

100 Years of Quality Indian Society for Quality Quality Month Online Talk November 2020 N Ramanathan ram@100water.org







- When we apply Quality in any form today, we draw upon the wisdom of great thinkers, theorists, mathematicians and doers of millennia
- Here we briefly explore the development of the art, science and philosophies of Quality of the past 100 years, and a little beyond



Knowing where our knowing comes from widens and deepens our knowing, adding to its power





Quality Discipline – Draws from Many Sources

- The history of Quality is not only about what the original principles, systems, mechanisms and methods brought into it by Gurus and practitioners of Quality
- Quality has drawn from many philosophers, management thinkers, researchers and practitioners, mathematicians, statisticians and linguists
- Quality has also dipped into industrial engineering, maintenance, management of constraints and marketing research disciplines







Over a hundred years ago

Scientific Management





Frederick Winslow Taylor (1856~1915)

1900: *Shop Management* 1911: Principles of *Scientific Management*



- Instruction card for each operation detailing each piece of work. Time the best workmen.
- Relieve workmen, foremen of the work of planning. Centre brainwork in the Planning Department
- 'Thoroughly standardize methods. Classify and tabulate knowledge to frame rules, laws and formulae useful to workmen in daily work.
- Workman cannot change implements or methods on his own, but "every encouragement should be given him to suggest improvements, both in methods and in implements."
- Management reports based on 'exception principle'
- Qualities of an executive: grit, determination, bulldog endurance, tenacity
- Employer should dirty his hands and talk to his men without condescension
- "... nine tenths of the improvements that have come under scientific management have come from ... friendly cooperation (between) workmen and management."

Harrington Emerson: Ahead of his Times



THE TWELVE PRINCIPLES

- 1. Clearly defined ideals
- 2. Common sense
- 3. Competent counsel
- 4. Discipline
- 5. The fair deal
- Reliable, immediate, adequate and permanent records
- 7. Despatching
- 8. Standards and Schedules
- 9. Standardized conditions
- 10. Standardized operations
- 11. Written standard practice instructions
- 12. Efficiency reward

THE POWER OF PRINCIPLES

...principles applied by mediocre men are more powerful for good than the spasmodic floundering of unusually great men

PIECE RATES

Piece rates are a reversion to savage standards...

PRINCIPLE 1: IDEALS

(Examples) ... that customers are treated with utmost fairness... employees have permanency of employment

- ... that employees lead wholesome New England Lives
- ... wish to surpass the world in the excellence of our products

PRINCIPLE 2: COMMON SENSE

Environment: (After taking out) the soil value, net income (of farming) is nil.

PRINCIPLE 4: DISCIPLINE

... ideals ... must be communicated... the worker (cannot) rise above the spirit of the place he works in





From France, a Word on Improvement

...a constant search for improvements that can be introduced into every sphere of activity. The search for improvements should be pursued unceasingly at all levels and throughout all parts of the business. The executive in charge should have an active, unrelenting intent to effect improvement.

The collaboration of all concerned leads to a united front. The plan charts the course: its general acceptance builds unity and mutual confidence

Your professional work will not entirely consume your time; you will always find the time required for study.

The body corporate ... has its reflex responses ... which take place without intervention on the part of the higher authority...

Two Excerpts from his Fourteen Points:

- Division of work for managerial and worker levels for productivity and efficiency ٠
- Unity of command only one boss per person •







Industrial Engineering & Organizing

- Frank Gilbreth (1868-1924), starting as bricklayer's apprentice, turned to management, advocated Scientific Management and pioneered time and motion study (1911, first book)
- With wife Lilian Gilbreth (1878-1972) introduced Industrial Engineering. Broke up work into elemental motions called *therbligs* ... to reduce the number of motions. Lilian Gilbreth's worked on ergonomics for the homemaker







 Henry Gantt (1861-1919): Worked six years with Taylor at steel plants. Known for book Organizing for work 1919, and the Gantt Chart for planning and tracking actual progress

Some Early Statistics



- Mode (known to Athenians). Median: Late 16th Century. Mean of two numbers known to ancient Greeks, but for more than two numbers in 16th Century
- Bayesian (1770) ideas of prior beliefs and the impact of new evidence in building a degree of belief (important in interpreting experiments) about future outcomes.
- Laplace (1749-1827): Exponential error distribution, Central limit theorem, Gauss-Laplace synthesis
- Gauss (1777-1855): Normal Distribution (named in 1873)
- Francis Galton (1822-1911): Fitted normal curves to data, discovered reversion (regression) to the mean, and correlation, the quincunx
- Edgeworth (1845-1926): Comparisons of means of two populations using precursor to two-sample t-test
- Karl Pearson (1857-1936): Introduced moments, correlation coefficient, p-value, chi-square test, principal component analysis... Established the discipline of mathematical statistics
- William Gossett (1876-1937) Student's t-distribution, statistical significance

GALTON's QUINCUNX



Quality and Standardization



- 1787: The concept of interchangeable parts
- 1870: 'Go'-'no-go' gauging
- 1901: Standards Organization established in Great Britain
- By 1920: Netherlands Germany, Belgium, Canada, Switzerland and the United States follow







1920 to 1945: The Dawn of Quality Control

Controlling Quality in Manufacturing

Methods for thorough inspection

- ... the control of quality is the correct starting point for economy... Quality by itself is not costly, but is always expensive to ignore
- ... the best way of solving problems in the control of quality is to use the scientific method
- Uniformity requires continuous and positive control
- ... Quality varies ... what we really mean is likeness, uniformity or standardization of quality *within limits*
- Inspection: the need for independent scrutiny. Combining it with remedy of defects
- (instilling) the pride of good workmanship...
- ... everything not needed and *used* in the work must be discarded



GS Radford, 1922

Forgotten Books



The Miracle of Mass Production: Henry Ford (1863~1947)

From ore to car (every 49 seconds) in a continuous flow in Ford's River Rouge plant

ON STANDARDIZATION

To standardize a method is to choose ... the **best one** and use it. Standardisation ... means **standardizing upward**. If you think of standardization as the best that you know today, but which is to be **improved** tomorrow - you get somewhere. But if you think of standards as confining, then the progress stops.

ON PROFITS

- When anyone attempts to run a business solely for profit and thinks not at all of service to the community, then also the business must die, for it no longer has a reason for its existence
- (Start) out to render a certain amount of service and let the profit take care of itself. We regard profit as the inevitable conclusion of work well done

ON SPIRIT OF SERVICE

• The spirit of service is just a knowledge that no man can survive, no industry can survive, no government can survive, no system of civilization can survive which does not continually give service to the greatest possible number. ... (there exists) ... nonsense ... when mere money brokers endeavour to manage productive business





There's no one but us...

Extracts from Talks 1924 to 1932

The Profession of Management:

- The word "profession" connotes ... a foundation of science and a spirit of service
- ... for there is no one else but yourselves to create the science, the art, the profession of management

Cross-functional Management

- In a meeting of the superintendents of departments, each should consider not merely what is good for his department but the good for the whole as seen from his department
- ... merchandising is not merely a bringing together of designing, engineering, manufacturing and sales departments, it is these in their total relativity

Experience & Control

- We should try experiments and note whether they succeed or fail ... and why they succeed or fail. This is taking an experimental attitude to experience
- We talk about learning from experience, but we cannot do that unless we 1)observe the experience, keep records of our experience and 3) organize our experience, that is, relate the parts
- Control is coming more and more to mean fact-control rather than man-control -





Mary Parker Follett (1868-1933) Management Thinker

Anticipating the days of TQM!

The Birth of Statistical Control



AT&T subsidiaries: Western Electric for Manufacturing and Bell Labs for Research. Bell labs to do 'buyers' inspection' of equipment from Western Electric

Walter A. Shewhart (1891~1967): Physicist

- 1924: Developed the concept of statistical control and became the architect of the control chart
- 1931: The book *Economic Control of Quality of Manufactured Product* published
- Prediction of a process the probability that the observed phenomena will fall within given limits
- 1939: Collection of his lectures, edited by Deming published as *Statistical Method from the Viewpoint of Quality Control*. This made control charts better known
- Long collaboration with Deming. Shewhart was influenced by the Pragmatist school of philosophy as expounded by C.I Lewis (*Mind and the World Order*) and influenced Deming in turn



Revised control chart for kilogram calibrations

The Birth of Statistical Sampling

- Methods of scientifically sampling from large numbers of essentially identical items
- Concept of Consumer's Risk and Producer's Risk
- 1923 First application based on probability calculations
- 1926: Plans based on Lot Tolerance Percentage Defective used in the shop
- 1927: Concept of Average Outgoing Quality Level developed
- Involved later in the development of the Army Service Forces Tables used throughout WW II (based on Producer's Risk) – Led to the MIL-STD series of tables

The intention in Bell Labs was always that both control charts and sampling methods were to be used in parallel





Harold F. Dodge (1893~1976) Bell Labs



Introducing Experimental Design

DOE: Fisher designed plant-breeding experiments. One major problem was to avoid biased selection of experimental materials, which results in inaccurate or misleading experimental data. Fisher introduced the principle of randomization - selecting samples from the whole population they are intended to represent.

ANOVA: Fisher originated the concept of analysis of variance, or ANOVA, which enabled experiments to answer several questions at once. An experiment got **arranged as a set of partitioned sub-experiments** that differ from each other in one or more of the factors or treatments applied in them.

Statistical Significance: Fisher used this concept regularly and was responsible for fixing it at 5%, something that has lasted some 80 years, not always appropriately.



Ronald A Fisher 1890~1962





The Humanist School Emerges

 The Hawthorne Experiments: in 4 phases 1924~1932 at the Western Electric Plant. 29000 employees. Effect on Productivity of changes such as illumination, incentives etc. Productivity soared irrespective of changes in the test group. Attention to the workers was the key



Conclusions of Elton Mayo (1880~1949)

- When given more freedom to determine the conditions of their working environment and set their own standards of output, job satisfaction increased;
- Increased attention and interaction led to cohesion within groups;
- A sense of self worth was more important than physical working conditions in creating job fulfilment and productivity





Purpose, cooperation

- An organization comes into being when there are persons willing to act to accomplish a common purpose
- "... not until I had ... relegated economic theory and economic interests to a secondary ... plane did I begin to understand organizations or human behaviour in them."
- The purpose is not profit, notwithstanding the businessmen, economists, ecclesiastics, politicians, labour unions, persistently mis-state the purpose... but the objective purpose of no organization is profit, but service
- The philosophy of giving as little as possible and getting as much as possible ... is the root of bad customer relations, bad labour relations, bad supply relations, bad technology.
- ... the general characteristics of systems are also those of organizations ... the components are interdependent variables.
- Responsibility ... is the power of a particular private code of morals to control the conduct of the individual in the presence of strong contrary desires or impulses.





Chuther J. Barnard.

Chester Barnard (1866~1961) 1938 book: The Functions of the Executive





The World in the 1950s



- Aftermath of World War II following the Great War. Atomic bombs on human population fresh in the minds. 17 million killed in WW1, and 50-80 million in WW2
- Cigarettes smoking was advertised and was fashionable
- Cold War Arms race, Space race
- UN formed in 1945. Decolonization of the world 36 countries free by 1960
- Racial Segregation U.S., South Africa ...
- Mechanical calculators needed for statistical operations. Graphs by hand
- Quantum Physics on a plateau from 1930
- High mechanical ingenuity





Quality Organizations

- February 1946: The American Society for Quality Control (ASQC) now ASQ - was founded. George Edwards, (boss of Shewhart and Dodge) one of the founders, argued for "the establishment of quality control as a functional part of management." and that QC should enter into "design, engineering, technical and quality pre-planning, specification, production layout, standards... and even into training.." The position of one in-charge of QC was to be analogous to that of the comptroller.
- May 1946: The Union of Japanese Scientists and Engineers (JUSE) was established. In 1949, decided that is main endeavour had to be in the field of quality control
- 1956: The European Organization for Quality Control (now EOQ) was founded









Father of Indian Statistics

- Like Shewhart and Deming, Mahalanobis was a physicist
- 17th December 1931: Set up the Indian Statistical Institute (ISI)
- 1933: Founded Sankhya, The Indian Journal of Statistics, still running
- Investigated the technique of large-scale surveys in Bengal, 1936, with interpenetrating samples. Later, Deming would work on this theory, especially simplifying estimates of the standard error.
- His proposal for sample survey of Jute crop in Bengal did not find Government approval, but in 1938, R.A. Fisher came to India and his support led to large scale sample survey in 1940
- 1950: Established the National Sample Survey, which continues to date.
- 1958: Found a technique known as Fractile Graphical Analysis.



Statistics is the universal tool of *inductive inference*, research in natural and social sciences, and technological applications. Statistics, therefore, *must always have purpose*, either in the pursuit of knowledge or in the promotion of human welfare.

- P.C. MAHALANOBIS

https://artsandculture.google.com/exhibit/father-of-indian-statistics-prof-prasantachandra-mahalanobis%C2%A0-indian-statistical-institute/0AISK23-669ILA?hl=en



Shewhart Visited India Three Times

- Walter Shewhart, popularly known as the father of Statistical Quality Control, was invited by Mahalanobis on behalf of ISI in 1947 to help in developing the Statistical Quality Control (SQC) in India. He reached India on 13 December 1947 and stayed here till 4 March 1948.
- During this period he visited and gave advice to managers and proprietors of 33 factories, addressed 35 meetings and held 30 round table conferences, with industrialists and government officials, and attended a session of the Indian Science Congress held at Patna in January 1948.
 - Shewhart was elected President of a conference on Standardization and Quality
 Control convened at the ISI, Calcutta. Shewhart and gave his Presidential
 address on the technique of SQC and its application, to 180 delegates
 - ISI established Statistical Quality Control units in different parts of India from 1953.



Shewhart received an honorary doctorate from ISI in 1962.



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Indian Statistical Institute

- Has seven Academic Divisions, the SQC & OR Division, started in 1953, now has eight centres. Offers M. Tech and PhD courses
- Subjects: Total Quality Management, Operations Research, Project Management, Quality Audit, Statistical Process Control, Six Sigma, Reliability Maintainability & Safety, Applied Statistics, Business Analytics, and Data Science
- Dr Deming's basement office in his home in Washington was stacked with Sankhya, the journal of the Indian Statistical Institute
- Among those who studied in ISI: Genichi Taguchi, Yasutoshi Washio!

On some of the contributions of interpenetrating networks of samples, an invited paper by Deming in honor of Mahalanobis's 70th birthday, Sankhya, vol.24, 196







SQC, Brainstorming...

1946: Eugene L. Grant published the first edition of his classic *Statistical Quality Control.* Six more editions were to follow until the 1990s

- Alex Osborn was an ad executive
- 1942 Book How to Think Up introduced brainstorming, a group creativity technique, popularized by his 1953 book Applied Imagination
- 1954: Set up Creative Education Foundation Osborn-Parnes Creative Problem-Solving Process





Eugene L Grant (1897~1996)







Deming's Three Visits to India

- As consultant in sampling to Government of India, invited by Mahalanobis. Delegate from the American Association for the Advancement of Science (AAAS) to the Annual Session of the Indian Science Congress, New Delhi, January 3~8, 1947, with Jawaharlal Nehru as General President.
- Second visit in 1951 also in the same capacity a year after his epochal visit to Japan
- Third visit, at the invitation of ISI, Deming gave a keynote speech at the All-India Conference on Quality Control held in New Delhi on 17th March 1971: Title: Some Statistical Logic in the Management of Quality. His speech anticipated much of what he wrote from 1980 onwards
- 1971 could have been the moment for India to make a breakthrough of the kind Japan made in 1950. India was not ready...





W. Edwards Deming (1900~1993)



By the time Janak Mehta, from CII, invited Deming again in 1986, it was too late!

Deming in Japan: 1950 – Defining Moment

- First Visit 1948 on behalf of US Occupation Forces. 1950: Invited by Union of Japanese Scientists and Engineers. Eight-day QC courses, also short top management courses
- Considerable emphasis on statistical methods
- Clarity on common cause and special cause variation, and the task of prediction. Distinguishing enumerative vs. analytical studies. Humanistic interpretation of statistics, not allowing blame of workers
- Like Shewhart, Deming's philosophy was founded on the study of C.I.
 Lewis Conceptual pragmatism^{*} a priori knowledge is necessary to build up experience and then 'degree of belief'
- Presented an eight-part and a four-part cycle which led to the PDCA Cycle
- Presented a classic chart of 'production viewed as a system'







Juran in Japan - from 1954...

- 1. For high policy or doctrine on quality "Quality is the ethical imperative for the senior executive."
- Choice of quality of design Standing "new products committee" reporting to and advising CEO
- 3. Organizational Plan Standing "quality committee" identification of unsolved and chronic problems, the identification of and recommendation of solutions to these problems, and monitoring the progress on quality "holding the gains" Creating the structure of a defect prevention program
- 4. Setting up the measurement (of the status of Quality) market share, complaint rates, costs of customer adjustments, defect rates, costs of quality, scrap, rework...
- 5. Reviewing results against goals and taking actions on significant variations



Joseph M Juran 1904~2008 That Quality is a top leadership issue



1951: Juran's classic reference book – *Quality Control Handbook* released



Coining the Term: Total Quality Control

- 1. Harvard Business Review article Nov-Dec 1956 titled Total Quality Control
- 2. Quality could only be accomplished by the cooperative (total) efforts of design, engineering, purchase, manufacturing, and sales, and not just by a QC department
- Concept of quality costs inspection, testing, scrap, rework, customer complaints are not trivial expenses
- 4. 1961: First Edition of the book *Total Quality Control*



A.V. Feigenbaum 1920~2014





More of the Humanistic School

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Throughout the fifties and sixties, many thinkers of the humanistic school flourished

- Douglas McGregor: Theory X and Theory Y
- Carl Rogers: Sensitivity Training
- Abraham Maslow: Need Hierarchy, self-actualization
- Abraham Zaleznik: Counselling in organizations
- Chris Argyris: Organizational defence mechanisms
- And others in behavioural science disciplines
- Supplemented by other schools such as *Est* (Werner Erhard), *Forum*

The discipline of Organizational Development (OD) evolved form such work. In the long run, its effect has not been great



Taguchi Methods

In his 1954-55 stint at ISI in Calcutta, Taguchi was introduced to the orthogonal arrays invented by C. R. Rao. Taguchi developed the arrays as foundational to his innovations in designed experiments

Loss function: A quadratic relationship of loss to society as actual values diverge form the best nominal o either side

Robust design: Ways to make certain desired outcomes 'forgiving' to variations in certain input factors

Individual Deming Prize at young age of 35



Genichi Taguchi 1924~2012



Beyond Deming to Management Mechanisms

Deming called himself a statistical consultant not a management consultant though he laid out profound ideas for management. He did not create management mechanisms though. These happened elsewhere



Deming's Business card in 1950s in plywood



Seven QC Tools, QC circles, Japanese TQC

- 1962: Creation of **Quality Control Circles** for foremen and frontline operatives, through a radio program and a journal *Foreman Quality Control*. Millions of workers joined QC circles.
- Ishikawa compiled the seven QC tools in support of QC circle activities. This
 included his cause-and-effect diagram introduced in 1950
- It was probably Mizuno who took the lead in creating the famous Plan-do-checkact (PDCA) cycle taking off from Deming's four-part cycle, extended from Shewhart's three
- Komatsu and Bridgestone pioneered policy management
- Nippondenso pioneered early-stage instability removal. Later, first company to win a TPM award
- Ishikawa introduced cross-functional management in mid 1960s in Toyota, which became more definitive in the 1970s
- Presidential (management) Diagnosis added as a management mechanism





Ishikawa and Humanism

- Ishikawa helped expand the Feigenbaum meaning of TQC to mean QC by everyone in all departments. Along with Shigeru Mizuno – the term Company-wide Quality Control was also used
- Everyone participates and is deeply involved in improvement activities. Everyone's opinion is asked for and is valued
- Ishikawa called for 'Respect for Humanity' as a basic principle of TQC
- If every nation plays its part in promoting quality control, the world will find peace, and its people will be able to live together harmoniously and happily.
- TQC is a thought revolution
- TQC consists of doing what should be done as a matter of course





The Toyota Production System

- Toyota Production System was born out of the need to catch up with the West "without the benefit of funds or splendid facilities."
- The principal objective was to produce many models in small quantities
- The basis is the absolute elimination of waste.
- Reducing the timeline from customer order to collecting the cash by removing non-valueadded activities
- If a small change in a plan must be accompanied by a brain command to make it work, the business will be unable to avoid burns or injuries and will lose great opportunities
- Flow, Pull (kanban), Jidoka (autonomy + automation), Production levelling (Heijunka), setup time reduction, standard operations, layout for multi-function worker, visual control, QC circles, idea system (kaizen), backed by cross-functional management
- Shingo was an industrial engineer adept with Taylor and Gilbreth systems. Worked miracles with set-ups (SMED) and error-proofing (poka-yoke). The IE system under TPS remained humanistic



Training Within Industry developed in the U.S in 1940s, Toyota adopted it in the 1950s – adoption of work instructions and worker training – fundamental to both TQC and TQM

Shigeo Shingo 1909~1990





Taiichi Ohno 1912~1990



Customer Needs: QFD

1966: Yoji Akao developed the concept of deploying customer needs into quality assurance. Coined the term 'quality deployment' in 1972. Leading a research committee set up by Japanese Society for Quality Control (JSQC) and with Mizuno, produced a book called *Quality Function Deployment* (QFD). QFD is a combination of matrices that go on from system design to part design and processes. Akao warned that every QFD exercise had to be unique.

Customer needs are identified through intensive interactions and through observation, converted to primary, secondary and tertiary levels through affinity diagrams, part of the Seven Management tools developed by a research committee of JUSE and published in 7.Relation between 1979 in a book edited by Shigeru Mizuno

These tools drew on the work of Jiro Kawakita.

4.Customer

competitive

assessment





characteristics

2. Quality Elements Table

3.Relating customer

requirements to

technical requirements

5.Competitive technical assessment

6.Operational goals

1.Demanded

Qualities

table



1978: Statistics for Experimenters 1st edition published

Introduced:

- Response surface methodology
- EVOP
- Multiple types of transformations, distributions and tests

"... all models are wrong, but some are useful"









1981 to 2000

The Deming Resurgence in the 1980 to 1993

1980: Many US companies had sent numberless delegations to learn the 'secret' of Japan's success. It all fell into place with a documentary *If Japan can why can't we* by NBC featuring Deming. He said Japanese products were better and cheaper because their management was better. Suddenly Deming, 80 was known all over the U.S. Quality became the single big news in management in the U.S.



The Deming Phase

- Book: Out of the Crisis, evolving and morphing from an earlier book. Later, 1993, The New Economics
- Deming's 14 Principles for transformation, seven deadly diseases, and a 'parade' of obstacles
- The System of Profound Knowledge
 - Appreciation for a system
 - Knowledge about variation
 - Theory of Knowledge
 - Psychology

Huge impact on Deming followers who wrote exceptional books. Brian Joiner's Fourth Generation Management is a classic

- Operational definitions (from Bridgman's *The Logic of Modern Physics*)
- Strong arguments against performance appraisals

More on the Quality Renaissance of the 1980s

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- > A string of new books by Juran, Ishikawa, Ohno, Deming...
- > 1984: Eliyahu Goldratt released his fictional book *The Goal*, applying his Theory of Constraints
- > 1985: Richard Schonberger publishes World Class Manufacturing, a book on TPS, followed by more books
- From 1986 onwards Motorola challenged its suppliers to pursue 'flawless execution' by applying its Six Sigma methods, which emanated from the Japanese PDCA model
- > 1987: ISO 9000 series ISO9000:1987 adopted as a global standard for Quality Management System
- > 1987: Establishment by U.S. Government of the Malcolm Baldrige National Quality Award
- The Profit Impact of Market Strategy (PIMS) study at the Wharton Graduate School of Business linked the relationship between market dynamics, customer satisfaction, and the profitability of new product investments
- 1988: John Krafcik, publishes paper naming TPS as Lean while working with James Womack and Dan Jones who, in 1990 publish The Machine that Changed the World
- > 1991: Establishment of the European Foundation for Quality Management (EFQM) Award

Attractive Quality, Task-Achieving...

1984: A seminal paper from Noriaki Kano on what is simply known as the Kano model

- It distinguished three type of qualities the *must-be*, like hygiene in Herzberg's theory of motivation, the *one-dimensional*, and the *attractive*, which pursues needs that are latent to the user. Later, Kano surveys came up to quantify these qualities
- Examples published form Konica's invention of auto-focus, auto-flash, auto-rewind in cameras, and in Juki's sewing machine improvements to enable even newcomers to avoid mistakes.

<u>1997: Way for Breakthrough and Creation: Task Achieving QC Story for Management-</u>

• Not just problem solving, but achieving objectives not within the framework of an existing system but by breaking that framework or creating a new system altogether



Noriaki Kano 1940~



1980s: TQM arrives in India

1982: Maruti Suzuki arrived, with quality practices new to India. Later, joint ventures with Japanese companies were formed to supply components to Maruti, and also for manufacture of LCVs and two-wheelers. They changed the transport landscape of India and triggered supplier development to meet Japanese quality standards

1983: India picked up QC Circles as 'Quality circles' from U.S. through the Quality Circle Forum of India. It boomed, faded, and rose again in the nineties when TQM arrived

- 1984: A TQC effort, now known as the Nashik Experiment under AIEI (precursor to CII) was launched under the leadership of Janak Mehta
- 1986: CII started the National Committee on Quality, a forum for CEOs to meet to discuss quality. K. Ishikawa visited India at the invitation of CII
- 1987: National Institution of Quality and Reliability (NIQR) formed by amalgamation of two other bodies
- 1988: CII TQM Division formed led by Janak Mehta
- 1989: CII Tie-up with JUSE: The first annual top management study mission (2 weeks) to Japan started

Janak Mehta 1941~





TQC, TQM, Six Sigma...



- 1985: Total Quality Control (TQC) renamed as Total Quality Management (TQM) by US Navy!!
- 1985 paper by Bill Smith of Motorola if defectives were found and corrected in manufacturing, other defects would be found in early use by customer. If manufacture was error free, failure in customer use rare. Hence Six Sigma Quality.
- 1990: Mikel Harry prepared "The Yellow Brick Road" a roadmap to achievement of Six Sigma. Then joined by Schroeder in ABB. Developed eight-step problem solving methodology (not very different from QC Story in sequence). Allied Signal adopted Six Sigma which then was propagated to GE. The rest is history!
- 1990: Michael Hammer of MIT introduced Business Process Reengineering to redesign processes as an approach, it has waned
- 1991: Ron Moen, Tom Nolan, Lloyd Provost write a book on experimental design using the Deming approach to statistics
- Don Wheeler statistical books echo Deming's thinking
- 1997: JUSE changing from TQC to TQM



The Story of Control Subjects – Performance Indicators

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- 1954: Juran in Japan introduced the concept of control subjects, later fully explained in his classic book Managerial Breakthrough in 1964 – concept of Executive Instrument Panel
- 1955: Peter Drucker; Set of eight metrics including public responsibility, MBO
- The development of classifying control subjects under **QCDSM** (by Mizuno?)
- 1961: Teijin's Deming Prize through pioneering work on control items table, with deployment and role clarity
- 1984: Kansai Electric wins Deming Prize, formalizes Daily Management, control items now mature
- 1985: Hewlett Packard develops Business Fundamentals Table, from YHP
- 1987-1992: Balanced Scorecard developed by Art Schneiderman as part of TQM in Analog Devices, covering all aspects
- 1992: Kaplan and Norton, Finance professors, use Schneiderman's system to develop their version of Balanced Scorecard (Not suitable in a TQM environment)

In Daily Management, choice of metrics tend to be relatively static, but in policy management, metrics can be unique year to year

The Story of Problem Solving Approaches

- 1964: The QC Storyline originated in searching for a method of reporting the projects of QC circles in Komatsu
- The QC Story used in Japan spread to the U.S. in the 1980s. Hewlett Packard's Japanese subsidiary was among the sources of this information to the U.S.
- 1985: The QC Story got published in English as a problem-solving methodology under TQM, in *Statistical Methods for Quality Improvement* edited by Hitoshi Kume
- 1985: A Problem-Solving Research Group of JUSE , chaired by K. Hosotani, published an exhaustive 14-step problem-solving method in Japanese
- 1987: 8D approach defined by Ford eight disciplines in problem solving
- 1991: The English version of the JUSE method was published in two volumes as TQC Solutions and included case studies
- 1990s: Six Sigma methodologies came up, both DMAIC and DMADV-type (Design fro Six Sigma)
- 1997: Task Achieving QC Story by N. Kano



The 1990s in India



- 1991: Economic liberalization acted as trigger for adoption of TQM or closure for many
- 1992: Vikram Cements won the first TPM award of Japan Institute of Plant Maintenance (JIPM)
- 1993: Annual Quality Summits in November launched as a flagship event of CII, often with international participation
- 1994: CII and Exim Bank join to start a Business Excellence Award under license from EFQM
- 1996: Indian Society for Quality (ISQ) founded by Janak Mehta as a national forum for interaction among quality professionals, leaders, practitioners and academics.
- 1997: Quality Council of India (QCI) founded cooperatively by Government of India and three industry bodies to establish and operate national accreditation structure and promote quality through National Quality Campaign.
- Cluster approach initiated by CII for Maruti vendors under the guidance of Prof. Tsuda leading to India's first Deming Prize winner in 1998 – the Brakes Division of Sundaram Clayton. This approach takes off with clusters by CII/ACMA, UNIDO and others for rapid propagation of TQM
- 1998: Cll ties up with JIPM for propagation of TPM



2000 to 2020

India in the First Twenty Years of the Millennium



Deming Prizes 1998~2020

	Japan	India	Other	Total
Deming Prizes	41	28	19	88
Deming Grand Prizes	6	8	2	16
Total	47	36	21	104

TPM Awards India

280 companies have won a total of 434 TPM awards at four levels from JIPM Source: Prem Motwani

1st Deming Prize 1998 Brakes Division, Sundaram Clayton
2009: V Krishnamurthy conferred The Grand Cordon of the Order of the Rising Sun, from Japan
2012: Janak Mehta first to win the Deming Distinguished Service Award for dissemination and
promotion (overseas) followed by Venu Srinivasan 2019
2020: Prem Motwani Order of the Rising Sun, Gold Rays with Neck Ribbon, Japan. His forthcoming book
captures India's quality journey and status especially TPM

More on India in 21st Century



- > 2002: Asian Network for Quality (ANQ) formed with great initiative from N. Kano
- ➢ ISQ hosts ANQ Congresses in 2004 and 2010, launches awards
- Hitoshi Kume's Management by Quality published in India
- Indians in International Academy for Quality, starting with Janak Mehta who became its Chairman and is now Honorary Member
- CII: Shoji Shiba innovation cluster 2004, Visionary Leaders for Manufacturing (VLFM) collaborating with IIMs and Japan in 2006, name later changed to Champions for Societal Manufacturing program
- > Indian companies practicing quality become more adept at product development
- Lean Six Sigma (LSS) used mainly as problem solving method rather than as management approach in many companies. MNCs adopt LSS



The International Character of Quality Today

- Source of the management mechanisms of TQM kaizen activities, QC circles, Daily Management, Policy Management and Cross-functional Management – Japan
- Core methodologies like problem-solving also from Japan, now also American
- Quality standards mainly from Europe
- Statistical tools barring Taguchi from the West
- Semantic tools* the contribution is mixed between Japan and the West
- Toyota Production System (Japan) has become international as Lean. Value Stream Mapping (Rother and Shook, 1998) has become standard practice, followed by a string of works on Lean, including Lean for process industries - West.
- Six Sigma morphs to Lean Six Sigma, incorporating Lean and even parts of TPM West
- A quality professional necessarily must apply knowledge from both the East and the West



*Language processing for affinity diagram from Hayakawa – Japanese origin American English professor

World State of Quality

100WATER

- Where does quality figure in the mind space of CEOs now?
- Many companies and some geographical regions are out
- Business schools teach management ways that seem to be fundamentally at odds with quality-based thinking
- Quality can deal with both *what* and *how*. But business strategy tends to stand apart from Quality ways
- Confusion prevails about integrating advancing digital technologies with the established ways of quality
- Environmental issues still stand as externality to Quality methods
- Quality failures some spectacular, some mundane, are all too common



We had None of These in the 1950s

100WATER

- Smart phones, Internet, PCs, laptops
- Dematerialized books, music, photos, videos, movies...
- Electronics in cars, fridges, washing machines, robotics
- Hybrid cars, Electric cars, Hydrogen fuel cell cars now even a hyperloop
- Online retailing, banking, journalism, education, health care, counselling, conferences, work-from-home...
- 3D printing, space stations, drones, plastics, LED lamps...
- Big Data, Analytics, IoT, Machine Learning, AI the world of Digitalization
- Minimally invasive surgeries and AI based medical diagnoses
- Advanced Bio and Nano technologies



The World in 2020: Society and Environment



- Fall in communicable diseases, not counting the unprecedented Covid-19 pandemic
- Human population 7.8 billion, up from 2.6 in 1950
- World GDP up 7 times since 1950 consumption up of energy, fertilizers, water, paper, transportation...
- CO2 in atmosphere ~400 ppm against ~310 in 1950, 9 billion tons of plastics clogging land and oceans
- Bio-extinction in some cases 10000 times the background rate
- Marine fish capture peaked in 1996, there aren't enough fish left
- 100,000 chemicals produced, most with unknown toxicities.
- Stratospheric ozone accumulation, ocean de-alkalization. Loss of tropical forests, topsoil...
- Hormones, antibiotics, pesticides, heavy metals, oils, endocrine-disrupting chemicals, in food
- Rise of cancer, heart disease, allergies, obesity,
- Global life expectancy up from ~48 in 1950 to ~70 today
- Global illiteracy down from 64 percent in 1950s to 14 today
- Religious terrorism, rise of nationalism
- Revolutionary change in data and communication, bio and nano technologies



The Rest of the 21st Century: A Manifesto

New Definitions and Meanings of Quality



<u>Quality</u>

Fulfill stated, implied and latent requirements of customers and society while causing no harm.





Through quality, enable humanity to thrive in healthy planet

Quality and New Age Developments



- The New Age businesses offer never-before-imagined features that dazzle the world. They offer many attractive qualities. Quality professionals must rise to serve this emergence with fresh thinking. Orthodoxy will cause stagnation in the field of Quality. Seven Quality 4.0 Tools have already been proposed (Jim Duarte).
- At the same time, the New Age Businesses intimidate users with not just complexity in use, but also with high levels of unreliability – failures, malfunctions, tricky bye lanes. Low 'must-be' qualities – which are justified as the price of early releases
- Similar issues are with biological, materials, transportation and medical technologies

Mary Parker Follett's advice rings out loud: "... not to adapt ourselves to a situation – we are all more necessary to the world than that; neither to mould a situation to our liking – we are all ... too little important for that; but to (make) reciprocal adjustment ... a change in both the situation and ourselves



Quality professionals must embrace the New Age businesses, which must in turn embrace quality management

Quality Manifestos



- 1986: American Society for Quality Control (ASQC) published *The Quality Manifesto*, signed by 25 of its past presidents. 1996: Now called ASQ, manifesto reaffirmed through its endorsement by the ten past presidents of the intervening decade.
- Two parts of the Manifesto a lofty declaration and a call for action directed at government leaders, businesses, labour organizations, educators, professional and trade associations, and individuals, to advance quality as a personal and national priority and set high standards for its delivery

1997: Along with the change in nomenclature from TQC to TQM, JUSE issued a *Manifesto for TQM*. The changes were: address all stakeholders, not just customers; stress leadership and the long-term; and affirm importance of people and information.

China Quality Development Outline 2011-20 is like a manifesto for the development of quality throughout China, with a long-term strategic plan of action.

1997: Juran declared that the 21st Century would become the 'Century of Quality.' In 2004, he wanted a major research effort to develop a manifesto on quality leadership and the means to advance its principles and methods to all people.

Revitalizing the Quality Manifesto, Globally



A new manifesto – is underway – from IAQ

It will stress

the primacy of meeting the needs of customers and society over all other priorities.

Above all it shall emphasize the paramount importance of Doing no harm





... there is an expanding frontier of ignorance.

-Richard Feynman, Physicist

Thank you