

Maciej ZGORZELSKI

## **THE LEAN THINKING PARADIGM AND WHAT IT MEANS FOR ENGINEERING EDUCATION**

### **The beginnings:**

- Dr. W. Edwards Deming in Japan after World War Two
- Taiichi Ohno at Toyota after World War Two

### **A very brief history of industry: craft production around 1900**

- One of a kind products
- Flexible, simple tools
- Quality through tinkering
- Build to order
- Costs did not decline significantly with volume

### **A very brief history of industry: flow (Ford Motor Co around 1915)**

- Flow production
- Dedicated tools
- Long product life
- Unlimited demand
- Zero product variety

This was the “special case” of learn thinking

### **A very brief history of industry: mass production (GM around 1930)**

When Ford’s special conditions did not exist, it was possible to run volume manufacturing with large buffers, long throughput times, and by working to forecast. This exacerbated quality problems and created the world of General Motors and mass production

### **A very brief history of industry: lean production (Toyota around 1965)**

- Flow production
- Flexible tools
- Short product lives

- Wide product variety
- First-time quality
- Work to demand

This was the general case of lean thinking

### **The principles of lean thinking (What we have learned from Toyota)**

- Shift the management focus
- to differentiate value from waste
- Start with primary actions affecting
- products, rather than organizations, technologies and assets
- Specify value by product, from
- the standpoint of the ultimate customer, not that of firms, departments, or functions
- Identify the value stream running all the way from:
  - Concept to launch
  - Order to deliver
  - Raw materials into the arms of the customer
 and eliminate steps which create no value but cause waste (*muda*)
- Make the product flow continuously  
with no:
  - detours
  - rework
  - scrap
  - waiting
- At the pull of the customer:
  - making only what is wanted
  - when it is wanted
- Continually and unceasingly perfection your processes

### **Lean thinking paradigm in summary:**

- Specify value by product
- Identify the value stream
- Make the product flow
- At the pull of the customer
- In pursuit of perfection

**What a visual enterprise looks like:**

- Safe, orderly, and immaculately clean
- Production is Just-In-Time
- Quality is Six-Sigma
- Employee teams are empowered to make key decisions
- Visual aids track performance and open company to all people
- There are systems to assure a relentless pursuit of perfection

**Lessons for us, educators:**

- Quality is what our customers consider or perceive to be quality.
- Value is what our customers perceive as value.
- We have to provide what our customers need and when they need it.
- We have to install systems that assure relentless pursuit of perfection in our organizations

**A tricky question: who is our customer?**

- our current students
- our alumni,
- our potential future students,
- future employers of our students.
- the society, which grants our organization tax-free or even subsidized status, expecting us to educate young people well, and with integrity, in return.

The society does not express its perceptions of quality and value of our services directly, this is done mostly through various accreditation bodies, which we may consider to be the voice of the society, society's proxy.

In most schools we simply do not monitor continuously our customers' perception of the value and quality of our services.

At best we evaluate, in a rather crude way, individual professor's teaching performance. We do not seek students' and alumni evaluation of their entire experience with the educational process, of programs and curricula, of our classrooms and laboratories, of course scheduling, advising and registration processes, tutoring, campus life, etc.

We seldom evaluate students' perception of how well we resolve their employment issues.

Thus, it seems to me that we currently usually lack a very fundamental knowledge about the quality of our value stream, and without such knowledge any improvement undertakings are no better than a blind search.

### **Bibliography**

1. Rafael Aguayo, *Dr. Deming*, Simon and Schuster, New York, NY, 1990
2. Bruce A. Henderson, Jorge L. Larco, *Lean Transformation*, The Oaklea Press, Richmond, VA 1999
3. James P. Womack, Daniel T. Jones, Daniel Roos, - *The Machine that Changed the World*. Macmillan Publishing Co., New York, NY, 1990
4. James P. Womack, Daniel T. Jones, *Lean Thinking*, Simon and Schuster, New York, NY, 1996
5. Jim Womack's presentation at the GMI/Industry Symposium, Flint, MI, 1997