

DEPARTMENT OF NUCLEAR TECHNOLOGY
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CIDA COURSE ON QUALITY MANAGEMENT

"INTRODUCTION TO QUALITY MANAGEMENT" (QM)

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1. Objective Of Presentation :

This presentation will discuss the historical and cultural background of quality concepts and the development of scientific basis for the growth of Quality Management in the 20-th century.

Specifically, the following will be discussed : -

- historical background of quality
- role and contribution of the "pioneers" of Quality Management, the development and application of quality concepts
- development and significance of Quality Standards and Awards

2. Historical Background :

2.1 The basic concepts of quality control have been developed and implemented several thousand years ago. The beginnings of quality control reach back into antiquity, especially into China, India, Greece and the Roman Empire. All of these states have developed the **classical components of a Quality System**, namely :

- the central control extended over the entire progression of the process through which end products were produced
- the concept of special organization for quality control which was an integral part of central control
- the special hierarchy for administration of quality control was linked to the overall control organization of the central government

2.2 For example, **in China** at the time of **Zhou Dynasty (1000 to 500 BC.)** the system to control the production of handcraft was organized into five departments in charge of :

- production, collection, storage and distribution of raw and semifinished materials
- manufacturing and assembly of finished products
- storage and distribution of finished products
- formulating and implementing standards
- supervision and examination of products (audit)

2.3 The **Greeks and the Romans** had a quality system complete with standards for materials and for measurements, specifications for prefabricated materials (bricks) , they had standard tools and procedures, training and even, in some cases, quality warranties.

2.4 These systems of quality control were applied mainly to products important to the king, the nobility and the religious authorities, such as, for example :

- control of land (surveys)
- building and layout of cities
- provision of services to cities (aqueducts)
- public buildings and temples
- palaces
- burial mausoleums (Egyptian pyramids)
- coins, noble metals and jewels
- weapons
- ships

2.5 All these quality systems continued with small developments and improvements through centuries. Production served the purposes of the kings and the nobility and was based on individual craftsmanship. The craftsmen were very jealous of their skills , guarded them carefully and relied on formal qualifications and control to limit the number of people permitted to practice their craft. Products were individually "signed" using special markings, so that they could be traced to the maker for recognition as well as accountability.

3. Modern Quality Management.

3.1 The advent of **Industrial Revolution in Europe** in the 18-th century introduced the need for more consistent products which were about to be mass-produced, and parts of which needed to be interchangeable. Again, initially at least, interests of the kings and the emperors were the key consideration : land, money (coins), weapons, jewelery, agricultural tools and products , such as beer, on which taxes could be levied.

3.2 Industrial Revolution was made possible by the simultaneous development of power-driven machinery and sources of mechanical power, such as the steam engine. The results eventually were **mass production of reasonably priced goods** and general rise in wealth of the population, which stimulated demand for the goods.

3.3 Quality of these products was controlled by inspection, with the non-conforming products rejected after manufacturing has been completed. In many cases, the rejection rates were very high with management not being able to improve them. And so it went on until the beginning of the 20-th century.

3.4 The science of modern Quality Management started at a farm in Britain early in this century. To speed up development of crop growing methods, **R. A. Fisher** perfected scientific shortcuts for sifting through mountains of data to spot key cause-effect relationships.

3.5 Fisher's work during the first two decades of this century electrified **W. A. Shewhart**, a physicist at AT&T Labs. By the 1930's he had transformed Fisher's methods into a quality-control discipline for factories - and also inspired W. E. Deming and J. M. Juran to devote their lives to quality.

3.6 After World War II, **G. Taguchi**, a Japanese engineer amplified Fisher's and Shewhart's insights and developed what is known as "Taguchi method" for **scientific design of experiments**. More recent research by G. E. P. Box (Univ. of Wisconsin), J. Wu (Univ. of Waterloo, Canada) and D. W. Marquardt at DuPont has moved beyond these pioneers. Much of this recent work is just starting to be used by industry.

3.7 The Japanese quality revolution started in 1950 with lectures presented to JUSE by **Dr. W. E. Deming on Statistical Control of Quality**. These were followed a few years later by lectures given by **Dr. J. M. Juran on the subject of Quality Management**, which emphasized involvement of managers and workers in quality improvement.

3.8 Quality Control at last started to be used as a management tool. This marked a gradual transition from statistical **Quality Control to Quality Assurance to Quality Management**, in which all managers, all employees and all departments participated.

3.9 The second world war saw the first large scale application of Quality Control, where the more sophisticated weapons demanded more careful production and reliability. Statistical controls and extensive inspections were applied with reasonably satisfactory results, albeit at large cost.

3.10 The real demands for error-free manufacturing arose with explosive growth of aero-space industries and development of computers. As cost of performance failures and discovery and correction of errors grew, there was more and more pressure to prevent them from happening. It was realized that inspections are an inefficient and ineffective way of error control, and so methods were developed to prevent them. This is the premise of Quality Assurance where steps are taken to prevent errors, and also to find and correct causes, should they happen.

3.11 Amongst the leaders in application of these techniques were the Japanese car manufacturers, the aero-space industry and computer manufacturers. Additional developments in response to continually escalating requirements led to inclusion of all aspects of management and production process in the improvement efforts and that is called the "Total Quality Control" or "Quality Management".

3.12 In parallel with the development of these management concepts went development of the tools to facilitate assurance of quality, beginning with Statistical Process Control (SPC) and progressing through various methods of diagnosis of problems (root cause analysis) and development and testing of solutions.

3.13 These tools centre around systematic collection of relevant data which is then analyzed and transformed into information. Information is used to identify conditions adverse to quality and to correct them.

4. Recent Advances In Quality Management.

4.1 In the early 80's, Japan has become the world leader in the field of Quality Management, and many of her products were recognized as the best. As recognition of the overriding significance of Dr. Deming's lectures in launching Japan's quality movement, the Japanese Union of Scientists and Engineers (JUSE) has in 1951 established **two quality prizes** :

- Denning Prize for individual contribution
- Deming Application Prize for outstanding implementation and application of SQC (Statistical Quality Control)

4.2 There were also several success stories in the USA, where companies have achieved excellent results through the application of quality techniques. These companies, in collaboration with **ASQC (American Society for Quality Control!)** have developed a list of key strategies which produced these excellent results.

These are:

- customer focus
- upper managers involved and in charge of quality improvement programs
- strategic quality planning
- the concept of "Big Q"
- quality improvement
- business process quality management (also re-engineering)
- training in managing for quality
- measurement of quality
- bench marking
- human resources and quality - empowerment
- motivation - recognition and reward

4.3 In 1987 the US government established the **Malcolm Baldrige National Quality Award** as a stimulus to improving quality. The key strategies enumerated above became the basis for this award.

4.4 At approximately the same time **Canada has established its "Award for Excellence"** . Other countries in Europe and Latin America have also created quality awards, as has the European Foundation for Quality Management.

4.5 This proliferation of awards is proof of the growing recognition that quality of products and services has greatly risen in importance and has become an important - if not the key - competitive tool.

4.6 Also in the 1980's the countries of Western Europe began to use the International Standard Organization's **(ISO) 9000 series of standards** which define a comprehensive quality management system. The standards are used as the basis of judging adequacy of quality management systems of companies. These standards have become widely accepted .

4.7 Certification to these standards has been recognized as sufficient proof and guarantee of a company's product meeting the ISO criteria. Therefore , having such certification has become the necessary requirement to world-wide distribution of product and a significant competitive advantage. As the result, there has been a rush of companies wishing to become certified. The certification process get rid of multiple assessments , by potential buyers, which have plagued suppliers in the past.

4.8 In the field of nuclear power, the **International Atomic Energy Agency (IAEA)** , an agency of the United Nations' Organization , has also been busy with developing **Safety Codes, Safety Guides and Safety Practices** for the nuclear power program.

4.9 These standards form part of the **NUSS Program (NUclear Safety Standards)** an deal with the following aspects of nuclear power development and operation :

- Governmental Organization
- Siting
- Design
- Operation
- Quality Assurance

4.10 Other publications by IAEA , notably the **INSAG Series** (International Safety Advisory Group) and proceedings of various conferences offer additional conceptual and detailed advice on the various aspects of nuclear power.

definitions:

quality management : that aspect of the overall management function that determines and implements the quality policy

quality system : the organizational structure, responsibilities, procedures, processes and resources for implementing quality management

quality assurance : all those planned and systematic actions necessary to provide adequate confidence that an item or service will satisfy given requirement for quality

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