

THE DEMING WHEEL

- A STUDY

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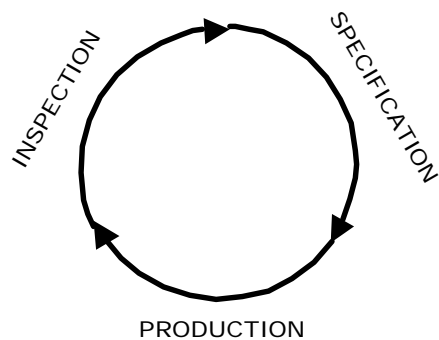
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A lot of speculation has been there as regards the evolution of the Deming Wheel . There have been many who have said that it should be actually called the PDSA / PDCA wheel without attaching any name to it . The purpose of writing this paper is to look into the events that led to the evolution of what we know as the Deming Wheel . Also a brief introduction to epistemology has been included , which forms the bedrock of the Deming Wheel .

THE BEGINNING

The first person to come up with the concept of a cyclic nature of operations was Walter Shewhart . Although he came up with the concept in the late twenties , the first recorded explanation of this cycle was not until 1939 in a series of lectures which he delivered at the University of New York . This series of lectures was then converted into a book called "**Statistical methods from a viewpoint of Quality Control**" . This book was edited by Dr. Deming . It must be noted here that the series of lectures which Dr . Shewhart delivered at the New York University was organised by Dr. Deming . The pictorial representation of this "cyclic nature of operations " is shown here .



SHEWHART CYCLE - I

Craftsman now lost " direct " contact with the Customer , there were no longer " customised " products . Now items were mass - produced : i.e. they were produced in large numbers .

In order to determine how to meet the general needs of a number of customers Shewhart suggested the use of the above cycle by defining the three parts of the cycle thus :

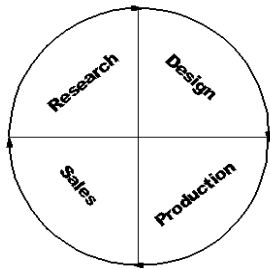
Specification : A commitment that has to be met to satisfy requirements

Production : An effort that is carried out to meet these requirements .

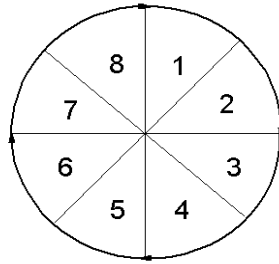
Inspection : An act carried out to assess the effectiveness of the efforts to meet these requirements .

Shewhart called this "**The Scientific Process of acquiring Knowledge**" . He suggested the use of Statistical Methods to " break " the barriers between the manufacturer and the customer . By the use of Statistical Methods , one could determine the " average " needs of the customers and could hence be " ensured " of meeting the needs of a number of customers . Also Statistical Methods could be applied at the three stages in the cycle to improve the operations within the company thus : After going through the cycle once , whatever learned from the inspection process - shortfalls / advantages of the production and specification processes - could be used as a starting point of the second journey through the cycle .

That is , the specifications could be found wanting from a customer point of view which could be improved further , alternatively , the production process could be found



The Cycle for Executives



The Cycle for Engineers

1. Idea for placing importance on Quality
2. Responsibility for Quality
3. Research
4. Standards for Designing and Improvement of Products
5. Economy of Manufacturing
6. Inspection of Products
7. Expansion of Sales Channels
8. Improvement

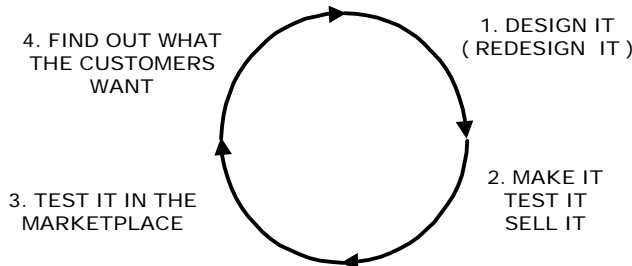
wanting in some respects as regards meeting specifications - which could be then corrected, and so the cycle would continue to rotate, every journey through the cycle making the outcomes better and better, and also giving the manufacturer better and better insights into his manufacturing processes, his customers and ultimately his organisation.

Dr. Deming, who was one of Walter Shewhart's most revered students and friends, understood exactly what it was

Shewhart was trying to say. When he got an opportunity to deliver lectures to the Japanese on Quality in 1950, his lectures carried a lot of concepts that were introduced by Shewhart. In fact it was because the Japanese read Dr. Deming's name on Shewhart's books, they invited Dr. Deming to explain the concepts to them. The lectures that Dr. Deming delivered to the Japanese were converted into a book called "**Elementary Principles of the Statistical Control of Quality**" which was published in 1950 and re-



THE OLD WAY



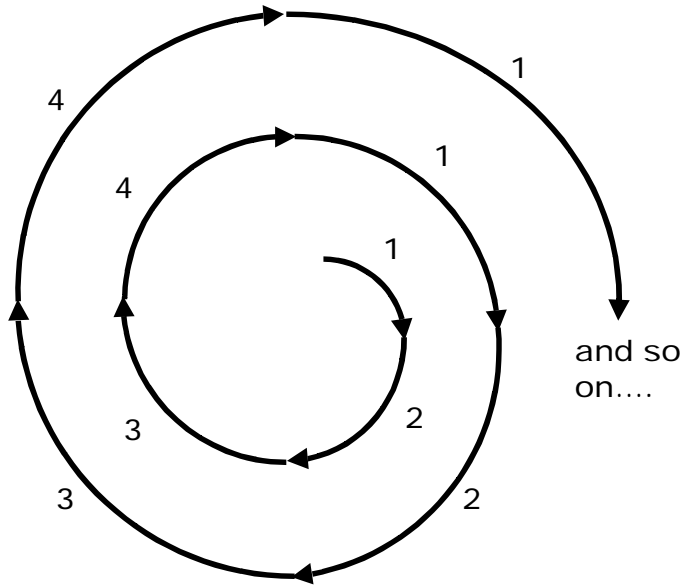
THE NEW WAY

printed in 1952.

While going through these texts, I came across what I saw to be perhaps the "origin" of the Deming Wheel. Dr. Deming was trying to get the idea of the cyclic nature of operations to the Japanese. While doing so he mentioned how products used to be designed before the Industrial Revolution and how the same concept were used even after the Industrial Revolution. He also mentioned as to how the "OLD WAY" was flawed in this that the manufacturers did not pay any attention to the Customer. He went

on to explain the "NEW WAY" of providing Customer satisfaction. This idea of Dr. Deming is shown in the figure above. Here the difference between the old way and the new way is evident - especially how Dr. Deming has explained Shewhart's ideas.

The courses that Dr. Deming conducted for the Engineers and Scientists in Japan were 8-day courses. He gave two different versions of the cycle then. It is interesting to note how he made the distinction between the steps to be taken on the shop floor and the broad steps to be taken by management. See the insistence by Dr. Deming to continue Research continually and place importance on Quality of the Product - the message was the same to the Engineers and the Executives. He basically expanded on THE NEW WAY of manufacturing making the steps in the cycle more elaborate. He further went on to describe what he called "THE BETTER WAY". This concept of a "Helix" or "Spiral" of Improvement was perhaps the first ever recorded. I am saying this because there were many who claimed that the first to come up with the concept of the Spiral of Quality was Dr. Juran. Dr. Juran did not put forth the spiral concept of Quality till 1974. Dr. Deming conceptualised this in 1950! This does not lessen Dr. Juran's contribution in any way. The wonderful part of this is that both had similar ideas but chose to represent them in different ways.



THE BETTER WAY

The steps 1,2,3,4 are the same from THE NEW WAY . The radius of the helix which goes on increasing in size indicates the improvement in the product due to an increase in knowledge of the process , materials , etc.

Now we come to the problem - how did this cycle become the PDCA and later the PDSA loop?

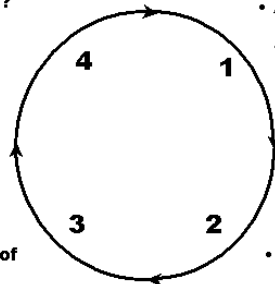
THE METAMORPHOSIS

The Japanese continued to follow the methods of Dr. Deming and were achieving unprecedented levels of Quality of Product and Processes . In 1954 , Dr. Juran went to Japan and introduced to them the methods of " Managing for

Quality ". Dr. Juran is a great exponent of " Universals " - i.e. A set of common steps to be followed no matter what the circumstance - more like a mathematical equation wherein you just have to change the variables to get a different answer , the basic skeletal equation remains unaltered . He introduced the concept of having " Universals " which must have led the Japanese to generalise the cycle Dr. Deming taught them . This sentence and what follows is pure conjecturing on my part based on certain facts , I have

- Study the results .
- What did we learn ?
- What can we predict ?

- What could be the most important accomplishments of this team ?
- What changes might be desirable ?
- What data are available ?
- Are new observations needed ? If yes , then plan a change or a test. Decide how to use the observations .



- Observe the effects of the change or test

- Carry out the change or test decided upon , preferably on a small scale .

The Shewhart Cycle

drawn certain conclusions after reading innumerable texts - if there are any conflicts regarding these conclusions , I would be more than happy to share my thoughts .

Dr. Ishikawa in his book " **Introduction to Quality Control** " has given the first indications of how the name PDCA was given . He said that as an outcome of Taylor's " Scientific Management " there was a slogan "

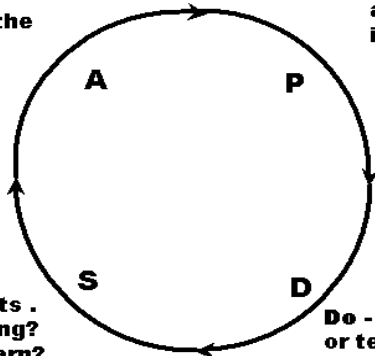
PLAN - DO - SEE ". The Japanese word for SEE is " *miru* " which actually means " to look " - that is to just stand gazing at something . This method or slogan was not effective . To make it effective , the Japanese already fresh from Dr. Juran's teachings came up with a " Universal " cycle - a " one size fits all " cycle derived from the Deming Cycle and called it the PLAN - DO - CHECK - ACT cycle . Since they derived the idea from Dr. Deming , they must have found it fitting to alternatively call it the " Deming Cycle "(my conclusion) Now Dr. Deming visited Japan every year to give away the DEMING PRIZES . After being their teacher , he became their greatest student - always learning and then giving them his thoughts so that they could improve their economy further . He must have come across the " Universal " cycle and saw how the Japanese had become successful in applying it to improve their processes (my conclusion) .

When Dr. Deming was re-discovered in America in 1979, he was primarily known to be a Statistician rather than a Management Guru. He began consulting many of the top companies in America and soon wrote a book on Management called "**Quality, Productivity and Competitive Position**" in 1982 which he then updated in 1986 and called it "**Out of the Crisis**". In this book he outlined his famous 14 points. As an explanation for Point no 14, he urged Managers to make use of the Shewhart Cycle which is shown in the figure above. He called it the Shewhart Cycle but also clarified that this what was the Japanese called the Deming Cycle. Although he did not use the acronym PDCA, the steps in the cycle do indicate that it is a PLAN - DO - CHECK - ACT cycle. Dr. Deming kept on evolving his thinking through the years - in fact there was a famous joke about his 4 - day seminars. If someone said that s/he attended Deming's 4 - day seminar, people would ask - Which one? - they're all different! In 1990, Dr. Deming professed what he called - **A System of Profound Knowledge**. This was the culmination of his philosophy. As a result of this, the Deming Wheel further underwent a change and the word "CHECK" was replaced with the word "STUDY". Dr. Deming emphasised that you need to "Study" the results - in checking you might miss something

In his last book "**The New Economics for Industry, Government and Education**" the Deming Wheel appears as shown above. There has been no further change in this wheel since 1993, because, sadly, Dr. Deming passed away in 1993. As seen in the figure, he has altered the wordings of the Cycle shown above and made it sound simple. He has called it the PDSA cycle in this book. It should be noted now that the cycle is no longer called the PDCA loop but the PDSA loop. This loop has become the underlying philosophy of the QS 9000 standard. Many have gone on to add different

Act - Adopt the change, or abandon it, or run through the cycle again

Plan a change or a test aimed at improvement



Study the results. What went wrong? What did we learn?

Do - Carry out the change or test (preferably on a small scale)

steps under the PLAN, DO, STUDY and ACT phase, but the basic notion of a cyclic nature of operations has remained the same.

To sum up, the Deming Wheel has evolved thus:

- **1939** : Dr. Walter Shewhart introduces the concept of a "Cyclic Nature of Operations". It has three steps. Dr. Deming being one of

Shewhart's Students and friends, understands these concepts.

- **1950** : Dr. Deming introduces Shewhart's concept of the "Cyclic Nature of Operations" to the Japanese - only he modifies it to four steps.
- **1954** : Dr. Juran comes to Japan and introduces to the Japanese the concept of "Universals".
- **1955 - 1965** : The Japanese, led by Dr. Ishikawa, create a "Universal" Cycle with the acronym PDCA and call it the Deming Cycle.
- **1982 - 1986** : Dr. Deming introduces the Shewhart Cycle to the Americans. It bears a close resemblance to the PDCA wheel. Dr. Deming also mentions that it is called the Deming Wheel in Japan.
- **1990** : Dr. Deming professes what he calls "A System of Profound Knowledge". He alters the word **Check** to **Study** and calls the cycle "The Shewhart / PDSA Cycle for Improvement".

THE ORIGINS - THE PHILOSOPHY

Ideally, this paragraph should have been given in the beginning of the article, but I deliberately chose not to put the philosophy up front lest I lose the readers' attention.

I hope you enjoy the explanation of a theory – an idea I built on after reading Dr. Deming's last book.

Walter Shewhart was a great follower of the philosopher and epistemologist , Clarence Irving Lewis . Epistemology deals with the science of learning and acquiring knowledge . Lewis had written a book in 1929 called “ **Mind and the World - Order - An outline of the Theory of Knowledge** “ . In this book he had mentioned that we must have a theory to begin with when we want to acquire knowledge . A theory could be a hunch , a set of principles , a set of laws , etc . Actual testing of the theory and recordings of the observations could make us improve the theory , change the theory or , even abandon the theory .

No theory is wrong – only effective or ineffective . Every theory is good in it's own world , but may be ineffective in another . Let us take an example to explain this .

There is a child aged 6 years who has been watching his father go to work everyday . The father goes to work on a motorcycle . The child has seen something that happens every morning and has drawn a conclusion – “ My father kicks the lever on the right hand side very hard , and the motorcycle revs to life “ . His theory is very simple , you just have to kick the lever very hard to make the motorcycle start . One fine day , when no one was at home , he decided to “ start “ the vehicle himself . He climbed on the motorcycle and kicked on the lever hard , but nothing happened . He kicked again , but nothing happened again .

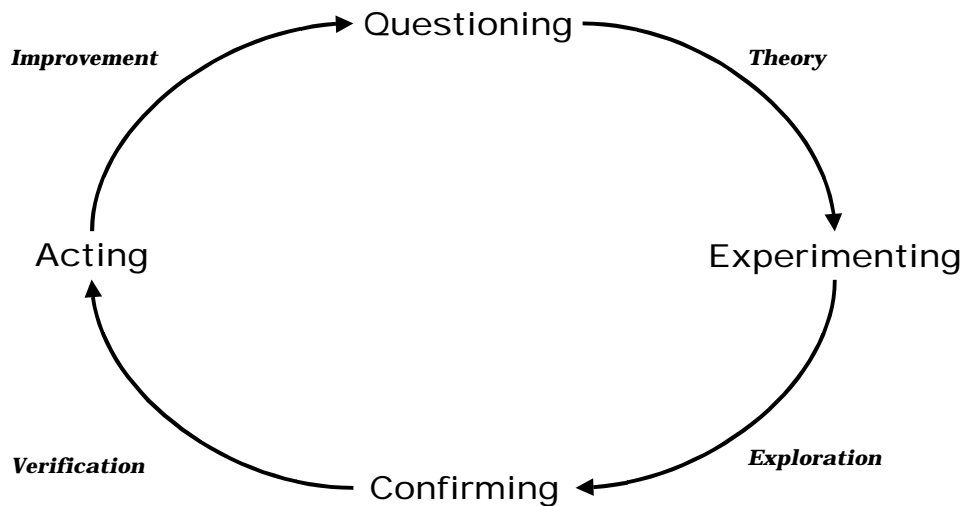
Obviously , his theory was ineffective . There must have been something he missed out . So , the next time he observed his father closely as he started his motorcycle . He found that he did miss out something ! His father turned a key on top before kicking at the lever ! So that was it ! His theory changed – now he realised that one had to open a “ lock “ before he kicked the lever . Now if he did not have a theory – he would not have anything new to learn , he would not have had any questions . So now with his revised theory , he tried to start the motorcycle himself and succeeded .

Some time later , he saw his father kicking away at the lever , but the motorcycle did not start . He then heard his father tell his mother that he would take the bike to the neighbours' to see if they could help out . The boy accompanied his father to the neighbours house . The neighbour was an elderly gentleman who listened to the boy's father very attentively . He then took the bike , ran with it for some distance , then jumped and sat on it and lo and behold ! - the bike started ! The boy was pretty confused by now . His revised theory about the " key " and " kick " needed some revision . He asked his father " what did he do that you weren't doing ? " . The father told the boy that " he would understand when he grew up ! " .

When the boy grew a little older , he learnt about Newton's laws of motion in school . It then struck him that the neighbour had got the bike into some kind of momentum before starting it ! So that's what the lever was used for ! It gave the rear wheel some momentum and that's how the bike started ! why couldn't he think of this before ? He couldn't because he did not know of certain principles - i.e. Newton's laws of motion . Now , armed with these principles , he could predict the starting of the bike .

Soon he grew up and inherited his father's motorcycle . Whenever he faced a problem of starting , he would just run with the bike and start it ! One fine day , he faced a starting problem again , only this time , even when he ran with the bike , it did not start . So , he approached the mechanic who had put up shop a few blocks away and gave him the following explanation – “ I tried to run with the bike and start it in motion , but it wouldn't start . “ . To which the mechanic just bent down and put his hand under the chassis and removed a contraption which he called the “ Spark Plug “ . He then went on to show the boy “ how dirty it was “ , cleaned the tip and put the plug back in it's place under the chassis . Now when the mechanic kicked the lever , the bike started . It was then that it dawned on the boy that when he kicked at the lever or ran with the bike , a spark was formed in the gap in the Spark Plug which then ignited the fuel and started the bike . (I know this explanation will make hard boiled engineers laugh)

Now all through his stages of growth , the boy lived in different worlds , and , he had a theory that was useful until it was replaced by a better theory that “ explained ” things better and more importantly – helped him predict the outcome of actions . So we can say that a theory is -



UNDERSTANDING A THEORY OF KNOWLEDGE

“ A sentence that relates cause with effect ; fits without fail all observations of the past , and , helps us predict the future for a similar set of causes , with the risk of being wrong . “

Thus information by itself is not knowledge . Information , coupled with theory which helps interpret the information / observations at any instant , leads to knowledge . Thus theory has temporal spread . Theory is a window into the world . Without theory there are no questions to ask . Without theory we will have nothing new to learn . All knowledge advances theory by theory . This is the foundation of the PDSA cycle .

To sum up , the steps in understanding a “ Theory of Knowledge “ are :

- Ask Questions
- Formulate Theories
- Carry out Experiments
- Observe
- Confirm Theories
- Verify Theories
- Act on any differences
- Make improvements if necessary
- Repeat the cycle

A pictorial representation is shown below . I would like to quote Brian Joiner here . He once said “ The basic notion of PDSA is so simple that when I first heard it , I felt I understood it in five minutes . Now , more than a decade later , I think I might understand it some day . “ **I too feel the same** . I would like feedback about this article if possible – especially regarding the conjecturing I have made . I can be contacted on balaji@demingindia.org . I am also available on ++ 91 – 20 – 553 5396 .

CITATIONS :

The Figure " Shewhart Cycle – I " is adapted from " The Deming Dimension " by Prof. Henry R. Neave

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