lppd Lean Product & Process Development

Lean Process Creation: *Why Developing a Product that Customers Actually Want Requires a Great Process*

Matt Zayko
LEI LPPD Coach

LPPD Summit 2018: Learning Session

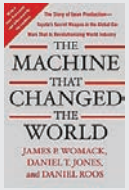
Lean Enterprise Institute

Learning Session Overview

- Lean Process Creation within *Lean Product & Process Development (LPPD)*
- Failure Modes with Lean Process Creation
- Hands-On Exercise
- Framework and Key Enablers for Lean Process Creation
- Action Steps for Moving Forward

About LPPD...

What is Lean Product & Process Development (LPPD) ?



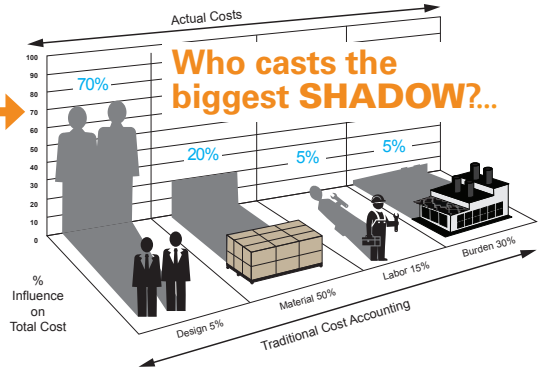
The Elements of Lean Production:

1. Running the Factory
2. Designing the Car
3. Coordinating the Supply Chain
4. Dealing with Customers
5. Managing the Lean Enterprise

The industry focused on elements 1 & 3, but where should WE focus?

"Your product is not the most important thing. It is the only thing."

- Jim Morgan

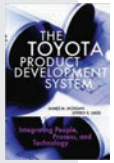


... Product Development!
The most powerful leverage point in creating a Lean Enterprise.

LPPD Core Principles

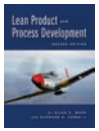
A sustainable system for consistently delivering great products/outcomes and profitable value streams.

- It's all about people
- Deeply understand what your product needs to be
- Create flow and eliminate waste for speed to market
- Learning is what creates new value



Community | **Education** | **Learning** | **Research**

lppd



A LEAN ENTERPRISE INSTITUTE PROGRAM

Changing the Way New Value is Created

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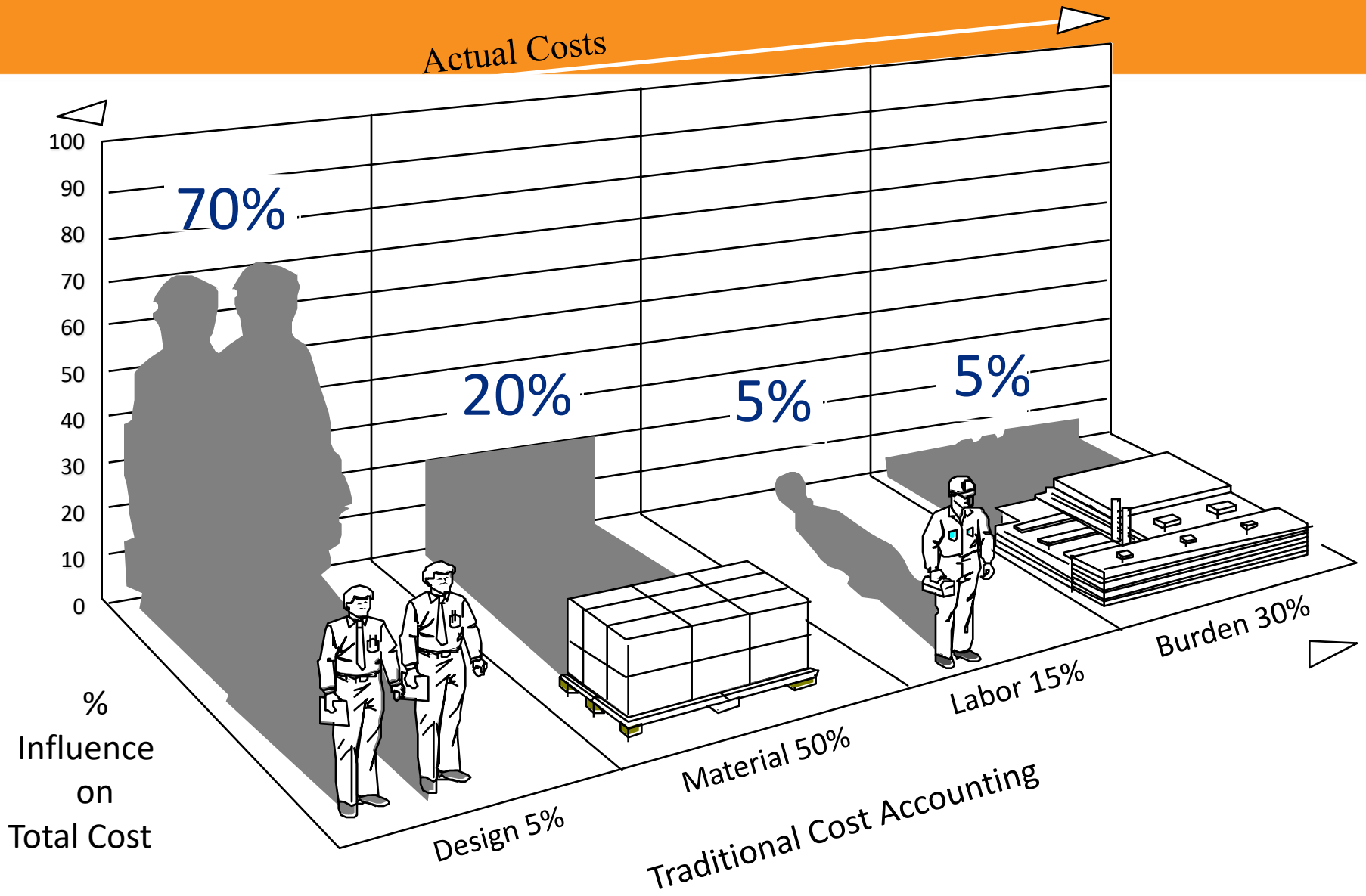
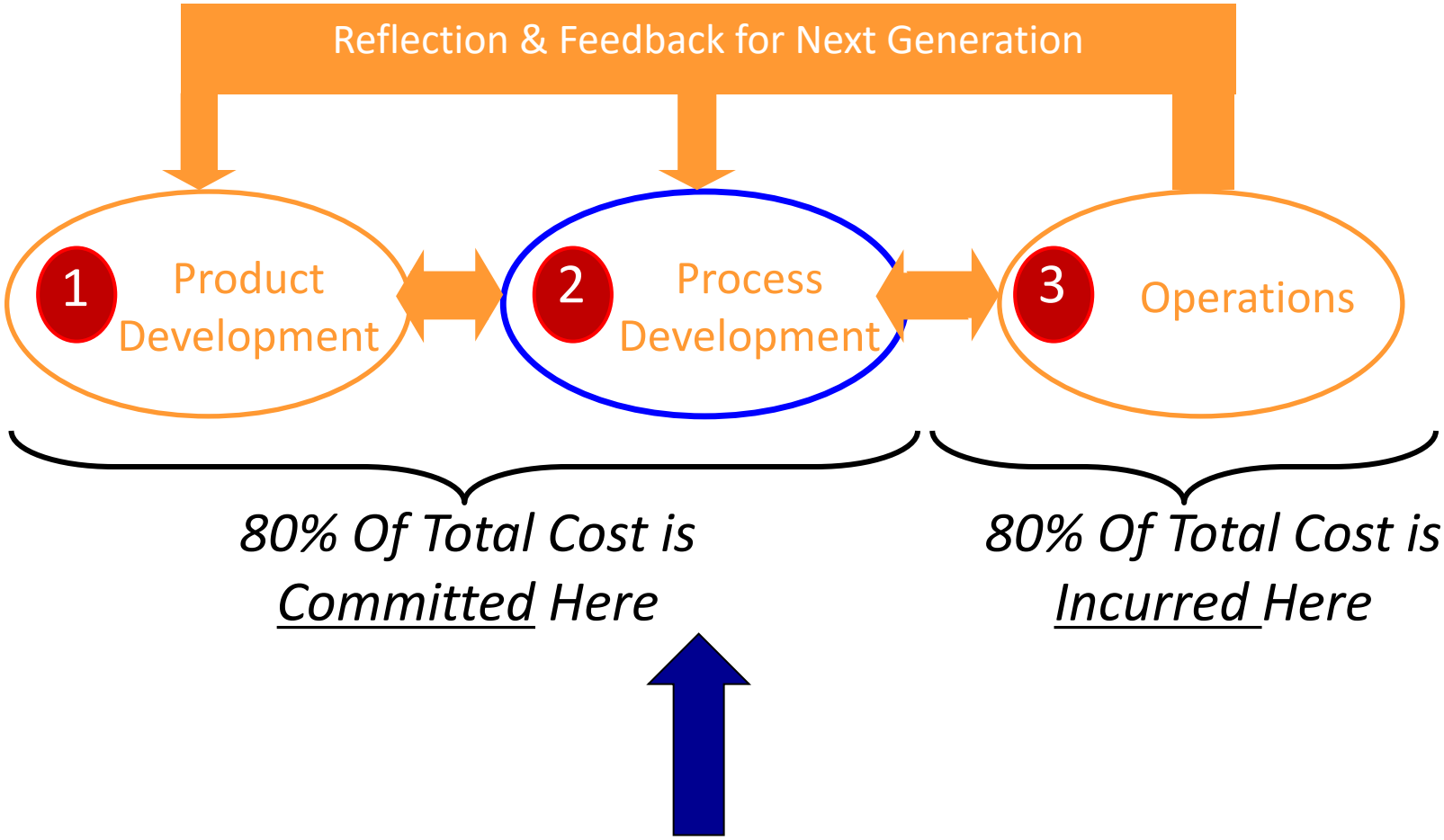
lppd Lean Product & Process Development

Development has the greatest influence…



Based on Munro & Associates

LPPD *should* consider this entire cycle…



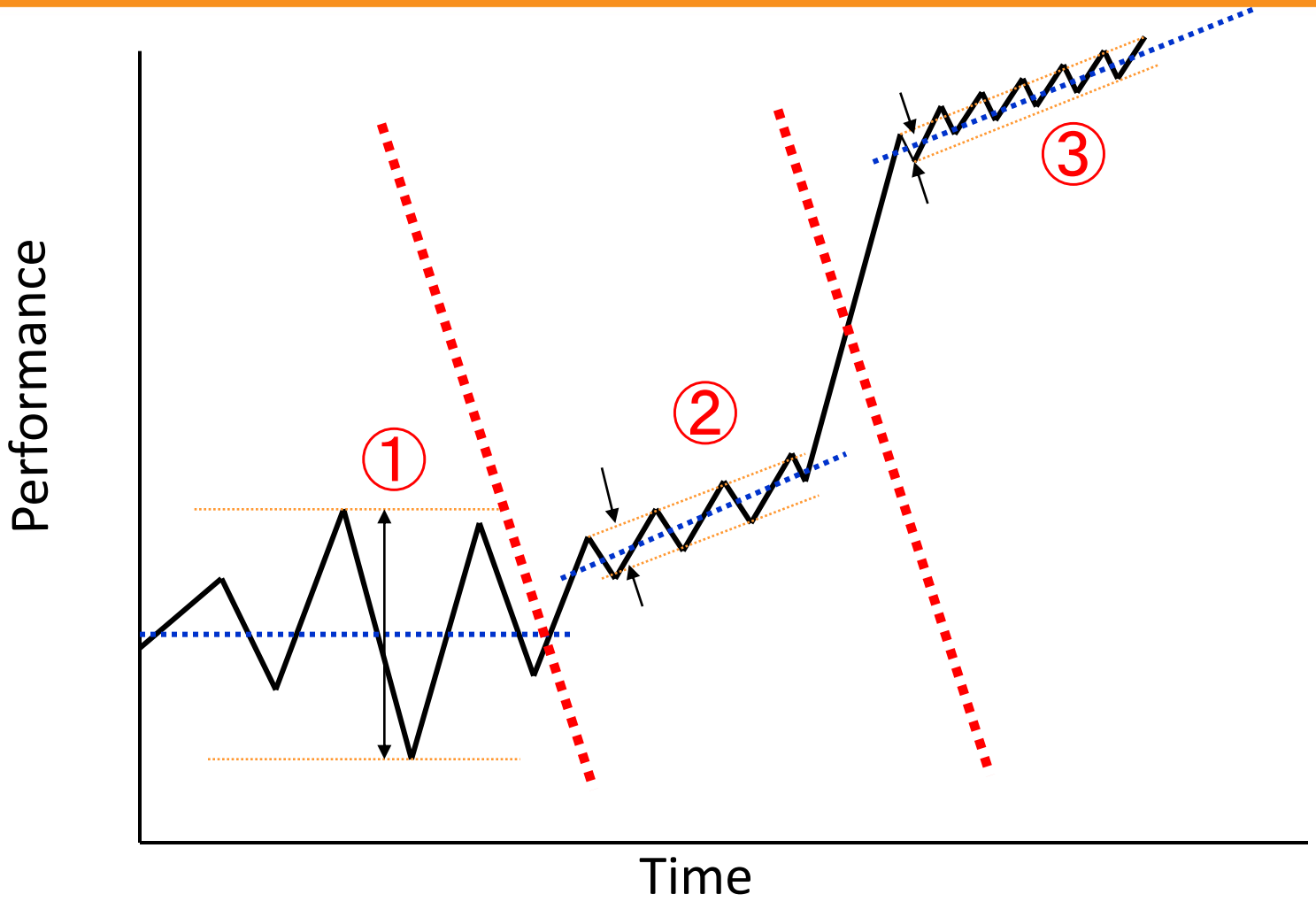
Today's focus: *Lean Process Creation*

Process Kaizen…..*or Engineering Rework*?

New Process Example	***vs.***	***Improved New Process***
➢ Hospital Patient Discharge having *250 hand-offs*	→	*….63 hand-offs*
➢ Hospital Blood Sample Testing taking *309 steps and > 24 hours*	→	*….57 steps and < 3 hours*
➢ Auto Electronics Assembly Line with $2.8 million capital and 17 people	→	*….$0.4 million capital and 13 people*
➢ Industrial Machining Value Stream with *74 days system lead time*	→	*….21 days system lead time*

How do you feed the lessons learned up front?

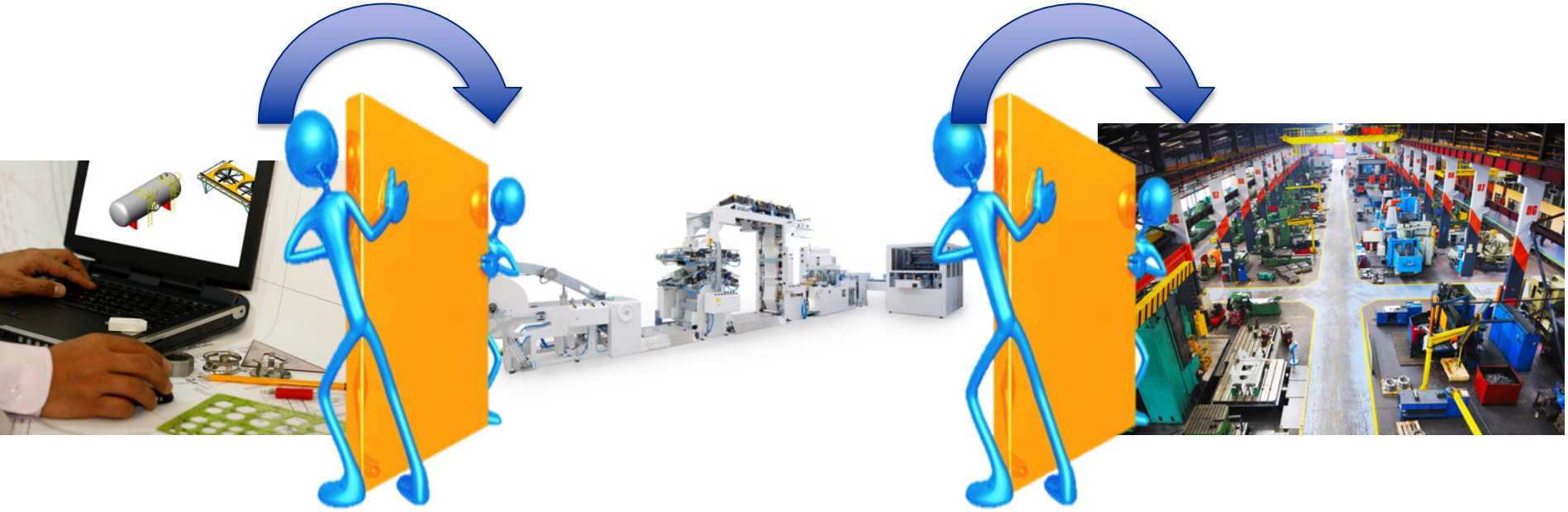
Where do you want to Launch? ①? ②? ③?



Is moving from ① to ③ after launch really kaizen?

Case Study Introduction:
Acme Devices and the
High Voltage Switch Product

Process “Development” As Usual



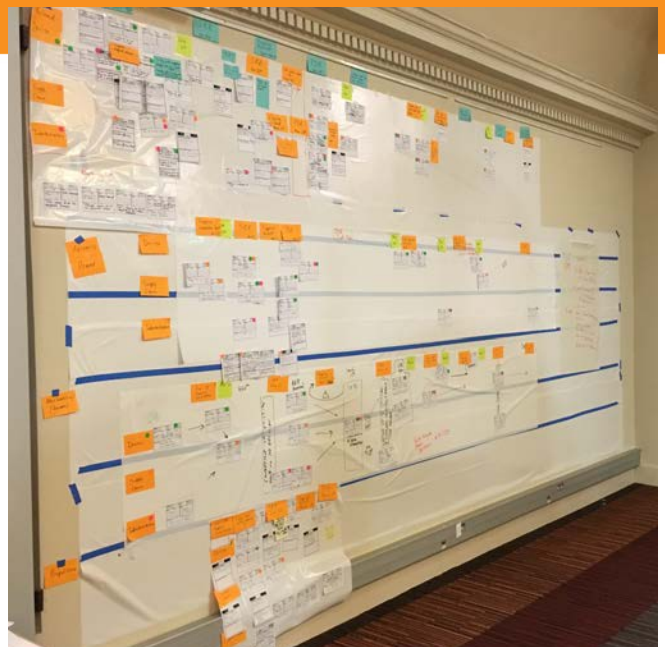
Product Design **Process Selection** **Operations**

Who is thinking about designing a profitable value stream?

Before jumping to solutions, Acme Devices leadership asked:

What is our current "method of work" for developing a new process?

PDVSM Workshop–Shared Understanding & Vision



Typical Steps for PD Current-State Mapping

1) Map Boundaries: Customer/Supplier/Timeline/Swim Lanes
   - Document information & needs for Customers and Suppliers
   - Identify project timeline from start to finish, along with key milestones / phases
   - Determine swim lanes needed to show work flow
2) Identify main processes (in order) within & across swim lanes
3) Value-stream "walk" through the actual program steps
   - Add handoffs and communications, as well as program interrupts
   - Look for the waste: Add wait times, in-boxes, and rework points
   - Fill in data boxes for each process (P/T, L/T, %C/A)
   - Add program events and percent of re-use
4) Calculate system lead-time (L/T) vs. process time (P/T), calculate First Pass Yield (%C/A) and other summary measures

Process Development VSM Example Framing

Acme Devices Current-State Map for Recent New Process Development Work

- 26 months total development cycle for idea-to-launch (product + process)
- 3 major product design changes impacted process development timelines, leading to 6+ months delayed launch, ongoing warranty issue, and lower operating margin
- 29 significant risks and opportunities identified with this recent program with regard to process development

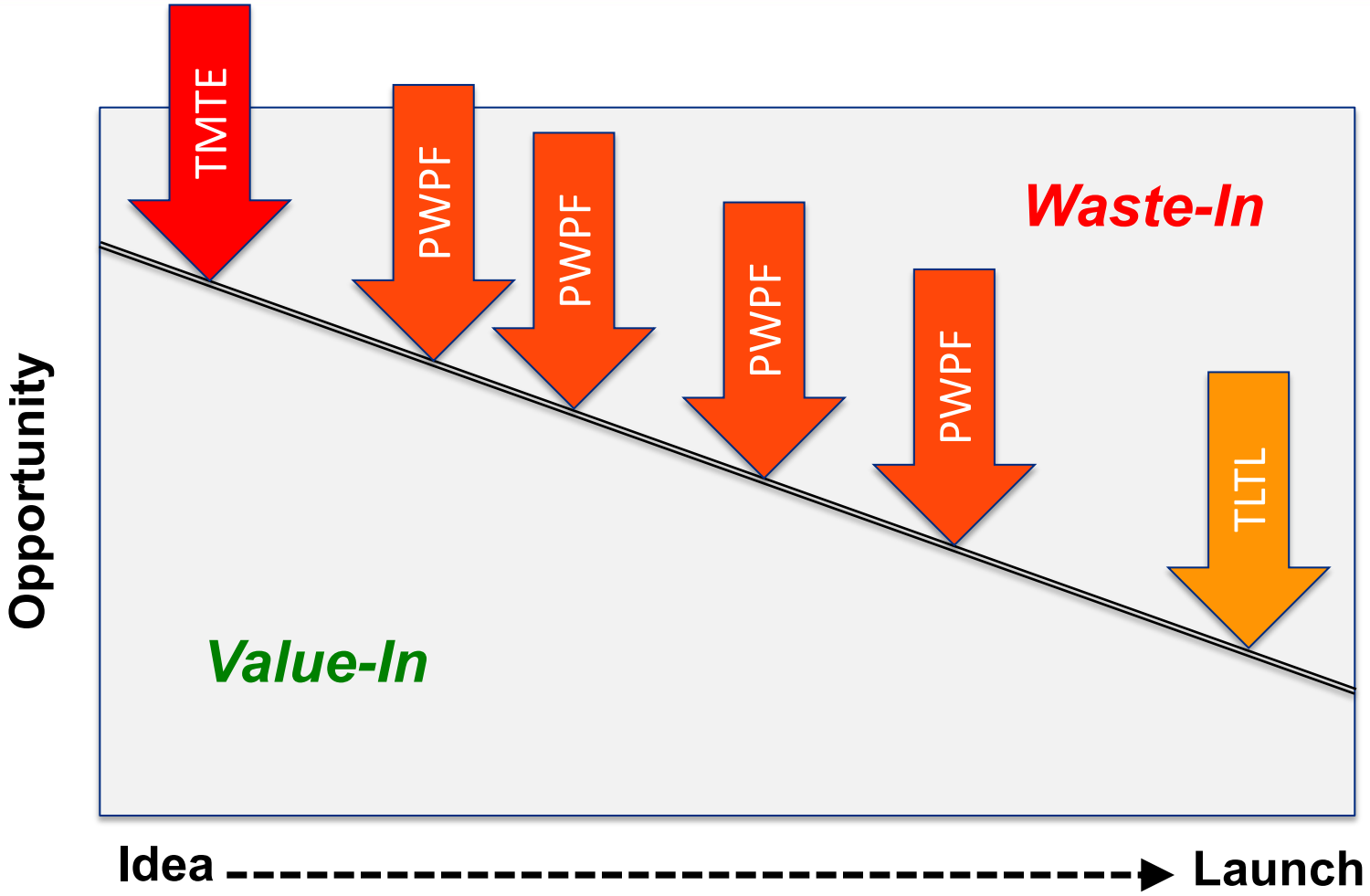
Failure Modes with Lean Process Creation

- Too Much, Too Early (TMTE)
  - Critical decisions are made too far in advance
  - Knowledge incomplete
  - Prematurely locks-in a process design
- Penny-Wise, Pound-Foolish (PWPF)
  - Short-sighted decisions are made for local optimization throughout the design cycle
  - Results in overall performance reduction
- Too Little, Too Late (TLTL)
  - Insufficient upfront design activity before launch
  - Creates a flurry of rework after launch

Failure Modes: *Examples*

- Too Much, Too Early (TMTE)
  - In an effort to eliminate conveyors, an organization purchased 2500 carts and configured the next generation operation accordingly
  - It was discovered that the $2.5 million of carts were too large, driving large batch flow and extra operator motions
- Penny-Wise, Pound-Foolish (PWPF)
  - Machine designers combined two operations into one station to minimize space, handling and number of employees
  - This resulted in a bottleneck station and underutilized resources throughout the value stream
- Too Little, Too Late (TLTL)
  - During the final phases of construction, a hospital decided to standardize room configuration to support repeatable work and the patient experience
  - It was determined to be cost prohibitive due to changes to the building's physical structure

Failure Modes, Timing and (Lost) Opportunity



Hands-On Exercise

Example for Exercise

Development Process:
New House Build

Failure Mode	What was Observed?	What was the impact?
Too Much, Too Early	Owner early on decides on geothermal heating & cooling system	Final house plan square footage requires 50% larger lot to enable the geothermal system or supplemental heating / cooling system
Penny-Wise, Pound-Foolish	Owner selects lower-quality window to save on construction costs (and put toward a bigger lot!)	Owner experiences significantly higher ongoing utility costs (and an increased load on the geothermal system!)
Too Little, Too Late	Main electrical panel is placed into unfinished lower-level space. Owner decides to partially finish lower-level and include another bedroom.	Main electrical panel is in the middle of the bedroom space

Exercise Instructions: Part 1

- Think deeply of a new process developed and launched in your organization
- Fill out handout 1 based on your understanding / experience with your new process
  - 12 minutes
- As a table, briefly share your failure mode examples
  - 2 minutes takt time per person
- Each table, select one failure mode example to share with the entire room
- We will wrap up this part of the exercise with a group debrief

Exercise 1 Handout

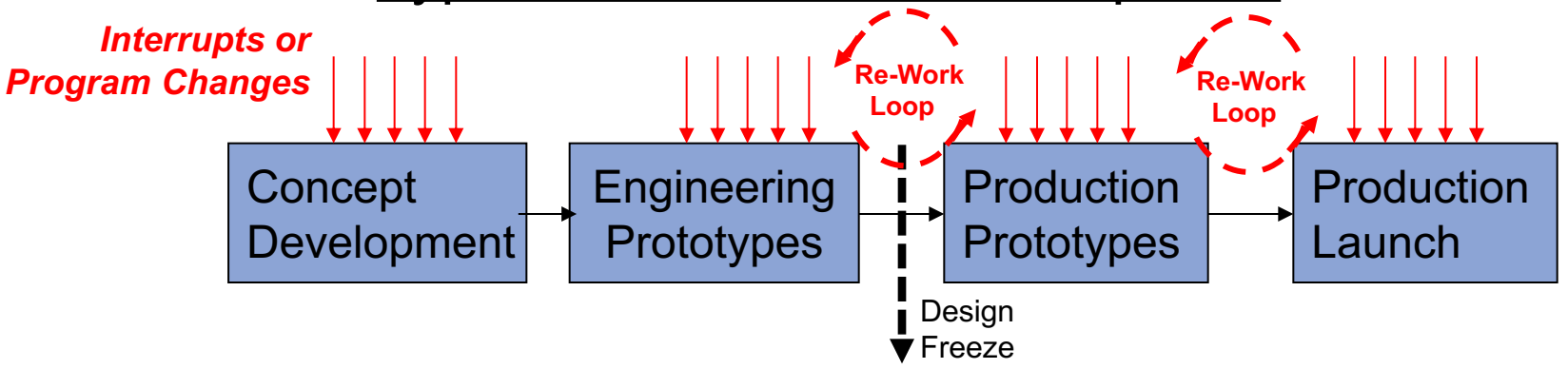
Area:

Failure Modes	What was observed?	What was the impact?
Too Much, Too Early *(Upfront Operational Decisions)*		
Penny-Wise, Pound-Foolish *(Decisions throughout Lifecycle)*		
Too Little, Too Late *(Late-Stage Operational Actions)*		
Additional Failure Mode(s)		

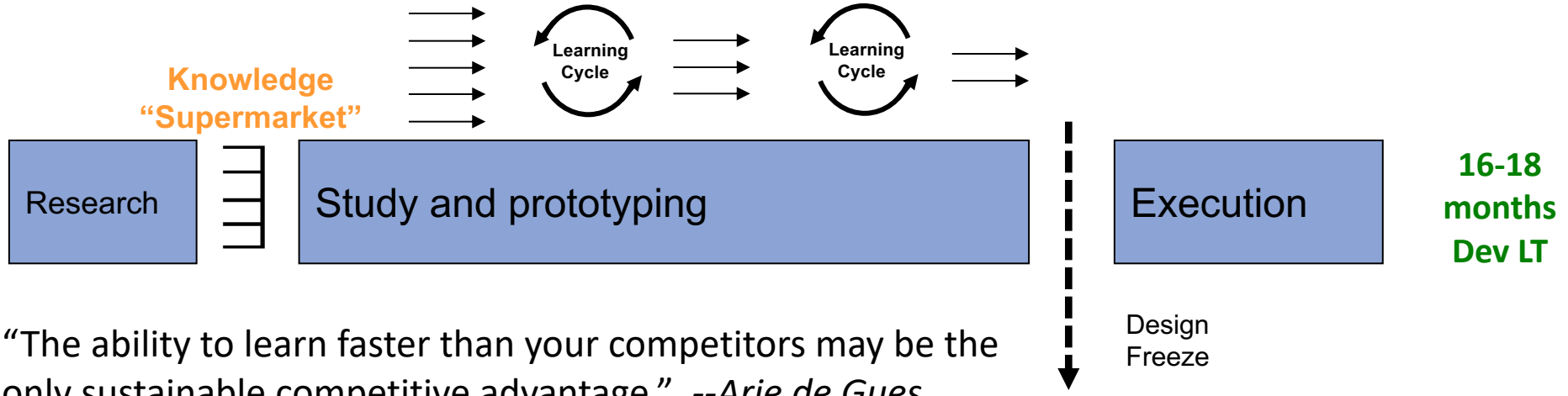
What's the Process to Get Better for Acme?

Key Enabler: *Set-Based to Pull Learning Forward*

Typical Phase Gate Development



Lean Development: Set-Based



"The ability to learn faster than your competitors may be the only sustainable competitive advantage." *--Arie de Gues*

Why not jump to a solution?....Remember the Pontiac Aztek: Point-Based, "Development by Committee"

Pontiac Aztek Original Design Vision

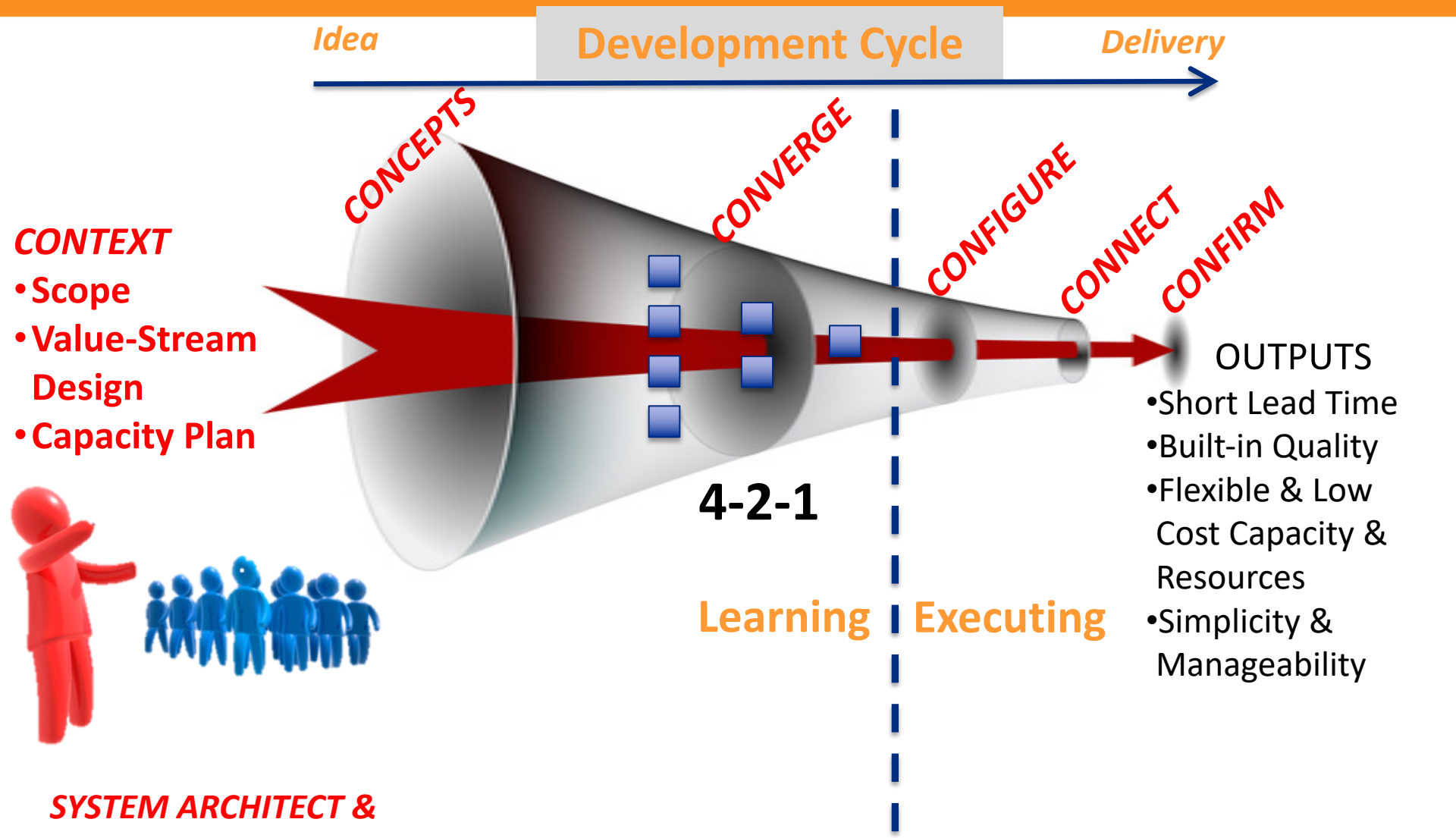
≠

"The Ugliest Car Ever", 2008, The Daily Telegraph

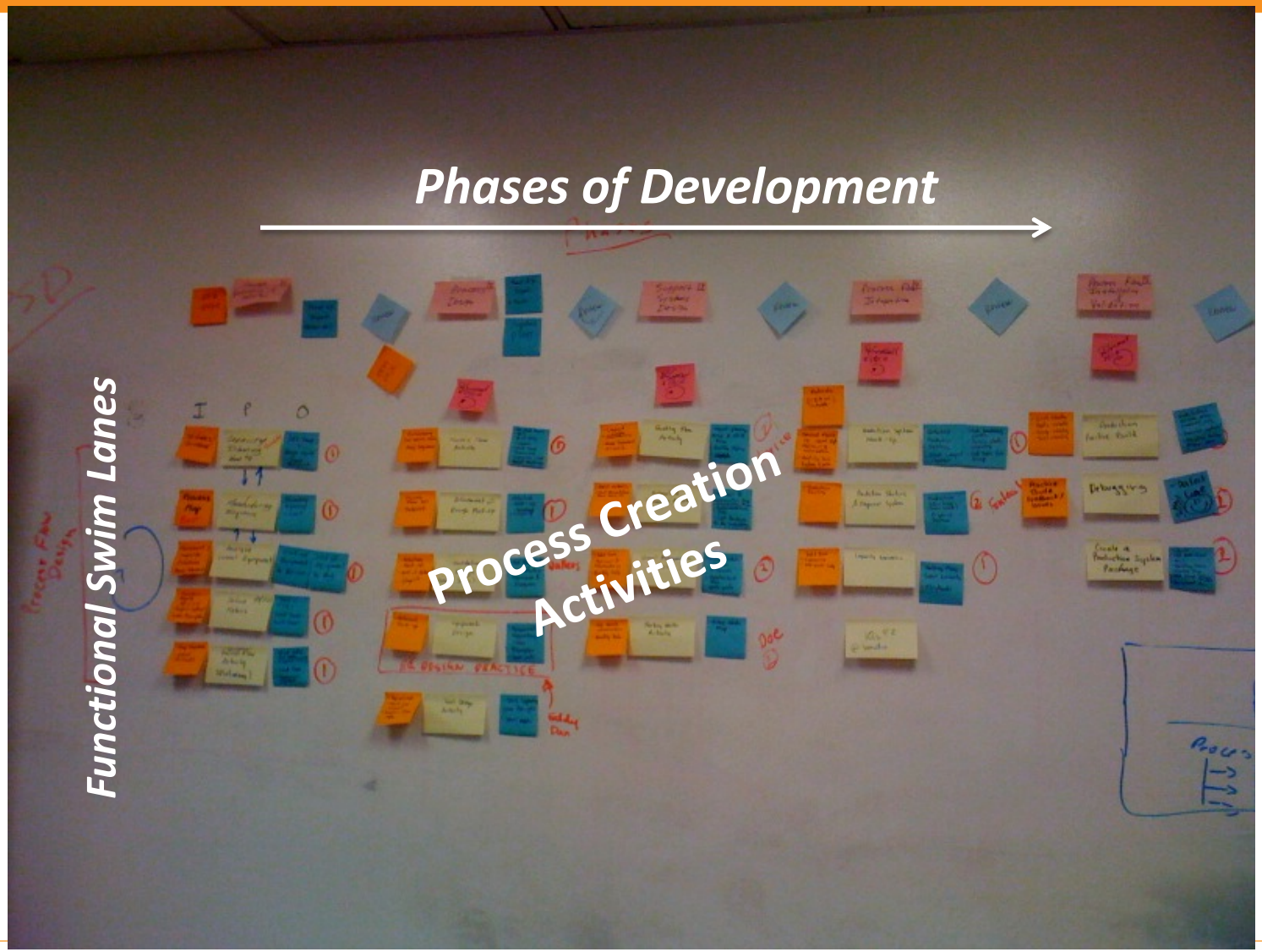
"A good idea ruined when forced onto a minivan chassis. If there are any executives left at GM who signed off on this, there is no justice in the universe." Edmunds.com, 2013

Pontiac Aztek Actual Launch

Process Development within LPPD



Acme Lean Process Creation, Future-State Design: What is the Work? When to do the Work? How to do the Work?

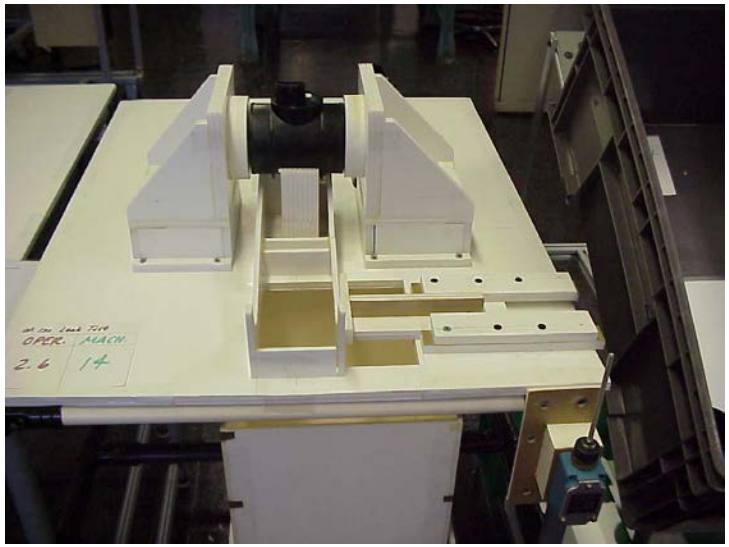


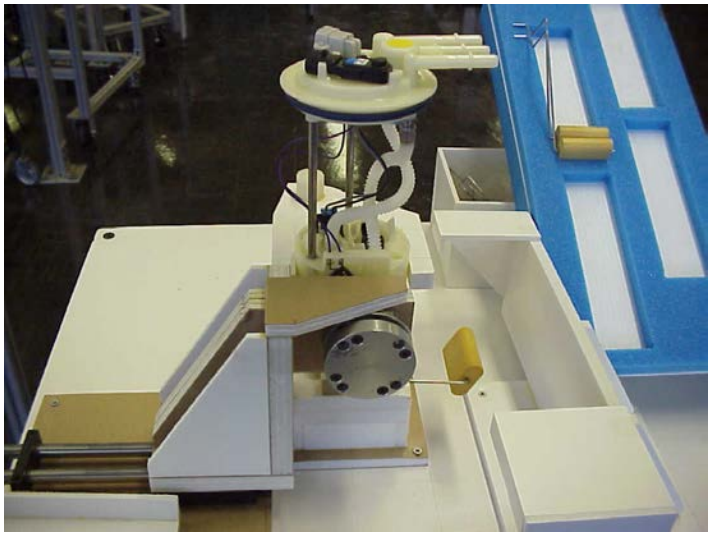
Acme Devices Case Study Observations & Results

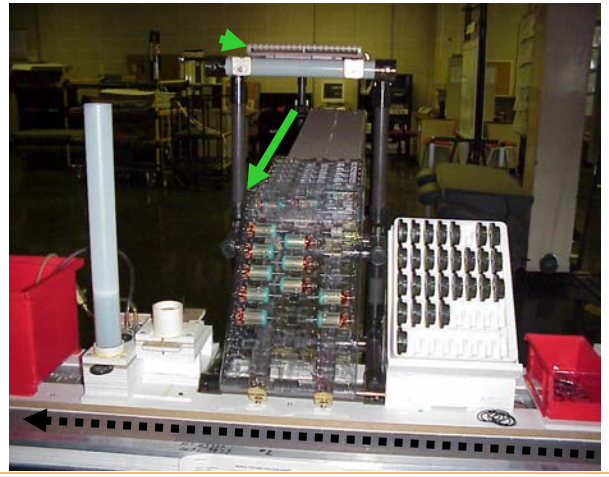
Fast, Low Cost Learning:
Mock-Up Examples

Mock-Up Example: Medium Fidelity

Full-Scale Mock-Up







Observations from Acme Devices

PROCESS:
Acme Devices High Voltage Switch

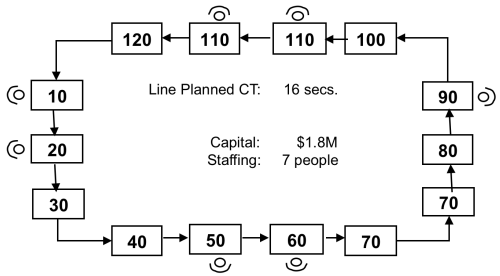
Failure Modes	What was Observed?	What was the impact?
Too Much, Too Early	HVS Project Team designs a semi-automated conveyor line to meet their goal of minimizing direct labor	10 Year Lifecycle Cost Difference = **$5.6 Million** between Concept 1 & 8
Penny-Wise, Pound-Foolish	HVS Project Team decides to combine Overweld and Leak Test to save space on their conveyor concept	Bottleneck of 28 seconds vs. 15 seconds would have required investing in a second line
Too Little, Too Late	HVS Project Team hands-off the process design to the Chicago plant without any input from the Operational Team	Concept 1 is 20% more costly than Concept 2, and 138% more costly than Concept 8

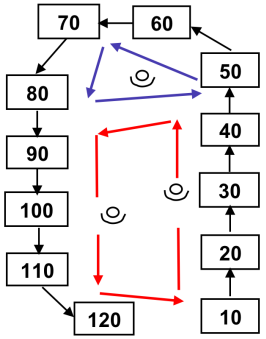
Set-Based Challenge:
Comparing Options with a *Total Lifecycle Focus*

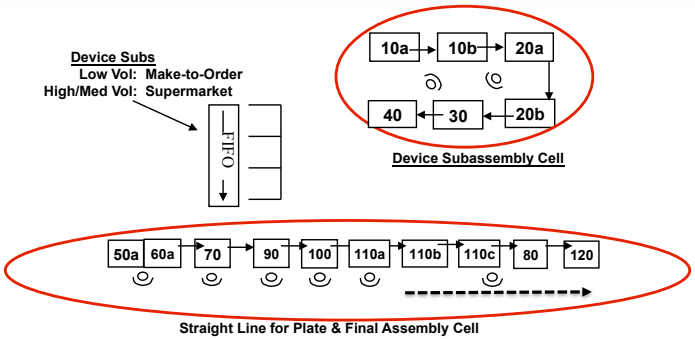
High Voltage Switch
Lean Process Creation Scorecard

		Sec / Unit		Sec			10 Years
Concept	**Effective Labor Efficiency**	**Capacity Flexibility**	**Lifecycle Cost per Unit**	**Manual Work Per Unit**	**Total Lifecycle Labor Investment**	**Total Lifecycle Capital Investment**	**Total Lifecyle Operational Cost**
1	51%	16	$2.26	120	$6,150,000	$3,600,000	$9,750,000
2	86%	60, 90, 180	$1.88	158	$5,642,857	$2,475,000	$8,117,857
3	86%	30, 45, 60, 120	$1.61	158	$5,642,857	$1,320,000	$6,962,857
4	80%	15,30,45,60	$1.23	123	$4,392,857	$940,000	$5,332,857
5	82%	15, 30, 45, 60	$1.18	113	$4,035,714	$1,050,000	$5,085,714
6	87%	15, 30, 45, 60	$0.98	106	$3,785,714	$445,000	$4,230,714
7	84%	15, 30, 45, 60	$0.95	102	$3,642,857	$465,000	$4,107,857
8	84%	15, 30, 45, 60	$0.95	102	$3,642,857	$465,000	$4,107,857
						Cost Avoidance:	**$5,642,143**

Results







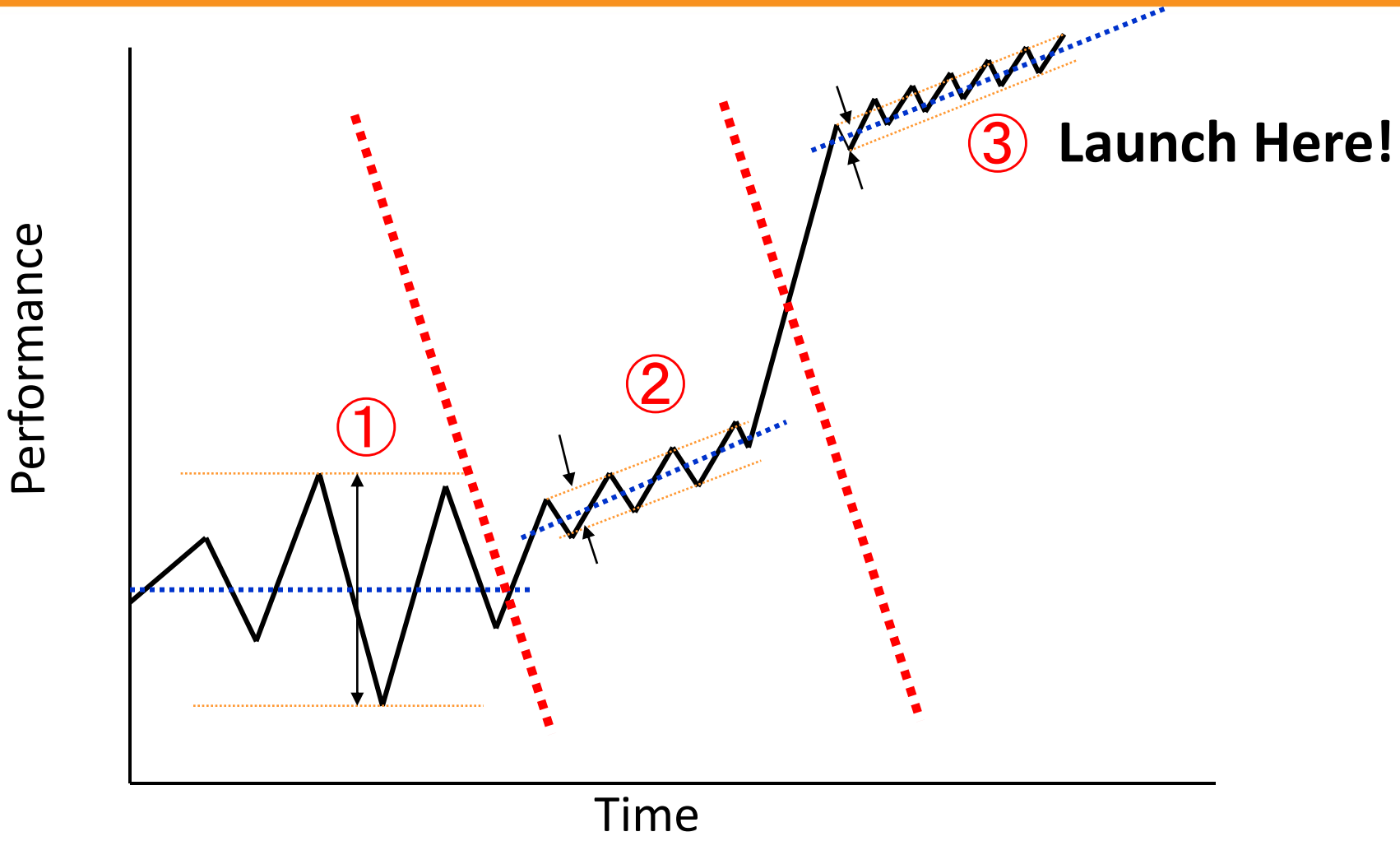
Metric	Product Team's Proposal (later, Concept 1)	Operational Team's Counterproposal (later, Concept 2)	LPPD Team's Final Proposal (Concept 8)
Cost per unit	$2.26	$1.88	$0.95
Labor Efficiency	51%	86%	84%
Capital Spend	$3.6 Million	$2.5 Million	$0.5 Million
Total Lifecycle Cost	$9.8 Million	$8.1 Million	$4.1 Million

Key Learning at Acme Devices

- **Lifecycle Focus**: Over 8x Payback for Upfront Engineering Effort
- **Product Design Influence**: Re-designed part eliminated Crimp step, reducing capital & manual time
- **Quality Improvement**: Crimp re-design improved quality & reduced key warranty issue
- **Process *Re-Selection***: In-line bolt feeders reduced manual station time by 41% and process variability by 80%
- **Resource Efficiency**: People, Capital, Environmental
  - 6 different flexible process rates for Concept 8; 1 for Concept 1
- **Learning Organization**: People were given a chance to use their creative talents to add value for customers and Acme
- **Knowledge Supermarket**: Identified future opportunities for next generation product
- **Simplified Process Management**: Manual work close together, load & go stations close together

Reflection

Where do you want to Launch? ①? ②? ③?



How to embed LPPD into the LPPD System?

Process Development Thinking:
Key Questions

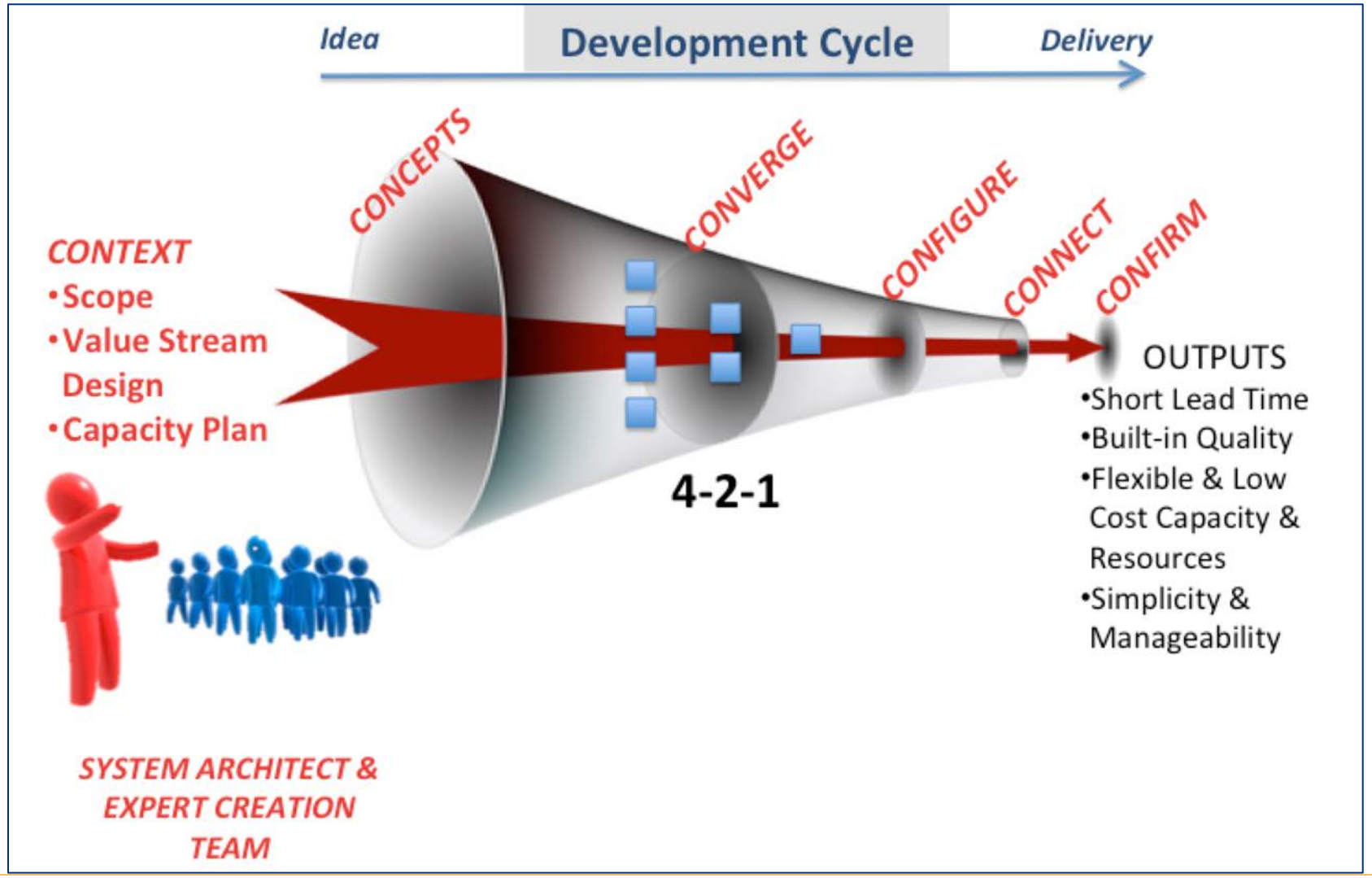
- What is the Work?
- When to do the Work?
- How to do the Work?
  - Flow with minimal interruption
  - Built-In Quality

What is the Work? When to do the Work? How to do the Work?

“Monday Morning”

- Pick a new product / process for your “learning laboratory”
- Nominate the system architect or chief engineer
  - Take responsibility
  - Link to product development for one overall *Development Team*
- Identify your responsible experts
  - Be prepared to collaborate & co-locate
- Take a value-stream view of the work
- Consider these phases
  - 6Cs *(Context, Concepts, Converge, etc.)*
  - 4:2:1 or some variation of set-based learning early-on
- Focus on the work
  - It will define the process

Q&A


Idea
Development Cycle
Delivery
CONCEPTS
CONVERGE
CONFIGURE
CONNECT
CONFIRM
CONTEXT
•Scope
•Value Stream Design
•Capacity Plan
4-2-1
OUTPUTS
•Short Lead Time
•Built-in Quality
•Flexible & Low Cost Capacity & Resources
•Simplicity & Manageability
SYSTEM ARCHITECT & EXPERT CREATION TEAM

Exercise Instructions: Part 2

Continuing to think deeply of new processes developed and launched in your organization….

- Set handout 2 next to handout 1 and complete based on your understanding / experience with your new process
  - 12 minutes
- As a table, briefly share your updated exercise sheet
  - 3 minutes takt time per person
- Each table, select one updated failure mode example to share with the entire room
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Exercise 2 Handout

Area:

Failure Modes	What existing process controls of yours prevent the failure mode or its cause?	What Actions are recommended to reduce Probability of the Failure Mode Occurring?
Too Much, Too Early *(Upfront Operational Decisions)*		
Penny-Wise, Pound-Foolish *(Decisions throughout Lifecycle)*		
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Additional Failure Mode(s)		

Full Example Handout

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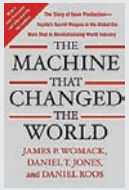

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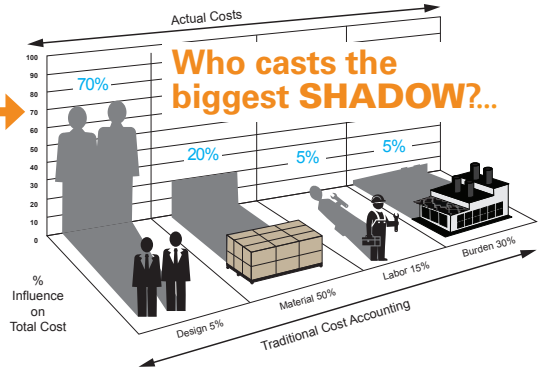

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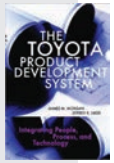

Community | **Education** | **Learning** | **Research**

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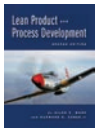

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