Daring to Explore the Econometrics of Thinking Together

Presented by
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School of Forestry and Environmental Studies
Yale University
February 16, 2006, 4-6pm
Abstract: The aim of this session is to offer insights on “new business economics” with applicability to “eco-nomics” and examples of individuals who have discovered how to improve business performance without neglecting environmental awareness.
Agenda

- Education / Background
- W. Edwards Deming
- Insights
- InThinking and Enterprise Thinking
- Better Value
- Possibilities
- Q & A
NO DUMPING

THIS DRAINS TO RIVER

TO REPORT ILLEGAL DUMPING, CALL
THE LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS

1-800-303-0003
Education and First Job

- BSME, Rensselaer
- MSME, Rensselaer
- Ph.D., Rensselaer, Mechanical Engineering
- AVCO Lycoming, Stratford, CT - Heat Transfer Analyst
3-D Diffusion Equations of Heat

\[ \frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} + \frac{\partial^2 T}{\partial z^2} + \frac{Q'''}{k} = \frac{1}{\alpha} \frac{\partial T}{\partial t} \]
Powell, WY, 1904 - 1918
Yale and Beyond, 1928-1993
Production as a System

We all live downstream
Deming and Toyota

“There is not a day I don't think about what Dr. Deming meant to us. Deming is the core of our management.”

These glowing words were spoken at the 1991 Deming Prize ceremony by Shoichiro Toyoda, president of Toyota Motor Corp.
Genichi Taguchi on Quality

“Quality is the minimum of loss imparted to the Society by a product after its shipment to a customer”

Source: Introduction to Quality Engineering, G. Taguchi, 1983
Role

Introduce the potential energy of integrating the management theories and thinking of

W. Edwards Deming

Genichi Taguchi

Edward de Bono

and many others...
Transformation

Potential Energy

“Better Thinking”

Kinetic Energy

“Better Value”
“Once the individual understands the system of profound knowledge, he will apply its principles in every kind of relationship with other people. He will have a basis for judgment of his own decisions and for transformation of the organizations that he belongs to.”

W. Edwards Deming

Counting Straws

Which straw broke the camel's back?
Causes & Effect

No single rain drop believes it is to blame for the flood
Adding Rain Drops
Cause & Effect

- Pulse
- Exam Grade
- Football Results
- Business Results
Perception & Thinking

“How the world we perceive works depends on how we think. The world we perceive is a world we bring forth through our thinking.”

H. Thomas Johnson

Source: Profit Beyond Measure, H. Thomas Johnson, 1999
Counting Heads

Are two heads better than one?
Togetherness

What does it mean to “work together”? 
What does it mean to “learn together”? 
What does it mean to “think together”? 

Team?
United We Stand
Philip Crosby on Quality

“Zero defects is another way of saying ‘do it right the first time’”

Quality is defined as conformance to requirements

Source: Let’s Talk Quality, P. Crosby, 1989
Interchangeable Parts ??

Space Shuttle Main Engine
Parts
or
Parts Of?
“The significant problems we face cannot be solved at the same level of thinking we were at when we created them.”

Albert Einstein
Resource Management
Cutting Wood

Given a piece of wood that will be cut into 2 pieces....

how many lines will be drawn across the top face before the cut is made?
Cutting Wood
Cutting Wood
Taguchi’s Quality Loss Function

“Loss to Society”

Lower Specification Limit

TARGET (desired value of parameter)

Upper Specification Limit
A Better View

“The Taguchi Loss Function is a better view of the world.”

W. Edwards Deming

Source: Out of the Crisis, W. Edwards Deming, 1986
Picking Up Nails
Spending time (yours) to Save time (others)

Minimizing Loss to Society
Investment Thinking

- Seeing connections
- Spending $ to save $
- Spending time to save time
- Spending resources to save resources
- Examples
  - a stitch in time, an ounce of prevention, college education, roof repair, time with kids
InThinking

InThinking is about a transformation of the ways people think into effective predetermined patterns and sequences of thinking. The organization of thinking itself and the awareness that there is a choice of alternative ways of thinking when creating better solutions, presents a significant and exciting departure from traditional approaches.
InThinking & Enterprise Thinking

Increase individual awareness on thinking (InThinking)

Evolve the way we behave

Evolve the way we think together (Enterprise Thinking)

Evolve the way we run our organizations
Investment Opportunities

Thinking

Technology
What is needed?

Thinking that promotes better discovery
Prevailing System of Management

- Driving Change
- Reliance on Reforming
- Reducing Variation, Cost, Waste, Inventory, etc
- Talk about “Working Together”
- Striving for “Zero Defects” and “Zero Waste”
- Continuous Improvement
- Using Metrics for Alignment*

*without a thinking transformation
Enterprise Thinking
Organization

- Leading Transformation
- Use of Reformation and Transformation
- Resource & Relationship Management (Striving for Balance)
- Thinking & Learning Together - Then Working Together
- Continuous Investment
- Using Thinking for Alignment
  - InThinking and Enterprise Thinking
Better Value
Better Value – Tube Fit in Hole

Consider a tube fit into a hole

![Diagram showing a tube fit into a hole with labels for Tube, Manifold, and Liquid hydrogen. Flames are shown emerging from the bottom of the tube.]
Better Value – Tube in Hole - Next Assembly

Traditional Approach
- Ream/ rework holes
- Braze flow thru holes
- Crack welds
- Add grind operation
- Add etch operation
- Add better etch operation
Better Value – Drilled Hole Data

MACHINING RESULTS FOR 1080 HOLES

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Better Value – Tube in Hole - Next Assembly

- **Traditional Approach**
  - Ream/ rework holes
  - Braze flow thru holes
  - Crack welds
  - Add grind operation
  - Add etch operation
  - Add better etch operation

- **Better Approach**
  - Improve hole drilling
    - To target
    - Better distribution
  - Successful first-cycle braze
  - No excess braze

Tube

Manifold

Next assembly part

No excess braze
### Machining Results for 1080 Holes - "Before" & "After"

<table>
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<tr>
<th>Hole Diameter, Inches</th>
<th>Frequency</th>
<th>Lower Spec Limit</th>
<th>Upper Spec Limit</th>
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- **Before**: Drilled Hole Data
- **Post Taguchi Experiment**

**Better Value — Drilled Hole Data**

**MACHINING RESULTS FOR 1080 HOLES - "BEFORE" & "AFTER"**
Additional Examples of Better Thinking

- Alan Winlow at Marshalls (UK)
- Ray Anderson at Interface (US)
- John Elter at Xerox (US)
Alan Winlow
UK Brick – Where’s the Crisis?

“The late 1980’s and early 1990’s were a time of crisis for the UK brick industry and for Yorkshire Brick Company. The market for our products dropped dramatically and the number of people employed in the industry fell from 14,000 to 8,000 within a short space of time. Luckily for Yorkshire Brick Company I did not rely on previous knowledge to tackle the problem of the Company’s survival but introduced Dr Deming’s ‘Fourth Generation Management’ concepts into the organisation…….”
UK Brick – Where’s the Crisis?

The result of introducing systems thinking, understanding variation, the theory of knowledge and people principles – psychology was profound and the business outperformed the rest of the industry by a wide margin……What I would like to consider is what Dr Deming, if he were alive today, would be paying attention to. I can only think that he would be seeking to focus his attention on what for man is the ultimate system – the system of life on Earth.”

Alan Winlow

Source: Reflections on Natural Systems, Alan Winlow, 2002 In2:IN Forum
Yorkshire Brick – Before
“In 1974 the UK government introduced a Health & Safety at Work Act. Under this Act I had to consider the risks to children swimming in ponds in the worked out quarries. The Act laid the responsibility for any accidents on the Company and to minimise risks we set about restoring the worked out land with domestic and commercial waste. This was a stroke of good fortune, for not only did the activity produce a significant income, but also in addition on the 5th of May 1981 we discovered the site was producing Landfill Gas – a source of energy for firing our products……”
“Landfill Gas is a mixture of methane and carbon dioxide that is formed by the biodegrading of the organic fraction of the waste. We established that there were large commercial quantities available and by 1983 we had implemented a Landfill Gas recovery system that enabled us to use the gas as a substitute for natural gas in our kilns. The benefit to date is several million dollars and the emissions produced when the gas is burnt are less dangerous to the planet than if they were allowed to leak into the atmosphere.”

Source: Reflections on Natural Systems, Alan Winlow, 2002 In2:IN Forum
Yorkshire Brick – After
Alan Winlow, MBE
Ray Anderson, Interface
Ray Anderson, Interface
John Elter, vice president of systems research and architecture at Plug Power, a fuel cell company, will give a talk on Monday, April 12. In his lecture, titled "Reshaping Corporations: Adding Value Through Responsible Business Practices," Elter will discuss the LAKES program, an award-winning 7-year, $450 million effort to develop a new platform for photocopiers.

Source: www.yale.edu/opa/v32.n25/visiting.html
Imagine the Possibilities...

● when operating in an “Enterprise Thinking” environment

● if we could develop a broader appreciation of “continuous and connected learning”

● if we could develop a deeper appreciation of “working together”, “learning together” and “thinking together”
Imagine the Possibilities...

- and the markets we could create
  
  Working Together
  Investing Together
  Designing Together
  Building Together
  Learning Together
  Thinking Together
  Leading Together
Edward de Bono on Quality

“The quality of our thinking will determine the quality of our future.”

Edward de Bono
Profit Beyond Measure

This book is dedicated to the memory of Dr. W. Edwards Deming 1900-1993

May the Seventh Generation after us know a world shaped by his thinking