a contract, such as ISO 9001:2015)

- Testing parameters
- Performance standards and how performance will be documented
- Acceptance criteria
- Deliverables
- A feedback mechanism for internal and/or external customer feedback
- Quality control procedures
- Audits
- Training (e.g., overview, job-specific, or refresher training)
- Corrective action and preventive actions, including the person(s) responsible for CAPA
- Suggested corrective action
- Required notifications
- Any references or related materials, including performance ratings or performance reports

**Compare Performance With Competition:** Watching competitor activity is a good learning tool for any organization. This is a way of benchmarking us vis- à-vis others.

**Identify Customer's Needs:** There is a saying that salesman who discovers a customer need before everyone else is more likely to get the sales. The same logic holds for organizations as well. You can always reap the benefits of first mover advantage. Let us take example of Frooti. Probably Frooti is the first brand to identify the Indian taste and to make an effort to cater to that taste. No matter how many drinks with mango flavour has come Frooti remains the numerous undo in its segment.

**Determine Opportunities for Improvement:** Customer feedback also helps an organization in determining about opportunities for improvement.

## **TYPES OF CUSTOMERS**

**Internal Customer:** The customer inside the company are called internal customers

**External Customers:** An external customer is the one who used the product or service or who purchase the products or service or who influences the sale of the product or service.

**Tools of Customer Feedback:**

- **Comment Card:** This can have simple open questions so that customer can answer it quickly.
- **Customer Questionnaire:** Design of questionnaire is of utmost importance to get timely and relevant information.
- **Focus Groups:** Focus groups are mostly used in B2B set up. Especially in pharmaceuticals industry, key opinion makers are made part of the trial. Their opinion holds sway over doctors of hinterland. It helps them get a word to mouth publicity as well.
- Toll Free Telephone Numbers
- **Customer Visits**
- Report Cards
- **Social Networking Sites:** There are certain sites where visitors can share good or bad experience with a product or service. These sites give real insight into customer's minds. On other social networking sites, like Twitter and Facebook, people share their experiences and sometimes, unknowingly may give opinion about a company. Now certain companies are having devoted teams to analyse these data.

**Mass Customization:** Mass customization is another good tool to know about changed preferences. Levi's gives a facility on its website which enables a potential customer to choose certain fabric, colour and design. Once the customer places an order Levi's gets the jeans stitched and delivered at customer's doorstep.

**Service Quality: Organization Level**

**Identify Each Market Segment:** Each market segment has its own dynamics, so customer needs tend to vary as per a market segment. For example in a diverse country like India, customers of north India will have different needs compared to those in south India.

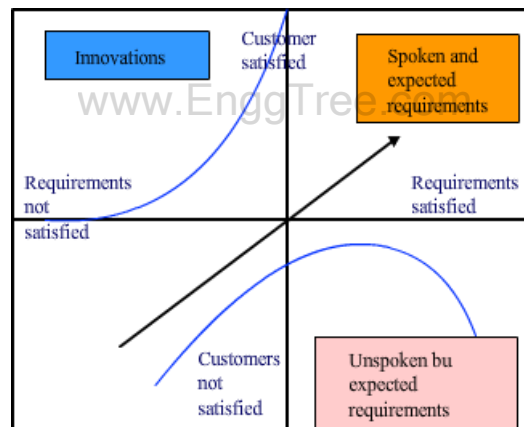
**Write Down The Requirements:** A very good example of chalking out requirements

of a particular market is shown during recent launch of a dark chocolate brand by Cadbury's in India. India is hot country so selling dark chocolates has its own issue of logistics management. Cadbury's is supplying these chocolates in insulated boxes to key retailers so that customer can get the right quality of chocolate.

**Communicate The Requirements:** Communicating your quality requirements is a way of convincing the front line people so that they will implement everything as per the original plan. Around 2000 the pharmaceuticals giant Pfizer launched a hepatitis-B vaccine. The product needed to be supplied through cold chain up to the vaccination point. All personnel in sales force were properly educated on this issue to ensure proper implementation of cold chain. This ensured that the product reached the end user at right temperature to provide desired efficacy.

**Organize Processes:** Every process should be well organized to ensure optimum output and resultant benefit to the customer.

### KANO Model



KANO Model

Kano Model is very interesting depiction of how an unsatisfied customer can be turned to a satisfied customer by properly implementing quality goals. In bottom left quadrant lies the most unsatisfied customer. This can be because of many reasons. The product is not fulfilling customer need or the product is not matching his expectations. When the customer moves to the bottom right quadrant then he is just a mute buyer of the product. He may be buying the product because that is his necessity. The product is just fulfilling certain basic needs of the customer. This can be compared by how customers must have been feeling when Bajaj scooter was

the only major brand available in the Indian market. People had to choose from some very basic models like Bajaj Chetak, Rajdoot and Yezdi. Then came the onslaught of 100 cc bike. This gave more convenience to customers. In the late nineties many models arrived on the scene and some of them gave real customer delight taking the customer to the top left quadrant of the Kano model.

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## 4.2 QUALITY FUNCTION DEPLOYMENT

Quality Function Deployment (QFD) is a process and set of tools used to effectively define customer requirements and convert them into detailed engineering specifications and plans to produce the products that fulfill those requirements. QFD is used to translate customer requirements (or VOC) into measurable design targets and drive them from the assembly level down through the sub-assembly, component and production process levels. QFD methodology provides a defined set of matrices utilized to facilitate this progression.

QFD was first developed in Japan by Yoji Akao in the late 1960s while working for Mitsubishi's shipyard. It was later adopted by other companies including Toyota and its supply chain. In the early 1980s, QFD was introduced in the United States mainly by the big three automotive companies and a few electronics manufacturers. Acceptance and growth of the use of QFD in the US was initially rather slow but has since gained popularity and is currently being used in manufacturing, healthcare and service organizations.

### Why Implement Quality Function Deployment (QFD)

Effective communication is one of the most important and impactful aspects of any organization's success. QFD methodology effectively communicates customer needs to multiple business operations throughout the organization including design, quality, manufacturing, production, marketing and sales. This effective communication of the Voice of the Customer allows the entire organization to work together and produce products with high levels of customer perceived value. There are several additional benefits to using Quality Function Deployment:

Quality Function Deployment (QFD) is a tool used in Total Quality Management (TQM) to translate customer needs into product and service design. QFD is a structured method that helps ensure customer needs are considered throughout the product development process:

#### **Identify customer needs**

QFD uses a graphical methodology to identify customer needs and expectations, both stated and unstated.

#### **Prioritize needs**

QFD uses a matrix diagram, called the House of Quality, to prioritize customer needs and link them to technical characteristics.

### **Deploy needs**

QFD deploys the prioritized needs to the relevant organizational functions for action.

### **Consider competitors**

QFD may include a competitive analysis to evaluate how well competitors' products meet customer needs.

QFD was developed in Japan in the 1960s and became popular in the United States in the 1980s. It's often described as "deploying the voice of the customer". TQM is a philosophy and set of principles that guide an organization's quality management. It involves the participation of everyone in the organization to achieve customer satisfaction and continuous improvement.

**Customer Focused:** QFD methodology places the emphasis on the wants and needs of the customer, not on what the company may believe the customer wants. The Voice of the Customer is translated into technical design specifications. During the QFD process, design specifications are driven down from machine level to system, sub-system and component level requirements. Finally, the design specifications are controlled throughout the production and assembly processes to assure the customer needs are met.

**VOC Competitor Analysis:** The QFD "House of Quality" tool allows for direct comparison of how your design or product stacks up to the competition in meeting the VOC. This quick analysis can be beneficial in making design decisions that could place you ahead of the pack.

**Shorter Development Time and Lower Cost:** QFD reduces the likelihood of late design changes by focusing on product features and improvements based on customer requirements. Effective QFD methodology prevents valuable projecttime and resources from being wasted on development of non-value added features or functions.

**Structure and Documentation:** QFD provides a structured method and tools for recording decisions made and lessons learned during the product development process. This knowledge base can serve as a historical record that can be utilized to aid future projects.



## **TAGUCHI QUALITY LOSS FUNCTION**

Taguchi methods are statistical methods, sometimes called robust design methods, developed by Genichi Taguchi to improve the quality of manufactured goods, and more recently also applied to engineering, biotechnology, marketing and advertising. Professional statisticians have welcomed the goals and improvements brought about by Taguchi methods, particularly by Taguchi's development of designs for studying variation, but have criticized the inefficiency of some of Taguchi's proposals.

### **Loss functions in the statistical theory**

Traditionally, statistical methods have relied on mean-unbiased estimators of treatment effects: Under the conditions of the Gauss–Markov theorem, least squares estimators have minimum variance among all mean-unbiased linear estimators. The emphasis on comparisons of means also draws (limiting) comfort from the law of large numbers, according to which the sample means converge to the true mean. Fisher's textbook on the design of experiments emphasized comparisons of treatment means. However, loss functions were avoided by Ronald A. Fisher [clarification needed -loss functions weren't explicitly mentioned yet]

### **Taguchi's use of loss functions:**

Taguchi knew statistical theory mainly from the followers of Ronald A. Fisher, who also avoided loss functions. Reacting to Fisher's methods in the design of experiments, Taguchi interpreted Fisher's methods as being adapted for seeking to improve the mean outcome of a process. Indeed, Fisher's work had been largely motivated by programmes to compare agricultural yields under

The Taguchi loss function is a statistical tool that helps manufacturers understand and reduce the economic losses that occur when a product or process deviates from its target performance. It was developed by Japanese business statistician Genichi Taguchi.

The Taguchi loss function is based on the idea that even small quality variations can lead to higher costs and lower customer satisfaction. The function shows that as a product or process deviates from its target, the loss increases exponentially.

The Taguchi loss function is different from the American concept of quality, known as "goal post philosophy". In goal post philosophy, a product is considered poor quality if it doesn't meet the designed specifications, regardless of how much it deviates from the target. The Taguchi loss function, however, shows that loss increases gradually as a product deviates from its intended condition.

The formula for the Taguchi loss function is:

The Taguchi Loss Function equation is:

$$L(x) = K * (x - T)^2$$

Where:

- $L(x)$  represents the financial loss associated with a specific deviation from the target value.
- $K$  is the loss coefficient, a constant that determines the rate at which financial loss increases with deviations from the target value.
- $x$  is the actual value of the quality characteristic being evaluated.
- $T$  is the target value, the ideal or optimal value of the quality characteristic.

The loss function can help manufacturers make improvements by guiding investments based on the relationship between product performance and the cost of failures.

However, Taguchi realised that in much industrial production, there is a need to produce an outcome on target, for example, to machine a hole to a specified diameter, or to manufacture a cell to produce a given voltage. He also realised, as had Walter A. Shewhart and others before him, that excessive variation lay at the root of poor manufactured quality and that reacting to individual items inside and outside specification was counterproductive.

## 4.3 TOTAL PRODUCTIVE MANAGEMENT

### I. TPM CONCEPTS:

Total Productive Maintenance (TPM) and Total Quality Management (TQM) are both management philosophies that aim to improve an organization's quality and efficiency, but they have different focuses:

**Focus:** TPM focuses on improving equipment and production processes, while TQM focuses on improving the quality of products and services.

**Goals:** TPM's goal is to increase production and efficiency, while TQM's goal is to meet or exceed customer expectations.

**Involvement:** Both TPM and TQM require employee involvement, but TPM uses a multi-disciplinary approach and continuous training, while TQM focuses on all departments.

**Tools:** TQM uses tools like Lean Six Sigma, Kaizen, and SPC.

**Relationship:** TPM can be seen as a way to help achieve TQM's goal.

Here are some more details about TPM:

**Maintenance :**TPM involves placing routine maintenance tasks, like cleaning and lubrication, in the hands of operators. This gives operators more ownership of their equipment and increases their knowledge of it.

#### **Planned maintenance**

TPM schedules maintenance tasks based on predicted or measured failure rates. This reduces unplanned stop time and allows most maintenance to be planned for times when equipment is not scheduled for production.

#### **Eight pillars**

- The eight pillars of TPM are:
- Seiri (organize)
- Seiton (orderliness)
- Seiso (cleanliness)
- Seiketsu (standardize)
- Shitsuke (sustain)
- Autonomous maintenance
- Quality maintenance
- Focused improvement

## II. TPM improvement needs:

Total Productive Maintenance (TPM) improvement needs in Total Quality Management (TQM) include: **Employee involvement** :TPM should be an organization-wide initiative that involves all employees, from top management to frontline operators.

### Continuous improvement

Both TPM and TQM require a commitment to continuous improvement.

### Quality maintenance

Quality maintenance is a pillar of TPM that can be integrated with other business systems, such as supply chain management and customer relationship management.

### Data analytics

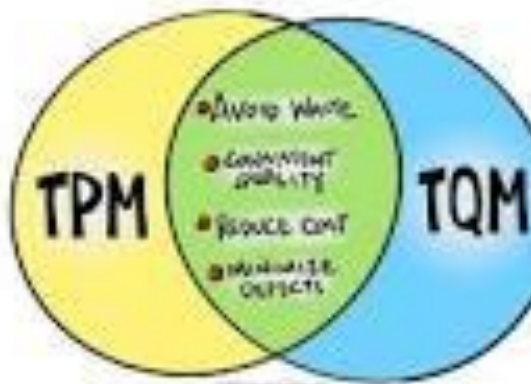
Increased use of data analytics and predictive maintenance can help identify and prevent equipment failures.

### Sustainability and energy efficiency

Maintenance processes should focus on sustainability and energy efficiency.

### Technology

Increased use of technology, such as the Internet of Things (IoT) and artificial intelligence (AI), can improve maintenance processes and decision making.



TPM is a maintenance program that focuses on improving the performance and reliability of production equipment and processes. TQM is a management philosophy that focuses on improving the overall quality of an organization's products and services.

## III. TPM Performance measures

Total Productive Maintenance (TPM) performance measures can be used to track the success of TPM implementation in manufacturing. Some key performance indicators (KPIs) for TPM include: Overall Equipment Effectiveness (OEE), Mean time between failures (MTBF), Mean time to repair (MTTR), Equipment downtime, and Maintenance costs.

TPM metrics can provide valuable insights into the performance of equipment and processes. They can help organizations excel in their operations by going beyond traditional maintenance. TPM can play a significant role in achieving quality in processes and products. Quality products can help improve operational performance at the plant level by reducing work in process inventory, defective products, and scrap.

Organizations can use a variety of tools and techniques to implement Total Quality Management (TQM). These methods can help identify, analyze, and resolve quality issues. Some common objectives for TQM include improving customer satisfaction and achieving business goals.

### **Tools and Techniques used in TPM**

TPM uses a variety of tools and techniques to achieve its objectives, including:

1. **Root Cause Analysis:** A problem-solving technique used to identify the underlying cause of equipment problems and prevent recurrence.
2. **Data Analysis:** Using data to identify patterns and trends that can be used to improve equipment performance and prevent downtime.
3. **Standard Operating Procedures (SOPs):** Written procedures that describe how to perform maintenance tasks and ensure consistency and quality.
4. **Preventive Maintenance:** Regular maintenance tasks performed to prevent equipment failure and prolong equipment life.
5. **Kanban:** A visual management tool used to control inventory levels and ensure that equipment and materials are available when needed.
6. **5S:** A workplace organization technique used to improve efficiency and productivity by organizing the workplace and eliminating waste.
7. **Standard Work:** A process improvement technique used to establish a standard way of performing tasks to ensure consistency and quality.

8. Visual Management: The use of visual aids, such as signs, labels, and displays, to communicate important information and improve workplace organization.
9. Single-Minute Exchange of Dies (SMED): A process improvement technique used to reduce equipment changeover time and increase production efficiency.
10. Asset Management: A system for managing equipment throughout its lifecycle, from acquisition to disposal, to ensure that it is reliable, maintainable, and optimized for performance.
11. Quality Control: A set of techniques used to measure and control product quality, ensuring that products meet or exceed customer expectations.
12. Problem-Solving: A systematic approach to identifying and solving problems, using tools and techniques such as the 5 Whys and Fishbone Diagrams to identify root causes and develop solutions.
13. Continuous Improvement: A philosophy of constantly striving for improvement, using techniques such as Kaizen to make small, incremental changes that add up to significant improvements over time.

These tools and techniques are essential to the success of TPM, allowing organizations to identify and address equipment problems, improve efficiency and productivity, and maintain high levels of quality and safety.

### **TPM and other Maintenance Management Philosophies**

#### **TPM and Lean Manufacturing**

TPM and Lean Manufacturing share similar objectives, including reducing waste, improving efficiency, and enhancing customer value. TPM focuses on equipment maintenance and effectiveness, while Lean manufacturing focuses on process improvement and waste reduction. Both philosophies emphasize employee involvement and continuous improvement.

#### **TPM and Six Sigma**

TPM and Six Sigma both focus on continuous improvement and reducing defects and waste. Six Sigma uses statistical tools and techniques to improve quality control, while TPM emphasizes equipment maintenance and reliability. Both philosophies require employee involvement and a commitment to continuous improvement.

### **TPM and RCM**

TPM and Reliability-Centered Maintenance (RCM) both focus on maximizing equipment effectiveness and reliability. RCM emphasizes a risk-based approach to maintenance, while TPM emphasizes a holistic approach that involves all employees. Both philosophies require continuous improvement and a commitment to proactive maintenance.

### **TPM and TQM**

TPM and Total Quality Management (TQM) share similar objectives, including improving quality control and customer satisfaction. TQM focuses on process improvement and quality control, while TPM focuses on equipment maintenance and effectiveness. Both philosophies require employee involvement and a commitment to continuous improvement.

### **TPM and World Class Manufacturing**

TPM is an essential component of World Class Manufacturing, which focuses on creating a culture of continuous improvement and excellence in manufacturing operations. World Class Manufacturing emphasizes employee involvement, waste reduction, and quality control, and TPM is essential for maximizing equipment effectiveness and reliability.

### **Implementing TPM in your Manufacturing Process**

Implementing TPM in your manufacturing process requires a strategic approach that involves the following steps:

- Identify equipment and process problems
- Engage all employees in TPM implementation
- Develop a TPM implementation plan
- Implement the 8 Pillars of TPM
- Monitor and continuously improve TPM effectiveness

Implementing TPM requires a significant commitment to employee involvement, continuous improvement, and a proactive approach to equipment maintenance.

### **Challenges in TPM Rollout and Mitigation Plan**

Implementing TPM can be challenging, and organizations may face various obstacles during the rollout. These challenges can include resistance to change, lack of employee buy-in, inadequate resources, and insufficient training. To mitigate these challenges, organizations should focus on clear communication, employee engagement, and training, as well as creating

a culture of continuous improvement and teamwork. Organizations should also allocate sufficient resources and provide adequate training to ensure that TPM implementation is successful.

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## 4.4 COST OF QUALITY

In Total Quality Management (TQM), the cost of quality (COQ) is a methodology that helps organizations calculate the costs associated with ensuring product quality:

### What it is

The COQ is the sum of the cost of good quality (COGQ) and the cost of poor quality (COPQ):

$$\text{COQ} = \text{COGQ} + \text{COPQ}$$

### What it includes

- The COQ includes all costs associated with product quality, including:
- Preventive costs to reduce failures
- Process controls to maintain quality
- Costs of internal and external failures

### Why it's important

The COQ helps organizations understand how quality impacts the bottom line. It also helps organizations:

Assess how resources are used for quality

Determine where to allocate resources to improve product quality

Analyze and improve quality operations

### How to implement it

To implement the COQ in project management, you can:

- Gather input data
- Develop a project quality management plan
- Analyze data
- Establish quality metrics
- Perform quality assurance and control
- Devise an improvement plan

### TYPES OF QUALITY COST:

#### Appraisal costs

Appraisal costs are associated with measuring and monitoring activities related to quality.

These costs are associated with the suppliers' and customers' evaluation of purchased materials,

processes, products, and services to ensure that they conform to specifications. They could include:

- **Verification:** Checking of incoming material, process setup, and products against agreed specifications
- **Quality audits:** Confirmation that the quality system is functioning correctly
- **Supplier rating:** Assessment and approval of suppliers of products and services

### **Internal failure costs**

Internal failure costs are incurred to remedy defects discovered before the product or service is delivered to the customer. These costs occur when the results of work fail to reach design quality standards and are detected before they are transferred to the customer. They could include:

- **Waste:** Performance of unnecessary work or holding of stock as a result of errors, poor organization, or communication
- **Scrap:** Defective product or material that cannot be repaired, used, or sold
- **Rework or rectification:** Correction of defective material or errors
- **Failure analysis:** Activity required to establish the causes of internal product or service failure

### **External failure costs**

External failure costs are incurred to remedy defects discovered by customers. These costs occur when products or services that fail to reach design quality standards are not detected until after transfer to the customer. They could include:

- **Repairs and servicing:** Of both returned products and those in the field
- **Warranty claims:** Failed products that are replaced or services that are re-performed under a guarantee
- **Complaints:** All work and costs associated with handling and servicing customers' complaints
- **Returns:** Handling and investigation of rejected or recalled products, including transport costs

### Prevention costs

Prevention costs are incurred to prevent or avoid quality problems. These costs are associated with the design, implementation, and maintenance of the quality management system. They are planned and incurred before actual operation, and they could include:

- Product or service requirements: Establishment of specifications for incoming materials, processes, finished products, and services
- Quality planning: Creation of plans for quality, reliability, operations, production, and inspection
- Quality assurance: Creation and maintenance of the quality system
- Training: Development, preparation, and maintenance of programs

### How to Calculate Cost of Quality in Projects

Calculating the COQ in projects is an important step towards improving quality and reducing costs. While the calculation may differ across organizations, a comprehensive overview of all quality costs is essential for better understanding.

- The basic equation for Cost of Quality is the sum of Cost of Good Quality (COGQ) and Cost of Poor Quality (COPQ).
- To calculate the COGQ, add the Prevention Cost (PC) and Appraisal Cost (AC) ( $COGQ = PC + AC$ ).
- To calculate the COPQ, add the Internal Failure Cost (IFC) and External Failure Cost (EFC) ( $COPQ = IFC + EFC$ ).
- By combining the COGQ and COPQ equations, the COQ can be more clearly defined as follows:
- $COQ = COGQ + COPQ = (PC + AC) + (IFC + EFC)$ .

### How to Interpret and Optimize Cost of Quality in Projects

To interpret and optimize COQ in projects, businesses must understand the different components of the cost of quality. Moreover, they must identify areas for improvement, and implement strategies to reduce costs while maintaining quality standards. Here is a breakdown of the key points to keep in mind for interpreting and optimizing the cost of quality in projects:

### **Analyze Data**

Start by gathering and analyzing data on the different costs of quality, including prevention, appraisal, internal failure, and external failure costs.

### **Identify Areas of Improvement**

Use the data analysis to identify areas where quality can be improved and expenses can be reduced.

### **Set Quality Metrics**

Establish quality metrics that can help you track progress towards achieving your quality goals.

### **Conduct Quality Control**

Put a system in place for monitoring quality and conducting quality control checks to ensure that products and services meet standards.

### **Continuous Improvement**

Develop a plan for continuous improvement that involves identifying and addressing the root causes of quality issues and implementing strategies to prevent future problems.

### **Optimize Costs**

Use the data you have gathered to optimize expenditure by reducing waste, improving efficiency, and streamlining processes.

### **Examples of the Cost of Quality in Project Management**

**Lost Time:** When a project has quality issues, it can result in delays, causing the project to go over budget and miss deadlines. Moreover, the cost of lost time can be significant as team members may need to spend additional hours on the project. Or work overtime to catch up, resulting in increased labor spends

**Rejected Deliverables:** If project deliverables do not meet quality standards, they may need to be redone, causing additional spends. Moreover, this can include expenses related to materials, labor, and time spent. This can also be on the rejected deliverables, as well as the cost of redoing the work

**Training Costs:** If the project team lacks the necessary skills or knowledge, it can lead to quality issues that can increase project spends. Moreover, investing in training can help prevent quality issues by ensuring that team members have the necessary skills and knowledge to complete their tasks effectively. Also, while training may seem like an added expense, they can

ultimately save the project money by reducing the need for rework and improving the overall quality of the project.

### **BUSINESS PROCESS RE-ENGINEERING (BPR)**

Business process re-engineering (BPR) is a business management strategy, originally pioneered in the early 1990s, focusing on the analysis and design of workflows and business processes within an organization. BPR aimed to help organizations fundamentally rethink how they do their work in order to improve customer service, cut operational costs, and become world-class competitors.

BPR seeks to help companies radically restructure their organizations by focusing on the ground-up design of their business processes. According to early BPR proponent Thomas H. Davenport (1990), a business process is a set of logically related tasks performed to achieve a defined business outcome. Re-engineering emphasized a holistic focus on business objectives and how processes related to them, encouraging full-scale recreation of processes rather than iterative optimization of sub-processes. Business process reengineering is also known as business process redesign, business transformation, or business process change management.

Business process can be defined as "a set of logically related tasks performed to achieve a defined business outcome." It is "a structured, measured set of activities designed to produce a specified output for a particular customer or market." Improving business processes is important for businesses to stay ahead of competition in today's marketplace. Over the last 10 to 15 years, companies have been forced to improve their business processes because customers are demanding better products and services. Many companies begin business process improvement with a continuous improvement model. The BPR methodology comprises of developing the business vision and process objectives, identifying the processes to be redesigned, understanding and measuring the existing processes, identifying IT levers and designing and building a prototype of the new process. In this context it can be mentioned that, some of the biggest obstacles faced by reengineering are lack of sustained management commitment and leadership,

unrealistic scope and expectations, and resistance to change.

### **Business Process Reengineering (BPR) and Total Quality Management (TQM)**

Total Quality Management and BPR share a cross-functional relationship. Quality specialists tend to focus on incremental change and gradual improvement of processes, while proponents of reengineering often seek radical redesign and drastic improvement of processes. Quality management, often referred to as TQM or continuous improvement, means programs and initiatives, which emphasize incremental improvement in work processes, and outputs over an open-ended period of time. In contrast, reengineering, also known as business process redesign or process innovation, refers to prudent initiatives intended to achieve radically redesigned and improved work processes in a specific time frame. In contrast to continuous improvement, BPR relies on a different school of thought. The extreme difference between continuous process improvement and business process reengineering lies in where you start from and also the magnitude and rate of resulting changes.

In course of time, many derivatives of radical, breakthrough improvement and continuous improvement have emerged to address the difficulties of implementing major changes in corporations. Leadership is really important for effective BPR deployment, and successful leaders use leadership styles to suit the particular situation and perform their tasks, giving due importance to both people and work. Business process is essentially value engineering applied to the system to bring forth, and sustain the product with an emphasis on information flow. By mapping the functions of the business process, low value functions can be identified and eliminated, thus reducing cost. Alternatively, a new and less costly process, which implements the function of the current process can be developed to replace the present one.

### **The Role of Consultants in BPR projects**

New reengineering teams typically employ the assistance of a consultant for their project. Consultants can play a valuable role in BPR projects. They are objective and immune to internal politics. Having followed the processes before, they provide valuable information and best practices from a wide range of experience.

Consultants can also serve as good communication bridge between the team and management, write project documentation, lead the project and facilitate meetings, make presentations to stakeholders and associates, and last but not the least, contribute subject-matter expertise in your organization's work processes.

### **BPR and Information Technology**

Business Process Re-engineering has rapidly developed towards a new management philosophy. The inherent business process orientation changes the perspective of international management from a structural to that of a process view. The re-engineering of business processes is only one aspect of the management of business processes. In particular, the re-engineering of international business processes needs special attention, because the multi-faceted structure of multinational corporations increases the complexity of business processes, there by influencing the options for redesign. Business Process Re-engineering has rapidly developed towards a new management philosophy based upon predecessors like Total Quality Management, Overhead Value Analysis, Kanban or Just-In-Time-Management. Business processes can be re-engineered by redesigning the steps, by changing the logical and temporal sequence of the steps, or by changing any other characteristics of the process. The role of IT is discussed in contradictory way. Advocates of information systems favor the view that the new technology is an enabler of process re-engineering. IT has to be monitored constantly to determine whether it can generate new process designs or contribute to the performance of a business process. The breakthrough of BPR is closely connected with IT, which opens new dimensions of process reorganization. Moreover, those who take the initiative in process improvement/redesign, influence the role of IT. If the data processing department initiates the process change, then IT will have more of a generator function for new process redesigns. If on the other hand, the top management sets off the change process, then the process will be first restructured and later optimized through IT.

## 5.1 QUALITY MANAGEMENT SYSTEM

### I. INTRODUCTION

Total Quality Management (TQM) is a management approach that involves the entire organization in improving products and services to meet or exceed customer expectations. A Quality Management System (QMS) is a set of rules that helps organizations meet customer needs and statutory and regulatory requirements. ISO 9001:2015 is a globally recognized QMS standard that can help organizations improve their performance.

Here are some principles of TQM:

**Customer focus:** Put the customer first and meet or exceed their expectations

**Employee commitment:** Involve all employees in quality improvement

**Continuous improvement:** Commit to ongoing improvement of products and processes

**Process orientation:** Emphasize the importance of well-defined and controlled processes

**Fact-based decision making:** Make decisions based on facts

**Deliver high-quality work:** Deliver high-quality work the first time

**Strategic project approach:** Approach projects strategically

**Foster cooperation and mutual respect:** Foster a culture of cooperation and mutual respect

Some benefits of a QMS include: Meeting statutory and regulatory requirements, cutting costs and reducing waste, improving customer and employee satisfaction, and continually improving organizational processes.

### II. Benefits of ISO Registration:

ISO registration, or certification, can provide many benefits for an organization, including:

**Quality:** ISO certification demonstrates a commitment to quality and can improve the quality of products and services.

**Customer satisfaction:** ISO certification can improve customer satisfaction by ensuring that the organization meets customer requirements and provides a consistent, reliable service.

**Efficiency:** ISO certification can improve operational efficiency by standardizing processes and reducing waste.

**Employee morale:** ISO certification can improve employee morale by defining roles and responsibilities, establishing training procedures, and making employees accountable.

**Credibility:** ISO certification can increase credibility and recognition, which can help an organization compete in the market.



**Regulatory compliance:** ISO certification can help an organization align with industry regulations and standards.

**Risk management:** ISO certification can help an organization improve its risk management by emphasizing risk-based thinking.

**Supplier relationships:** ISO certification can help an organization improve relationships with suppliers and partners. ISO stands for International Organization for Standardization, and it's an independent, non-governmental organization

### **III. Key benefits of a quality management system**

1. Identify risks and opportunities
2. Prevent problems from reoccurring
3. Boost your marketing and sales efforts
4. Improve employee performance
5. Improve your control over the business

#### **Identify risks and opportunities:**

The best way to deal with quality issues is to prevent them from occurring in the first place. To achieve this goal, ISO 9001—the popular quality management standard—asks you to identify potential risks to your business and control them in a structured way. This risk-based thinking leads to fewer surprises, improved planning, more effective decision-making and better relationships with suppliers, customers and employees.

“We sit down and think about the things that have gone wrong historically,” Mohamud says. “And we try to prevent those things from happening. It allows you to reduce the likelihood of things going wrong in the first place.” At the same time, ISO asks you to look for opportunities for your business and consider how to take advantage of them in an organized fashion.

#### **Prevent problems from reoccurring**

Too often businesses repeat the same mistakes because they don't have a system to record and correct problems as they occur. ISO requires you to maintain careful records of problems, seek out their root causes and come up with lasting solutions. The result is less waste, better quality and lower costs.

“There's so much waste that comes from rework and defective products and services that could be prevented,” Mohamud says. “With ISO, you figure out what the problem is and correct it. You also make it part the organization's knowledge so you prevent it from reoccurring.”

**Boost your marketing and sales efforts**

Just think of how many times you've seen companies promote their ISO certification in advertising, on their website and even on a banner outside their building. As an internationally recognized quality management system, achieving ISO certification will support your marketing and help increase your sales. Indeed, many large companies require their suppliers to be ISO certified. And certification can be particularly important if you want to enter foreign markets. "We see a lot of SMEs that want to grow and sell outside of Canada, and they're almost always asked to have ISO 9001 and any industry specific ISO standard," Mohamud says.

**Improve employee performance**

Employee morale improves when they know you are committed to eliminating waste and producing the highest quality products and services. ISO also requires you define tasks (who does what), eliminate skills gaps in your business and communicate your quality policies to employees. "When things are not done in an organized fashion, we see a lot of confusion and doubt for the employees," Mohamud says. "With ISO, you're giving people the comfort of a framework in which they can succeed. You're giving them the tools, the resources, the training to do their jobs well. When it's organized people are going to be happier and they're going to want to do better."

**Improve your control over the business**

ISO requires you monitor, measure, analyze and evaluate the effectiveness of your quality management system. By doing so, you will generate performance metrics that allow you to judge how well you're doing and where you need to improve. These are powerful tools for gaining insight into your business and make better decisions.

"As an entrepreneur, it helps you to get the full picture and then say: Maybe, we need to drill down in more detail to find out where we need to focus our improvement efforts. Besides creating a stronger, more efficient and productive company today, ISO can also make your business more attractive to buyers when it comes time for you to sell, Mohamud says. "You are demonstrating your commitment to an effective management approach with quality at its heart to your suppliers, your customers, your shareholders and potentially a company that wants to buy you."

**IV. ISO 9000 Series of Standards:**

The ISO 9000 family of quality management systems (QMS) is a set of standards that helps organizations ensure they meet customers and other stakeholder needs within statutory and regulatory requirements related to a product or service. ISO 9000

deals with the fundamentals of quality management systems, including the seven quality management principles that underlie the family of standards. ISO 9001 deals with the requirements that organizations wishing to meet the standard must fulfil.

Third-party certification bodies provide independent confirmation that organizations meet the requirements of ISO 9001. Over one million organizations worldwide are independently certified, making ISO 9001 one of the most widely used management tools in the world today. However, the ISO certification process has been criticized [self-published source?] as being wasteful and not being useful for all organizations.

ISO 9000 is defined as a set of international standards on quality management and quality assurance developed to help companies effectively document the quality system elements needed to maintain an efficient quality system. They are not specific to any one industry and can be applied to organizations of any size. ISO 9000 can help a company satisfy its customers, meet regulatory requirements, and achieve continual improvement. It should be considered to be a first step or the base level of a quality system.

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### **ISO 9000:2000:**

ISO 9000:2000 refers to the ISO 9000 update released in the year 2000.

The ISO 9000:2000 revision had five goals:

Meet stakeholder needs

Be usable by all sizes of organizations

Be usable by all sectors

Be simple and clearly understood

Connect quality management system to business processes

ISO 9000:2000 was again updated in 2008 and 2015. ISO 9000:2015 is the most current version.

### **ISO 9000:2015 principles of Quality Management**

The ISO 9000:2015 and ISO 9001:2015 standards are based on seven quality management principles that senior management can apply to promote organizational improvement.

#### **Customer focus**

- Understand the needs of existing and future customers
- Align organizational objectives with customer needs and expectations
- Meet customer requirements
- Measure customer satisfaction
- Manage customer relationships
- Aim to exceed customer expectations



## 2. Leadership

- Establish a vision and direction for the organization
- Set challenging goals
- Model organizational values
- Establish trust
- Equip and empower employees
- Recognize employee contributions
- Learn more about leadership

## 3. Engagement of people

- Ensure that people's abilities are used and valued
- Make people accountable
- Enable participation in continual improvement
- Evaluate individual performance
- Enable learning and knowledge sharing
- Enable open discussion of problems and constraints
- Learn more about employee involvement

## 4. Process approach

Manage activities as processes

Measure the capability of activities

Identify linkages between activities

Prioritize improvement opportunities

Deploy resources effectively

Learn more about a process view of work and see process analysis tools

## **5.Improvement**

Improve organizational performance and capabilities

Align improvement activities

Empower people to make improvements

Measure improvement consistently

Celebrate improvements

Learn more about approaches to continual improvement

Evidence-based decision making

Ensure the accessibility of accurate and reliable data

Use appropriate methods to analyze data

Make decisions based on analysis

Balance data analysis with practical experience

See tools for decision making

## **6. Relationship management**

Identify and select suppliers to manage costs, optimize resources, and create value

Establish relationships considering both the short and long term

Share expertise, resources, information, and plans with partners

Collaborate on improvement and development activities

Recognize supplier successes

Learn more about supplier quality and see resources related to managing the supply chain.

## **V. NEED FOR ISO 9000- ISO 9000-2000 QUALITY SYSTEM**

### **Basic Requirements of ISO 9001**

Procedure to cover all processes in the business

Monitoring process to ensure effectiveness  
Keeping adequate record  
Defect verification and appropriate correction  
Regular review of individual processes  
Facilitating continual improvement

### **Benefits of ISO Registration**

Increase in internal quality – reduction of scrap, rework etc  
Production reliability – measure of breakdowns, time and shift management etc  
External quality – acceptance by customers, less claims, return of goods  
Time performance – marketing, delivery, production time etc  
Cost of poor quality – scraps and rework

### **ISO 9000 Family**

ISO 9000:2000 QMS – Fundamental and Vocabulary

Basic QMS

Guidance document for certification

Revised in ISO 9000:2005 [www.EnggTree.com](http://www.EnggTree.com)

### **ISO 9001:2000 QMS – Requirements**

Design, development and installation

Customer satisfaction through products and service

### **ISO 9004:2000 QMS – Guidelines for Performance**

Continuous improvement

Enhance the mature system

## **VI. PROCESS OF OBTAINING ISO CERTIFICATION**

What Are the Steps of the ISO Registration Process? **ISO Registration Process:**

The ISO Registration Process comes after your company's ISO 9001 audit. The purpose of registering your company is to show that you've met the requirements. And to do this effectively, you will need to follow eight essential steps.

### **Finding an ISO 9001 Registrar**

You'll need to begin searching for an ISO registrar during the 2 to 3 months your company is still building its quality system. You can search the ANSI-ASQ National Accreditation Board (ANAB) to select the registrar right for you.

Registrars must meet the requirements of the ISO Accreditation Bodies. These requirements include things such as independence; Registrars cannot consult for instance. This system ensures uniformity in the registration process.

Accreditation Bodies maintain directories of the Registrar organizations that they accredit. These directories are available on their websites. You can normally find these websites by doing a search on the Accreditation Body's name or initials.

A directory of registrars in the U.S. can also be found at the ANSI-ASQ National Accreditation Board website which offers access to a searchable database of accredited registrars in the United States.

In Canada, contact the Standards Council of Canada for a list of registrars. All other countries should consult the accreditation authority or member body for their country. Consult the ISO website for a complete list of ISO Member bodies.

### **Selecting an ISO Registrar**

Select a registrar that has experience within the scope category of your specific industry, which you can also find on the ANAB site. Keep in mind accreditation, scheduling issues, fees and comfort level when selecting the registrar right for you.

Registrar qualifications are a key consideration. As you research Registrars you will notice that some appear to be very limited in scope just based on their names. Registrars must be accredited in a particular industrial sector in order for them to be able to certify a company in that sector. Some Registrars are accredited in several if not all sectors; others specialize in certain sectors. The best approach to evaluating a Registrar's qualifications for your industrial sector is to contact the Registrar.

After qualifications, price is always a concern. Be sure to evaluate the total cost including expenses, fees and the cost of surveillance.

Probably as important as price, within limits of course, is the overall experience a client gets with a registrar. Important areas to consider are the interpersonal skills of the auditors; the office support and ability to get questions answered; are the audits a value-added experience, will the Registrar work with you, how flexible are they in adjusting dates – how many weeks notice.

### **Creating an ISO Application**

A company and a registrar will agree on the application contract. This is an important step of the ISO Registration Process because it defines the rights and obligations of both parties, and includes liability issues, confidentiality and access rights.

### **Conducting a Quality Document Review**

The registrar will require a copy of your quality manual and procedures to verify that all the requirements of the standard are addressed. The ISO Registration Process is not a quick process, be sure to allow 2-4 weeks in advance for the registrar to fully review all of the necessary documents.

### **Determining Pre-assessment Need**

Though optional, this 2-4 week initial review of the system identifies any significant omissions or weaknesses. It saves time and allows the registrar to assess any issues and resolve logistics before the actual assessment audit.

The Pre-assessment is an initial review of your Quality Management System to identify any significant omissions or weaknesses in the system and provide your organization an opportunity to correct any deficiencies before the regular registration assessment is conducted.

### **Issuing an ISO Assessment**

During the audit, or physical onsite inspection of procedures in action, the auditors will issue findings if they assess anything that doesn't meet requirements, or nonconformities. The length of this step of the ISO Registration Process will depend on the scope of the audit and the size your organization.

### **Completing ISO 9001 Registration**

After all of the findings are put into the ISO audit report and nonconformities are addressed, your company has the option to register as ISO 9001 conformant. You will receive a certificate and can also be listed in a register, which the company can use to publicize its registration and use in advertising.

### **Checking with Surveillance Audits**

To ensure that the system is maintained and that changes don't result in deficiencies in the system, registrars perform regular surveillances of the system. Over the three-year period of your certificate, auditors will perform one full and two partial checks



of your system.

## VII. ESSENTIAL STEPS TO ISO CERTIFICATION

The costs for developing and registering a formal management system vary depending on the size and complexity of your organization and your internal processes.

**First**—There are developmental costs, namely the time spent documenting and implementing the system.

**Second**—There are costs associated with training employees to prepare the necessary documents and to plan and conduct effective internal audits.

**Third**—There is the cost of registration, which includes conducting the audit and registering the management system. The cost depends on the number of locations, the scope of work, the number of shifts and so on.

### 1. Develop your management system

Identify your core or business processes. Document processes with the involvement of employees.

Review, approve and distribute the documents to those who need access to the information.

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### 2. Implement your system

Ensure procedures are being performed as they are described in your documentation. Ensure employees are trained properly for the tasks they are performing. Create effective reporting systems to cover inspection, testing, corrective actions, preventive actions, management, review, meetings, objectives, statistical techniques and so on. Monitor the effectiveness of your processes through the use of measurable data, where possible. Review and take action to improve in the areas required.

### 3. Verify that your system is effective

Conduct the audit and review the processes and system for compliance and effectiveness. Observe, interview people and look at sample records. Identify and report strengths and weaknesses of the management system. Take corrective or preventive action as required.

### 4. Register your system

Select the appropriate auditing body for external registration. Submit your

management system documentation for review to ensure it complies with the applicable standard. Prepare for review by an external auditor to confirm that the system's requirements are being satisfied and that the management system is implemented effectively.

## **VIII. ADVANTAGES OF ISO CERTIFICATION**

### **Benefits of ISO 9001:2008/ISO 9001:2015 to your business**

ISO 9001 aims to provide a practical and workable Quality Management System for improving and monitoring all areas of your business. Achieving the ISO 9001 standard is not about establishing a set of procedures that are complicated and difficult to manage. The aim is to provide a workable management system that is suitable for your organization. With the right support and the knowledge of your employees, you will end up with a system that will improve all areas of your organization.

Implementing an effective and robust ISO 9001 Quality Management System (QMS) will help you to focus on the important areas of your business and improve efficiency. The management processes that are established throughout your business will provide a sound foundation, leading to increased productivity and profit. This in turn will improve your customer acquisition and retention.

Some of the main benefits of ISO 9001 certification include:

Suitable for both small and large organisations

Better internal management

Less wastage

Increase in efficiency, productivity and profit

Improved customer retention and acquisition

Consistent outcomes, measured and monitored

Globally recognised standard

Compatible with other ISO standards

### **Benefits of ISO 9001 to your customers**

The ISO 9001:2008/ISO 9001:2015 standard is recognised worldwide and your customers will understand the benefits of working with companies that are ISO 9001 certified. In fact, some of your customers will only do business with certified

companies because it gives them assurance that your management systems are constantly assessed and approved.

They will know from experience that working with ISO 9001:2008/ISO 9001:2015 certified companies provides many advantages:

Minimizes mistakes

Improves reporting and communications

Better quality products and service

More reliable production scheduling and delivery

Standards maintained by annual assessments

## IX. NEW VERSION OF ISO STANDARDS

The International Organization for Standardization (ISO) is a worldwide federation of national standards' bodies from more than 140 countries (one from each country). ISO standards are documented quality systems and activities, used as the basis for adoption of uniform quality systems norms for international exchange of goods and services.

In fact, 'ISO' is a word, derived from the Greek word ISO meaning 'equal', which is the root of the prefix 'ISO' that occurs in a host of terms, such as 'isometric' (of equal measure or dimensions) and 'isonomy' (equality of laws, or of people before the law). From 'equal' to 'standard', the line of thinking that led to the choice of 'ISO' as the name of the organization is easy to follow.

The name 'ISO' is used around the world to denote the organization, thus avoiding a plethora of acronyms resulting from the translation of 'International Organization for Standardization' into the different national languages of members, such as, IOS in English, OIN in French, etc.

The objectives of ISO 9001:2000 quality management systems for an organization are:  
To identify the goals that the organization intends to achieve. Goals may be efficiency and profitability, consistently meeting customer requirements, etc.

To consistently meet customer requirements

To achieve customer satisfaction

To enhance market share

To sustain market share

To improve communications and morale in the organization

To reduce costs and liabilities

To increase confidence in the production system

The organization meeting expectations of various stakeholders, such as, customers, suppliers, shareholders, employees, and the society achieve all these objectives.

### **Contents of ISO 9001:2015**

A fish wholesaler in Tsukiji, Japan, advertising its ISO 9001 certification ISO 9001:2015 Quality management systems — Requirements is a document of approximately 30 pages available from the national standards organization in each country. Only ISO 9001 is directly audited against for third-party assessment purposes.

Contents of ISO 9001:2015 are as follows:

Section 1: Scope

Section 2: Normative references Section 3: Terms and definitions Section 4: Context of the organization Section 5: Leadership

Section 6: Planning

Section 7: Support

Section 8: Operation

Section 9: Performance evaluation Section 10: Continual Improvement

Essentially, the layout of the standard is similar to the previous ISO 9001:2008 standard in that it follows the Plan, Do, Check, Act cycle in a process-based approach but is now further encouraging this to have risk-based thinking (section 0.3.3 of the introduction).

The purpose of the quality objectives is to determine the conformity of the requirements (customers and organizations), facilitate effective deployment and improve the quality management system.

### **Criticisms of ISO 9001 certification**

A common criticism of ISO 9000 and 9001 is the amount of money, time, and paperwork required for a complete implementation of the ISO 9001 certification. Dalglish cites the "inordinate and often unnecessary paperwork burden" of ISO, and says that "quality managers feel that ISO's overhead and paperwork are excessive and extremely inefficient". The level of minimum documentation for a minimum scope organization has been greatly reduced, going from ISO 9001:2000 to ISO 9001:2008

to ISO 9001:2015.

According to Barnes, "Opponents claim that it is only for documentation. Proponents believe that if a company has documented its quality systems, then most of the paperwork has already been completed". Wilson suggests that ISO standards "elevate inspection of the correct procedures over broader aspects of quality", and therefore, "the workplace becomes oppressive and quality is not improved".

One study showing reasons for not adopting this standard include the risks and uncertainty of not knowing if there are direct relationships to improved quality, and what kind and how many resources will be needed. Additional risks include how much certification will cost, increased bureaucratic processes and risk of poor company image if the certification process fails. According to John Seddon, ISO 9001 promotes specification, control, and procedures rather than understanding and improvement. Wade argues that ISO 9000 is effective as a guideline, but that promoting it as a standard "helps to mislead companies into thinking that certification means better quality, ... [undermining] the need for an organization to set its own quality standards". In short, Wade argues that reliance on the specifications of ISO 9001 does not guarantee a successful quality system.

The standard is seen as especially prone to failure when a company is interested in certification before quality. Certifications are in fact often based on customer contractual requirements rather than a desire to actually improve quality. "If you just want the certificate on the wall, chances are you will create a paper system that doesn't have much to do with the way you actually run your business", said ISO's Roger Frost.

#### **X. Specific Standards - AS 9100, TS16949 and TL 9000**

AS 9100, TS 16949, and TL 9000 are quality management systems (QMS) that specialize in specific industries:

##### **AS 9100**

For the aerospace industry, this standard was released in 1999 by the European Association of Aerospace Industries and the Society of Automotive Engineers. It combines the requirements of the FAA, DOD, and NASA, while also meeting the needs of the industry.

##### **TS 16949**

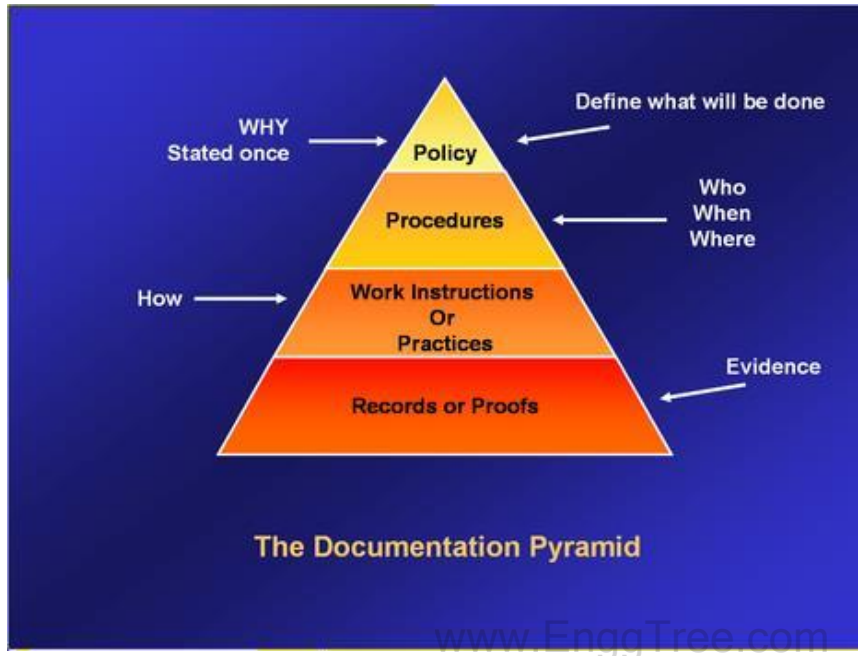
For automotive suppliers, this standard combines the quality requirements of US suppliers with those of German, French, and Italian automakers. It aims to reduce variation and waste, prevent defects, and provide continuous improvement.

**TL 9000**

For the telecommunications industry, this standard specializes the generic ISO 9001 standard to meet the needs of the ICT sector. It focuses on customer-organization relationships, continual improvement, and effective performance-based measurements.

## 5.2 DOCUMENTATION

A quality system is the method used to ensure that the quality level of a product or service is maintained. The system documentation can be viewed as a hierarchy containing four tiers, as shown in the following illustrations:



All documentation moves from one level to the next in a descending order. If the system is properly structured, changes at one level will seldom affect the level above it, but may affect those below.

### **Policy**

The first tier of documentation is the policy manual. This is the document that defines what will be done and why. A quality policy manual should be written so it is clear, precise and practical, and easy to understand. The why can be stated just once as a quality policy statement. This statement should be a short, simple definition of the organization's quality intentions. For example:

Quality is the responsibility of each Tempest employee. We pledge to continuously provide products and services that meet or exceed customer expectations.

### **Procedures**

The second tier of documentation is quality procedures. These procedures describe the methods that will be used to implement and perform the stated policies. The

procedures define who should perform the specific tasks, when the task should be done, and where the documentation will be made showing that task was performed. They indicate the strategies that will be used to ensure the quality of the system. Procedures are more detailed than policies; however, they, too, should be written in a manner that will allow for easy understanding. It should be noted that procedures are not required for all elements. Many organizations combine the policy and procedures into one document. A procedure is needed if its absence would adversely affect the activity.

### **Work Instructions**

Work instructions are usually department, machine, task, or product oriented and spell how a job will be done. The instructions are the most detailed of the documentation hierarchy. A work instruction may be in the form of a detailed drawing, recipe, routing sheet, specific job function (for example, turn nut four turns clockwise), photograph, video, or simply a sample for comparison or conformity.

The writing of work instruction is best carried out by the employee who performs the task. This person knows the process and problems encountered in that process. However, a documentation specialist may be needed to do the actual writing. This method also creates a pride of ownership in the document, making it more likely to be carried out. Additionally, employee participation helps to ensure that future improvements will be suggested. Not every task requires a work instruction. For example, you don't need to tell a computer specialist to turn on the PC.

### **Records**

Records are a way of documenting that the policies, procedures, and work instructions have been followed. Records may be forms that are filled out, a stamp of approval on a product, or a signature and date on some type of document, such as a routing sheet. Records are used to provide traceability of actions taken on a specific product or batch of products. They provide data for corrective actions and a way of recalling products, if necessary.

### **Create and maintain a QMS document**

A quality management system (QMS) is a set of policies, procedures, and processes that define how an organization ensures the quality of its products and services. A QMS document hierarchy



is a way of organizing and controlling the QMS documents according to their level of importance, scope, and authority. A well-designed QMS document hierarchy can help you achieve consistency, clarity, and compliance in your QMS. Read on to learn how to create and maintain a QMS document hierarchy in four steps.

1. Identify the document types
2. Establish the document levels
3. Create and review the documents
4. Control and update the documents

### **Identify the document types :**

The first step is to identify the different types of documents that make up your QMS, such as quality manuals, procedures, work instructions, forms, records, and templates. Each document type has a specific purpose, format, and audience. For example, a quality manual describes the overall QMS and its objectives, a procedure outlines the steps and responsibilities for a process, and a work instruction provides detailed instructions for a task or activity. You should also define the naming conventions, numbering systems, and revision levels for each document type.

### **Establish the document levels** [www.EnggTree.com](http://www.EnggTree.com)

The second step in establishing a Quality Management System (QMS) is to create document levels, which are layers of the QMS document hierarchy. Document levels indicate the degree of detail, complexity, and authority of the documents. The number of document levels may vary depending on the size and nature of an organization; typically, there are three or four. For example, a common QMS document hierarchy could include a Quality Manual at Level 1, Procedures at Level 2, Work Instructions at Level 3, and Forms, Records, and Templates at Level 4. It is also important to define the relationships and references between documents at different levels such as cross-references, hyperlinks, or appendices.

### **Create and review the documents**

The third step is to create and review the documents according to the document types and levels. Follow the guidelines and templates for each document type and ensure that the documents are clear, concise, and accurate. You should also involve the relevant stakeholders, such as process owners, subject matter experts, and quality managers, in the document creation and review process. You should use a document approval workflow to ensure that the documents are authorized and approved by the appropriate personnel before they are published and distributed.

### **Control and update the documents**

The fourth step is to control and update the documents to ensure that they are current, accessible, and secure. You should use a document control system, such as a software application or a cloud-based platform, to store, manage, and track the QMS documents. You should also establish a document control procedure that defines the roles and responsibilities for document control, such as document identification, distribution, retrieval, retention, disposal, and archiving.

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### 5.3 INTERNAL AUDITS AND REGISTRATION

ISO 9001 is an internationally recognized framework that outlines the criteria for a robust QMS to enhance customer satisfaction and continual improvement. The ISO 9001 has set forth requirements for the Quality Management System of organizations (QMS). A systematic examination of the QMS to ensure its compliance with the requirements is called Internal Quality Audit ISO 9001.

Internal audits are a fundamental component of ISO 9001, serving as a proactive tool to assess whether the organization's processes, procedures, and practices align with the standard's stipulations and the company's own objectives. These audits are conducted by qualified personnel independent of the audited area, ensuring impartiality and objectivity in their evaluations.

The primary objectives of internal quality audit ISO 9001 include verifying the effectiveness and efficiency of the QMS, identifying areas for improvement, ensuring compliance with ISO 9001 requirements, and determining whether implemented processes align with planned arrangements. Auditors examine documentation, records, procedures, and practices to evaluate conformity and effectiveness.

The audit process typically involves planning, conducting the audit, reporting findings, and implementing corrective actions where necessary. Through this systematic review, companies can detect non-conformities, inefficiencies, or gaps in their processes, allowing them to take corrective and preventive actions to enhance overall performance.

Internal quality audit ISO 9001 ensure compliance with ISO standards and facilitate a culture of continual improvement within the organization. By addressing shortcomings and optimizing processes, companies can enhance product or service quality, increase customer satisfaction, reduce risks, and ultimately improve their competitiveness in the market. Regular and thorough internal audits are crucial in maintaining the effectiveness of the QMS and achieving sustained success in today's competitive business landscape.

#### **Steps in Internal Audit of Quality Management System**

Conducting an internal audit of a Quality Management System (QMS) involves a systematic and structured approach to assess compliance with established procedures, standards, and regulations

by its own personnel. Internal audit of a quality management system aims to assess compliance, identify areas for improvement, and ensure effectiveness in achieving the objectives while adhering to established standards, policies, and procedures. Here are the critical steps involved in performing an internal audit of a quality management system:



### **Planning:**

Define the audit scope, objectives, and criteria based on the requirements of the ISO 9001 standard and the organization's goals.

Select qualified auditors and assemble an audit team.

Develop an audit plan detailing the schedule, areas to be audited, resources needed, and evaluation methods.

### **Documentation Review:**

Examine documented processes, procedures, quality manuals, and records related to the QMS.

Verify that documented procedures align with actual practices and meet the requirements of ISO 9001.

### **On-Site Assessment:**

Conduct interviews and discussions with personnel involved in various processes to understand their roles and responsibilities.

Observe processes and activities to ensure they comply with documented procedures and standards.

### **Evaluate Compliance:**

Use checklists or audit tools to systematically assess each area of the QMS against ISO 9001 requirements.

Collect evidence and data to support findings, including records of non-conformities and areas for improvement.

**Reporting and Analysis:**

Prepare an audit report summarizing audit findings, observations, identified non-conformities, and opportunities for improvement.

Differentiate between minor non-conformities and critical issues requiring immediate attention.

**Corrective Actions and Follow-Up:**

Collaborate with relevant stakeholders to develop corrective action plans to address identified non-conformities.

Monitor and verify the implementation and effectiveness of corrective actions taken.

**Closure and Continuous Improvement:**

Close the audit process by verifying the resolution of identified issues.

Use audit findings to initiate improvements in the QMS, fostering a culture of continuous improvement.

**Types of Internal audits:**

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Types of Internal audits include

- Compliance audits
- Operational audits
- Financial audits
- Information technology audits.

**A compliance audit** is an examination of conformity and adherence of a particular area, process, or system to policies, plans, procedures, laws, regulations, contracts, or other requirements that govern the conduct of the area, process, or system subject to audit.

**An operational audit** is a review mainly focused on the internal controls of key processes, procedures, or systems. The main objective is to improve productivity, as well as efficiency and effectiveness of the operation.

**A financial audit** is an objective examination and evaluation of the internal controls and systems surrounding financial reporting processes and preparation of financial statements for the benefit of management and the board of directors.

**An information technology audit** is an examination of the management controls within IT applications, operating systems, databases, or the infrastructure. Reviews may be focused exclusively on IT or performed in conjunction with a compliance, operational, or financial audit.

### **The Four Pillars of High-Performing Internal Audit Functions :**

Internal audit departments play a critical role in safeguarding an organization's health. But what separates a good internal audit function from a truly high-performing one? Research suggests four key characteristics distinguish the best internal audit teams. Let's explore these pillars and how they contribute to overall success.

#### **Alignment with Organizational Value**

High-performing internal audits don't operate in a vacuum. They ensure their activities align strategically with the organization's goals and objectives. This means understanding the company's value proposition and tailoring audits to identify and address risks that could hinder its success.

#### **Stakeholder Relationship Management**

Internal audits don't exist solely for internal audit departments. Effective teams cultivate strong relationships with a wide range of stakeholders, including management, the board of directors, and even external auditors. Clear communication and a collaborative approach foster trust and ensure everyone benefits from the audit process.

#### **Empowering Leadership**

Micromanagement stifles innovation and engagement. High-performing internal audit functions embrace empowering leadership styles. These leaders provide clear direction and support but also give their teams the autonomy and freedom needed to deliver high-quality audits.

#### **Accountability and Efficiency**

Transparency is key. High-performing internal audit teams are accountable for their work and strive for continuous improvement. This means being open about their performance metrics and

actively seeking feedback from stakeholders. They also operate efficiently, maximizing their impact without unnecessary bureaucracy.

### **The Synergy Effect**

These four characteristics are not independent; they work together to create a powerful synergy. By aligning with organizational goals, fostering strong relationships, empowering their teams, and remaining accountable, internal audit functions can deliver significant value to their organizations. This, ultimately, positions them as true business partners, driving positive change and contributing to the organization's overall success.

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## 5.4 ENVIRONMENTAL MANAGEMENT SYSTEM

An environmental management system (EMS) can be developed in compliance with the ISO 14001 standard as part of an organization's strategy to implement its environmental policy and address governmental regulations. An EMS focuses resources on meeting the commitments identified in the organization's policy, which could include reducing or eliminating the negative environmental impacts of its products, services, and activities and/or increasing their positive effects.

- EMS components
- ISO 14001:2015 and EMS
- EMS benefits

### **EMS components :**

The three primary processes of a management system include:

1. Core processes, their outputs, and the identification of significant environmental aspects and impacts
2. Key supporting processes, such as those for maintaining awareness of legal requirements, ensuring competency of employees, providing infrastructure, communicating EMS information, and monitoring and evaluating environmental performance
3. Management system supporting processes, such as document control, record control, and internal auditing

Like many quality management systems, environmental management systems reinforce a need to align processes into integrated systems of processes, all focused on providing the highest value to the customer. In this sense, the primary customer of the EMS is the local, regional, and global environment. Secondary customers may include the organization's owners or shareholders, customers, government agencies, and employees.

### **ISO 14001:2015 and EMS:**

ISO 14001 defines criteria for an EMS. It does not state requirements for environmental performance but rather maps out a framework that a company or organization can follow to set up an effective EMS. It can be used by any organization that wants to improve resource efficiency, reduce waste, and reduce costs. Using ISO 14001 can

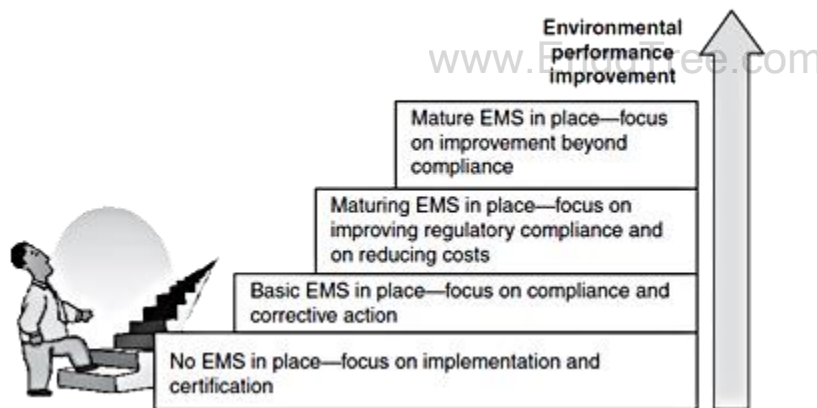


provide assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved. ISO 14001 can also be integrated with other management functions and assists companies in meeting their environmental and economic goals.

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

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

### Evolutionary model of Environmental Management System development



Quality approaches have traditionally maintained a fairly strict focus on business and customer issues, such as reducing defects and waste and improving efficiency, profitability, and customer satisfaction.

Environmental and sustainability goals for quality initiatives are relatively recent. Because the business world is accustomed to treating environmental practices as sources of added costs, the challenge for quality practitioners is to identify where environmental and sustainability quality issues, such as reduction of waste and use of renewable energy, also serve business and customer interests.

The characteristics of each stage in the evolution of compliance management to sustainability:

- 1990 to 1994: Compliance management (CM) meant focusing on regulation and relying on environmental departments to react to issues.
- 1994 to 1998: Environmental management systems (EMS) brought a more systematic, organization-wide focus on environmental issues.
- 1998 to 2002: Environmental information management systems (EIMS) involve using web-based systems and integrating multiple systems.
- 2002 to 2006: Environmental process management systems (EPMS) make use of quality tools, using a project focus to drive improvements.
- 2006 to current: Sustainability requires integrating environmental, social, and economic goals and using best practices to address risk and uncertainty.

#### **ISO 14000 SERIES STANDARDS :**

ISO 14000 is a family of standards related to environmental management that exists to help organizations (a) minimize how their operations (processes, etc.) negatively affect the environment (i.e. cause adverse changes to air, water, or land); (b) comply with applicable laws, regulations, and other environmentally oriented requirements; and (c) continually improve in the above.

ISO 14000 is similar to ISO 9000 quality management in that both pertain to the process of how a product is produced, rather than to the product itself. As with ISO 9001, certification is performed by third-party organizations rather than being awarded by ISO directly. The ISO 19011 and ISO 17021 audit standards apply when audits are being performed.

The requirements of ISO 14001 are an integral part of the European Union's Eco-Management and Audit Scheme (EMAS). EMAS's structure and material are more demanding, mainly concerning performance improvement, legal compliance, and reporting duties. The current version of ISO 14001 is ISO 14001:2015, which was published in September 2015.

#### **Development of the ISO 14000 series:**

The ISO 14000 family includes most notably the ISO 14001 standard, which represents the core set of standards used by organizations for designing and implementing an

effective environmental management system (EMS). Other standards in this series include ISO 14004, which gives additional guidelines for a good EMS, and more specialized standards dealing with specific aspects of environmental management. The major objective of the ISO 14000 series of norms is to provide "practical tools for companies and organizations of all kinds looking to manage their environmental responsibilities."

The ISO 14000 series is based on a voluntary approach to environmental regulation. The series includes the ISO 14001 standard, which provides guidelines for the establishment or improvement of an EMS. The standard shares many common traits with its predecessor, ISO 9000, the international standard of quality management[10], which served as a model for its internal structure[8], and both can be implemented side by side. As with ISO 9000, ISO 14000 acts both as an internal management tool and as a way of demonstrating a company's environmental commitment to its customers and clients.

### **ISO 14001 STANDARD**

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

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

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

**CONCEPTS AND REQUIREMENTS OF 14001:****Plan: Establish objectives and processes required**

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

**Do: Implement the processes**

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

**Check: Measure and monitor the processes and report results**

During the "check" stage, performance is monitored and periodically measured to ensure that the organization's environmental targets and objectives are being met. In addition, internal audits are conducted at planned intervals to ascertain whether the EMS meets the user's expectations and whether the processes and procedures are being adequately maintained and monitored.

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

After the checking stage, a management review is conducted to ensure that the

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

### **Continual Improvement Process (CI)**

ISO 14001 encourages a company to continually improve its environmental performance. Apart from the obvious – the reduction in actual and possible negative environmental impacts – this is achieved in three ways:

- **Expansion:** Business areas increasingly get covered by the implemented EMS.
  - **Enrichment:** Activities, products, processes, emissions, resources, etc. increasingly get managed by the implemented EMS.
  - **Upgrading:** The structural and organizational framework of the EMS, as well as an accumulation of knowledge in dealing with business- environmental issues, is improved.
- Overall, the CI concept expects the organization to gradually move away from merely operational environmental measures towards a more strategic approach on how to deal with environmental challenges.

### **BENEFITS OF ISO 14001**

ISO 14001 was developed primarily to assist companies with a framework for better management control, which can result in reducing their environmental impact. In addition to improvements in performance, organizations can reap a number of economic benefits, including higher conformance with legislative and regulatory requirements by adopting the ISO standard. By minimizing the risk of regulatory and environmental liability fines and improving an organization's efficiency, benefits can include a reduction in waste, consumption of resources, and operating costs. Secondly, as an internationally recognized standard, businesses operating in multiple locations across the globe can leverage their conformance to ISO 14001, eliminating the need for multiple registrations or certifications. Thirdly, there has been a push in the last decade by consumers for companies to adopt better internal controls, making the incorporation of ISO 14001 a smart approach for the long-term viability of

businesses.

**Direct benefits derived from implementing an effective ISO 14000 include:**

- Material savings through more complete product input processing, substitution, and recycling of by-products and waste
- Reduced energy consumption
- Reduced material storage costs
- Reduced costs for emissions, discharges, waste handling, transport and disposal
- Increased process yields
- Reduced insurance rates
- Reduced customer audits
- Reduced environmental liability
- Reduced enforcement fines

**Intangible ISO 14000 benefits include:**

- Improved corporate image among regulators, customers and the public
- Proof of social responsibility
- Improved employee morale

The benefits of acquiring ISO certification go beyond the satisfaction of doing a good deed. Adhering to the standard may result in better conformance to environmental regulations, greater marketability, better use of resources, higher quality goods and services, increased levels of safety, improved image and increased profits.

The environmental awareness and the documentation that are required by the ISO 14000 standards assist a company in conforming to environmental regulations. This means that a company, by diligently adhering to the standard, is less likely to violate environmental regulations and is always ready for inspection by a regulatory agency. In addition, the certification and documentation may aid a company in acquiring capital, in defending itself during environmental litigation and in receiving insurance or permits.

A wider market for a company's goods and services may result from certification. Many corporations and governments will be looking for suppliers that are ISO 14000 certified in order to maintain their own certification and environment-friendly image. Although the European Union claims that ISO 9000 certification is not required to do business

in Europe, that was the message received by many non-European firms and led to the amazing success of that standard. If ISO 14000 is similarly successful, the companies who are already ISO 14000 certified will have an advantage in global markets. Also, producers of consumer goods may find that many consumers not only try to purchase goods from environment-friendly companies, but will spend a little more if they feel they are helping the environment. In order to reap this benefit, a company must make their environmental efforts known through advertising and labeling.

The process analyses that go along with ISO 14000 certification may result in streamlining processes and more efficient use of resources and raw materials and subsequently reduce a company's costs. Finding ways to capture emissions or recycle the products may, in the long run, reduce the amount of raw materials and utilities used. Reducing the amount of potentially dangerous substances in an end product may result in less use of dangerous chemicals in a plant.

#### **BENEFITS OF EMS:**

Environmental Management System (EMS) can provide a number of benefits to a business, including: **Improved compliance**

An EMS can help ensure compliance with environmental regulations, which can reduce the risk of fines.

#### **Reduced environmental impact**

An EMS can help reduce waste, pollution, and negative environmental impacts.

#### **Improved sustainability**

An EMS can help businesses use resources efficiently and maximize their resources.

#### **Better corporate image**

An EMS can help businesses demonstrate their environmental performance to consumers, which can improve their corporate image.

#### **Increased profits**

An EMS can help businesses reduce costs, which can increase profits.

#### **Improved employee morale**

An EMS can help improve employee morale.

#### **Continuous improvement**

An EMS can help businesses regularly measure their progress and change plans to improve their environmental performance.

**Planning**

An EMS can help businesses conduct an environmental impact analysis to examine the potential environmental effects of their op

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