Quality assurance

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Quality assurance, or **QA** for short, is the systematic monitoring and evaluation of the various aspects of a project, service or facility to maximize the probability that minimum standards of quality are being attained by the production process. QA cannot absolutely guarantee the production of *quality* products.

Two principles included in QA are: "Fit for purpose" - the product should be suitable for the intended purpose; and "Right first time" - mistakes should be eliminated. QA includes regulation of the quality of raw materials, assemblies, products and components, services related to production, and management, production and inspection processes.

Quality is determined by the product users, clients or customers, not by society in general. It is not the same as 'expensive' or 'high quality'. Low priced products can be considered as having high quality if the product users determine them as such.

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[edit] Early efforts to control the quality of production

During the Middle Ages, guilds adopted responsibility for quality control of their members, setting and maintaining certain standards for guild membership[citation needed].

Royal governments purchasing material were interested in quality control as customers. For this reason, King John of England appointed William Wrotham to report about the construction and repair of ships[citation needed]. Centuries later, Samuel Pepys, Secretary to the British Admiralty, appointed multiple such overseers[citation needed].

Prior to the extensive division of labor and mechanization resulting from the Industrial Revolution, it was possible for workers to control the quality of their own products. The Industrial Revolution led to a system in which large groups of people performing a similar type of work were grouped together under the supervision of a foreman who was appointed to control the quality of work manufactured.

[edit] Wartime production

At the time of the First World War, manufacturing processes typically became more complex with larger numbers of workers being supervised. This period saw the widespread introduction of mass production and piecework, which created problems as workmen could now earn more money by the production of extra products, which in turn occasionally led to poor quality workmanship being passed on to the assembly lines. To counter bad workmanship, full time inspectors were introduced into the to identify, quarantine and ideally correct product quality failures. Quality control by inspection in the 1920s and 1930s led to the growth of quality inspection functions[citation needed], separately organised from production and large enough to be headed by superintendents.

The systematic approach to quality started in industrial manufacture during the 1930s[citation needed], mostly in the USA[citation needed], when some attention was given to the cost of scrap and rework. With the impact of mass production required during the Second World War made it necessary[citation needed] to introduce an improved form of quality control known as Statistical Quality Control, or SQC. Some of the initial work for SQC is credited to Walter A. Shewhart of Bell Labs, starting with his famous one-page memorandum of 1924[citation needed].

SQC includes the concept that every production piece cannot be fully inspected into acceptable and nonacceptable batches. By extending the inspection phase and making inspection organizations more efficient, it provides inspectors with control tools such as

sampling and control charts, even where 100 per cent inspection is not practicable. Standard statistical techniques allow the producer to sample and test a certain proportion of the products for quality to achieve the desired level of confidence in the quality of the entire batch or production run.

[edit] Postwar

In the period following World War II, many countries' manufacturing capabilities that had been destroyed during the war were rebuilt. General Douglas MacArthur oversaw the re-building of Japan. During this time, General MacArthur involved[citation needed] two key individuals in the development of modern quality concepts: W. Edwards Deming and Joseph Juran. Both individuals promoted the collaborative concepts of quality to Japanese business and technical groups, and these groups utilized these concepts in the redevelopment of the Japanese economy.

Although there were many individuals trying to lead United States industries towards a more comprehensive approach to quality, the U.S. continued to apply the Quality Control (QC) concepts of inspection and sampling to remove defective product from production lines, essentially ignoring advances in QA for decades[citation needed].

[edit] Accuracy of quality assurance

One of the primary devices of QA is metrics, or measurability. One QA process involves product evaluation and testing to determine if they meet specifications, such as performance measures. As a result, quality assurance can involve delays in production until all rework or remediation steps have been undertaken.

The costs related to products that do not meet minimum quality standards can be unacceptably high.

[edit] Steps for a typical quality assurance process

There are many forms of QA processes, of varying scope and depth. The application of a particular process is often customized to the production process.

A typical process may include:

- test of previous articles
- plan to improve
- design to include improvements and requirements
- manufacture with improvements
- review new item and improvements
- test of the new item

[edit] Quality assurance versus quality control

Quality control emphasizes testing of products to uncover products which do not meet specifications (i.e., do not meet the minimum level of quality). Quality assurance attempts to improve and stabilize production, and associated processes, to avoid, or at least to minimize, issues that led to the products which do not meet the metrics in the first place.[citation needed].

To maximize QA effeciveness, several methodologies may be used. QA does not eliminate the need for QC, as metrics testing is still required. QC activities are treated as one aspect of the overall QA process.[citation needed]

[edit] Failure testing

Valuable processes to perform on a whole consumer product is failure testing or stress testing.[citation needed] In mechanical terms this is the operation of a product until it fails, often under stresses such as increasing vibration, temperature, and humidity. This exposes many unanticipated weaknesses in a product, and the data are used to drive engineering and manufacturing process improvements. Often quite simple changes can dramatically improve product service, such as changing to mold-resistant paint or adding lock-washer placement to the training for new assembly personnel.

[edit] Statistical control

Many organizations use statistical process control to bring the organization to Six Sigma levels of quality,[citation needed] in other words, so that the likelihood of an unexpected failure is confined to six standard deviations on the normal distribution. This probability is less than four one-millionths. Items controlled often include clerical tasks such as order-entry as well as conventional manufacturing tasks.[citation needed]

Traditional statistical process controls in manufacturing operations usually proceed by randomly sampling and testing a fraction of the output. Variances in critical tolerances are continuously tracked and where necessary corrected before bad parts are produced.

[edit] Total quality management

The quality of products is dependent upon that of the participating constituents,[1] some of which are sustainable and effectively controlled while others are not. The process(es) which are managed with QA pertain to Total Quality Management.

If the specification does not reflect the true quality requirements, the product's quality cannot be guaranteed. For instance, the parameters for a pressure vessel should cover

not only the material and dimensions but operating, environmental, safety, reliability and maintainability requirements.

[edit] QA in software development

See also: Software quality assurance

The following are examples of QA models relating to the software development process.

[edit] Models and standards

ISO 17025 is an international standard that specifies the general requirements for the competence to carry out tests and or calibrations. There are 15 management requirements and 10 technical requirements. These requirements outline what a laboratory must do to become accredited. Management system refers to the organization's structure for managing its processes or activities that transform inputs of resources into a product or service which meets the organization's objectives, such as satisfying the customer's quality requirements, complying with regulations, or meeting environmental objectives.

The CMMI (Capability Maturity Model Integration) model is widely used to implement Quality Assurance (PPQA) in an organization. The CMMI maturity levels can be divided in to 5 steps, which a company can achieve by performing specific activities within the organization. (CMMI QA processes are excellent for companies like NASA, and may even be adapted for agile development style).

[edit] Company quality

During the 1980s, the concept of "company quality" with the focus on management and people came to the fore[*citation needed*]. It was realized that, if all departments approached quality with an open mind, success was possible if the management led the quality improvement process.

The company-wide quality approach places an emphasis on four aspects[*citation needed*] :-

1. Elements such as controls, job management, adequate processes, performance and integrity criteria and identification of records
2. Competence such as knowledge, skills, experience, qualifications
3. Soft elements, such as personnel integrity, confidence, organizational culture, motivation, team spirit and quality relationships.
4. Infrastructure (as it enhances or limits functionality)

The quality of the outputs is at risk if any of these aspects is deficient.

QA is not limited to the manufacturing, and can be applied to any business or non-business activity:

- Design work
- Administrative services
- Consulting
- Banking
- Insurance
- Computer software development
- Retailing
- Transportation
- Education

It comprises a quality improvement process, which is generic in the sense it can be applied to any of these activities and it establishes a behavior pattern, which supports the achievement of quality.

This in turn is supported by quality management practices which can include a number of business systems and which are usually specific to the activities of the business unit concerned.

In manufacturing and construction activities, these business practices can be equated to the models for quality assurance defined by the International Standards contained in the ISO 9000 series and the specified Specifications for quality systems.

In the system of Company Quality, the work being carried out was shop floor inspection which did not reveal the major quality problems. This led to quality assurance or total quality control, which has come into being recently.

[edit] Using contractors and/or consultants

Consultants and contractors are sometimes employed when introducing new quality practices and methods, particularly where the relevant skills and expertise are not available within the organization or when allocating the available internal resources are not available. Consultants and contractors will often employ Quality Management Systems (QMS), auditing and procedural documentation writing CMMI, Six Sigma, Measurement Systems Analysis (MSA), Quality Function Deployment (QFD), Failure Mode and Effects Analysis (FMEA), and Advance Product Quality Planning (APQP).

[edit] Quality assurance in European vocational education & training

With the formulation of a joint quality strategy, the European Union seeks to fostering the overall attractiveness of vocational education & training (VET) in Europe. In order to promote this process, a set of new policy instruments were implemented, such as **CQAF** (Common Quality Assurance Framework) and **EQARF** (European Quality Assurance Reference framework), each of which shall contribute to the establishment of a common quality assurance policy and quality culture in VET throughout Europe. Furthermore the new policy instruments shall allow for an increased transparency and mutual trust between national VET systems.

In line with the European quality strategy, the member states subsequently have implemented national structures (QANRPs: reference points for quality assurance in VET), who closely collaborate with national stakeholders in order to meet the requirements and priorities of the national VET systems and support activities to training providers in order to guarantee the implementation and commitment at all levels. At European level, the cooperation between QANRPs will be ensured through the **EQAVET** network.

Over the past few years, with financial support of the European Union as well as the EU member states, numerous pilot initiatives have been developed, most of which are concerned with the promotion and development of quality in VET throughout Europe. Examples can be found in the project database **ADAM**, which keeps comprehensive information about innovation & transfer projects sponsored by the EU.

A practical example might be seen in the **BEQUAL** project, which has developed a benchmarking tool for training providers, who with the help of the online-tool can benchmark their quality performance in line with the CQAF quality process model. Furthermore the project offers a database with European good practice on quality assurance in the field of vocational education & training.

- Online Benchmarking Tool For Vocational Training Institutes
- European Quality Assurance in Vocational Education & Training

[edit] Industrial resources

- Quality Progress magazine, Published by the American Society for Quality

[edit] Scientific resources

- Accreditation and Quality Assurance: Journal for Quality, Comparability and Reliability in Chemical Measurement, ISSN: 0949-1775 Print, ISSN: 1432-0517 [2]
- Quality Assurance in Education, ISSN 0968-4883, Emerald Publishing Group
- Food Quality and Preference, ISSN: 0950-3293 [3]

[edit] Academic resources

- The Quality Assurance Journal, ISSN: 1087-8378 [4]

This section requires expansion.

[edit] See also

- Best practice
- Data quality
- Data integrity
- Farm assurance
- GxP, a general term for Good Practice quality guidelines and regulations
- ISO 9000
- Mission assurance
- Quality control
- Quality infrastructure
- Quality management
- Quality management system
- Ringtest, part of a quality assurance programme in which identical samples are analysed by different laboratories
- Software testing
- Software quality assurance
- Total Quality Management

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2. ^ Accreditation and Quality Assurance: Journal for Quality, Comparability and Reliability in Chemical Measurement
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Please help improve this article by adding reliable references. Unsourced material may be challenged and removed. *(January 2010)*

[edit] External links

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