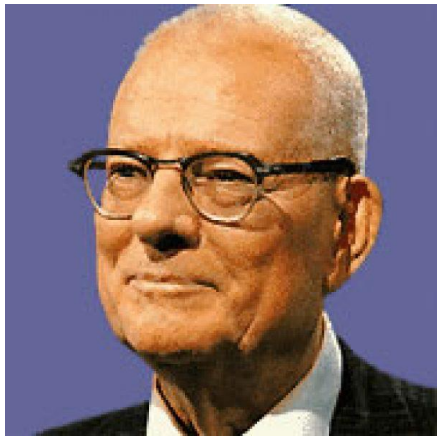
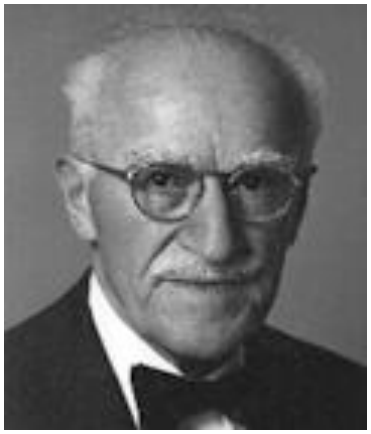
Raising the Bar

Deming and Juran: Impact Past and Present





ASQ Orange Empire
Quality Day
October 27, 2017

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Professor Emeritus, Cal Poly Pomona

We will address the following questions…

- Backgrounds of Deming and Juran and how that impacted their teachings? Impact of Taylor and Shewhart who preceded them.
- Major concepts and teachings of Deming and Juran?
- Are their teachings similar or different? How do they compare?
- Are their teachings still relevant today compared to the last century? Have their ideas evolved?
- How are each guru's teachings being perpetuated?

Unintended Results of Preparing this Presentation

- Much deeper appreciation of Juran's Trilogy
- Realized the strong connection between Juran's teachings and how they were used by Motorola to develop Six Sigma Quality.
- Understanding behind the development of Pareto charts by Juran and strong use by Motorola.
- Belief that understanding and communicating modern quality to management is enhanced by studying the vantage points of both gurus.

Background: Early 1900's - Frederick Taylor

- Father of *Scientific Management*
- Searched for the "*one best way*" to do any operation
- Developed time and motion study
- Believed management and labor should cooperate, people should be treated fairly, and work should be balanced among all workers
- Did not believe workers had the ability to understand scientific management or contribute
- Taylor and his ideas are still widely respected

Taylor's Work with Henry Ford and the River Rouge Plant

- Vertically integrated automobile production from steelmaking to final assembly
- Operated with a fixed cycle time producing one car per cycle.
- No options or accessories so all jobs were repetitive and could be optimized without concern for variation
- Very early example of Lean Manufacturing using Scientific Management

Studying the River Rouge Plant Led in Two Directions

- First source of variation is product variation
- Based on the success of Ford, American and Japanese companies went in two different directions when faced with variation in customer orders:
  - **American companies** – Take common operations off line to economize in manufacturing. Move away from full integration. Worked as long as all competitors did the same. Evolved over decades into huge non-value-added systems filled with waste.
  - **Japanese Companies** – Keep operations fully integrated but give operators flexibility to balance workloads and maintain cycle time. Evolved into Lean Manufacturing.

Traditional American Quality Control

- Started with the inception of mass production and continues today.
- Overriding assumption is that poor quality is the result of people not doing their job
- Quality Strategy:
  - Inspection & repair
  - Punish offenders
  - Reduce inspection error
  - Train and monitor
- Attitude is that improving quality will increase costs (more inspection costs money)
- Acceptance that quality problems will always exist

Common Roots: 1920s - Shewhart developed Statistical Process Control

Walter Shewhart (1981-1967) developed the concepts and tools of Statistical Process Control (SPC) based on statistical theory and sampling.

An essential concept of SPC is recognizing that there are different sources of variation that contribute to overall process variation.

Each type of variation requires different management action.

Deming and Juran both studied under Shewhart and were very active in promoting SPC and management understanding of the basic concepts.

Types of Variation

- Shewhart taught that there are several types of variation. (Note that Six Sigma quality focuses on reducing variation):
  - **Common cause variation** - Built-in random variation in the system. Difficult to reduce without changing the system or process.
  - **Assignable or Special cause variation** - Variation caused by identifiable events usually under control of the work group.
  - **Tampering** - Over adjusting of the process resulting in increased variation.

Common Cause vs. Assignable Cause Variation

- According to Dr. Deming's research, more than 85% of problems are the result of "common cause" variation. Management is responsible for the system and it is their responsibility to work on reducing this type of variation. Later research puts the estimate at over 94%.
- The work group is responsible for preventing and reducing "assignable cause" variation.
- Management needs to understand these concepts.

Major Concept #1: Process Capability (common cause variation)

- The ability of a process to produce within specification limits:
  - Able to produce within specifications – process is "capable"
  - Not able to produce within specifications – "not capable"
- Often quantified with process capability indices:
  - C_p – Ability to stay within specs if centered
  - C_{pk} – Ability based on current process center

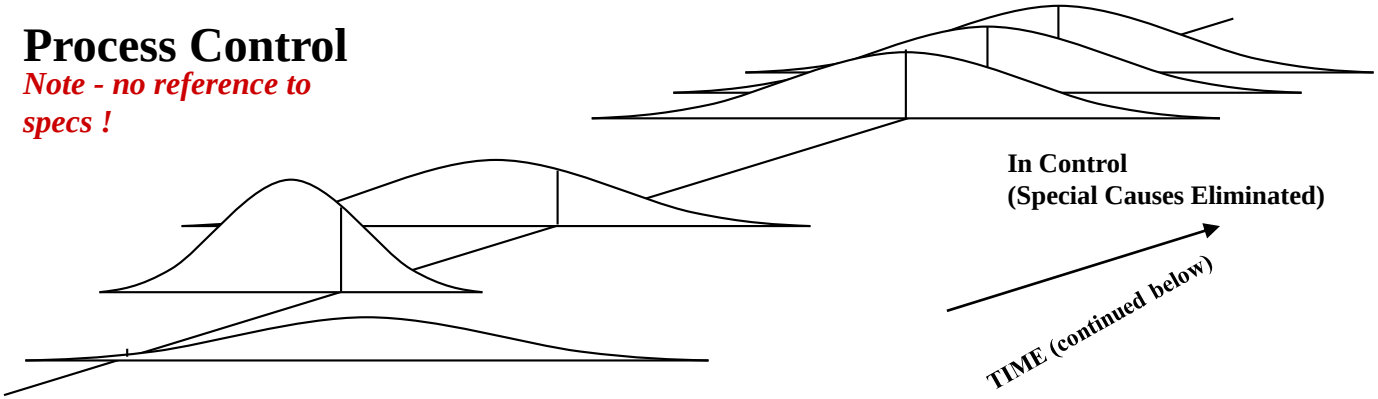
Major Concept #2: Process Control

- Process Control refers to how stable and consistent the process is:
  - "In-control" – stable and only experiencing systematic or *common cause* variation.
  - "Not in-control" – Process is not stable. Mean and variation are changing due to identifiable or *special causes* (usually controllable by those running the operation, sometimes called *assignable cause*).
- Special cause variation represents <10% of the problems

Process Capability

Process Control

Note - no reference to specs !

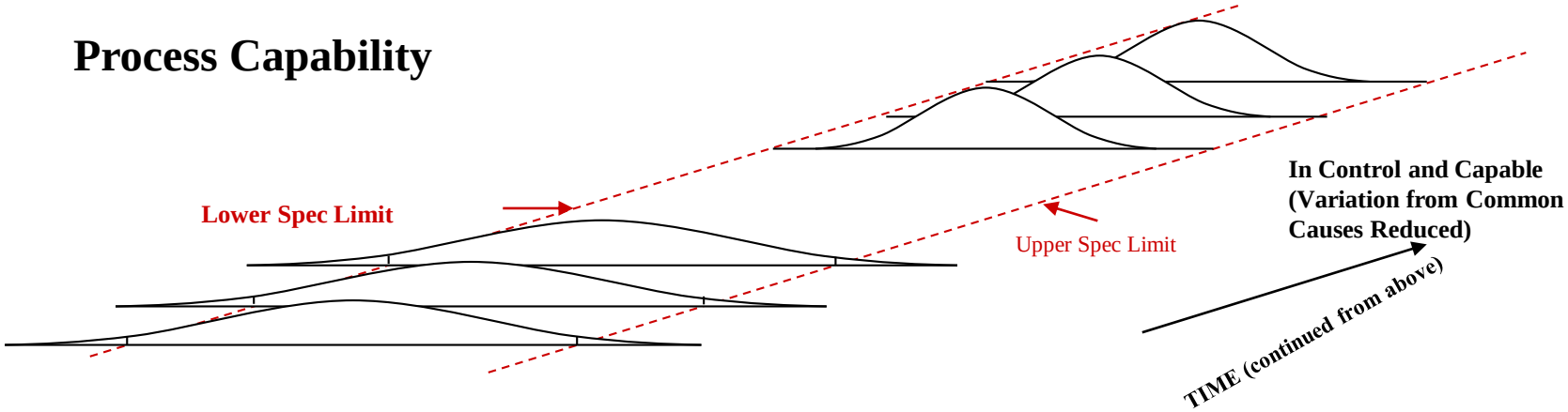


In Control
(Special Causes Eliminated)

TIME (continued below)

Out of Control
(Special Causes Present)

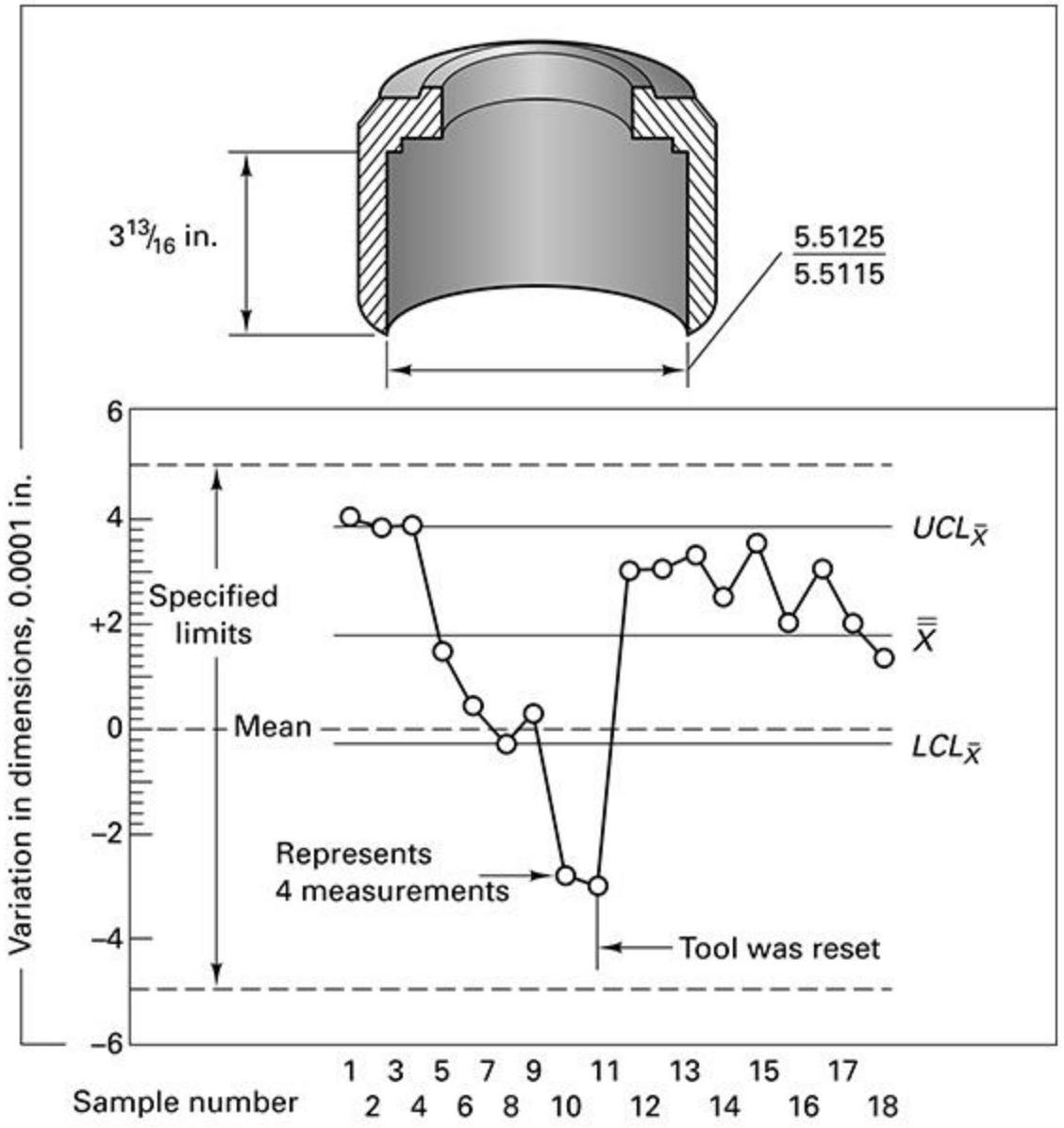
Process Capability



In Control and Capable
(Variation from Common Causes Reduced)

TIME (continued from above)

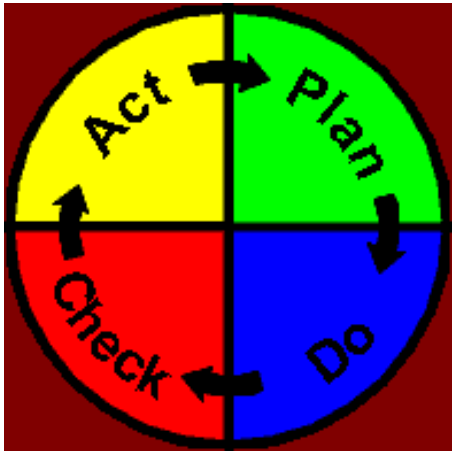
In Control but not Capable
(Variation from Common Causes Excessive)

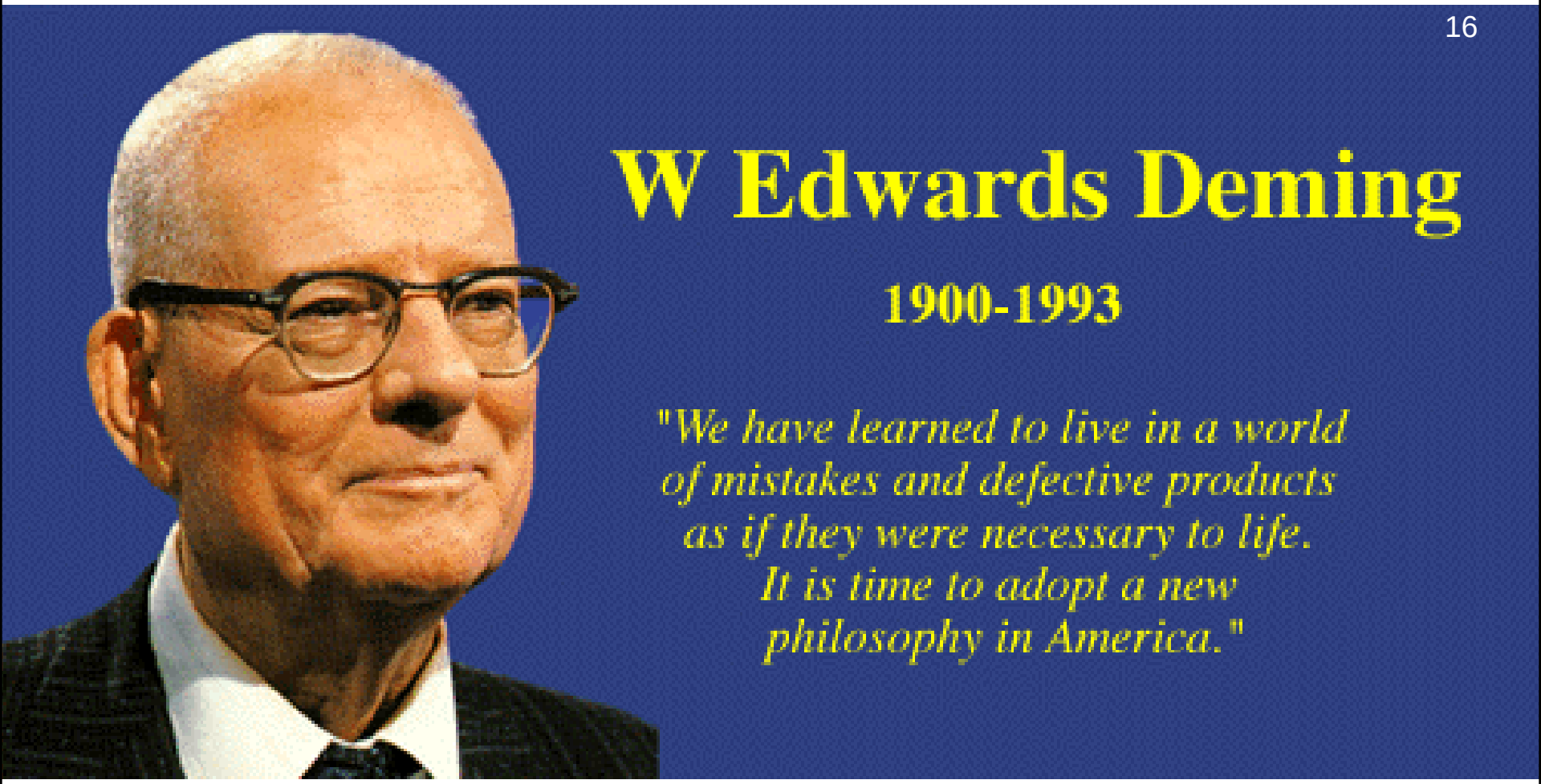

$3^{13}/_{16}$ in.
5.5125
5.5115
Variation in dimensions, 0.0001 in.
6
4
+2
0
−2
−4
−6
Specified limits
Mean
$UCL_{\bar{x}}$
$\bar{\bar{x}}$
$LCL_{\bar{x}}$
Represents 4 measurements
Tool was reset
Sample number
1 3 5 7 9 11 13 15 17
2 4 6 8 10 12 14 16 18

PDCA Cycle

Shewhart Cycle was especially useful in solving quality problems. The PDCA Cycle denotes continuous improvement by repeating the basic cycle of:

- Plan -- Analyze the problem
- Do It -- Get the data
- Check – Measure and study the change
- Act -- Modify as needed





Dr. W. Edwards Deming Is known as the Father of the Japanese Post-war Industrial revival and was regarded by many as the leading quality guru in the United States.

Dr. W. Edwards Deming Milestones

- Born October 14, 1900 – Sioux City, Iowa
- Died December 20, 1993 (aged 93) Washington, D.C.
- Alma maters:
  - University of Wyoming, BS Electrical Engineering (1921)
  - University of Colorado, MS Statistics (1925)
  - Yale University PhD Statistics & Statistical Physics (1928)

Dr. W. Edwards Deming Milestones

- In addition to his other education, Dr. Deming studied under Walter Shewhart.
- Dr. Deming worked with census data for the U.S. Government.
- During WWII he was asked to implement SPC and Acceptance Sampling for the defense industry.
- After WWII American management went back to their former inspection-based methods.

Reviving Japan

Deming was invited to Japan around 1950 by Japanese industrial leaders and engineers.

He guided them on how to implement quality control.

Awarded Second Order of the Sacred Treasure

Japanese scientists and engineers named the famed Deming Prize after him.

Out of the Crisis

- Due to popular demand Deming conducted an intensive four-day seminar for managers and educators across the country
- Deming's first book expounded on some of these concepts as well titled: *The New Economics (1984, 2000)*
- Deming published an explanation of his philosophies and concepts for managers in 1986 in his book: *Out of the Crisis*

Deming's 14 points

- The 14 points are the basis for transformation of American industry.
- Not simply a matter of solving problems
- Management is responsible for creating the culture and improving the systems they operate with.
- The 14 points apply anywhere, to small organizations as well as to large ones, to service industries as well as to manufacturing.

Deming's *14 Points for Management*

1. Create constancy of purpose
2. Adopt philosophy of prevention
3. Cease mass inspection
4. Select a few suppliers based on quality
5. Constantly improve system and workers
6. Institute worker training
7. Instill leadership among supervisors
8. Eliminate fear among employees
9. Eliminate barriers between departments
10. Eliminate slogans
11. Remove numerical quotas
12. Enhance worker pride
13. Institute vigorous training
14. Take action

Deming's *Seven Deadly Diseases of Management*

- Lack of constancy of purpose
- Emphasis on short-term profits
- Evaluation by performance, merit rating, or annual review of performance
- Mobility of management
- Running a company on visible figures alone
- Excessive medical costs
- Excessive costs of warranty, fueled by lawyers who work for contingency fees

Deming's System of Profound Knowledge

- Deming advocated that all managers need to have what he called a System of Profound Knowledge, consisting of four parts:
  - ***Appreciation of a system***: understanding the overall processes involving suppliers, producers, and customers (or recipients) of goods and services.
  - ***Knowledge of variation***: the range and causes of variation in quality, and use of statistical sampling in measurements.
  - ***Theory of knowledge***: the concepts explaining knowledge and the limits of what can be known.
  - ***Knowledge of psychology***: concepts of human nature.

"*The transformation will take us into a new method of reward. We must restore the individual, and do so in the complexities of interaction with the rest of the world. The transformation will release the power of human resource contained in intrinsic motivation. In place of competition for high rating, high grades, to be Number One, there will be cooperation on problems of common interest between people, divisions, companies, competitors, governments, countries. The result will in time be greater innovation, applied science, technology, expansion of market, greater service, greater material reward for everyone. There will be joy in work, joy in learning. Anyone that enjoys his work is a pleasure to work with. Everyone will win; no losers.*"

W. Edwards Deming, *The New Economics for Industry, Government, Education*

Dr. Joseph M. Juran (1904-2008)

- Joseph Moses Juran was a Romanian-born American engineer and management consultant. He is principally remembered as an evangelist for quality and quality management having written several influential books on those subjects.
- Juran believed quality is associated with customer satisfaction and dissatisfaction with the product, and emphasised the necessity for ongoing quality improvement through a succession of small improvement projects carried out throughout the organisation

Joseph M. Juran Milestones

- **1904:** Born December 24, in Romania
- **1920:** Graduated from Minneapolis South High School
- **1924:** Degree in electrical engineering from the University of Minnesota
- **1935:** Master's degree in Law (LL.M.)
- **1937:** Head of Industrial Engineering at Western Electric

Joseph M. Juran Milestones

- **1937:** Dr. Juran creates the "Pareto Principle," also known as the 80-20 principle, to help separate the "vital few" from the "useful many" in their activities.
- **1945:** Dr. Juran is invited by General MacArthur to train Japanese leaders following World War II.
- **1951: P**ublishes the first standard reference work on quality management, the Quality Control Handbook.
- **1954:** Dr. Juran visits Japan and introduces the managerial aspect of quality to the country's top executives.

Joseph M. Juran Milestones (cont'd)

- **1964: P**ublishes *Managerial Breakthrough* – One of the foundations for Lean and Six Sigma today.
- **1970:** Dr. Juran gains guru status as his expertise is used to combat quality crisis issues in the private sector.
- **1979:** Dr. Juran founds Juran Institute
- **1986:** The Juran Trilogy® is published and accepted worldwide as the basis for quality management.
- **2008:** Dr. Juran passes away at age 103 after laying the foundation for modern quality control.

Books by Joseph M. Juran

- *Quality Control Handbook, McGraw-Hill, 1951*
- Eventually published in six editions. *Managerial Breakthrough, McGraw-Hill, 1964*
- *Management of Quality Control. 1967*
- *Quality Planning and Analysis, McGraw-Hill, 1970*
- *Upper Management and Quality, 1980*
- *Juran on Planning for Quality, The Free Press, 1988*

Juran's Definition of Quality

- Quality means those features of products which meet customer needs and thereby provide customer satisfaction (Fitness for Use)
- Quality means freedom from deficiencies—freedom from errors that require doing work over again (rework) or that result in field failures, customer dissatisfaction, customer claims, and so on. In this sense, the meaning of quality is oriented to costs, and higher quality usually costs less

Juran

- "It is most important that top management be quality-minded. In the absence of sincere manifestation of interest at the top, little will happen below."
  — Joseph M. Juran

How To Manage For Quality: The Juran Trilogy

- To attain quality begin by establishing the "vision" for the organization, along with policies and goals
- Makes extensive use of three managerial processes:
  - Quality Planning
  - Quality Control
  - Quality Improvement
- Juran's Trilogy shows how an organization can improve every aspect and business results by better understanding of the relationship between processes that plan, control and improve quality.

Quality Planning

- Establish quality goals
- Identify who the customers are
- Determine the needs of the customers
- Develop product features that respond to customer's needs
- Develop processes able to produce the product features
- Establish process controls; transfer the plans to the operating forces

Quality Control

- Evaluate actual performance
- Compare actual performance with quality goals
- Act on the difference

Quality Improvement

- Prove the need and establish the infrastructure
- Identify the improvement projects
- Establish project teams
- Provide the teams with resources, training, and motivation to:
  - Diagnose the causes Stimulate remedies
  - Establish controls to hold the gains

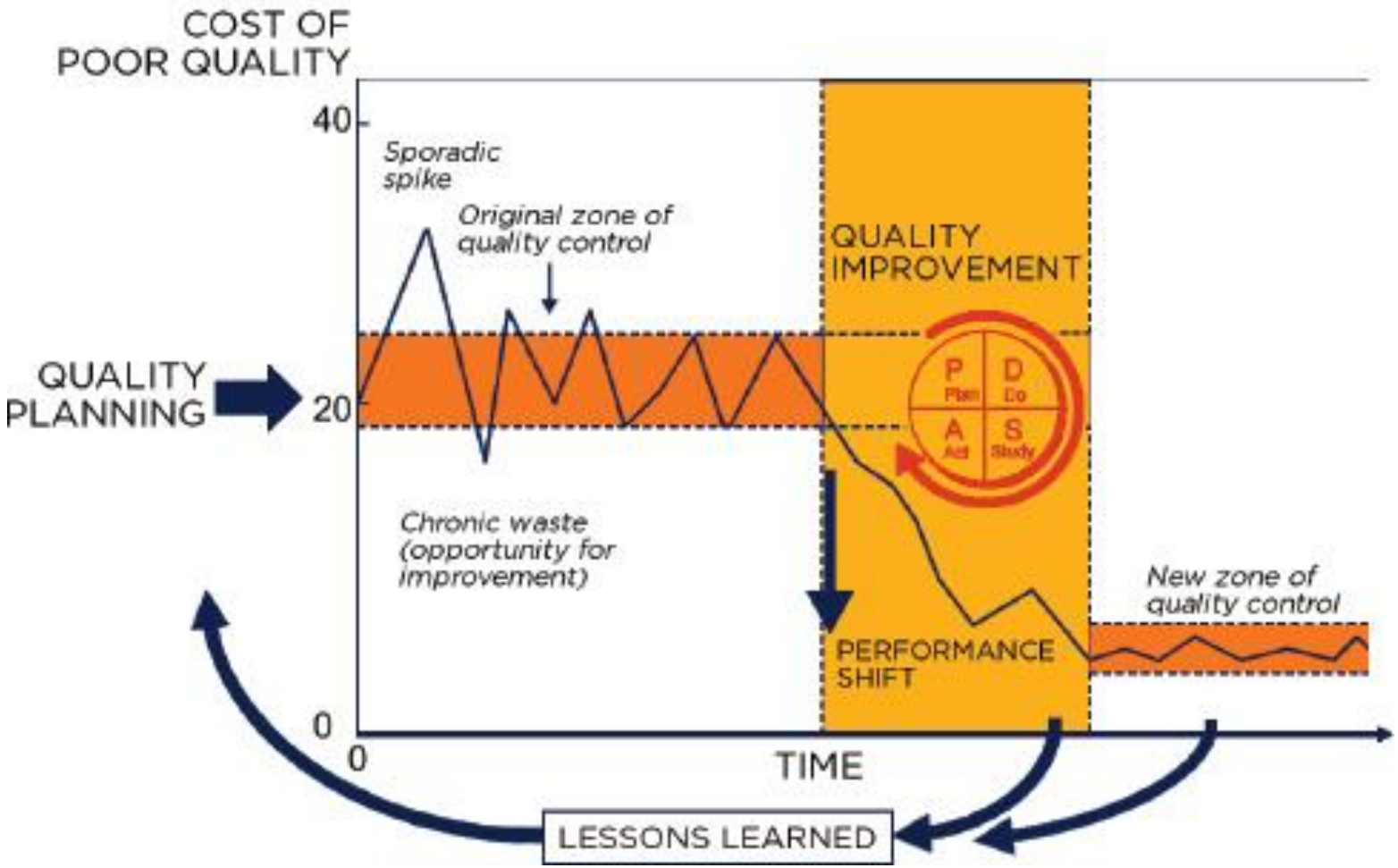
Breakthrough & Control

- Two diverse but interrelated things managers need to understand.
  - Control is performance to a standard, holding gains, eliminating flare ups, fire-fighting, holding-the-line, and getting back on target.
  - Breakthrough refers to drives, campaigns, programs and breakouts designed to take a process to a whole new level of performance.
- The organization goes through alternating phases of breaktrough and control to achieve long term results.

Breakthrough

- Breakthrough in Attitude
- Pareto Analysis
- Organization of Steering and Diagnostic Arms
- Breakthrough in Knowledge - Diagnosis
- Breakthrough in Cultural Patterns
- Breakthrough in Results

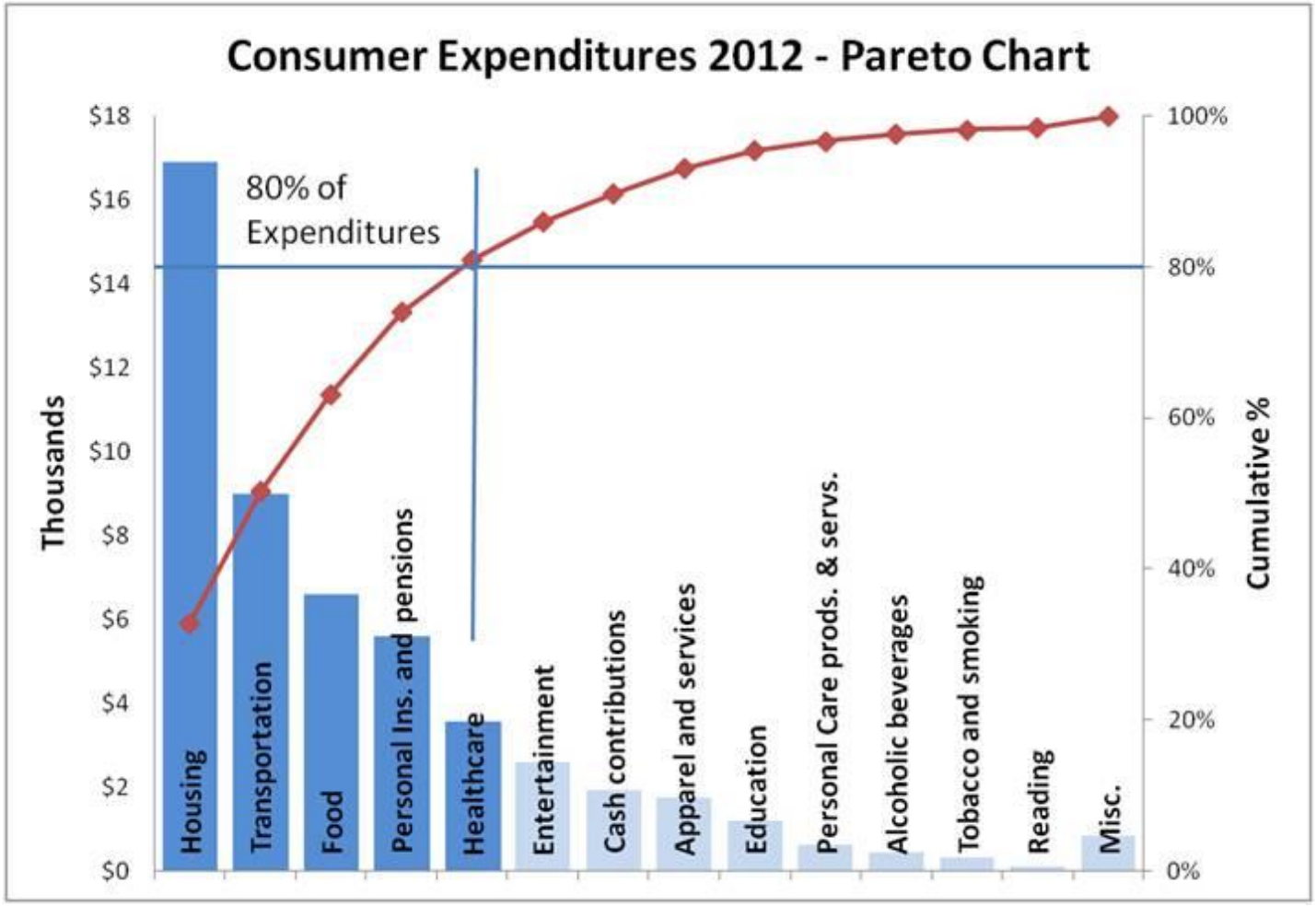
The Juran Trilogy



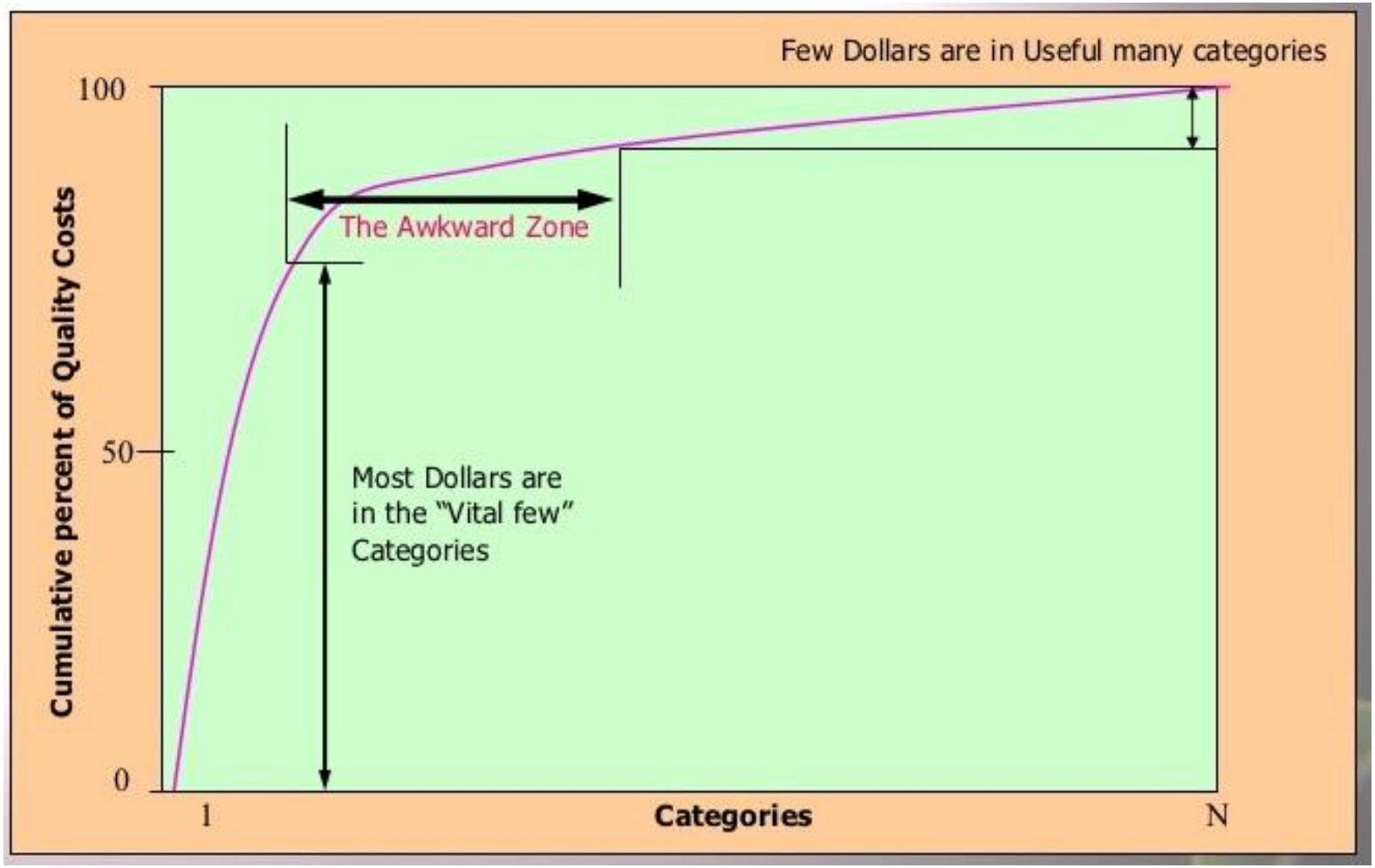
Diagnostic Arms

Breakthrough needed:	Diagnostic arm:
New markets	Market Research
New processes	Process Research
Manufacturing Cost	Industrial Engineering
Improvement in product quality	Quality Control Engineering
New Products	Product R&D

Pareto Analysis



Pareto Analysis



Strength of Juran's Trilogy

- The methodology searches for continuous improvement of quality in every aspects of the organization.
- The methodology illustrates the use different quality tools to cover the steps of Juran's Trilogy. It creates a better understanding of the relationships of every stage of the company
- The methodology is well structured and allows the companies that implement it, an easy understanding and application.

Comparison of Deming & Juran Teachings (Dr. Arnold Goodman)

Deming	Comparison	Juran
Be constant in purpose	D: Transformed quality control into improvement & strategy J: Transformed quality control into management & design	Define goals
Understand customers (implied)	D: Quality is satisfaction of customer requirements J: Quality is among the most productive of competitive weapons	Identify customers
Accept new challenges	D: What could be revolutionary if done? J: Quality is “fitness for use”	Determine requirements
Go quality over price	D: Quality journals help to define and solve quality problems J: “Customer progress spirals” facilitate customer improvement	Develop features

Comparison of Deming & Juran Teachings (Dr. Arnold Goodman)

Deming	Comparison	Juran
Be better always	D: Become and stay competitive to create and keep customers and jobs J: Quality measures and improves services as well as products	Generate processes
Don't depend on inspection	D: Replace inspection with teamwork to construct quality in J: Quality processes are designed & managed	Establish controls
Lead… don't boss	D: Eliminate special causes, miminize process variation & then foolproof J: Generalized the 80-20 rule and named it after Pareto	Focus upon the Vital Few
Cooperate over the organizatio n	D: Avoid short term thinking and managing J: Control prevents bad change and breakthrough creates good change	Breakthrough new attitudes

Comparison of Deming & Juran Teachings (Dr. Arnold Goodman)

Deming	Comparison	Juran
Eradicate quotas	D: Unrealistic tasks & schedules frequently produce misleading results J: Quality implements the vision of the organization	Mobilize for improvement
Eliminate slogans	D: Reduce impediments from artificial sayings and arbitrary objectives J: Quality generates income in addition to cost	Diagnose for improvement
Promote all pride	D: Reward the quality of work in addition to the quantity of work J: “Criticality analysis” aids quality improvement	Steer toward improvement
Train on the job	D: Plan--Do--Study--Act J: Motivating people to change behavior will lead them to change attitude	Breaktrough knowledge

Comparison of Deming & Juran Teachings (Dr. Arnold Goodman)

Deming	Comparison	Juran
Erase fears	D: Translate fear in the workplace into a joy of doing and calmness in being J: Quality need to manage the politics of desired cultural change	Overcome any resistance
Improve oneself	D: Statisticians have a broader role in quality than statistical analysis J: Anticipation and preparation are the parents of timing	Breakthrough performance
Transform everybody	D: Profound knowledge J: Quality will be in the 21st century what productivity was to the 20th century	Transition to new levels

Deming Quality Structure

- Customer-oriented statistician who made quality control into improvement
  - Be constant in purpose
  - Understand customers
  - Accept new challenges
  - Go quality over price
  - Be better always
  - Don’t depend on inspection

Deming Quality Structure

- From tactics to teamwork
  - Lead…don't boss
  - Cooperate over organizations
- From teamwork to treatment
  - Eradicate quotas
  - Eliminate slogans
  - Promote pride
  - Train on the job
  - Erase fears

Deming Quality Structure

- From treatment to transformation
  - Improve oneself
  - Transform everybody

Juran Quality Structure

- Management-oriented engineer who made quality control into management
  - Define goals
  - Identify customers
  - Determine requirements
  - Develop features
- From planning to developing
  - Generate processes
  - Establish controls

Juran Quality Structure

- From developing to evaluating
  - Focus on the Vital Few
  - Breakthrough new attitudes
- From evaluating to organizing
  - Mobilize for improvement
  - Diagnose for improvement
  - Steer toward improvement

Juran Quality Structure

- From organizing to performing
  - Breakthrough knowledge
  - Overcome any resistance
  - Breakthrough performance
  - Transition to new levels

Are Deming and Juran's teachings still relevant today compared to the last century?

Have their ideas evolved?

Modern Quality Management

- Underlying premise is that over 90% of quality problems result from problems with manufacturing and service systems—not human error.
- Emphasis is on finding and permanently fixing system problems. Thus problems go away permanently.
- Quality is the responsibility of everyone in the organization.
- Team problem solving is necessary to fix systems.
- Know *internal* and *external* customers and constantly work on customer satisfaction.
- Redesign systems with quality and customer needs in mind.

Level of Quality System Implementation (Hayes)

1	No quality system
2	Realization of the need to change
3	In the process of developing a top down policy/strategy
4	Quality system in place to react to customer needs
5	Proactive quality system in place to prevent quality problems
6	Fully integrated customer-focused quality system

Senge's Mental Models of Quality
(From: *The Fifth Discipline*)

1	**None**	Status quo – "We hire good people and have competitive products."
2	**Realization**	
3	**Strategy**	Quality control – "We 100% inspect and only send good products to our customers."
4	**Customer**	Customer Service – "We have an 800 number and correct problems right away."
5	**Proactive**	Process Improvement – "We use SPC and teams to constantly improve how we operate"
6	**Integrated**	Total Quality – "We operate a seamless, value-adding system which incorporates quality control, customer service, process improvement and design, and supplier relationships."

Leadership Theory

1	**None**	**Transactional Leadership** (Frederick Taylor) – Hierarchical management with focus on individual performance, how work is done, and problem solving. Incremental improvements in work methods and productivity. Non-threatening.
2	**Realization**	
3	**Strategy**	
4	**Customer**	**Transformational Leadership** (Deming, Juran, Senge, and others)– Emphasis on empowerment and how people think about work. System thinking, team learning, and major culture change. Policy Deployment.
5	**Proactive**	
6	**Integrated**	

Leadership Roadmap

1	**None**	**Realization Phase** – Leadership transformation. Training on values, communications. Basic tools. "Low hanging fruit". Build Trust. Shift emphasis away from targets.
2	**Realization**	
3	**Strategy**	**Transition Phase** – Strategic planning & systems thinking. Department level teams. Quality tools. Int/Ext customer focus.
4	**Customer**	
5	**Proactive**	**Performance Phase** – Alignment. Empowerment. Process improvement. High performance teams. Variation reduction tools. Redesign.
6	**Integrated**	

The Essence of Transformational Leadership

- Transformational Leadership is about changing the focus from work and problems, to helping others…helping the system
- Job of leaders and teachers is to help others learn and grow. If they learn and grow they will understand. Then they will find better ways serve their co-workers, customers, and society and stay in business while contributing to society.
- The transformational change process requires leadership that understands how to move the organization from one stage to the next

Emotional Leadership

- Refers to a leader that has “emotional intelligence” (EI), a phrase made popular by Daniel Goleman. Goleman’s ideas center around these qualities:
  - **Self-awareness** — the ability to read one's emotions and recognize their impact while using gut feelings to guide decisions.
  - **Self-management** — involves controlling one's emotions and impulses and adapting to changing circumstances.
  - **Social awareness** — the ability to sense, understand, and react to others' emotions while comprehending social networks.
  - **Relationship management** - the ability to inspire, influence, and develop others while managing conflict.

A Closer Look at Level 6?

- Can get through Level 5 by fixing and improving existing systems.
- Level 6 may require major redesign & reorganization

Level 6 Thinking

- Tapping into larger body of knowledge, innovation, creativity
  - TRIZ, Six Hat Thinking, Scenarios
- Enterprise Thinking
- Policy Deployment
- Robust Technology
- Coaching & Mentoring

Level 6 & Senge

- Tapping into larger body of knowledge, innovation, creativity (Team Learning)
  - TRIZ, Six Hat Thinking, Scenarios
- Enterprise Thinking (Systems Thinking)
- Policy Deployment (Shared Vision)
- Robust Technology (Mental Models)
- Coaching & Mentoring (Personal Mastery)

The W. Edwards Deming Institute

- Founded in1993, in Washington, D.C., where the Deming Collection at the U.S. Library of Congress includes an extensive audiotape and videotape archive.
- The aim of the Institute is to "Enrich society through the Deming philosophy."
- Vision is for the System of Profound Knowledge® to be the standard lens people use to understand and improve the world.

"*The transformation will take us into a new method of reward. We must restore the individual, and do so in the complexities of interaction with the rest of the world. The transformation will release the power of human resource contained in intrinsic motivation. In place of competition for high rating, high grades, to be Number One, there will be cooperation on problems of common interest between people, divisions, companies, competitors, governments, countries. The result will in time be greater innovation, applied science, technology, expansion of market, greater service, greater material reward for everyone. There will be joy in work, joy in learning. Anyone that enjoys his work is a pleasure to work with. Everyone will win; no losers.*"

W. Edwards Deming, *The New Economics for Industry, Government, Education*

Juran
Corporate Headquarters, Southington CT

- In 1979, Juran founded The Juran Institute, whose mission is to "Create a global community of practice to empower organizations and people to push beyond their limits."
- Top management involvement, the Pareto principle, the need for widespread training in quality, the definition of quality as fitness for use, the project-by-project approach to quality improvement. These are the ideas for which Juran was best known, and they are still widely used today.

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