Successful Innovation Based on Lean Product Development

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The Goodyear Tire & Rubber Co.

LEAN DRIVEN INNOVATION

Goodyear Products













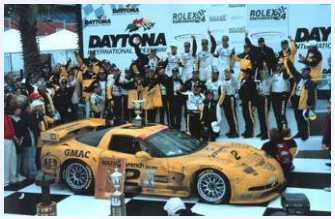



Tires are an integral element of all Vehicle Systems

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Business Overview

- Goodyear Specialty = Tires and Tire Materials
- Global company – 42 manufacturing facilities in 22 countries
- Third largest tire company - $20 Billion annual sales
- 3 Innovation Centers – Akron-Ohio, Luxembourg and Hanau/ Germany – 2,500 professionals

At Goodyear we release about 1,500 new (innovative, high value added) SKU's every year around the world – 4,000 learning cycles - $450 Mi/yr

GO LEAN

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Lean at Goodyear

- R&D first division to start (2006)
- R&D is an investment, not a cost
- Lean focused on customer value ***and*** profitable value streams **NOT cost reduction**
- Gains from waste reduction were re-invested (innovation capability)
- **Before lean**
  - Less than 20% new products delivered on time
  - ~50% of new projects were profitable

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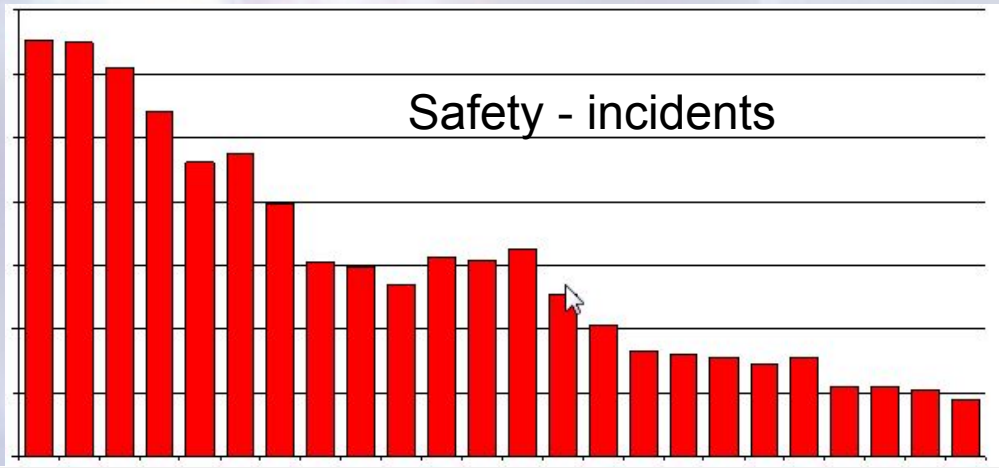
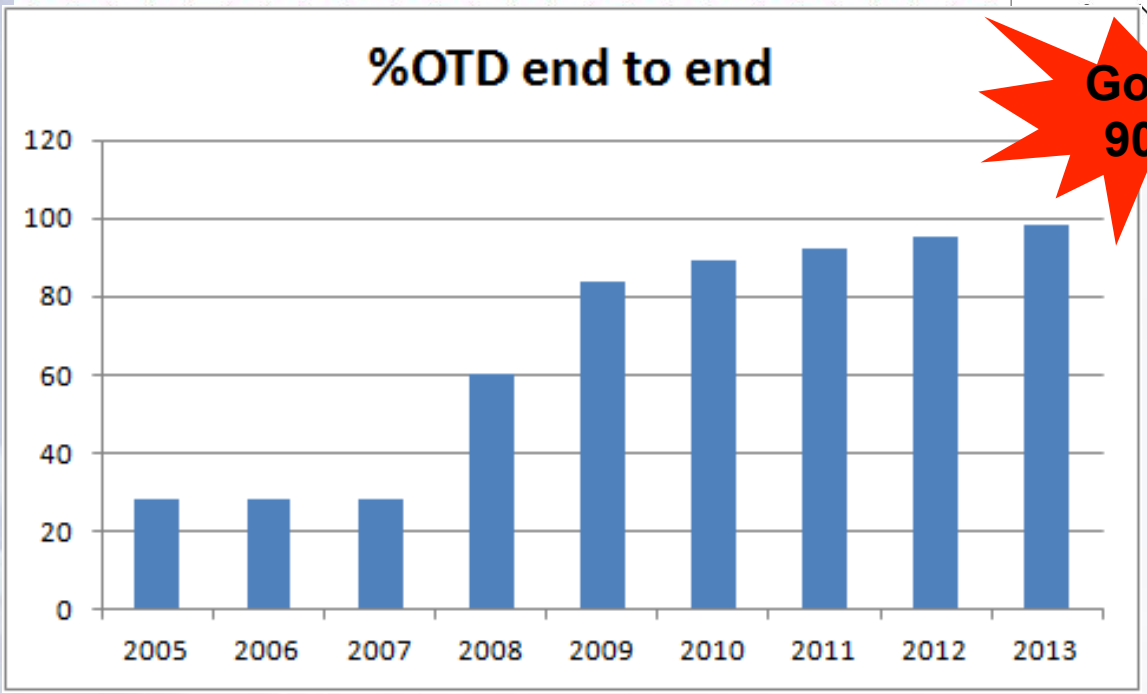
Results





Goal= 90%

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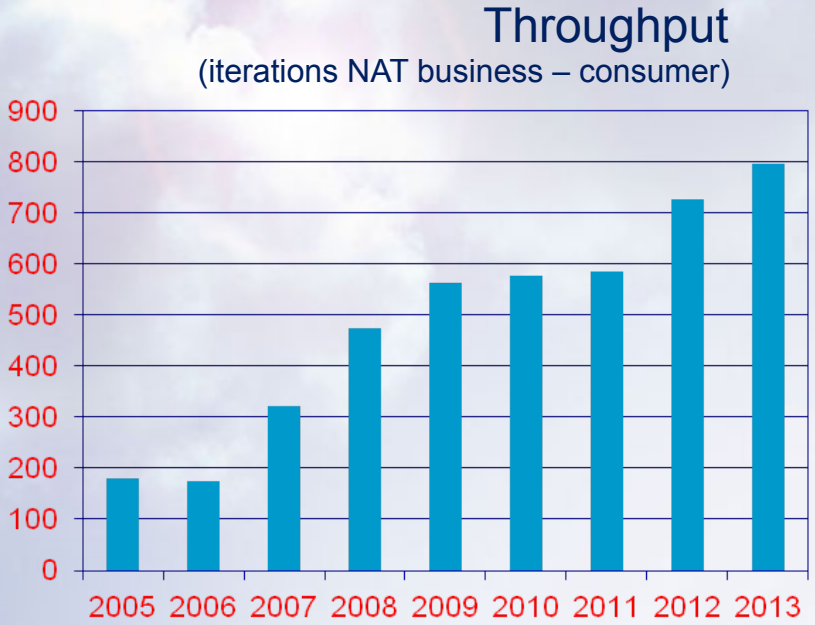
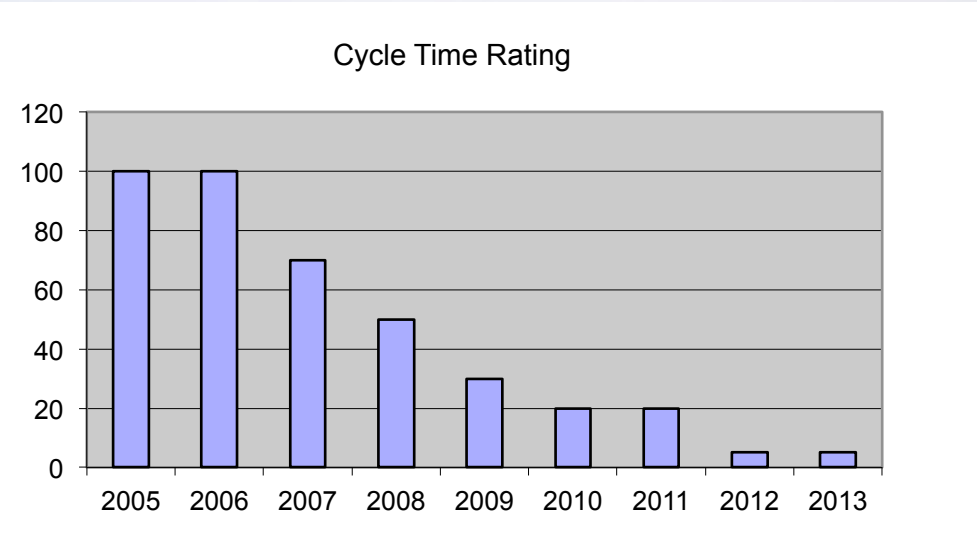
Results





….With a Flat Budget and No Cost To Any Other Factors!

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The (Missing) Link Between Lean and Innovation

"I have long felt that a great weakness of the lean movement is that we tend to take customer value as a given, asking how we can provide more value as we currently define it, at lower cost with higher quality and more rapid response to changing demand. This is fine as far as it goes. **But** *what if the customer wants something fundamentally different from what our organizations are now providing?"*

Jim Womack, ***Gemba Walks***
LEI - v1 2011

Customers do not ask for (disruptive) innovation

Has lean failed innovation?

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Myth

Lean is detrimental to creativity and innovation!

What do YOU think?

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Myth

Lean CAN BE detrimental to creativity and innovation!

Lean focus on cost cutting had detrimental consequences – 3M case

Association of lean with six sigma (lean-sigma), BPR and others

Rigid protocol and narrow focus of lean/sigma

Poor timing – launch of lean coincides with necessary cost reductions

Rigid application of lean manufacturing tools

Restrictive and controlling standards and counterproductive metrics

Good variability thrown out with the bad

INNOVATORS ARE DIFFERENT

There are good reasons for the bad reputation!
The further lean gets away from value and the closer it gets to waste elimination, the more this can be true

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Myth

~~**Lean is detrimental to creativity and innovation!**~~

Myth(buster)

If the lean product development **principles** are understood and applied correctly, lean can turbo-charge the innovation creation process

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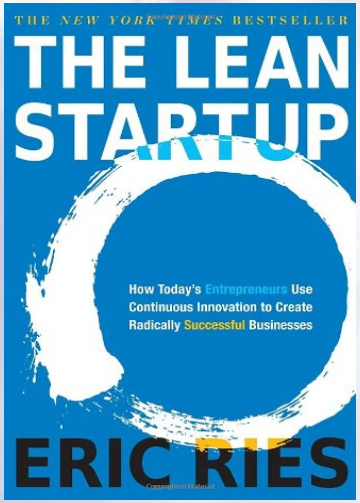
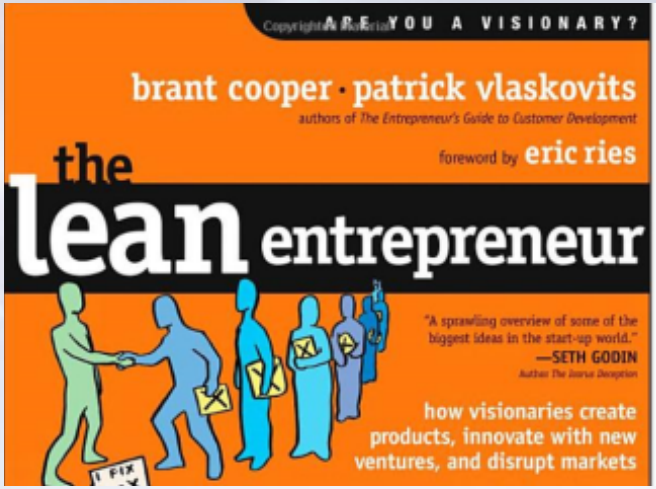
The Turning Point





- **Consequences:**
  - Lean scholars discovered "innovation"
  - Innovation scholars discovered lean principles and started some good research
- **Companies**
  - Most new insight from companies (like Goodyear) who discovered the synergy between lean and innovation

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Setting the Stage….

- Lean does not create innovation
- Lean is NOT the only answer to become innovative
- Lean principles can help solve some notorious problems in the innovation creation process

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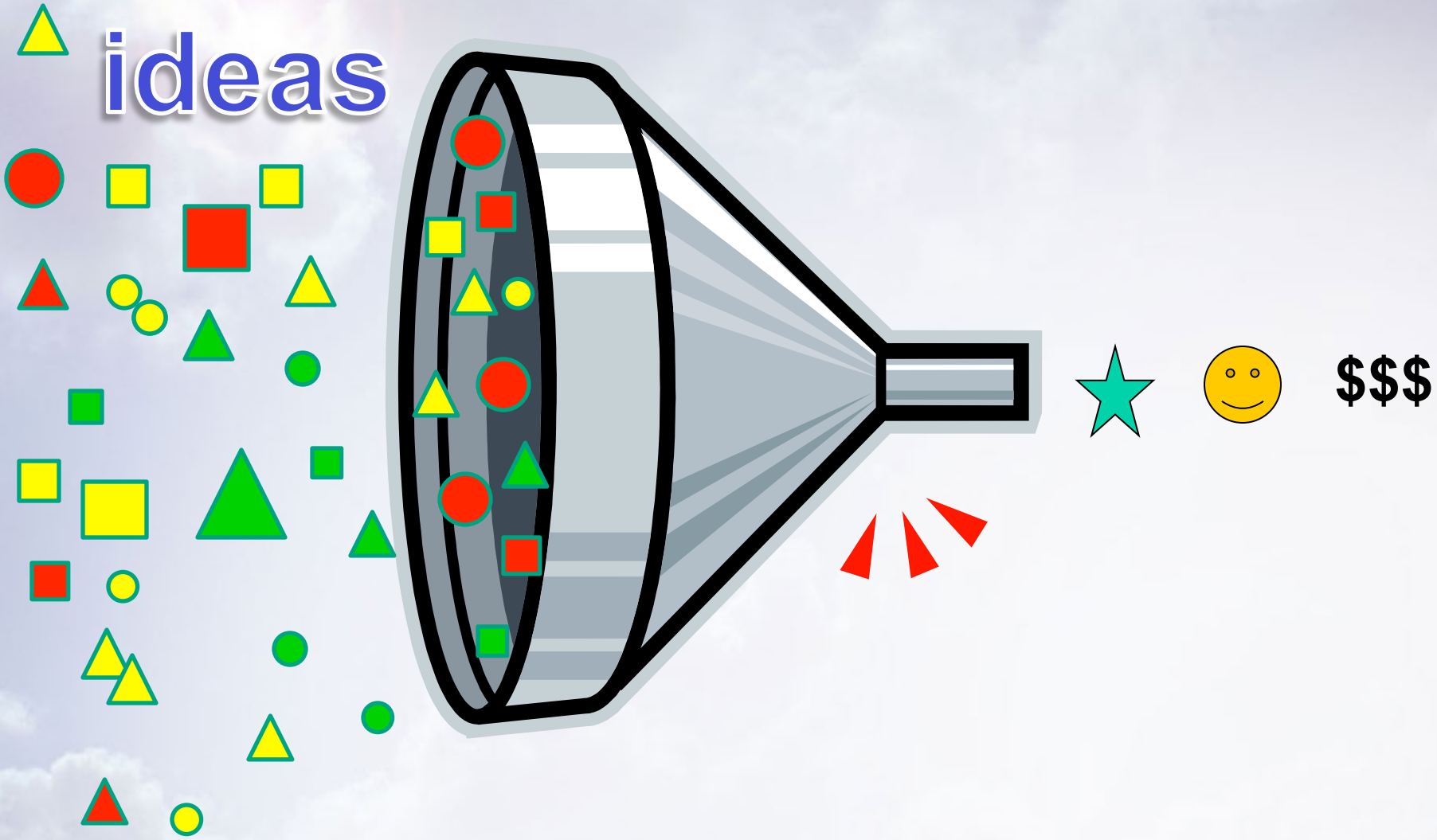
Generic Product Innovation Process



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“Reality”

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Goodyear Innovation Process

Product Leadership Strategy

30 Years Later

ICP: Innovation Creation Process (Global)

TCP : Technology Creation Process (Global)

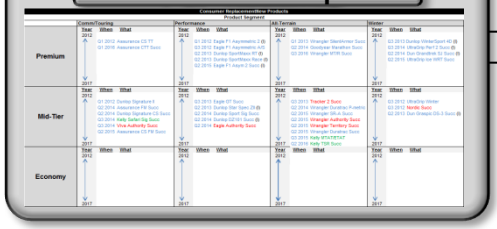
Gate A → Phase B Concept Scoping → Gate B → Phase C Proof of Concept → Gate C → Phase D Detailed Assessment → Gate D

Transition Phase

PCP : Product Creation Process (Regional)

Stage 1 Product Concept Screening → Gate 1 → Stage 2 Business Evaluation → Gate 2 → Stage 3 Product/ Process Devel → Gate 3 → Stage 4 Industrial -ization → Gate 4 → Stage 5 SOP/ Launch → Gate 5 → Stage 6 Product Monitoring → Gate 6

PCP Roadmap



Corporate R vs Cc

Need a process to learn and continuously improve

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Innovation Trivia

Which statement is TRUE?

- 60% of new product development projects succeed
- 99.7% of new product ideas fail (not always for technical reasons)

>>BOTH

Stevens, G; Burley, J; 3,000 raw ideas = 1 commercial success!; Research Technology Management; May/June97, Vol. 40 Issue 3, p16-27

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2 Phases

Product Leadership Strategy

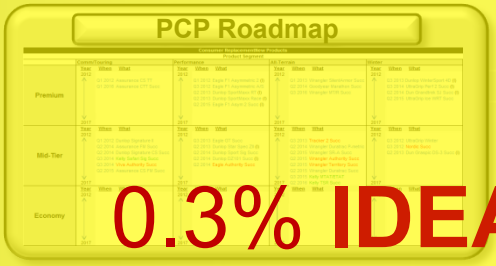
ICP: Innovation Creation Process (Global)

TCP : Technology Creation Process (Global)

Gate A | Phase B Concept Scoping | Gate B | Phase C Proof of Concept | Gate C | Phase D Detailed Assessment | Gate D

Transition Phase

PCP Roadmap



0.3% IDEA Success

Kentou

Time and effort 10 to 80%

Time and effort 10 to 80%

60% Project Success

PCP : Product Creation Process (Regional)

Stage 1 Product Concept Screening | Gate 1 | Stage 2 Business Evaluation | Gate 2 | Stage 3 Product/ Process Devel | Gate 3 | Stage 4 Industrial -ization | Gate 4 | Stage 5 SOP/ Launch | Gate 5 | Stage 6 Product Monitoring | Gate 6

Execution

Success Assured

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Validated Lean Principles Execution Phase

- "LEAN" stage gate collaboration
- Concurrent Engineering
- Late Start
- Computer modeling / knowledge management
- WIP control
- Visual plan to 80% of capacity
- Standard Work (Based on Knowledge)
- Quick/no prototyping/testing
- Pull process
- Flexible resources
- Matrix org – PM – operations
- Etc ….

Lean can do a lot for this process

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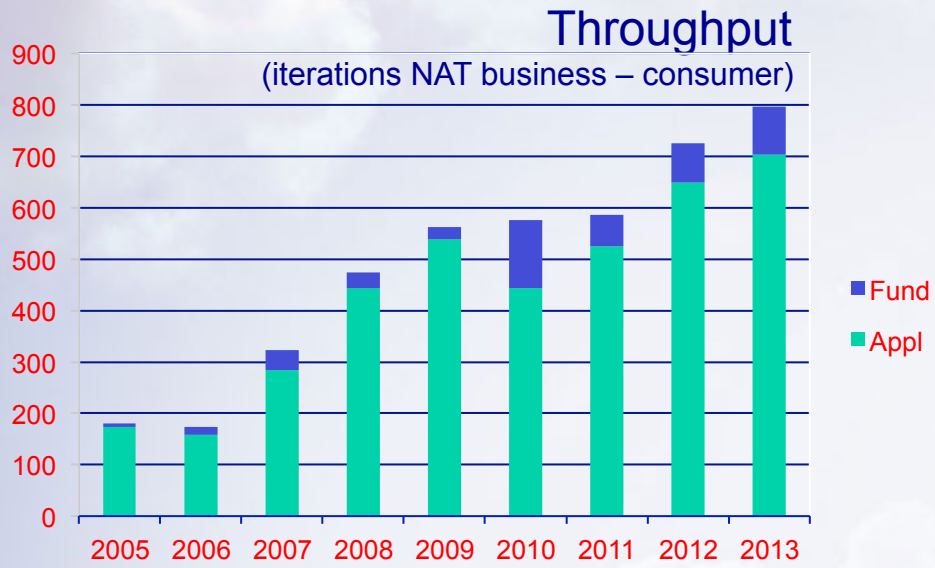
alidation of the "Hidden Factory"



Capacity Re-invested

Key is HOW

Lean gave Goodyear the front end back.

Used for more value added work and

INNOVATION CREATION!

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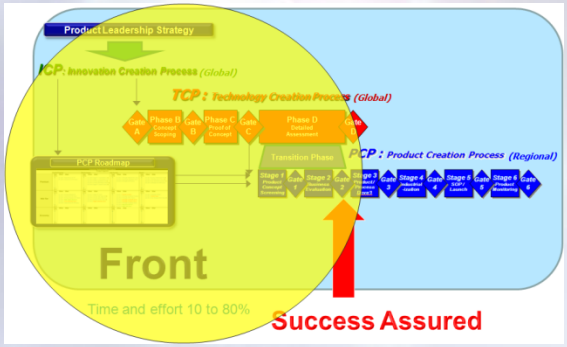
The Kentou Phase



Key "challenges" of kentou phase

A. Enable innovation

B. Manage Innovation Talent

C. Generate a product that the customer actually buys - and make a **profit**

D. **FAST** is better than slow

- **Jim Euchner – Director Goodyear Innovation**
- **Paul Zaffiro – P&G Innovation**

How can LEAN help?

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A. Enable Innovation

- Create SPACE to innovate (15%)
- Create the capability
- Take a risk and allow for failed experiments
- Avoid Innovation "killers"

Get the process right and the results will follow

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Avoid "LEAN" Innovation Killers

- Killers of disruptive innovation are ROI and "When can I get it"? (Brant Cooper – Lean Entrepreneur*)
- Need to leave space in standards that allow for innovation – fixed and flexible part of the standards.
- Make innovation easy and fun
- Be careful about metrics (100% OTD)
- Allow for failure and good variability – clarify consequences

* AME Conference Irvine Ca March 2014

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B. Manage Innovation Talent

- **Biggest inventions originated from technical organization and a very few innovators!**
- **The "serial innovator" - (personal experience)**
  - Very few people tied to successful innovative products
  - Validated at Goodyear and other companies
- **Innovative talent**
  - Rarely included in management plans (career, succession ..)
  - Often round peg in square hole
  - Google thinking about desired behaviors
- **Serial innovators thrive on empowerment and some companies have a hard time with empowerment**
- **Right management support is important**

Not managing innovative talent is a large WASTE

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C. Create Value for the Customer

Generate a product that the customer actually buys:

> "I had committed the biggest waste of all: building a product that our customers refused to use. That was *really* depressing."
>
> -Eric Ries, The Lean Startup
>
> Crown Business, 2011

Lean principles:

- COLLABORATE to deliver value AND profit
- Manage incoming work

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Managing Incoming Work

- **Too much work is among biggest problems of most R&D organizations.**
- **This problem is unique to PD (no issue in manufacturing/services) – and there is a history of inaccurate assessments**
  - Identify a good idea as good – launch for profit
  - Identify a bad one as bad – disregard
  - Not working on a good idea -
  - Working on a bad idea -

What is worse?

Must mange WIP

st effective: Have a process and improve it continuou

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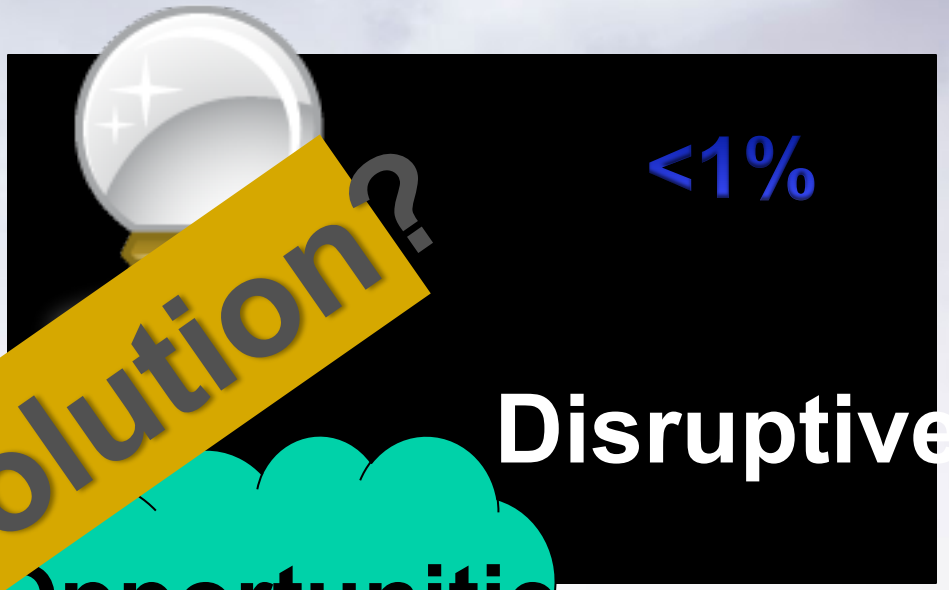
Innovation Grid

Project Uncertainty



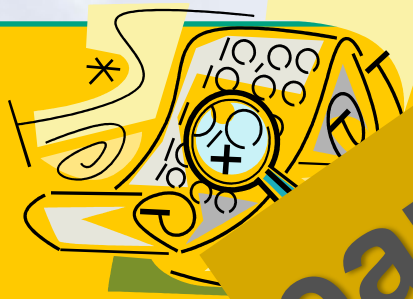
<1%

Disruptive

Lean Solution?

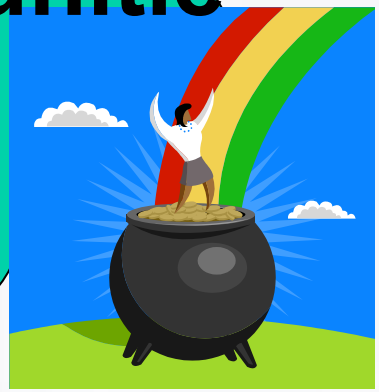
Opportunities

~20%



Incremental

~80%



Project Value

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How To Do This??

- **The more you investigate/try the higher the chances to succeed**
- **Fashion com ies*, paper boy**, bread sh**
- **Winter tires**

Decide quickly which ideas are good and learn fast (fast fail)

* Don Reinertsen – Lean product Development Flow Celeritas Publishing; 1 edition (May 8, 2014
**Faster, Cheaper, Better = Michael Hammer, Lisa Hershman
***Mats Magnusson, IPPDE 2014 Copenhagen

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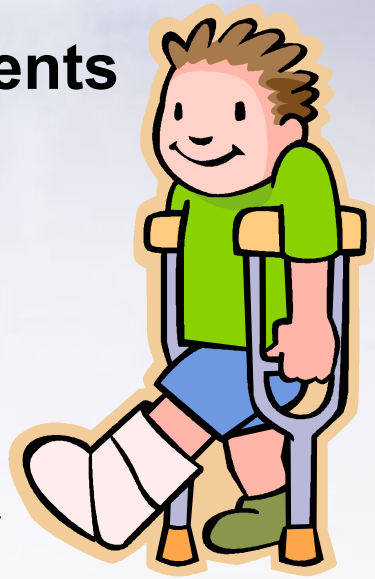
Prescribe Therapy @ Goodyear

- R&D invests in projects like therapy in patients
- Investment grows fast with time
- Incoming work – Patients - High WIP
- High variability and uncertainty
- Very expensive – often high risk
- Assess patients quickly and systematically
- Try many things – quickly stop what does not work
- Pursue what works and reassess quickly
- Discharge quickly



Try a lot and decide quickly

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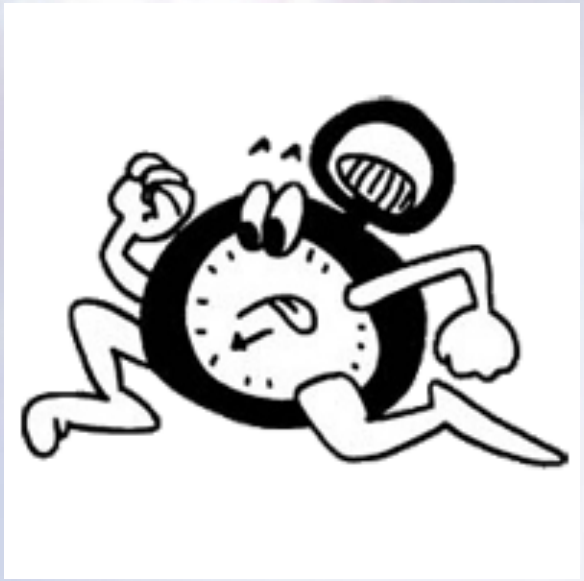
D. Fast is Better Than Slow



Learn FAST
First Mover Advantages
Speed/Agility is a competitive advantage
Collateral gains

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Lean Principles for SPEED

- Concurrent Engineering (Overlapping Tasks)
- Modeling and Knowledge Management
- Quick learning Cycles
  - Late Start
  - WIP control (CT=WIP/TH)
  - Visual plan to 80% of capacity – enough buffers
  - Standard Work (Based on Knowledge)
  - Quick/no prototyping/testing
  - Pull process
  - Flexible resources
  - Matrix org – PM – operations
  - Etc ….

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Concurrent Engineering

ITERATION KICKOFF MEETING

Prepare Design gn

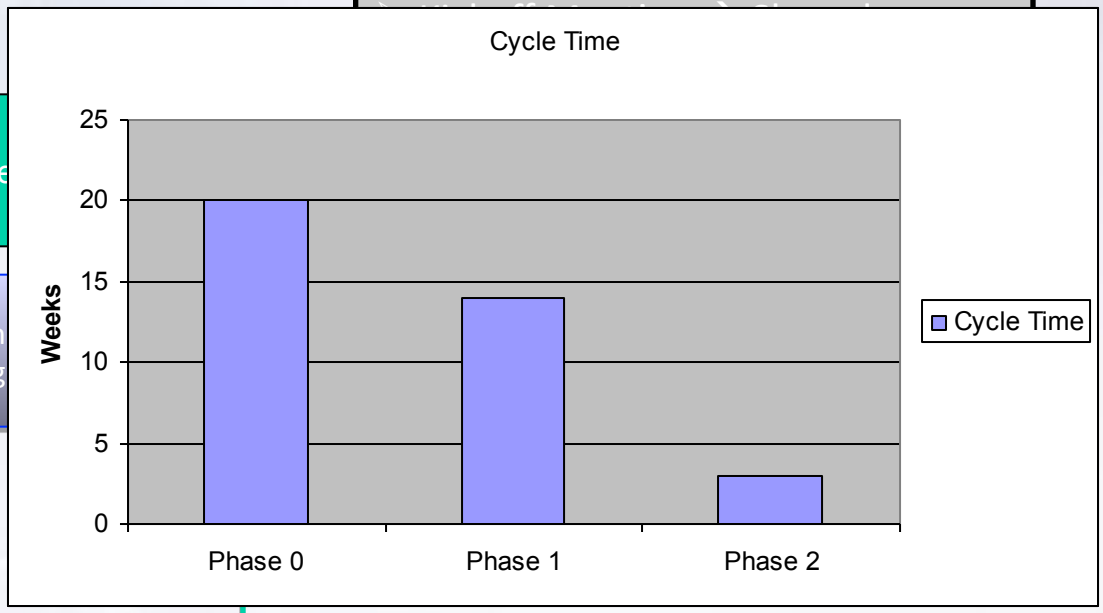
Prepare Mold Eng. d

Pre

Prepare Construction Modeling on ng

Prepare Materials Development laterials opment

- Single Piece Flow → Focus Resources and Eliminate Wait Times



Prepare Tire Build Tire Build

Prepare Tire Testing ire ing

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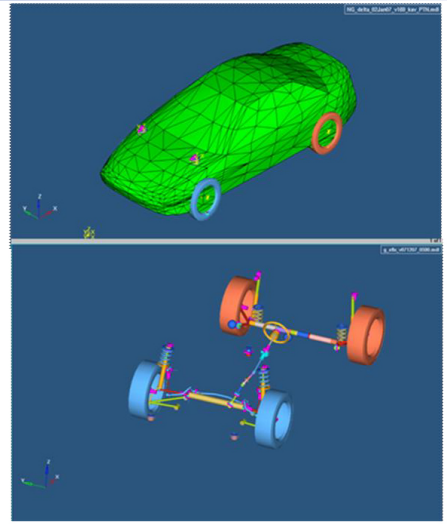
Modeling and Knowledge Reuse

- **Use knowledge to build good computer modeling or "predictive" tools**
- **Test to validate/improve the models**
- **Interpolations and extrapolations**
- **Allows quick set based and DOE's**



Tires for Chevy "VOLT" were developed **virtually** with a vehicle model supplied by *GM* – no tire/car built before "approval"

Tires and vehicle were developed concurrently

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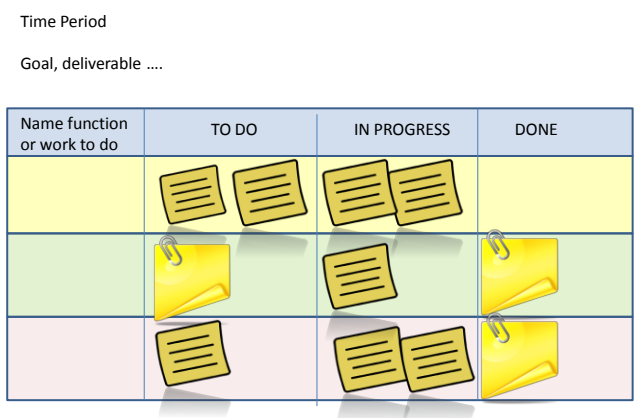
Quick Learning Cycles - SCRUM

- Short cycles are easier to schedule
- Easier to manage risk - Money and resources can be allocated in small manageable chunks
- There are frequent pivot reflection and decision points – where the customer can change direction if needed
- There is quick learning and every new cycle can be designed with the learning of the previous one in mind
- This includes frequent customer contact and the use of minimum viable fast prototyp



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Product innovation awards

auto motor sport TEST Goodyear Eagle Vector+

THE PRODUCT OF YEAR

CONSTRUCTION EQUIPMENT

eurotuner

NorTech

ROAD&TRACK

ConsumerReports

Newport's roadSTAR

Newport's Heavy Duty Trucking

GUTE FAHRT Goodyear Eagle Vector+ Testurteil GUT

WINNER evo TYRE TEST 2007 Eagle F1 Asymmetric

Popular Mechanics

Automotive News PACE AWARD

Auto ZEITUNG

ADAC motorwelt 10/08 GOODYEAR Ultra Grip 6 BESONDERS EMPFEHLENSWERT

Auto Bild Vorbildlich Testsieger Goodyear Vector 4Seasons Platz 1

R&D 100

evo THE THRILL OF DRIVING

CIO 100 2008 Award Winner

Auto Bild UltraGrip 7+ GUT sportscars

CAR AND DRIVER

ADAC motorwelt 10/2008 Goodyear Vector 4Seasons empfehlenswert 19 Winterreifen im Test ADAC

sport auto URTEIL Goodyear Eagle F1 Asymmetric

Inside Business

POWERCAR SEHR EMPFEHLENSWERT

auto motor sport TESTURTEIL EMPFEHLENSWERT

CONSUMERS BEST BUY DIGEST

NEW YORK

TUULILASI

INDUSTRIAL DESIGN EXCELLENCE AWARDS

AUTOCAR THE ORIGINAL CAR WEEKLY

TIRE RACK .com

wheels

POPULAR SCIENCE

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Latest Goodyear Innovations

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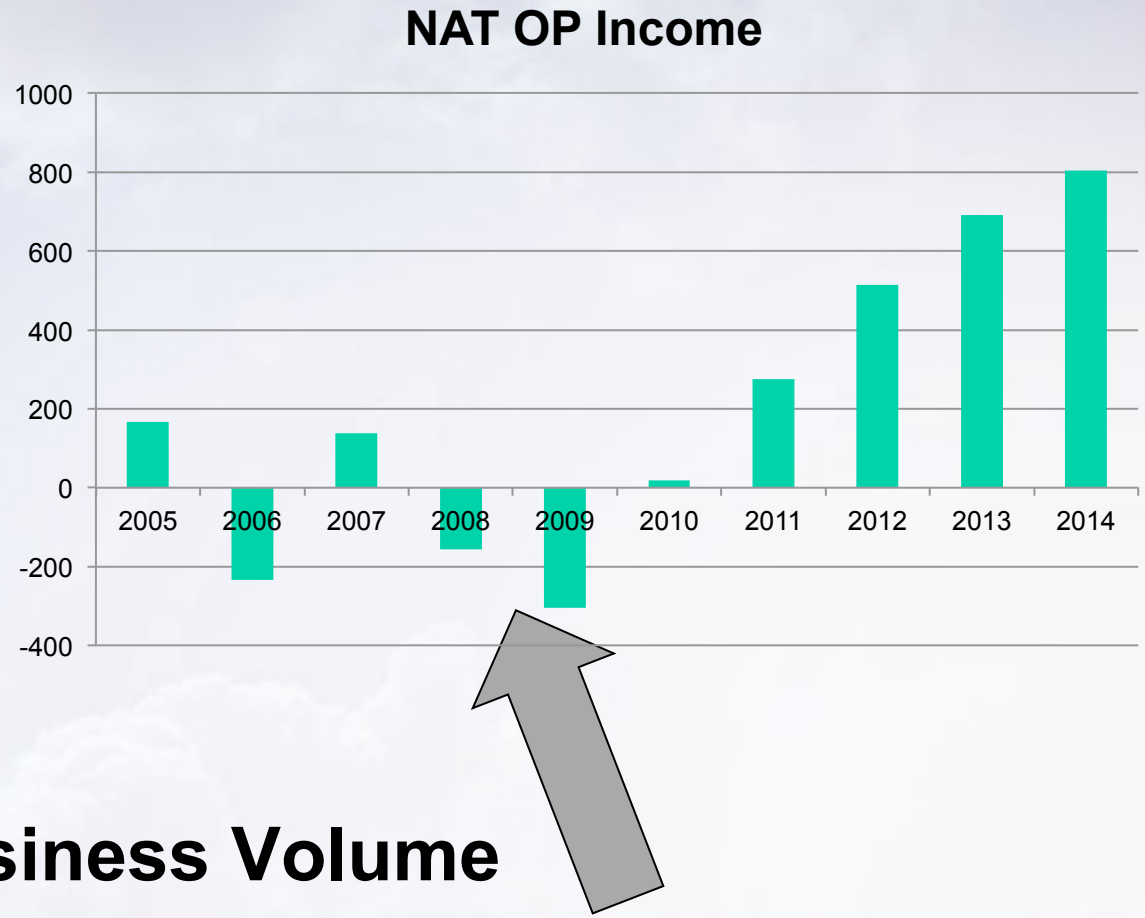
Goodyear Financial Results

Get the process right and the results will follow



- Reduced Business Volume
- .. Flat R&D budget

Investment in LEAN PD

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Myth

The Myth has Been BUSTED

Learn the lean principles and apply them correctly to the innovation creation process

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Summary

- ***Lean principles can do as much - or more - in R&D than any other function or organization.***
- ***Lean principles can enhance innovation***
- ***Lean innovation capability must be developed like any other capability***
- ***Follow Principle Based Lean = Learn the principles and empower the people who know the process to apply them to achieve visible results.***

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Thanks

If everything seems under control, you're just not going fast enough.

-- Mario Andretti

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