Lecture # 21

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The Red Bead Experiment

- Adapted from "The New Economics" by W. Edwards Deming, 1993
- Demonstrates the working of the "common cause system"
- Demonstrates that blaming workers is useless
- Demonstrates that motivation is not enough
- When a process is producing undesirable products, the process should be studied to identify improvement opportunities

The Northern Bead Company

CEO: Dr. John W. Sutherland

- NBC is trying to expand its business -- a new customer has given a big order
- The new customer needs White Beads -- it will take no Red Beads
- To complete the order the company must hire ten highly motivated employees to produce White Beads
- The company will lose the new customer and profitability if too many Red Beads are produced

New Employees

- **6 willing workers: Job Requirements**
  Highly Motivated -- Steady hand
  Minimal education requirement
  No experience in pouring beads is required
  Job security depends on performance

- **2 inspectors: Job Requirements**
  Must be able to tell red from white and count up to 20
  No experience required

- **1 inspector general: Same requirements as inspector**

- **1 Recorder: Job Requirement**
  Good at Math
  Must know how to write

Instructions

- **Training: Three days**
  Allowed to ask questions during training but once production starts no time for questions -- "we need to get the parts 'out the door' "
- **Procedures are fixed and must be followed to the letter**
- **There must be no variation in the production output**
- **No comments; No suggestions; Just do your job as instructed**

More on Instructions

- **Your job depends on your performance -- Those who produce too many Red Beads will lose their jobs.**
  Procedures for dismissal are in place
  Plent of other willing workers available to replace non-performers

- **Work Standards are in place - Everyone has to make precisely 18 beads per day, no more, no less**

- **Inspectors must count and record their results independent of each other -- find all of the red beads that we make**

- **Inspector General will make sure that counts match**

Instruction (Cont.)

- **Quality control procedures are very rigid -- no Red Beads must reach the customer.**

  We employ 100% inspection to ensure that customer receives only white beads

Any Questions?

Training

Willing Workers

- **Raw Material Preperation**

  Grab the long side of the tub with both hands
  Jiggle the tub slightly until beads are thoroughly mixed

- **Beads manufacturing**

  Grasp the paddle with your right hand
  Insert the paddle into the beads
  Raise and agitate the paddle briefly
  Stop agitation, tilt the paddle to exactly $20°$

- **Follow the above procedure to the letter**

Any Questions?

Training (Con't)

Inspectors

- **Inspector 1**

  Record results on paper, no talking
  Inspector 2 must not see Inspector 1's result
- **Inspector 2**

  Record results on paper, no talking
- **Inspector General**

  Inspect the work of the inspectors
  Loudly announces the final tally of Red Beads, then announces *Dismissed*

Recorder

Shows the results to each willing worker
Does not record results during the training

More on Training

- **Slogans and mottos**

  “Do it Right the First Time”

  “Take Pride in Your Work”

  “Be a Quality Worker”

  “Increase Productivity”

- **Company expects good quality all times -- rich quality tradition**

Begin Production

“Do it Right the First Time”

“Take Pride in Your Work”

“Be a Quality Worker”

“Quality is Valued Here”

LESSONS LEARNED

- **If you want to improve performance, you must work on the system.**

  Red beads were the result of a bad system

  The Willing Workers were not the problem. The system is the problem.

  Dr. Deming stated most of the problems (80-95%) come from the system rather than the worker. Yet most efforts at improvement are aimed at the worker.

  It's the system, not the workers.

- **Quality is made at the top.**

  Quality is an outcome of the system. Top management owns the system.

The systems developed by top mangers of an organization have far greater impact on the success of the organization than the best efforts exerted by Willing Workers.

The decision to produce white beads in the first place; the decision to use rigid procedures; and the decision to rely on mass inspection - all these decisions resulted in a system that contributed more to the waste, the lack of quality, and to going out of business.

- **Numerical goals and production standards are meaningless.**

  The number of red beads produced is determined by the process, not by the standard.

  The production standard of 3 red beads per day was impossible to achieve.

  The Willing Workers could not affect the number of beads produced; meeting the standard was beyond their control.

Even if the goal is "possible", there is little to be gained by announcing such a goal to the workforce.

If higher quality standards are required - a lower defect rate, for example - then the production process must be improved to achieve the standard. Management must provide the method.

- **Rewarding or punishing the Willing Workers had no effect on the outcome.**

  Extrinsic motivation is not effective.

  Fear was not the answer.

  All the red beads produced were an outcome of the system's performance, not the individual Willing Workers.

  Quality is achieved when workers have "Joy in Their Work" - are motivated from within (intrinsic motivation), not by rewards or punishment.

- **"Defects" are defined by specification, not by process.**

  A faulty item is not a signal of "special" causes. A process can be stable, in-control and be producing 100 percent defective items. The red beads produced were not a signal of special cause.

  It is wrong to assume that every faulty item, any failure, and any problem is due to special causes and that corrective action is required. This type of thinking results in fire-fighting with no permanent improvement achieved.

  Defects may result from random variation of a stable process that is capable of achieving the required specifications - an incapable process. We must improve the process to produce a product meeting specifications.

- **Rigid and precise procedures are not sufficient to produce the desired quality.**

  Despite following rigid procedures, quality was not achieved. The Willing Workers had no chance to offer suggestions for process improvement. Too many red beads were produced - the plant closed down.

- **The entire workforce must be engaged in process improvement**

  Everyone has an obligation to improve the system, and thus to improve his own performance and everyone else's.

  The Willing Workers were victims of the process. They could not, under the laid down rules, improve their performance.

  Only management can change a system or empower employees to change the system.

Dr. Deming would ask, "How can a man (or woman) do it right the first time when the incoming material is off gauge, off color, or otherwise defective, or if his (her) machine is not in good order?"

"What is the purpose of management?" Dr. Deming asks. "Not to play games but to use numbers so that we can predict the future."

- **Action taken on a stable system in response to variation within the control limits, in an effort to compensate for this variation, is tampering.**

Management was "tampering" with the system by rewarding and punishing the Willing Workers.

To react to an outcome as if it came from a special cause when it actually came from a common cause of variation is "tampering" with the system.

Tampering will inevitably increase the variation and increase costs. This fact holds even if the stable system is producing faulty items.

Rewarding and punishing Willing Workers for perceived good and bad performance is tampering with the system. This practice is wrong - even worse, it is destructive.

- **People are not always the dominant source of variability.**

  All the variation - differences between Willing Workers in the production of red beads, and the variation day to day of any Willing Worker - came entirely from the system itself.

  Variation is part of any process. The environment, equipment, materials and procedures all contribute to variation.

  The variation in performance arises from the system itself, not from the Willing Workers.

- **Slogans, exhortations and posters are at best useless to the willing worker.**

  Motivational posters had no effect on red bead production.

  Slogans like "Do it right the first time" are an insult.

  Exhortations and posters generate frustration and resentment. They advertise to the production worker that management is unaware of barriers to pride of workmanship.

  If we didn't set up the business properly, a slogan such as this will only frustrate the worker.

- **Thoughts from a "Willing Worker" named Ann.**

  A Willing Worker named Ann, after the experiment on the Red Beads came to a close, expressed to Dr. Deming some provocative thoughts. She wrote her thoughts down in the following letter:

  When I was a Willing Worker on the Red Beads, I learned more than statistical theory. I knew that the system would not allow me to meet the goal, but I still felt that I could. I wished to. I tried so hard. I felt responsibility: others depended on me. My logic and emotions conflicted, and I was frustrated. Logic said there was no way to succeed. Emotion said that I could by trying. After it was over, I thought about my own work situation. How often are people in a situation that they can not govern, but wish to do their best? And people do their best. And after a while, what happens to their drive, their care, and their desire?