Juran & Deming

Some personal reflections on the work of Dr J M Juran, in the light of studying the work of Dr W Edwards Deming.

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This paper describes some of the concepts central to the work of Dr J M Juran, and looks at them from the perspective of the work of Dr W Edwards Deming. It then draws some interim conclusions about differences and similarities in the two authors.

The paper is in no way exhaustive, and concentrates on the Juran concepts that I have found useful in my work.

1. The Juran Trilogy

For me, the essence of the work of Dr Juran is "The Juran Trilogy"

- Quality Control
- Quality Improvement
- Quality Planning

The "Juran Trilogy"
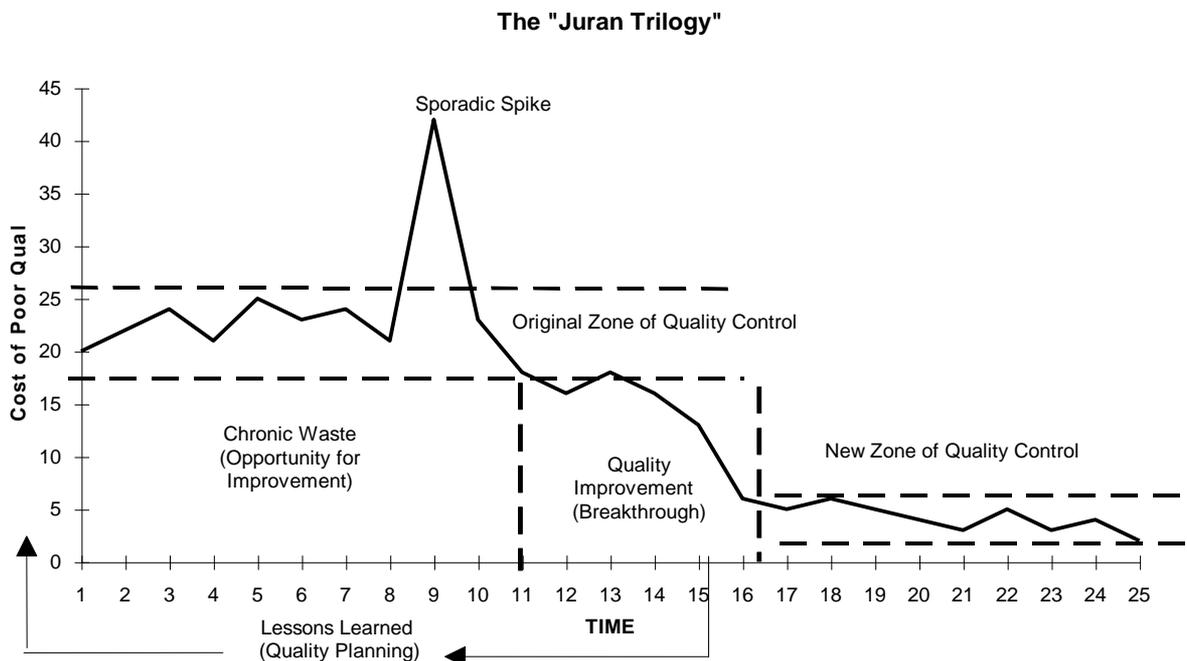
1.1 Description

Quality Control sees the people in the enterprise working with the process as provided and doing what they can to prevent things getting worse. They are equipped to deal with *sporadic spikes* in production (this might be described as *firefighting*), but do not generally have the ability to deal with underlying inefficiencies in the process as designed. Such underlying inefficiencies Juran calls *chronic waste*.

Quality Improvement is where managers begin to organise to attack the chronic waste. It requires managers to take a new view of the world and regard the chronic waste not as inevitable, but as an opportunity for improvement.

Quality Planning is the activity of establishing quality goals and developing products and processes to meet those goals. These goals may apply to the features required to meet customer needs or they may apply to making these products and processes free from all deficiencies.

Conceptually, planning precedes control and improvement; indeed, before a process exists Quality Planning is the discipline that is used to decide what is going to happen in the first place. My experience is of organisations that have previously understand "Quality" as being "Quality Control", and enter the "Trilogy" via Quality Improvement and the Improvement Project.

1.2   Common and Special Causes, and the Taguchi Loss Function

The Juran Trilogy is a very powerful conceptual diagram. On the surface, it appears to have much in common with Deming's special and common causes of variation. Sporadic spikes relate to special causes, so people react to bring the process back within the original zone of control. The "zone of control" gives conceptually the notion of process capability, or the extent of common cause variation present in a system.

Additionally, the Trilogy has conceptual issues in common with the Taguchi loss function. The loss function says that the more process output falls away from the nominal aim of a system, the greater the loss incurred by society. Sometimes Juran uses "Performance, Good to Bad" as the vertical axis of the Trilogy diagram; sometimes he uses "Cost of Poor Quality". Either way, Juran is saying that the more performance moves from "good" to "bad", the more chronic loss is built into the system.

Deming says on page 217 of The New Economics
> *"Use of a loss function is restricted to the realm of losses that are measurable....... The most important use of a loss function is to help us change from a world of specifications to a continual reduction of variation about the target, through improvement of processes"*

The real power for the loss function for me, therefore, is conceptual. This goes, too, for the Trilogy, and one might say:
> "The most important use of the Trilogy diagram is to help us change from a world that regards poor performance as inevitable, to a structured approach to quality improvement - getting performance toward the nominal ideal."

It is this structured approach to quality improvement that Juran calls "Project-by-Project Improvement".

Thus Juran is trying to draw attention to the "Heavy Losses" incurred by companies not effectively managing the systems they are charged with leading.

2.   Appreciation of a System

Deming quotes Juran a number of times in "Out of the Crisis". On page 134 Deming credits Juran with his insight about the need for working on the system

> *"It was Dr Juran who pointed out long ago that most of the possibilities for improvement lie in action on the system, and that contributions of production workers are severely limited".*

In looking at the reasons behind poor performance of a system, Juran categorises these as "Management-Controllable and Operator-Controllable Errors".

2.1 Management-Controllable   and   Operator-Controllable Errors.

Juran considers defects to be "Operator-Controllable" if workers have working arrangements that enables them to meet quality standards. This means they must have:
- A means of knowing what is expected of them
- A means of knowing what is their actual performance
- The means for regulating their output, to reach conformance.

If any of these criteria have not been met, Juran concludes that management's job is not complete, and the resulting defects are "management-controllable". Many managers believe that the bulk of defects are operator-controllable, but Juran's research (and that of others) shows the split of defects are:
- Management controllable - over 80%
- Operator controllable   - under 20%

If the project shows that the defects lie within the domain "management-controllable" then the diagnostic journey involves examining the system, the processes, the methods, the policies, the equipment, the materials - things that only management can change.

Deming, said (on page 315 of "Out of the Crisis")
> *"I should estimate that in my experience most troubles and most possibilities for improvement add up to proportions something like this:*
> *94% belong to the system (responsibility of management)*
> *6% special"*

Subsequently he revised these figures to 98% and 2%.

The underlying principle of what Deming and Juran are saying here is identical. The reason for the disparity in the figures becomes apparent when one examines what Juran describes as "Operator-Controllable".

2.2   Operator-Controllable errors.

Juran makes the point:
 "If the managers have met the criteria, then the means for doing good work are clearly within the hands of the operators."

So why isn't this always the case? Juran dismisses as a fallacy the "Zero defects movement" that assumed that all human error could be abolished if proper motivation were applied. For instance, golfers don't always hit par, but no-one could accuse them of lacking motivation!

Juran categorises Operator-Controllable errors thus:
- Inadvertent errors
- Technique errors
- Wilful errors.

Inadvertent errors come from workers' inability to maintain attention. The errors are unintentional, unwitting, and unpredictable (they exhibit randomness). The bulk of remedies lie in foolproofing the system.

Technique errors arise because the worker lacks some essential technique, skill, or knowledge needed to prevent the error from happening. They are typically unintentional, specific, consistent, and unavoidable. Remedies here often require the discovery (using the diagnostic techniques) of differences of technique, which represent the beneficial "knack" that produces superior results, and then training others or changing the process to embody the better method.

With both inadvertent errors and technique errors, usually workers cannot find the reasons for defects themselves, and therefore they will keep on doing what they have been doing. Hence they will keep on producing defects. **This will go on until they get the help they need from management.**

Wilful errors are witting, intentional, and persistent. Juran says that some will come from anti-social elements whose actions will not be defended even by fellow employees and unions. **Even so, many seemingly wilful errors are still the fault of management**; e.g. shifting priorities of delivery versus quality; workers hiding scrap because managers are using scrap figures to blame; posting production scores and not quality scores; shipping non-conforming product even after quarantining; exhortation campaigns causing cynicism.

Thus, apart from the "anti-social category" mentioned above, Juran's remedies here are again to do with management of the system and the style of leadership. **So even for Operator-Controllable errors, improvement will only come from management working on the system.**

3. Quality Leadership

3.1 Management's responsibility.

At the commencement of his video series on Quality Improvement Juran states for managers:

"Our objective is to develop the *habit* of making *annual* improvements in quality and *annual* reductions in quality-related costs."

Juran speaks against so-called quality campaigns based on exhortation. They do not identify the specific projects to be tackled, establish no clear responsibility for taking the necessary actions, no structured process for "how to go from here to there". "There is little substance behind the exhortation". "What we need are leaders, not cheerleaders".

He states the lesson is to put the emphasis on the results to be achieved. The formula for getting results is to:
- Establish specific goals to be achieved
- Establish plans for reaching the goals
- Assign clear responsibility for meeting the goals
- Base the rewards on results achieved.

Some examples given by Juran of strategic corporate goals for Quality;
"On-time arrivals must attain a level of 80% by the end of next year (an airline)"
"Any new model of product must have a level of reliability at least as high as the model it replaces"
"During the next calendar year we should create opportunities for workers to participate actively in quality matters"

Such goals should be "optimal as to overall results". Goals that suboptimise performance of various activities can easily damage overall performance. The optimum quality goal is to:
- Meet the needs of customer and supplier alike
- Minimise their combined costs

There are some dangers here, of course. Numerical goals such as on-time arrivals makes one look at Deming's Point 11b from "Out of the Crisis" "*Eliminate numerical goals for people in management".*
> *"...Management by numerical goal is an attempt to manage without knowledge of what to do, and in fact is usually management by fear"* (Page 76)
> *"Internal goals set in the management of a company, without a method, are a burlesque"* (Page 75).

Juran above takes management's responsibility beyond making the goals, to the need for plans to achieve them - to design a method.

Also Deming says

"The only number that is permissible for a manager to dangle in front of his people is a plain statement of fact with respect to survival. Example: Unless our sales improve 10% next year, we shall be out of business."

Maybe such a "Fact of Life" applied to the airline, too?

Juran here is also speaking of the need to optimise the system "as to overall results". To "Meet the needs of customer and supplier alike". He doesn't speak explicitly of the "Aim of a System", but Deming says on page 51 of "The New Economics"

"The aim proposed here for any organisation is for everybody to gain-stockholders, employees, suppliers, customers, community, - over the long term".

On the surface, Deming is saying that a system should be optimised with respect to a wider range of players, but Juran's "operational definition" of customers in "Juran on Planning for Quality" includes "consumers, the workforce, managers and professionals, merchants, and the public.

Perhaps the greatest danger relates to "Base the rewards on results achieved". Juran says, "that one should revise the merit rating system so that it stimulates managers to accept the new quality goals". Deming's words on merit pay are well debated: how does Juran's simple remark on merit rating does not appear to square with his seeming understanding of the need to optimise a system!

So what guidance does Juran offer on plans for meeting the quality goals?

3.2   Project-by-Project Improvement

Organisations have become accustomed to "managing the sporadic spikes". Without the sort of conceptual chart represented by the Trilogy, managers have believed that good practice is to react to the sporadic spike and get performance back to what is "normal". They have become detached from the "Alarm Signals" which indicate the true levels of chronic waste. The Trilogy begins to open eyes to the fact that sporadic spikes are not the only loss in a given level of performance. Underlying any level of performance is a level of chronic waste where opportunities for improvement lie.

In Dr Juran's experience "All improvement takes place Project-by-Project and in no other way", where a *Project* is a "*Problem scheduled for solution*", and all projects follow the "Universal Sequence for Breakthrough"

3.3   Universal Sequence for Breakthrough.

Juran defines breakthrough as:
"*The organised creation of beneficial change*"
 and has observed that all breakthrough follows a universal pattern:

- Proof of the need
- Project Identification
- Organisation to guide each project
- Organisation for diagnosis - for analysis of projects
- Diagnosis - breakthrough in knowledge
- Remedial Action on the findings
- Breakthrough in cultural resistance to change
- Control at the new level

3.4   Cost of Poor Quality

Sometimes Juran uses "Cost of Poor Quality" as the vertical axis of the Trilogy. Sometimes he uses "Performance". Either way he is trying to draw attention to the "Heavy Losses" incurred by companies not effectively managing the systems they are charged with leading.

Juran's use of "COPQ" immediately raises the "dangers of managing by visible figures alone" and that "the most important figures for management are unknown and unknowable".

If we examine Juran's use of this concept, however, it is exclusively in the "Proof of the need" and "Project Identification" stages of the "Universal Sequence for Breakthrough". How to draw managers' attention to a quality improvement project when they are so busy living with "business as usual" that they have learnt to endure the levels of chronic waste?

He suggests using a relatively quick "estimating" approach to assessing Costs of Poor Quality (and **not** to establish, for instance, Cost of Poor Quality reporting systems). The aim is to "Bring the Chronic troubles out of their hiding places and convert them into alarm signals".

3.5   Project Identification.
The Pareto Principle: the Vital Few and the Useful Many.

Juran applied the name of Vilfredo Pareto to a principle which applies widely across business (and nature); the "80/20" rule. It helps enterprises to focus efforts to have greatest effect. In Quality Improvement the enterprise can seek to separate the "Vital Few" projects from the "Useful Many", and address them appropriately. The vital few projects are generally inter-departmental in nature, and become the responsibility of management to address. For the useful many, Juran says, "Only the employee body has the time and volume of ingenuity needed to deal with these individually".

The Pareto Principle is a universal sorter of the Vital Few and the Useful Many. Cost Of Poor Quality is but one of the criteria. Other strategic issues might be sorted by time, by defects, by operating cost, by customer satisfaction, and many more. Whatever the criteria, though, management has to organise to tackle the vital few projects that will make the most significant impact, and also create the climate and mechanisms for employees to tackle the useful many.

(Again, problems of "managing on visible figures alone arise". Juran says, however, "But lots of things can't be counted - morale, good will, friction, etc. What do we do when we lack the numbers?" He gives some examples of how to isolate the vital few when the numbers are not known - for instance "What stands between us and improved marketing of our line?")

In seeking solutions for the Vital Few projects, Juran notes two journeys
- from symptom to cause - the diagnostic journey
- the cause to remedy - the remedial journey.

These are separated because they are made (in Juran's view) by different people with different skills. The easy journey is from cause to remedy because responsibility is clear; once the cause is known it becomes evident which department should provide a remedy. The difficult journey is that from symptom to cause; responsibility for diagnosis is vague, and the diagnostic skills are not readily available. Management has to create the responsibility for diagnosis- no-one else has the capability of doing this.

3.6   Organisation to guide each project

In many organisations, managers will form themselves into a body called "The Quality Council" who will consider the vital few projects and select teams of people tasked to carry out the diagnostic journey. "The diagnosticians chosen can be any persons who have the time and skills needed to perform the essential diagnosis"

But this must be led from the top, because "no-one else in the organisation can make this happen".

In "Juran on Quality Leadership" Juran advocates the establishment of a "Quality Council" to take overall responsibility for:

- Establishing processes for: nominating projects, assigning teams and making improvements
- Providing resources
- Establishing processes for: review of progress, dissemination of results and recognition
- Revising the merit rating and business planning systems to include Quality Improvement.

Upper Management must:

- Serve on the Quality Council
- Approve strategic quality goals
- Allocate the needed resources
- Review progress
- Give recognition to teams
- Serve on some project teams
- Revise the merit rating and business planning systems.

3.7   The diagnostic and remedial journeys.

The diagnostic journey (journey from symptom to cause) follows three phases
- Analysis of symptoms
- Formulation of theories of causes of the symptoms
- Test of the theories.

Juran has much to offer in this area, around who to involve, how to train diagnosticians, tools and techniques to use, how to stratify issues and data, how to experiment to test theories. In terms of producing solutions to well defined quality projects this is extremely useful, and follows a pattern similar to that used by several authors.

This part of managing for quality is perhaps, however, "Essential but unimportant"

The remedial journey (from cause to remedy) follows four phases
- Choice of alternatives
- Remedial action
- Dealing with resistance to change
- Establishing controls to hold the gains

4.   Psychology

In looking at Juran's work with respect to Deming's, the third part of the "remedial journey" that is the most interesting; "Resistance to Change".

4.1   Resistance to Change

After completion of the remedial journey, on the face of it all that remains is to apply the remedy. But this means change, and Juran says that at this point we run into a new obstacle "popularly called 'resistance to change'". This resistance can come from managers and workers alike, and often the stated reasons for the resistance can be puzzling.

Juran examines change more closely, and finds that generally we are dealing with two changes:
- a *technological* change
- a *social consequence* to the technological change.

The social consequence is the "trouble maker". For instance, when railways changed from steam to diesel traction, the need for a fireman was eradicated. Yet the railway and unions agreed to retain two men on the footplate following protracted negotiations (and consequences of this are still present today). The unions *stated* reasons were to do with public safety. Their *real* reasons were the loss of a secure job with respected status. Generally, such resistance can be culturally deep seated, and related to loss of importance, loss of status, loss of job security, loss of pride or loss of deep-seated beliefs.

This latter is the most intractable, and sometimes almost insurmountable. To illustrate this, Juran uses the story of the Earth-centred believers of the 14th Century.   The believers rejected the logical argument of the astronomers that the Earth revolved around the Sun, partly because they could see the Sun revolving around the Earth. The idea that the Earth was the centre of the Universe had come down from revered religious teachers. In the light of such evidence the old beliefs could not be rejected - it was easier to burn the astronomers!

Juran offers the following "Rules of the Road" for overcoming fears of change:

- Provide participation
- Provide enough time
- (Start small, avoid surprises, choose the right year)
- Omit excess baggage
- Work with the recognised leadership
- Treat the people with dignity
- Reverse the positions
- Deal directly with the resistance

4.2   Joy in Work

In the area of psychology Deming and Juran's thinking differs fundamentally. Deming is saying that people are born with innate intrinsic motivation, and that management (and society generally) "***must preserve the power of intrinsic motivation, dignity, co-operation, curiosity, joy in learning, that people are born with". "Remove barriers that rob people of pride of workmanship".*** Peter Scholtes enlarged on this with "People don't resist change, they resist being changed".

Thus the Deming perspective is that we should not try to motivate people, but stop de-motivating them. He is saying that a company truly on the path to transformation will respect the intrinsic motivation of the individual. Changes will undoubtedly result, but "***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 who enjoys his work will be a pleasure to work with. Everyone will win; no losers"***

Juran's advice on psychology feels rather "paternal" and "benevolent". Management have employed people to diagnose the causes of quality problems, and propose remedies. Now what do we need to do to the workforce in order to get all this accepted?

The advice he offers is well researched and tested by the "cultural anthropologists" as he calls them, and probably works well within the existing paradigm. But therein lies the problem. Deming's views are describing a company in "Transformation"; I believe that Juran here is describing change, which whilst representing improvement is not "Transformation". For within "Transformation", people's intrinsic motivation and joy in work is driving and causing change.   "***Improve constantly, and forever, every process for planning, production, and service".***

5. Comparing Deming and Juran

5.1 Appreciation of a System

This is possibly the issue where Deming and Juran are closest. Deming, indeed, credits Juran for early insights on how most opportunities for improvement lie in action on the system.

5.2 Variation

"If I had to reduce my message to management to just a few words, I would say it all had to do with reducing variation".

This is a central piece of Deming's thinking. Juran, too, deals with variation:
"It is well known that nothing repeats itself precisely... whether monthly sales, hourly production on the assembly line, or the dimensions of pieces turned out by a lathe. This natural fluctuation is the result of the interplay of numerous small variables and is called random or chance variation - i.e. not traceable to any specific cause.

One result of the random fluctuations is that it does not pay to investigate any small fluctuations; the cause is obscured by the random variables". Juran goes on to describe the Shewhart Control Chart as a device to determine which points are likely to be the result of findable causes.

Juran, though, has buried variation within chapters on Quality Control. The need to reduce variability, and to avoid the "Two Mistakes", is not emphasised as a central theme for managers.

5.3 Continuous Improvement

There is often debate about differences between Continuous Improvement and Project-by-Project Improvement. To Juran, what can appear "Continuous Improvement" is actually made up of many, many successful improvement projects. Juran's statement that "All improvement takes place Project-by-Project and in no other way" is not simply an assertion, but is based on many years of observation in the field.

In addition, Juran's methodology for guiding and running an improvement project is detailed and comprehensive, and has proven successful in a large number of organisations around the world.

5.4 Theory of Knowledge

The concept of PDSA is present in the Trilogy, both at the "Macro level" where after achieving control at the new level organisations should seek to address the new (but lower) levels of chronic waste, and at the "micro" level within the diagnostic and remedial journeys (also in Quality Planning, which this paper does not go into - see Appendix).

Juran also covers operational definitions (under the term "Glossaries"), and has some stories similar to Deming's about improvements brought about through better definition.

Juran's detailed advice about organising and guiding improvement projects are also extremely helpful in giving organisations the "wherewithal" to enter the macro-PDSA cycle in the first instance - "How to start - How to organise - What to do".

5.5 Innovation, and the Vital Few. (The Four Prongs of Quality)

Work on the Vital Few projects for Breakthrough will more than likely lead to innovation in processes. In addition, the Quality Planning phase covers actions that lead to innovation in products (and Juran gives examples). "Continual Improvement" of processes (and products?) will be the result of working on the useful many - "mobilising the employee body, who have the time and volume of ingenuity needed to deal with these individually".

5.6 Joy in work.

This, for me, is the area of most significant difference, and covered in paragraph 4.2 above.

5.7 System of Profound Knowledge

Finally, in the System of Profound Knowledge, Deming has a delightfully elegant way of describing his thinking. It is paradoxically simple, yet deeply difficult. It needs study, thought, and reflection.

Juran's work is, on the other hand, linear and detailed. It tells people how to start, how to organise and what to do.

The System of Profound Knowledge represents transformation, a new paradigm. Juran's work gives glimpses of a new paradigm, but it is quite possible to embark on the Trilogy without really addressing the transformation of management style - "Improvement within the existing paradigm". Eliminating some of the "Wilful Operator-Controllable Errors" will indeed demand changes in management policy, but without understanding how people behave

differently when motivated extrinsically as against intrinsically, the Transformation that Deming is describing will not be achieved.

5.8   Using Juran -With the benefit of knowledge

On page 116 of The New Economics, Deming asks, "What is a leader?"

He concludes:

- He has theory
- He feels compelled to accomplish the transformation
- He is a practical man - he has a plan, step-by-step, and can explain it in practical terms
- He must convince and change enough people in power to make it happen

How Transformational is the leader who can use Juran's practical, structured approach to quality within an understanding of the System for Profound Knowledge?

Deming Bibliography:
Out of the Crisis: MIT Center for Advanced Engineering Study: 1986
The New Economics: MIT Center for Advanced Engineering Study: 1994

Juran Bibliography:
Juran on Quality Improvement- Video series and workbook: Juran Institute Inc: 1981
Managerial Breakthrough: McGraw Hill Inc: 1995
Juran on Planning for Quality: The Free Press (MacMillan): 1988

Appendix

Quality Planning Road Map

- Identify who are the Customers
- Determine the needs of those Customers
- Translate those needs into our language
- Develop a product that can respond to those needs
- Optimise the product features so as to meet our needs as well as our customers' needs
- Develop a process which is able to produce the product
- Optimise the process
- Prove that the process can produce the product under operating conditions
- Transfer the process to the operating forces.