

## Lecture One:

### Introduction and Definition of Quality Control

#### Quality Control

##### Quality

Quality has many definitions. Quality can be defined in many ways, depending on who is defining it and to what product or service it is related.

The definition of quality by the American National Standards Institute (ANSI) and the American Society for Quality Control (ASQC) is “the totality of features and characteristics of a product or service that bears on its ability to satisfy given needs.”

##### DEFINITION OF QUALITY:

1. The meaning of “Quality” is closely allied to cost and customer needs. “Quality” may simply be defined as fitness for purpose at lowest cost.
2. The component is said to possess good quality, if it works well in the equipment for which it is meant. Quality is thus defined as fitness for purpose.
3. Quality is the ‘totality of features and characteristics’ both for the products and services that can satisfy both the explicit and implicit needs of the customers.
4. “Quality” of any product is regarded as the degree to which it fulfills the requirements of the customer.
5. “Quality” means degree of perfection. Quality is not absolute but it can only be judged or realized by comparing with standards. It can be determined by some characteristics namely, design, size, material, chemical composition, mechanical functioning, workmanship, finish and other properties.

##### (Quality) النوعية

ان مصطلح (Quality) في اللغة الإنكليزية يقابله في اللغة العربية استخدام مصطلحين (النوعية)

،(الجودة) وفي الغالب تخصصات الإدارة والهندسة تستخدم تعبير (الجودة) اكثر من تعبير النوعية

بينما في الإحصاء وعلوم أخرى يستخدم مصطلح النوعية وعرفت المنظمة الاوربية السيطرة النوعية

بانها الدرجة التي يكون فيها المنتج مستوفيا لمتطلبات الاستهلاك.

كذلك عرفها بكونها مطابقة السلعة للمواصفات ولكونه المستهلك هو المستفيد من الانتاج او الخدمة لذلك أيضا نعرف النوعية بانها ( قدرة المنتج او الخدمة على الوفاء بتوقعات المستهلك او تجاوزها )

## السيطرة Control

في اللغة الإنكليزية مصطلح (control) يقابله في اللغة العربية استخدام ثلاث مصطلحات هي (سيطرة)، (تحكم)، (رقابة) وكلها ضمن دائرة الإجراءات المتخذة للتأكد من مطابقة المنتج او الخدمة للمواصفات المحددة وعدم تجاوزها لتلك المواصفات بما يهدد المستهلك بمواجهة مخاطر متعددة نتيجة ذلك.

لذلك عندما نعبر عنها ب (السيطرة) هي نوع من الإجراءات التي تمنع تجاوز او مرور حالة خارج المواصفات بحيث ان هذا التعبير يستخدم حتى في الحالات الأمنية فسميت المفردة التي توضع في منطقة معينة لمراقبة مرور الأشخاص او العجلات بانها (سيطرة). ويمكن القول انها ( التحكم ) في مرور الاشخاص او العجلات وهكذا في الصناعة فإنه ( سيطرة ) تمنع مرور المنتجات غير المطابقة لمواصفات الانتاج .

## MEANING OF QUALITY CONTROL

Quality Control is a systematic control of various factors that affect the quality of the product. The various factors include material, tools, machines, type of labour, working conditions, measuring instruments, etc.

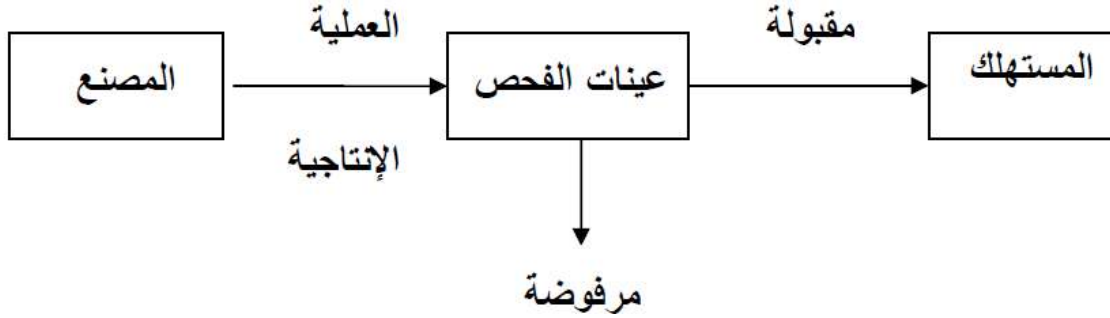
**Quality Control** can be defined as the entire collection of activities which ensures that the operation will produce the optimum Quality products at minimum cost.

**Total Quality Control** is: “An effective system for integrating the quality development, Quality maintenance and Quality improvement efforts of the various groups in an organization, so as to enable production and services at the most economical levels which allow full customer satisfaction”

## مراقبة الجودة Control Quality ( السيطرة النوعية:)

هي المحافظة على الجودة في مستوى معين بحيث تبقى مقبولة لدى المستهلك مع الحد من تكاليف الإنتاج قدر الإمكان . اي هي كافة العمليات والتقنيات والتفتيش التي تستند على خطط وفحص عينات الإنتاج او المنتج النهائي.

. المخطط التالي يوضح مفهوم السيطرة النوعية :



### اهمية مراقبة الجودة

الفوائد التي تترتب على مراقبة الجودة

1. اختيار انسب الخامات وأكفاً عمليات التصنيع . 2 -رفع كفاءة استخدام الآلات والسلامة في العمل
3. توفير ظروف الأمان والسلامة في العمل . 4 - ضمان انتظام وثبات درجة الجودة للمنتجات-
5. تبسيط مراحل عمليات التصنيع . 6 -تطوير وتحسين وتنويع الإنتاج ورفع مستوى الأداء-
7. تخفيض تكاليف الجودة . 8 -تحسين العالقة مع العملاء-

### بعض تعريفات للجودة

1. جليمور : (Gilmore 1974) درجة تحقيق منتج معين لرغبات مستهلك محددة
2. الجمعية الأمريكية لضبط الجودة (ASQ 1983): مجمل سمات وخصائص منتج أو خدمة تحمل تلك الخصائص القدرة على الوفاء باحتياجات محددة.
3. ديمينج : (Deming 1986) تحقيق احتياجات وتوقعات الزبون حالياً ومستقبلاً.
4. جوران (Juran 1988): الجودة هي الملائمة للاستخدام
5. ماكينلي (1993) تحقيق احتياجات وتوقعات الزبائن أو تجاوزها، وهذا يتطلب أن تركز المنظمة بشكل مستمر على الزبائن.
6. كروسبي (Crosby 1995) : هي المطابقة للاحتياجات
7. بيستر فيلد (Bester field 2001): الجودة هي شيء غير ملموس تعتمد على الإدراك .
- وباختصار يمكن تعريف الجودة (النوعية) بأنها يقصد ملائمة المنتج للاستعمال في الغرض المخصص له بدرجة ترضي المستهلك ويختلف مستوى الجودة المناسب للغرض في مختلف الأحوال..

8. The International Organization for Standardization ( ISO ) define Quality as :  
The degree to which as a set of inherent characteristics fulfills requirements  
ISO 9000 : 2000

**وعليه فإن السيطرة النوعية Quality Control** على العمليات الإنتاجية تعني مجموعة من الإجراءات التي تطبق لتحسين النوعية أو الحد من الانحرافات المحتملة في مستويات النوعية التي من الممكن حدوثها خلال العملية الإنتاجية بسبب العوامل العشوائية والإسنادية التي تسبب تغير النوعية :  
أما نظم السيطرة النوعية فتكون  
1. نظم السيطرة على المواد الأولية

2. نظم السيطرة على أجهزة وأدوات الفحص والقياس
3. نظم السيطرة على العمليات الإنتاجية
4. نظم السيطرة على نوعية المنتج النهائي
5. نظم السيطرة على النوعية أثناء التداول والتخزين

تختلف الوحدات المنتجة فيما بينها وذلك نتيجة لما يلي

**أ- عملية الإنتاج :** إذ تتعرض الوحدات الإنتاجية إلى ظروف إنتاجية مختلفة نتيجة لتقادم المعدات واهتزازات المكائن وتذبذب الطاقة الكهربائية .

**ب- المواد الأولية :** للمواد الأولية تأثير كبير على المنتجات إذ تتباين في مواصفاتها مثلًا درجة التركيز ، السمك ، التحمل ، نسبة الرطوبة ... إلخ

**ج- اليد العاملة :** إن اختلاف خبرة العامل ودرجة التزامه بتعليمات الإنتاج وحالتهم النفسية والبدنية قد يكون المصدر الأساسي للتباين ما بين الوحدات المنتجة

**د- عوامل أخرى :** مثل درجة الرطوبة ، درجة الحرارة ، شدة الضوء ... إلخ إذا كانت حدود التباين بين الوحدات المنتجة مقبول فالعملية الإنتاجية مسيطر عليها نوعيًا وإنه تحت السيطرة ، أما إذا كان التباين كبيرًا ويمكن تشخيص أسبابه غير العشوائية فالعملية الإنتاجية ليست تحت السيطرة النوعية

وتعتبر مخططات السيطرة من أهم الوسائل التي تميز استخدامها إذا كان التباين بين الوحدات المنتجة يعود إلى أسباب عشوائية وغير عشوائية عند وجود انحراف ما بين المنتج الفعلي والمواصفات الموضوعه له

### تطور أنظمة ضبط الجودة:

في عصرنا الحديث بدأت نشأة أنظمة الجودة منذ نهاية القرن التاسع عشر ومن جهة النظر التاريخية نجد أن التغيرات الجوهرية لأنظمة ضبط الجودة تحدث كل عشرين سنة تقريبًا . وفيما يلي ملخص لتطور هذه الأنظمة.

1. ضبط الجودة بواسطة العامل
2. ضبط الجودة بواسطة رئيس العمال
3. ضبط الجودة عن طريق الفحص
4. الضبط الاحصائي لجودة الانتاج
5. الضبط المتكامل لجودة الإنتاج
5. ادارة الجودة الشاملة

### التطور التاريخي للرقابة على الجودة :

1- الرقابة بواسطة العامل او الملاحظ : Control operator قبل 1900 حيث الإنتاج يتميز بالبساطة والعامل يقوم بكل مراحل الإنتاج ويقوم بالمراقبة ولايزال هذا النوع من الرقابة موجودا الى يومنا هذا في بعض الصناعات اليدوية .

2- الرقابة بواسطة مشرف العمال 1900-1920 Control Forman : ظهرت بعد تعدد المنتجات وتطور العملية الإنتاجية واصبح اكثر من عامل مسؤولين على نفس المنتج ومن هنا ظهرت طبقة مشرف العمال لمراقبة الجودة مما تتجه مجموعة من العمال .

3- الرقابة بواسطة الفاحص المتخصص 1920-1940 Control Inspector : وقد ظهرت هذه الرقابة بعد زيادة حجم المنشآت الصناعية وتعدد م نتائجها فظهرت إدارة متخصصة للرقابة على الجودة لفحص المنتجات والتأكد من بطاقتها لمعايير محددة .

4- الرقابة الإحصائية على الجودة 1940-1960 Statistical Control : كنتيجة للإنتاج الكبير فكانت الحاجة الى وجود اساليب احصائية للجودة مثال خرائط مراقبة الجودة – ونظم سحب العينات والقبول وغيرها من الطرق .

5- مرحلة توكيد الجودة 1960-1980 quality assurance : تم التركيز على التأكيد من جودة المنتجات .

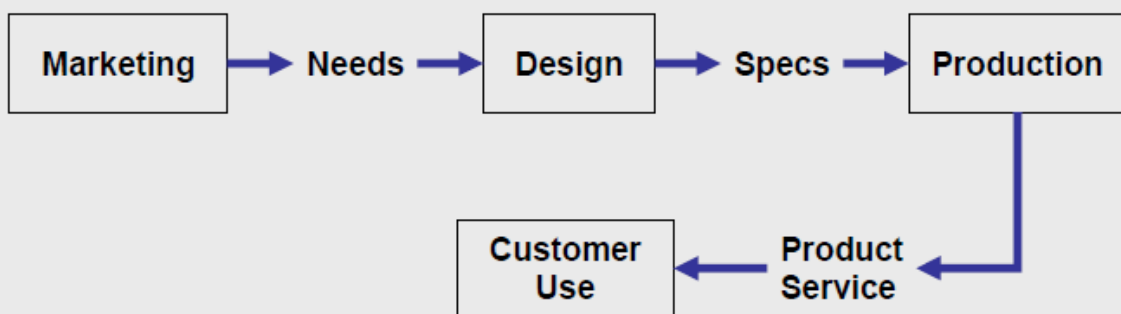
6- مرحلة ادارة الجودة الشاملة – Total quality management 1980 لحد الآن : هي المرحلة السائدة حاليا والتي اتخذت اساسا للمواصفات القياسية الدولية ايزو 9001 مع استمرار استخدام الأساليب الإحصائية وفي هذه المرحلة اصبحت الجودة هي جودة المنشآت ككل وليس جودة المنتج فقط واصبح مفهوم الجودة معتمدا على رغبات العملاء واثناء التصميم والتصنيع وما بعد التصنيع

## CONCEPTS OF QUALITY

- Q- Quest for excellence
- U- Understanding customers' needs
- A- Action to achieve customer's appreciation
- L- Leadership-determination to be a leader
- I- Involving all people
- T- Team spirit to work for a common goal
- Y- Yardstick to measure progress

# What is Quality?

1. Fitness to Standards
  2. Fitness to Use
  3. Fitness to Market
- } result from:



## Fundamental factors affecting quality

- 1. Market:** The customer wants are changing dynamically. So, it is the role of companies to identify needs and then meet it with existing technologies or by developing new technologies.
- 2. Money:** As competition has increased, profit margins have decreased. Companies have to spend heavily on new equipment's and processes. To absorb these costs productivity has to be increased, which means reworks and scrap has to be kept to the minimum.
- 3. Management**
- 4. Men:** The rapid growth in technical knowledge leads to development of human resource with different specialization.
- 5. Motivation:** The increased complexity of the product means that every employee has to give his best if quality is to be maintained. This requires that quality realization among employees are high. This can be achieved only through continuous education and motivation of the work force.

**6. Materials:** Due to high material costs engineers have to constantly keep coming up with ways to bring down the cost of material used. They also need to come up with new alternate materials that can replace costlier older material. Selection of proper materials to meet the desired tolerance limit is also an important consideration.

**7. Machines and mechanization:** The demand to cut costs is forcing companies to use newer machines, which will deliver better quality and product using lesser cycle times.

**8. Modern information methods:** The modern information methods help in storing and retrieving needed data for manufacturing, marketing and servicing.

**9. Mounting product requirements:** Product diversification to meet customers taste leads to intricacy in design, manufacturing and quality standards. Hence, companies should plan adequate system to tackle all these requirements.

### **OBJECTIVES OF QUALITY CONTROL:**

1. To decide about the standard of quality of a product that is easily acceptable to the customer and at the same time this standard should be economical to maintain.
2. To take different measures to improve the standard of quality of product.
- 3 To take various steps to solve any kind of deviations in the quality of the product during manufacturing.

### **FUNCTIONS OF QUALITY CONTROL DEPARTMENT :**

1. Only the products of uniform and standard quality are allowed to be sold.
2. To suggest method and ways to prevent the manufacturing difficulties.
3. To reject the defective goods so that the products of poor quality may not reach to the customers.
4. To find out the points where the control is breaking down and to investigate the causes of it.
5. To correct the rejected goods, if it is possible. This procedure is known as rehabilitation of defective goods.

## **Benefits ( Advantages ) of Quality Control**

1. Improving the quality of products and services.
2. Increasing the productivity of manufacturing processes.
3. Reducing manufacturing and corporate costs.
4. Determining and improving the marketability of products and services.
5. Reducing consumer prices of products and services.
6. Improving and/or assuring on time deliveries and availability.
7. Assisting in the management of an enterprise.
8. Scrap rejection and rework are minimized thus reducing wastage. So the cost of manufacturing reduces

## **Seven tools for quality control**

The seven quality control tools are simple statistical tools used for problem solving.

The seven quality control tools are:

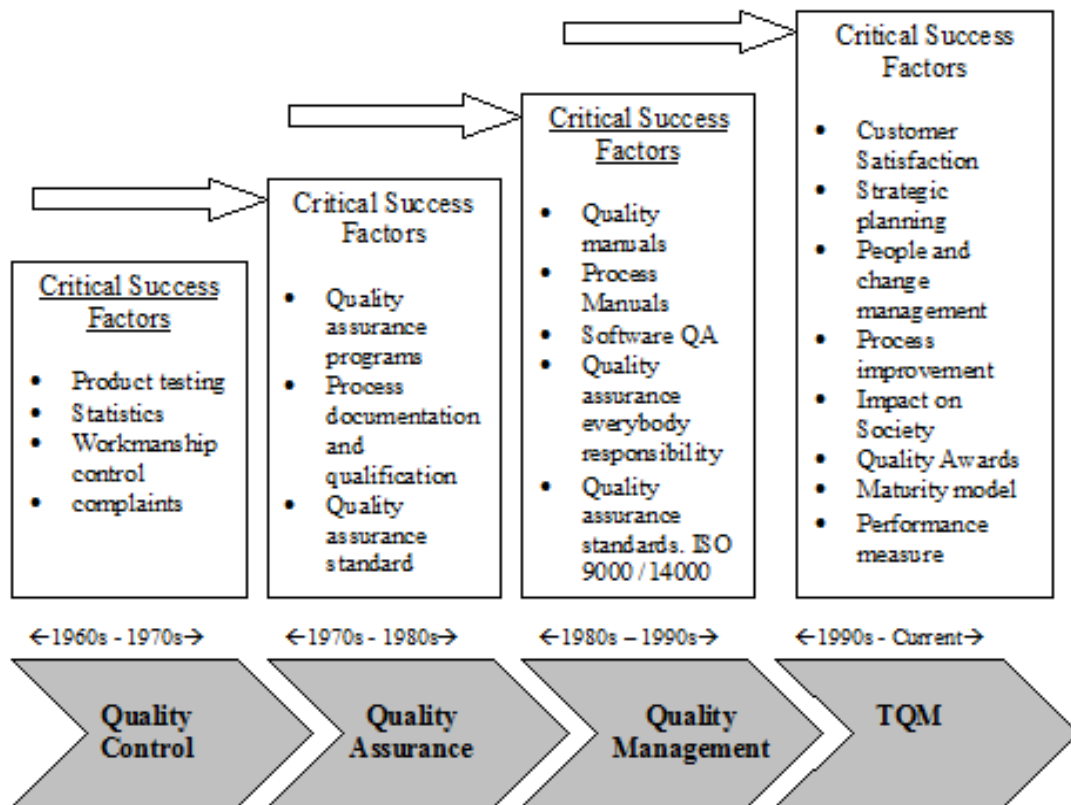
1. Pareto charts
2. Check sheets
3. Cause and effect diagram
4. Scatter diagrams
5. Histogram
6. Graphs or flow charts
7. Control charts

## **Key components of Quality Control may include:**

1. **Inspection:** Regularly examining products, materials, or services to identify defects, non-compliance, or deviations from quality standards.
2. **Testing:** Conducting various tests and measurements to assess the performance, functionality, or characteristics of products or services.
3. **Statistical Process Control (SPC):** Employing statistical techniques to monitor and control the production processes, ensuring that they remain within acceptable quality limits.
4. **Documentation and Records:** Keeping detailed records of inspections, tests, and corrective actions taken to maintain traceability and accountability
5. **Corrective Action:** Implementing appropriate measures to address any identified quality issues and prevent their recurrence.
6. **Training and Education:** Providing employees with the necessary skills and knowledge to maintain quality standards effectively.



7. Continuous Improvement: Constantly analyzing data and feedback to identify areas for improvement and enhancing the overall quality management system.



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## Evolution of quality

### *QUALITY CONTROL IN CONSTRUCTION*

Quality can be defined as the degree to which product is likely to meet the desired specification & limits given by the construction agency. This control ensures that the work done must be of required quality and durability.

This can be achieved by conducting inspection from the source of supply of material up to the finished production. Major items of control before and during construction are verifications of soil characteristics, drawings and designs, structural safety, durability, checking the quality of materials, specifications, testing of materials and inspection of equipment.

#### **. Quality assurance:**

All those planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality.

**NOTES:**

1 Unless given requirements fully reflect the needs of the user, quality assurance will not be complete.

2 For effectiveness, quality assurance usually requires a continuing evaluation of factors that affect the adequacy of the design or specification for intended applications as well as verifications and audits of production, installation and inspection operations. Providing confidence may involve producing evidence.

3 Within an organization, quality assurance serves as a management tool. In contractual situations, quality assurance also serves to provide confidence in the supplier.

## Lecture three, four

### **Variables and Attributes**

Quality characteristics fall into two broad classes: variables and attributes. Characteristics that are measurable and are expressed on a numerical scale are called **variables** like, length, width, height, diameter, surface finish, etc.

A quality characteristic that cannot be measured on a numerical scale is expressed as an **attribute**. The attributes will include performance, reliability, appearance, etc.

### **PRODUCTION FACTORS OF CONSTRUCTION QUALITY CONTROL**

#### **1. Human control**

The effect of humans in construction cuts across every aspect of the construction process. From funding, designing, drafting of contracts, operating machinery and pouring of concrete, humans are present and therefore play a vital role in ensuring quality is achieved. The general quality and individual capacity of human will decide the consequences of every single quality action. Along these lines, human is considered as both the controlled targets and controlling inspiration of other quality exercises . The substance of human control includes the general nature of association and person's learning, capacity, physical condition, mental state, quality awareness, conduct, idea of authoritative order, and expert morals.

#### **2. Materials control**

Another major and essential component of construction is materials. These could be raw materials, finished products, semi-finished products, components and parts. Material quality has a direct impact on construction quality. The main actions taken to control the quality of materials include material procurement, material inspection and testing and proper storage.

#### **3. Material procurement**

Involves the purchase materials in view of the incorporated thought of building qualities, development necessities, the exhibition and cost of materials. The acquisition ought to be organized ahead of time as indicated by the development plan. It should also be ensured that purchase orders, materials received and invoices match.

#### **4. Material inspection and testing**

Involves checking to ensure there is no disparity between purchase orders, and invoices and actual materials received. It also involves a progression of discovery strategies by contrasting the material information with quality benchmarks, to pass judgment on the dependability of value materials, and whether they can be utilized for designing. Testing review is ordinarily utilized .

#### **5. Storage and usage**

Is a critical material control process because the right materials could be procured and dully received but the quality of these materials may deteriorate if not properly stored. Agglomeration of wet cement, corrosion of steel, and mixing of similar materials (nails, reinforcements etc.) of different sizes amongst others are some of the problems related to poor material storage, (Cao Ying, 2010). The contractual worker should likewise make sensible game plan to abstain from overloading bunches of materials on location. Then again, materials ought to be put away with signs for the various classes, and with assessment and supervision on location when being utilized.

## **Total Quality Management**

### **1 Introduction**

Before we talk about the Total Quality Management(TQM), it is important to have a definition of what it is. Let's look at the three roots of TQM — Total, Quality, and Management.

Total- Made up of whole

Quality- Degree of excellence a product or service provides.

Management- Act, Art or Manner of planning, controlling, direction.

Therefore, Total Quality Management(TQM) is art of managing the whole to achieve excellence.

### **2 Definition of Total Quality Management(TQM)**

“T.Q.M. is a management approach of an organization, centered on the participation of all its members and aiming at long term success through customer satisfaction and benefit to the members of organization and society”.

- An enhancement to the traditional way of doing business.
- An art of managing the whole to achieve excellence.

- Both a philosophy and a set of guiding principles that represents the foundation of a continuously improving organization.
- Application of quantitative methods and human resources to improve all the processes within an organization and exceed customer needs now and in the future.
- Integrates fundamental management techniques existing improvement efforts, and Technical tools under a disciplined approach.

## What is TQM?

TQM is the integration of all functions and processes within an organization in order to achieve continuous improvement of the quality of goods and services. The goal is customer satisfaction.

فسّر Hansen, Dexter A:1998 مصطلح إدارة الجودة الشاملة TQM كالتالي

- الشاملة Total وذلك لأن الجودة تتطلب جميع الأفراد والأنشطة في المنظمة
- الجودة Quality أي المطابقة للمتطلبات والتقاء توقعات الزبون
- الإدارة Management أي أن الجودة يمكن إدارتها. ومن المفروض أن تدار دوماً بدقة.

### 3. Objectives of T.Q.M. Implementation:

1. Continuous quality improvement of product or service for its customers at every level, at every place, and at every stage.
2. Increase productivity and lower the cost of manufacturing or Service delivery.
3. Enhance the competitive position in the market place.
4. Achieve higher profits and growth with greater ease.
5. Provide job security to its workforce.
6. Achieve employees' satisfaction.
7. Prevention of producing bad quality.

### 4. Basic Principles of Total Quality Management:

1. The customer makes the ultimate determination of quality.
2. Top management must provide leadership and support for all quality initiatives.
3. Preventing variability is the key to producing high quality.

4. Quality goals are a moving target, thereby requiring a commitment towards continuous improvement.
5. Improving quality requires the establishment of effective metrics. We must speak with data and facts not just opinions or gut feelings.
6. Continuous improvement of the business and production process.

### **5. Elements of Total Quality Management:**

1. Customer satisfaction.
2. Employees involvement
3. Morale of employees.
4. Quality of control circles and suggestion system.
5. Higher revenue
6. Lower cost.
7. Quality control
8. Control of Production.
9. Quality planning
10. Quality improvement
11. Quality implementation
12. Quality Assurance System
13. Vendor control and quality in procurement.
14. Customer relationship management.
15. Total organization involvement.
16. Measurement information analysis.
17. Quality education and training.
18. Strategic quality management.
19. Leadership.

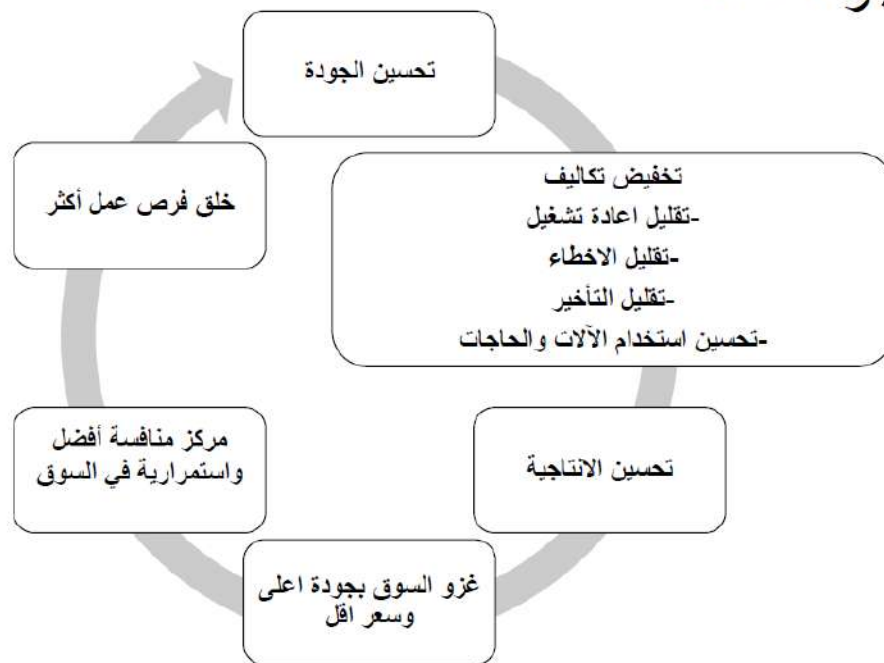
### **6. Ways for Total Quality Management:**

In order to implement T.Q.M., following actions are necessary:

1. Adapt new philosophy of refusing to allow defects.
2. Create consistency of purpose for improvement.
3. Improving production and service quality should be a continuous process.
4. Case dependence on mass inspection and adopt Statistical Quality Control.
5. Insist quantifiable evidence from the suppliers about their products.
6. All employees should be trained, retrained and refresher courses be arranged.
7. Provide proper tools to all the employees.
8. Adopt proper communication system.

9. Encourage productivity.
10. Encourage coordination between departments.
11. Permanent commitment of top management to quality.
12. Respect towards 'work' and 'humanity'.
13. Adapt consumer orientation and not the product orientation.
14. Objective should be, 'Quality first, not the short-term profits'.
15. Use facts and data.

## أهمية إدارة الجودة الشاملة



## فلسفة الجودة الشاملة

• تقوم فلسفة الجودة الشاملة على مجموعة من المراكز بوضوح الجدول التالي.

<p><b>العناصر الأساسية :</b></p> <ul style="list-style-type: none"> <li>• إيصال الرسائل والأهداف والغايات.</li> <li>• جمع ومقابلة الاستمارات الخارجية.</li> <li>• قياس أداء العمل الداخلي.</li> <li>• توكيد وتنسيق برامج الجودة.</li> <li>• التطبيق المستمر للتحسينات والتغييرات.</li> <li>• تحديد فرص التحسين.</li> </ul>	<p><b>وظائف الجودة الشاملة :</b></p> <ul style="list-style-type: none"> <li>• تخطيط الجودة الشاملة.</li> <li>• تنظيم الجودة الشاملة.</li> <li>• توجيه الجودة الشاملة.</li> <li>• تحسين الجودة.</li> <li>• نظم معلومات الجودة.</li> </ul>	<p><b>المفاهيم الأساسية :</b></p> <ul style="list-style-type: none"> <li>• الزبائن الداخليون والخارجيون.</li> <li>• التحسين المتنامي.</li> <li>• رقابة عمليات العمل.</li> <li>• الإدارة الوقائية.</li> <li>• العمل الوقائي المتنامي.</li> <li>• القيادة والعمل الجماعي.</li> </ul>
<p><b>متطلبات النجاح :</b></p> <ul style="list-style-type: none"> <li>• قيادة إدارية متميزة.</li> <li>• التطعيم والتدريب المستمر.</li> <li>• الاتصالات الفعالة.</li> <li>• بيئة تنظيمية ملائمة.</li> <li>• هيكل تنظيمي غير رسمي.</li> <li>• ثقافة متميزة للجودة.</li> <li>• التكلفة على أساس النشاط.</li> </ul>	<p><b>الفعاليات المؤثرة :</b></p> <ul style="list-style-type: none"> <li>• دراسة السوق.</li> <li>• تطوير السلعة.</li> <li>• هندسة التصنيع.</li> <li>• الشراء.</li> <li>• الإنتاج.</li> <li>• المعاينة.</li> <li>• التسويق.</li> </ul>	<p><b>العوامل المؤثرة :</b></p> <ul style="list-style-type: none"> <li>• المواد الأولية.</li> <li>• الآلات والمعدات.</li> <li>• الموارد البشرية.</li> <li>• طرائق التشغيل.</li> <li>• الإشراف الملاحظة.</li> </ul>

### W. Edward Deming: أولاً: فلسفة إدوارد ديمينج للجودة الشاملة

يعتبر "إدوارد ديمينج" ( 1900 – 1994 ) هو المؤسس الحقيقي لحركة إدارة الجودة الشاملة كمفهوم شامل ومتكامل لذلك لقب بأبي ثورة إدارة الجودة الشاملة، وقد ساهم ديمينج بأفكاره في تطوير الصناعة اليابانية، وفي خروج اليابان بنجاح من الدمار الذي لحق بها بعد الحرب العالمية الثانية.

وفلسفة "ديمنج" للجودة تقوم على وضع مفهوم الجودة في إطار إنساني، ووضع تعريف للجودة مؤداه أن "الجودة هي درجة الاختلاف الذي يمكن التنبؤ به من خلال استعمال معايير أكثر ملائمة وأقل تكلفة، وهذه المعايير تشتق من المستهلك"، وديمنج بذلك يركز على تحسين درجة مطابقة وانسجام المنتج أو الخدمة مع المواصفات الموضوعية سلفاً عن طريق اختزال درجة عدم التأكد والاختلاف في كل من التصميم والعملية الانتاجي.



ويؤكد ديمنج على ضرورة الاعتماد على الأساليب الإحصائية في الرقابة على الجودة حتى يمكن أن يكون هناك مقياس مفيد ومباشر للجودة، ويؤكد على ضرورة تدريب العاملين في كل المستويات الإدارية على تلك الأساليب الإحصائية حتى يكونوا على دراية وألفة بها بحيث يمكن أن يستخدموه في أعمالهم داخل المنظمة.

ويرى "ديمنج" أن السعي الحثيث نحو تحقيق الجودة الشاملة يتطلب تفهم أسباب فشل ، وذلك يقتضى تحليل أسباب فشل الجودة والتي **Causes of quality failure** الجودة :يقسمها "ديمنج" إلى نوعين من الأسباب:

- أ-الأسباب الشائعة: وهي الأسباب التي يمكن عزوها إلى فشل الأنظمة نفسها، وهي أسباب متأصلة في داخل العمليات المؤسسية، وفي النظام الإنتاجي نفسه، وهذه الأسباب يتطلب حلها أو اختزالها تغييرات جوهرية في النظام ،العمليات والإجراءات.
- ب-الأسباب الخاصة أو الفرعية: وهي الأسباب الناشئة من خارج النظام الإنتاجي نفسه . ويمكن عزوها إلى العاملين بخصائصهم واتصالاتهم، وإلى الموارد والأدوات والأجهزة المادية ويرى "ديمنج" أن هذين المدخلين-الأسباب الشائعة والخاصة- يمثلان مدخلين يمكن استخدامهما لتحسين الجودة في التنظيم.

تركز ادارة الجودة الشاملة على ثلاثة اتجاهات هي:-:

- 1- اتجاه يهتم بالزبون ومتطلباته واحتياجاته ورغباته.
- 2- اتجاه يهتم بالنتائج المتحققة من جراء تحسين المستمر في انتاجية العاملين واداء العمليات.
- 3- اتجاه يهتم بالأدوات والوسائل العلمية والاساليب الاحصائية لضبط الجودة.

اهداف ادارة الجودة الشاملة.

- 1- تحقيق رضا الزبون.
- 2- تحسن جودة الاداء.
- 3- احداث تغييرات كبيره وجوهريه في مهارات وقدرات وسلوكيات العاملين.
- 4- تحسين العلاقات الوظيفية والمنظمة بين العاملين.
- 5- زيادة الحصة السوقية للمنظمة.

## مبادئ ادارة الجودة الشاملة.

- 1 - دعم الادارة العليا.
- 2 - التخطيط الاستراتيجي.
- 3 - تصميم العمليات.
- 4 - التركيز على الزبون.
- 5 - مشاركة المجهزين.
- 6 - مشاركة العاملين.
- 7 - منع حدوث الاخطاء والانحرافات.
- 8 - التدريب والتعليم.
- 9 - التحسين المستمر.
- 10 - المقارنة المرجعية.
- 11 - قياس الجودة.

## فوائد ادارة الجودة الشاملة:-

- 1 - تحسن الربحية والقدرة على المنافسة.
- 2 - تركيز الادارة العليا على الحقائق كأساس لاتخاذ القرارات.
- 3 - تحقيق رضا الزبون.
- 4 - تقليل دوران العمل وتحسين بيئة العمل.
- 5 - تشجيع المشاركة والعمل الجماعي.
- 6 - المساهمة في تحسين نظام الاتصالات في المنظمة.
- 7 - التحسين والتطوير المستمر في جميع مراحل العمل.
- 8 - تعزيز الرغبة لدى الادارة العليا لحل مشكلات الجودة في المنظمة.

## مراحل تطبيق ادارة الجودة الشاملة

- 1 - الاعداد : تبدأ هذه المرحلة باتخاذ الادارة العليا قرار تطبيق TQM -
- 2 - التخطيط.

- 3تخطيط الجودة الاستراتيجي.
- 4تخطيط جودة المنتج.
- 5تخطيط جودة العمليات.
- 6التنفيذ: من خلال تنفيذ الخطط التي تم اعدادها في المرحلة السابقة. .
- 7الرقابة والتقويم تعتمد ادارة الجودة الشاملة على الرقابة المتزامنة والمتابعة المستمرة للعمليات.
- 8مرحلة ما بعد التنفيذ.
- 9الأدوات الحديثة لإدارة الجودة الشاملة.

معوقات تطبيق ادارة الجودة الشاملة:-

- 1مقاومة التغيير.
- 2المركزية الشديدة في جميع الاقسام او بعض منها.
- 3تعقد بعض الاجراءات واساليب العمل.
- 4عدم وجود معايير محده لا ودقيق لتقييم اداء العاملين والعمل المتحقق.
- 5ضعف نظم المعلومات في المنظمة.

## Lecture Five, six

### **Quality Control system and ISO 9001**

A quality management system (QMS) is a collection of business processes focused on consistently meeting customer requirements and enhancing their satisfaction. It is aligned with an organization's purpose and strategic direction (ISO9001:2015). It is expressed as the organizational goals and aspirations, policies, processes, documented information and resources needed to implement and maintain it. Early quality management systems emphasized predictable outcomes of an industrial product production line, using simple statistics and random sampling.

#### **Introduction to Quality Management Systems (QMS)**

A **quality management system** (QMS) can be expressed as the organizational structure, procedures, processes and resources needed to implement quality management.

#### **Quality Management System –**

- **Introduction to QMS**
- **What is QMS**
- **Why Implement QMS**
- **How to Implement QMS**
- **QMS Services**

#### **What is a Quality Management System (QMS) : ISO 9001**

If we look at QMS in reverse, we can develop a better understanding of its definition.

QMS is a System for Managing the Quality of a product or process.

QMS is a system for documenting the structure, procedures, responsibilities and processes needed for effective quality management.

QMS outlines how an organization will produce, document, control and deliver a product or service possessing customer perceived value.

#### **Why to Implement a Quality Management System (QMS)**

Multiple benefits result from development and implementation of a robust Quality Management System.

Some of the benefits to implementing QMS are as follows:

1. Managing product and process quality enables an organization to consistently meet the needs and wants of their customers through **Voice of the Customer (VOC)**. Increased **customer satisfaction** results in more sales, increased market share and a loyal customer base.
2. Ensuring that all government regulations and **requirements are met** with every new product introduction allows marketing products worldwide.
3. **Reduction of costly rework** and / or scrap is realized through implementation and monitoring of process controls.
4. Management is able to make decisions based on data not conjecture. The data collected through the implementation of **Statistical Process Control (SPC)** and other methods allows management to make decisions based on evidence. Valuable resources are utilized where they will have the most impact on improving process efficiency and reducing quality issues.
5. Engagement of the associates in the process and product improvement efforts helps to create a **continuous improvement culture** within the organization. Through the introduction of **Kaizen, 5S** and other quality tools, the associates gradually take mental ownership of the process. Associates invested in the processes they perform are best at **identifying opportunities for improvements that will result in better quality, efficiency and safety**.

## **How to Implement a QMS**

Implementing a QMS into any organization, either large or small, is not a quick or simple task. It will require an investment in time and resources to successfully implement an effective QMS. Below is a list of some key areas to consider when implementing a QMS.

### **1. Secure Support of Top Management**

Support from top management is vital to the success of any QMS implementation.

The management team of an organization must be committed to the success of the QMS. Management must be convinced of the positive impact on business efficiency and the bottom line.

Management should be directly involved in the QMS implementation process.

examples:

--. **Business Analysis:** The management team should review their business structure and determine the key areas for implementation of a QMS. The key areas should be determined according to critical to customer requirements. Consider the current needs of the organization and alignment with long-term strategic goals.

--. **Initial Planning:** Management should be actively involved in the planning stages by determining the resources required, assembling the teams and formulating an implementation plan. In addition, discussions should identify which existing processes will be improved first and confirm strategic or SMART goals.

## **2. Increase Awareness**

Spread the word; schedule informational meetings across the organization to inform all associates about the pending QMS. Include information regarding how the system will benefit the customers and employees. Explain how QMS works. In addition, include the roles and responsibilities of the associates at each level and in each department.

## **3. Provide Expert Training**

Proper training is essential for the success **of any new product** / process or management system introduction. The amount and type of QMS training is determined during the management team's initial planning phase.

The training materials should include a review of the basic concepts and tools used along with information regarding the positive impact that the QMS will provide for the associates and the organization.

## **4. Documents and Document Control**

Proper documentation is at the heart of a well-functioning QMS.

There must be documentation developed to support the implementation, education, deployment and control functions of the system.

Documents include:

- Policies
- Procedures
- Quality Manual
- Training Materials
- Work Instructions
- Audit Forms
- Process Maps
- Control Plans

Proper documentation is vital to the success of a QMS and maintaining control of those documents is equally important. A document control system manages the creation, approval, distribution, revision, storage and disposal of all quality documentation.

The system functions to assure everyone is performing tasks in the same manner using the correct revision of the document.

## **5. Deployment**

Deployment of the QMS should follow the implementation plan developed during the planning phase.

Document each process and define the current state. Involve the associates in the documentation of the process, utilization of various quality tools and development of metrics.

Once this is complete, the teams can focus on improvement efforts. Select an area or process with the most opportunity for improvement. Quick wins promote “buy-in” by the teams and associates by illustrating the improvements to the process and the benefit to the associates and the company as a whole.

Multiple quality and improvement tools available for use in improving a process.

They include:

- 5S +1
- Kaizen
- Process Flow Charts
- Process Failure Mode and Effects Analysis (PFMEA)
- **Value Stream Mapping**

The timing of the deployment is generally dependent upon the size of the organizations and the number of facilities that will be included in the implementation of the QMS.

Throughout the implementation, the company intranet is an effective tool for communicating progress towards planned objectives and sharing best practices to associates throughout the organization.

## **6. Measure and Control**

Once deployment has occurred, the various processes within the organization must be controlled and the key process and product characteristics measured and monitored to ensure continued production of quality products.

Manufacturing processes incorporate random inspections or routine audits. The specific methods will vary depending on the organization's size, structure, the process and potential risk.

## **7. Audit and Maintain**

Routine **Product / Process Audits** monitor adherence to policies, procedures and any certification requirements. A schedule should be developed and maintained to assure each department, area and process is audited on a regular basis. The timing of the audits will vary dependent upon the organization, process, potential risk and any regulatory or certification requirements. Audits will reveal whether or not you are actually doing what you said you were going to do to manage quality and ensure conformance to safety / regulatory requirements.

Routine audits are effective tools for:

- Identifying inadequacies in quality management process



- Discovering problems that could result in non-compliance penalties
- Maintaining adherence to established processes and quality controls

When an **internal auditing** process is well planned, implemented and maintained, the internal audits add considerable value to the quality management process.

## **8. Lessons Learned and Continuous Improvement**

Advantage of implementing a QMS is the ability to use lessons learned from one department or process to make improvements in similar processes across the organization. In addition, for organizations to remain competitive and thrive in today's world market, they must seek ways to continually improve their processes and product or service quality. Associates at all levels of the organization should be encouraged to look for opportunities for change and improvement every day.

Even by implementing small continuous improvements in the processes and work standards, the organization will realize sizable increases in quality, safety, efficiency and productivity. This ultimately results in a positive impact on the bottom line. Some organizations view continuous improvement as an activity, where others adopt it as a mindset.

### **QMS DEFINITIONS :**

A QMS is a set of policies, processes and procedures required for planning and execution (production/development/service) in the core business area of an organization (i.e., areas that can impact the organization's ability to meet customer requirements).

What are the different QMS?

### **List of the different types of QMS**

1. Document control.
2. Change control.
3. Enterprise & operational risk management.
4. Supplier management.
5. Equipment and asset management.
6. CAPA management.

7. Policy management.

8. Internal audit.

What are the 7 quality management principles?

**Seven Quality Management Principles are**

- QMP 1 – Customer Focus. Meet and exceed customer expectations.
- QMP 2 – Leadership. Provide purpose, direction and engagement.
- QMP 3 – Engagement of People. ...
- QMP 4 – Process Approach. ...
- QMP 5 – Improvement. ...
- QMP 6 – Evidence-based Decision Making. ...
- QMP 7 – Relationship Management.

**What is a QMS example?**

A QMS is a collection of business processes focused on consistently meeting customer requirements and enhancing their satisfaction. ... It is expressed as the organizational goals and aspirations, policies, processes, documented information and resources needed to implement and maintain it.

What are the principles of quality management?

“ **Quality management principles** ” are a set of fundamental beliefs, norms, rules and values that are accepted as true and can be used as a basis for **quality management**. The QMPs can be used as a foundation to guide an organization's performance improvement.

What is the ISO definition of quality?

The term "**quality**" has a relative meaning. **ISO definition:**

"The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs".

What are the four main elements of quality?

Quality management ensures that an organization, product or service is consistent. It has four main components: **quality planning, quality assurance, quality control and quality improvement.**

## **FACTORS INFLUENCING CONSTRUCTION QUALITY**

### **10 Factors That Affect Construction Quality Management– Creating a Strategy to Improve Construction Quality Management**

Every contractor and construction firm has the intention to offer the best quality services, but many obstacles can pop up along the way to interrupt these plans. A single mistake is all it takes to trigger a series of events that can lead to expensive rework and more serious penalties if the structure's safety is compromised. Improving construction quality management starts with an understanding of the factors that can impact both safety and quality.

“**Quality in Construction: Maintaining Quality on Construction Projects for Better Outcomes.**” there is relationship between quality control and safety practices.

#### **1. Damaged and Low-Quality Materials**

Too much water or sand in a concrete mix, lumber cut from undersized trees and improperly graded steel can all result in widespread construction quality issues. Not only do these materials fail early, they also create construction safety hazards by reacting unpredictably during the building process. Workers are often hurt when sparks are generated during cutting when they're not expected or as a structure collapses due to a lack of weight-bearing ability. Ordering only from trusted suppliers and assigning a quality control officer to check every shipment of materials is the only way to verify a project is properly supplied.

#### **2. Supplier and Vendor Failures**

Even when the materials themselves aren't to blame for a quality issue, problems with suppliers and vendors can raise costs and lower quality levels.

Replacing the requested building supplies with other brands and materials that don't offer the same quality can result in unhappy clients and time-consuming rework requests. Set clear expectations with all suppliers and perform random checks to verify they're still adhering to the contract. Finding new vendors may feel like a distraction in the middle of a construction project, but it can significantly improve construction quality management.

### 3. Subcontractor Mishandling

over half of construction defects can be attributed to human error. If a subcontractor hires employees without the right skills and fails to train them, workmanship errors occur that can go unnoticed for years. Screening subcontractors and other labour providers is essential to verify they're supplying skilled labourers that can catch their own mistakes. construction firms and project managers still need to follow up with independent audits of subcontractor performance to find any problems as early as possible.

### 4. Failure to Document Changes and Practices

Some quality issues aren't directly related to a mistake or design change, but rather to the lack of documentation of the change. If a material is substituted for another with a completely different maintenance and replacement cycle, failure to update the final documents can result in improper handling from the maintenance team. Use a digital file management system that simplifies the process of updating project documentation so that there's no reason to delay updates to drawings and other related files.

### 5. Last-Minute Changes

When essential features are still being engineered or discussed at late stages in the construction process, these last-minute changes often lead to serious quality issues. For example, a last-minute change in the design of the tie rod supports for a suspended walkway led to a deadly collapse at the Kansas City Hyatt Regency in July 1981. Set deadlines by which designs can't be altered anymore or make arrangements to extend the deadlines and set aside plenty of time for verifying and testing any changes to the existing designs.

### 6. Scope Creep

Construction projects often start out much simpler and smaller than the finished project. So how does a basic bridge or retail centre turn into a multi-lane highway or a three-story mall? This kind of **unplanned expansion** is often referred to as scope creep. While it's natural for all projects to change with time as new facts are discovered about costs, time constraints, and site limitations, the problem comes when the expansion in scope leads to cutting corners to stretch a limited budget and time frame. Managing the scope of a construction project ensures the contractors can maintain the same level of quality over the entirety of the work.

## **7. Miscommunication Between Teams**

Project managers feel that communication issues are the number one cause of quality issues. Miscommunication leads to misapplication of new techniques, mismatched materials, and a lack of secondary and tertiary testing to discover existing problems. Tools like PlanGrid are ideal for increasing communication between all of the various teams working together on a single construction project.

## **8. Complexity of Designs**

Unnecessary complexity is the enemy of high-quality work. While some level of complexity is unavoidable in cutting-edge infrastructure and commercial construction projects, designers should minimize complex techniques and unusual features whenever possible. Simplified designs are also more affordable, offering the construction firm a better profit margin even while they're producing the highest quality work.

## **9. Lack of Project Management System**

A project management system determines the ideal intervals for testing the work completed so far for errors and omissions. Without a management system or plan for quality control and assurance, most construction firms wait far too long to perform essential checks on their work. Implementing a project management system based around mobile apps is a flexible and fast way to bring current projects under control.

## **10. Ignored Audits and Testing**

Some construction companies stick strictly to their third-party testing and auditing plans, yet ignore the results of the tests and continue on with flawed

designs or existing quality issues. This is often due to a lack of proper designation for quality control, causing reports to bounce from project manager to lead engineer without a clear workflow for addressing the material. Determine who's responsible for reading the audit and test reports and making recommendations for rework or repairs to the contractors so that important information on quality issues isn't overlooked.

## Lecture seven

### *What is a Control Chart?*

A control chart is a statistical tool used to distinguish between variation in a process resulting from common causes and variation resulting from special causes. It presents a graphic display of process stability or instability over time (Viewgraph 1).

Every process has variation. Some variation may be the result of causes which are not normally present in the process. This could be **special cause variation**. Some variation is simply the result of numerous, ever-present differences in the process.

This is **common cause variation**. Control Charts differentiate between these two types of variation.

One goal of using a Control Chart is to achieve and maintain **process stability**.

Process stability is defined as a state in which a process has displayed a certain degree of consistency in the past and is expected to continue to do so in the future. This consistency is characterized by a stream of data falling within **control limits** based on **plus or minus 3 standard deviations (3 sigma)** of the centerline [Ref. 6, p. 82]. We will discuss methods for calculating 3 sigma limits later in this module.

### **What Is a Control Chart?**

A statistical tool used to distinguish between process variation resulting from common causes and variation resulting from special causes.

### **Why Use Control Charts?**

- Monitor process variation over time
- Differentiate between special cause and common cause variation
- Assess effectiveness of changes
- Communicate process performance

### *What are the types of Control Charts?*

There are two main categories of Control Charts, those that display *attribute data*, and those that display *variables data*.

**Attribute Data:** This category of Control Chart displays data that result from counting the number of occurrences or items in a single category of similar items or occurrences. These “count” data may be expressed as pass/fail, yes/no, or presence/absence of a defect.

**Variables Data:** This category of Control Chart displays values resulting

from the measurement of a continuous variable. Examples of variables data are elapsed time, temperature, and radiation dose.

### **Shewhart charts for measurement data:**

In this chapter we present the mathematical background of techniques to detect deviations in a production process that would lead to non-conforming items. Such deviations may lead to increase of production costs or rework costs. The key factor to success is to accurately assess variability in production processes. If we accurately know the variability of a production process that is in control, then we are able to detect observations that indicate that the process has gone out of control. These procedures are known under the name control charts.

The simplest and most widely used control chart is the Shewhart X-chart, which should be used together with an R-chart, an S-chart or an S<sub>2</sub>-chart. Shewhart introduced these charts in 1924 as simple tools to be used by workers in production lines. In spite of their simplicity, these charts turned out to be highly effective in practice. When properly set up, these charts quickly detect large changes in process means. In the 1950's CUSUM (Cumulative Sum) control charts were introduced to detect small process changes. Although they are mathematically optimal in a certain sense, it is hard to set them up correctly since they are very sensitive to small changes in the parameters. A convenient alternative is the EWMA chart (Exponentially Weighted Moving Average) which has its roots in time series analysis. The EWMA chart is easy to implement and not very sensitive to both parameter changes and non-normality of data, while it performs almost as good as a CUSUM chart for detecting small process changes.

It is important to note that there are two different uses of control charts in general. In retrospective or Phase I use (sometimes called Initial Study), observations are analyzed after they have all been collected. Usually this is done during a pilot study of a production process, when one needs to estimate in-control process behavior. This is input to a capability analysis.

The other use is on-line or Phase II (sometimes called Control to Standard), in which in-control process parameters are assumed to be known or estimated from Phase I. In this use analysis of data is performed sequentially, that is repeatedly after each observation.

### **The Shewhart X chart**

The basic data collection scheme for a Shewhart chart is as follows. At equidistant points in time one takes a small sample (usually of size 4 or 5) of a product and measures a relevant quality characteristic. Such

samples are called rational subgroups. We denote the observations in rational subgroups by  $X_{ij}$ ,  $i = 1, 2, \dots$ , and  $j = 1, \dots, n$ , where  $n$  is the size of the rational subgroups. The rational subgroup should be chosen in such a way that the observations are independent and represent the short-term variability. The Shewhart  $\bar{X}$  control chart basically is a time sequence plot of the averages  $\bar{X}_i$  of the rational subgroups, together with the following 3 horizontal lines that indicate the process location and spread. Assume that  $\mu$  is the mean  $E(X)$  of the quality characteristic and that  $\sigma^2$  is the variance  $\text{Var}(X)$  of the quality characteristic. Since  $E(\bar{X}_i) = \mu$  and  $\text{Var}(\bar{X}_i) = \sigma^2/n$  for all  $i$ , the standard deviation of  $\bar{X}_i$  equals  $\sigma/\sqrt{n}$ . The centre line (CL) is placed at the process mean  $\mu$  of the quality characteristic.

The other two lines are placed at distance  $3\sigma/\sqrt{n}$  of the centre line. These lines are called the upper control limit (UCL) and the lower control limit (LCL), respectively. The control charts signals an alarm if an observation falls outside the region  $(\mu - 3\sigma/\sqrt{n}, \mu + 3\sigma/\sqrt{n})$ .

If we assume that  $\bar{X}_i$  is normally distributed with mean  $\mu$  and variance  $\sigma^2/n$ ,

#### THE SHEWHART $\bar{X}$ CHART

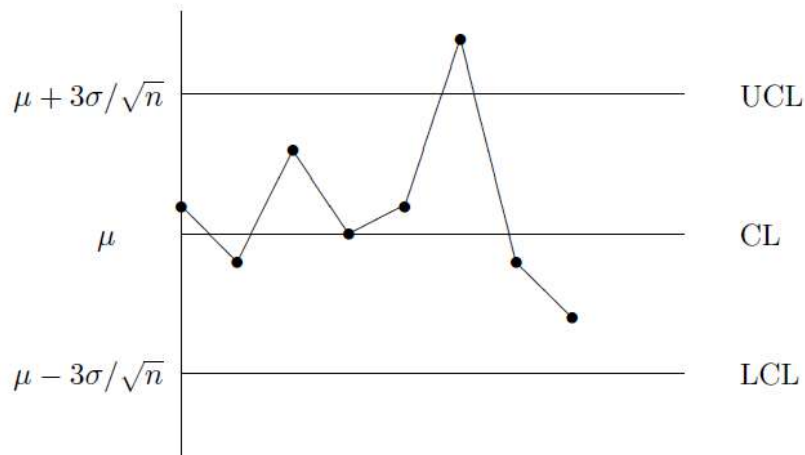


Figure 4.1: Shewhart  $\bar{X}$ -chart with control lines.