Innovation Performance:
The Good, The Bad, and The Worthy

This workshop will guide the development of a system to improve Innovation Performance.
Attendees will actively define measurements, structure a measurement process, and plan implementation of the system.

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Workshop Outline

- Part 1: Creating Your Innovation Performance Process
  - Objective: Map your Innovation Performance process
- Part 2: Measuring Your Innovation Performance Process
  - Objective: Identify and define your performance measurements
- Part 3: Implementing Improved Innovation Performance
  - Objective: Plan the implementation of improved performance

Part 1:
Creating Your Innovation Performance Process

- Innovation Performance Mythology and Reality
- Why Performance is Poor, and What Makes Innovation Worthy
- Innovation as a System
- Defining Your Innovation Performance Process

Innovation Performance Mythology and Reality

- The Ugly
  - Urban Legend: New products failure rate = 80% or More!
  - No. Not true. Not even close.
    - But the myth is well established
    - You may need to counter this perception with facts

Eli Wallach as Tuco
RareGallery.com

Castellion, George; Markham, Stephen; *New Product Failure Rates: Influence of Argumentum ad Populum and Self-Interest*, Journal of Product Innovation Management, 2013:30(5):976-979

Innovation Performance Mythology and Reality

- The Ugly
  - Sources of the Myth
    - Castellion/Markham cite 15 published sources, and estimate 100+
    - Including:
      - Harvard Business Review
      - Wall Street Journal
      - US Department of Commerce
      - and many more books, journals, and magazines
  - Why?
    - self-interest of practitioners, consultants, research providers, etc.
    - perhaps people are counting *ideas*, not projects, particularly for Phase-Gate-style processes

Castellion, George; Markham, Stephen; *New Product Failure Rates: Influence of Argumentum ad Populum and Self-Interest*, Journal of Product Innovation Management, 2013:30(5):976-979

Innovation Performance Mythology and Reality

- The Bad
  - The true average failure rate is about 40%
    - What? 40%? Clearly, this is not good.
  - This has been consistently verified in many studies
    - Crawford, C.M. (1977, 1987)
    - Cooper, R.G. (1979, 1980, 1986, 1993)
    - PDMA (1997, 2003, 2009, 2013)

Lee Van Cleef as Angel Eyes
RareGallery.com

Innovation Performance Mythology and Reality

- The Bad
  - Not good, and not improving

	2012	2004	1995	1990
Number of firms	453	416	383	189
Successes	61.0%	59.0%	59.0%	58.0%
Success-profits	56.2%	54.2%	54.6%	N/A
Sales from new products	31.1%	28.0%	32.4%	32.6%
Profits from new products	30.8%	28.3%	30.6%	33.2%
Number of ideas for one success	8.7	7.2	6.6	11.0

N/A, not available.

Successes = Launched product succeeded in the market
Sales from new products = sales of products introduced in past five years as percent of total company sales
Profits from new products = profits of products introduced in past five years as percent of total company profits

Markham, S., Lee H., *Product Development and Management Association's 2012 Comparative Performance Assessment Study*, JPIM, 2013

Innovation Performance Mythology and Reality

- The Bad
  - Why 40%?
    - This is real, validated performance on measurements of success
    - These are actual projects that get introduced to the market
    - It is very difficult to be successful on all attributes of market success
  - My observations
    - Development is not a normal business process
    - It is a complex system with long lead times and slow feedback loops
    - Such a system is very difficult to manage with high performance

Why Performance is Poor, and What Makes Innovation Worthy

The Good

- The Best and The Rest
  - It is clear that some firms are good at development

Project Metric	Average Companies	Best Companies
Percent Launched On Schedule	51%	79%
Percent Completed On Budget	57%	79%
Percent Meeting Sales Objectives	55%	74%
Percent Meeting Profit Objectives	56%	77%
Percent Commercially Successful	60%	79%

Clint Eastwood as
The Man with No Name
RareGallery.com

Cooper, R., Edgett, S., *Benchmarking Best Practices: Performance Results and the Role of Senior Management*, 2003

Why Performance is Poor, and What Makes Innovation Worthy

The Good

- The Best and The Rest
  - more evidence of firms that are good at development

	2012	
	The Best	The Rest
Number of firms	88 (24.6%)	270 (75.4%)
Successes	82.2%	52.9%
Success-profits	78.2%	47.9%
Sales from new products	47.9%	25.4%
Profits from new products	48.5%	25.0%
Number of ideas for one success	4.5	11.4

Successes = Launched product succeeded in the market
Sales from new products = sales of products introduced in past five years as percent of total company sales
Profits from new products = profits of products introduced in past five years as percent of total company profits
Note: Asia Successes is low due to large number of smaller companies in the sample. Large Asian companies are similar to rest of world.

Markham, S., Lee H., *Product Development and Management Association's 2012 Comparative Performance Assessment Study*, JPIM, 2013

Why Performance is Poor, and What Makes Innovation Worthy

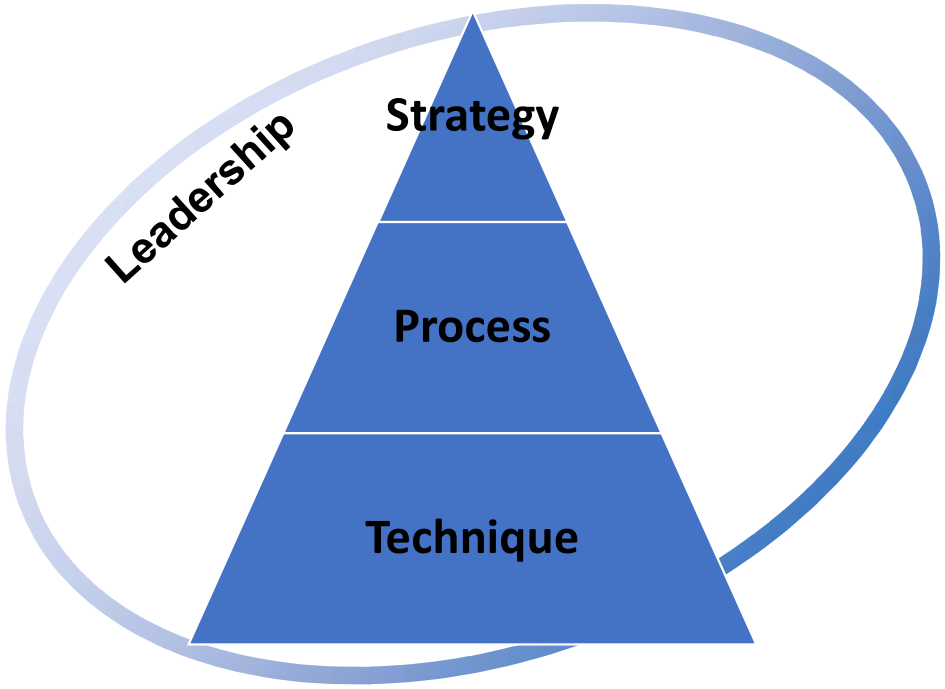
The Good

- So why do The Best do better?

- My observations
  - as a complex process, innovation requires a good leadership system
  - innovative firms seem to lead with good methods
    and simple countermeasures to manage complexity

Innovation as a System

- Innovation Development Ecosystem
  - *Innovation is Organic, not Mechanic !*



a culture for sustainable innovation
Synonyms: **atmosphere, environment, organization, framework, etc.**

The ecosystem is nurtured, and many projects grow surprisingly well, and some fail.

Navarre, L. (ed), Innovation Development Excellence, 2018

Innovation as a System

Characteristics of Innovation Development as a business process

Unpredictable

- Messy, surprising, seldom orderly
- But, the process should be organized

Cross-Functional

- Innovation is a “team-sport”
- Many parts of the organization are needed on the project team

Concurrent

- Overlapping of activities has proven successful

Multi-Part

- Organized into 4-7 activity groups
- Yet, sequential structure slows progress

Scalable

- The tasks must fit the project needs
- One size does not fit all innovations

Learning

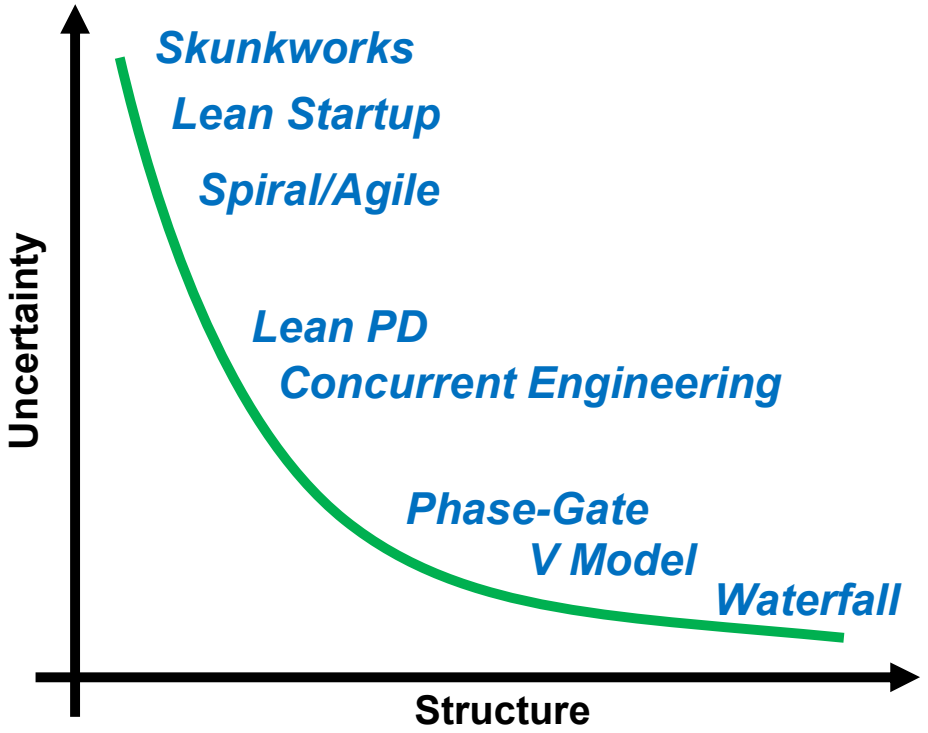
- Failure is common, and a rare opportunity for organizational learning

Navarre, L., Borkar, R., *Characteristics of Innovation Development as a Business Process*, MASAL 2018 (pending)

Innovation as a System

Innovation System Structure-Uncertainty Tradeoff

- Although there are many different systems for managing innovation, the fundamental tradeoff is Structure vs. Uncertainty
- Greater project Uncertainty suggests a less structured, more flexible development process for that project
- Conversely, projects with little uncertainty work well in highly structured development processes



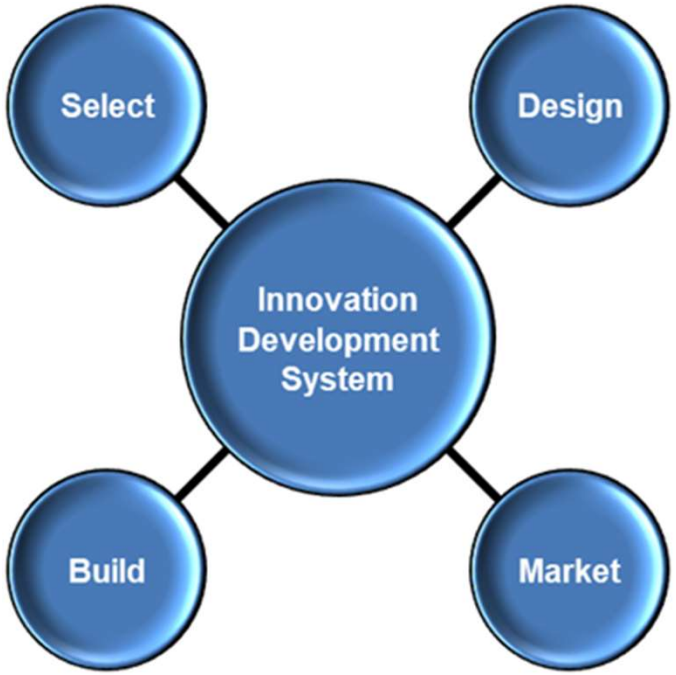
Navarre, L. (ed), Innovation Development Excellence, 2018

Innovation as a System

Not a process, a System

- Innovation is like a social network
  - A process as an information network
  - Activities connected by communication
  - Centrally coordinated
  - Flexibly responsive on demand

- In other words, not a linear process



Navarre, L., Borkar, R., *Characteristics of Innovation Development as a Business Process*, MASAL Conference March 9, 2018

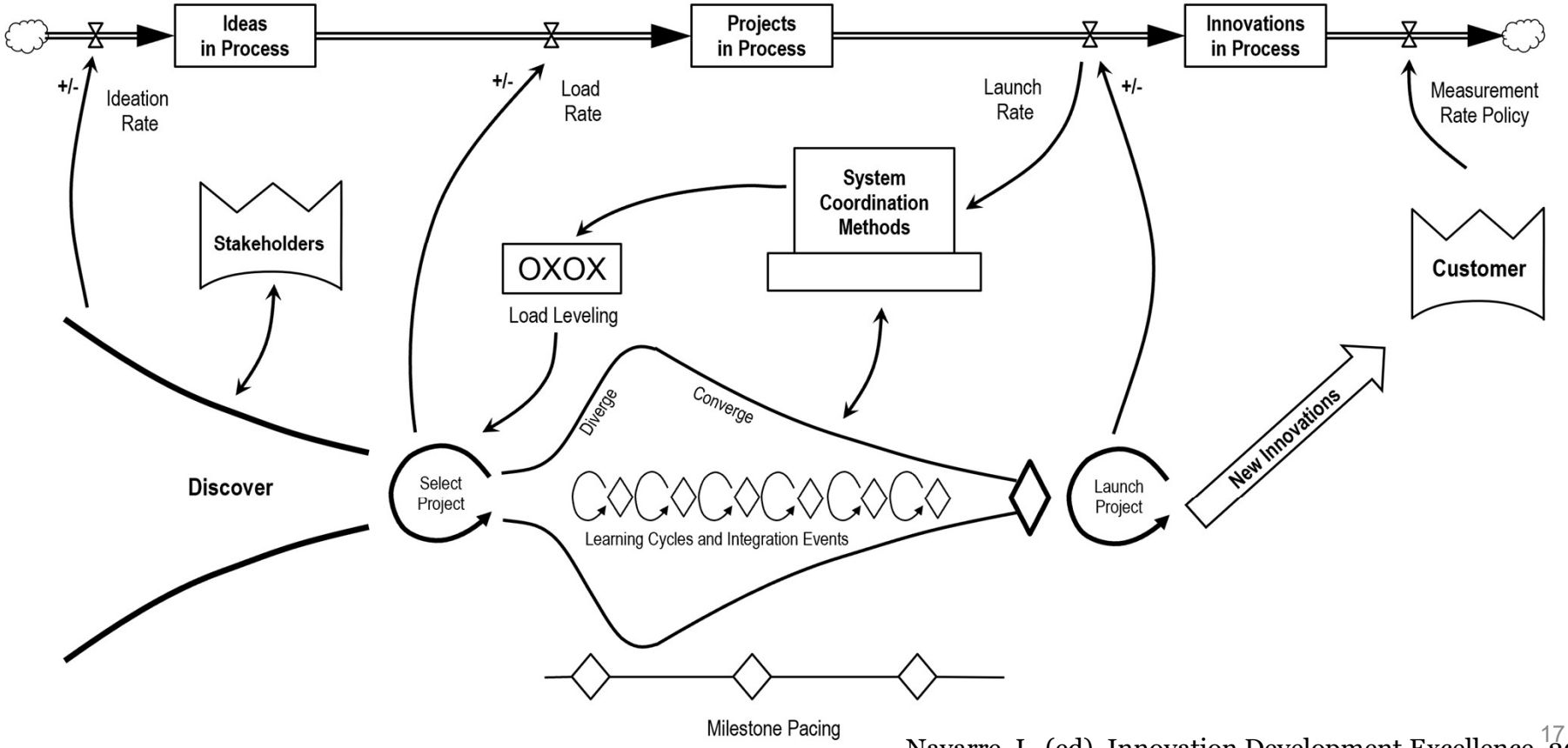
Innovation as a System

Takeaway Points

- Innovation is not a "Normal" Business Process
  - A system that delivers a continuous stream of new innovations is essential
  - Sincerely, innovation has characteristics that make it really strange
  - Don't fight it with ISO 9000, Six Sigma, or normal process improvement
  - Study the characteristics and apply methods that accommodate the oddity of innovation

Innovation as a System

Viewing the Innovation System as a Dynamic System



Navarre, L. (ed), Innovation Development Excellence, 2018-2023

The Worthy

- Development performance must improve

  Innovation is not an altruistic activity to be done as an end in itself.

  Adequate investment is the fundamental leadership activity…
  …then, follow up with expectations for high performance.

  The innovation system must deliver high performance but,
  operating a high-performing system is very challenging.

Defining Your Innovation Performance Process

- Exercise:
  - High-Level Process Map of your Innovation System

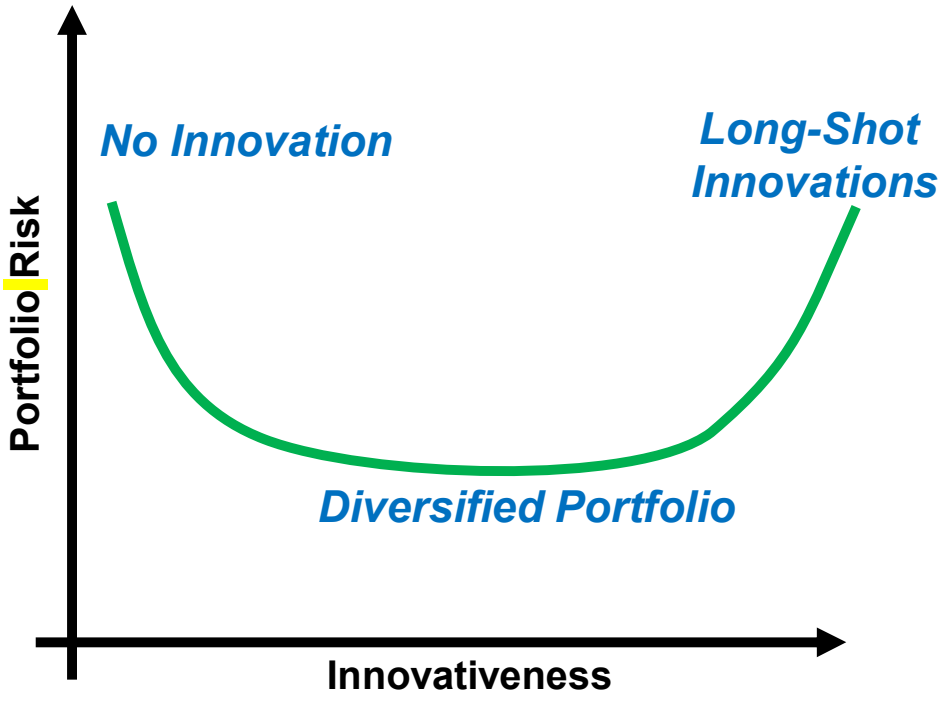
Part 2: Measuring Your Innovation Performance Process

- Innovation Economics
- Defining Your Critical Few Innovation Measurements
- Building a Measurement and Monitoring Process

Innovation Economics

Opportunity Selection Trade-off

- Strategy and Selection
  - An organization commonly balances risk with a portfolio of projects having a range of innovativeness
  - Few, long-shot innovations is highly risky
  - A balanced mix of project types minimizes risk
  - Note that little or no innovation is also highly risky



Adapted from Morris/Kuratko/Covin, Corporate Entrepreneurship & Innovation, 3e, 2011, pp. 68-69

Innovation Economics

- The Innovation Strategy must fit the Organization Strategy
  - The organization strategy will determine the degree and frequency of innovation
  - Portfolio risk is balanced with projects having a range of innovativeness
  - Trying to be "more innovative" may not be rewarded, but less innovation is typically punished
  - It is common to change strategy given the changing dynamics of organizations, markets, competition, and technologies

Innovation Economics

Craft Beer Game

- Welcome to BrauHaus Frankfort
  - A craft beer brewery in Northern Michigan
  - Started by young entrepreneurs with a passion for home brewing
  - Typical small brewpub, except that it became large
  - Now exceeds $40 million in annual sales
  - Focus on high quality beers, and clever product marketing
  - 200 employees, large brewery, bottling line, distribution center
  - Product Segmentation
    - New-To-Firm – never done before
    - Extension – simple recipe modification
    - Seasonal – seasonal beer for variety
  - Quarterly Budget - $130,000

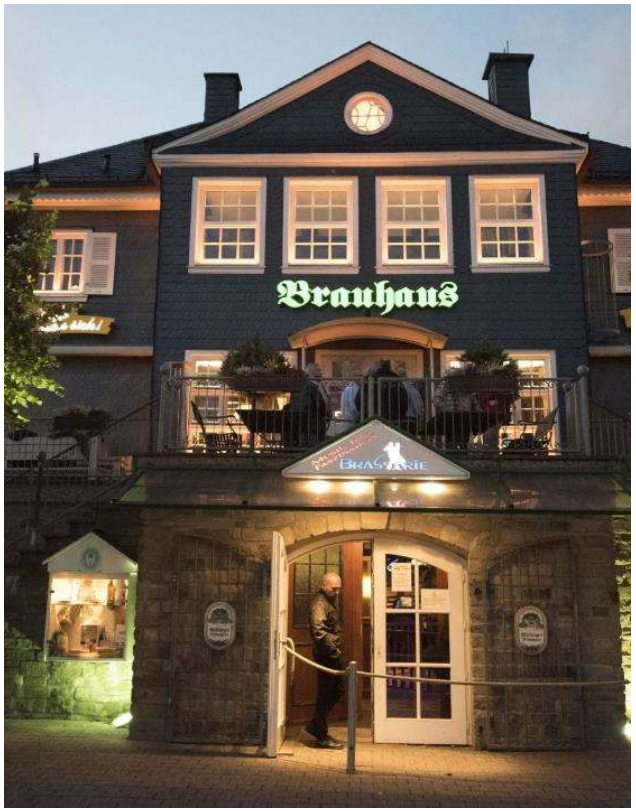


Photo credit: Brauhaus Willinger www.willinger-brauhaus.de

Innovation Economics

- Exercise: Innovation Project Justification
  - A simple project is being proposed for development
  - Complete the project justification
  - Work in small groups
  - After group work we will share and compare

- If you wish to use a spreadsheet:
  - https://tinyurl.com/46yf9zv4

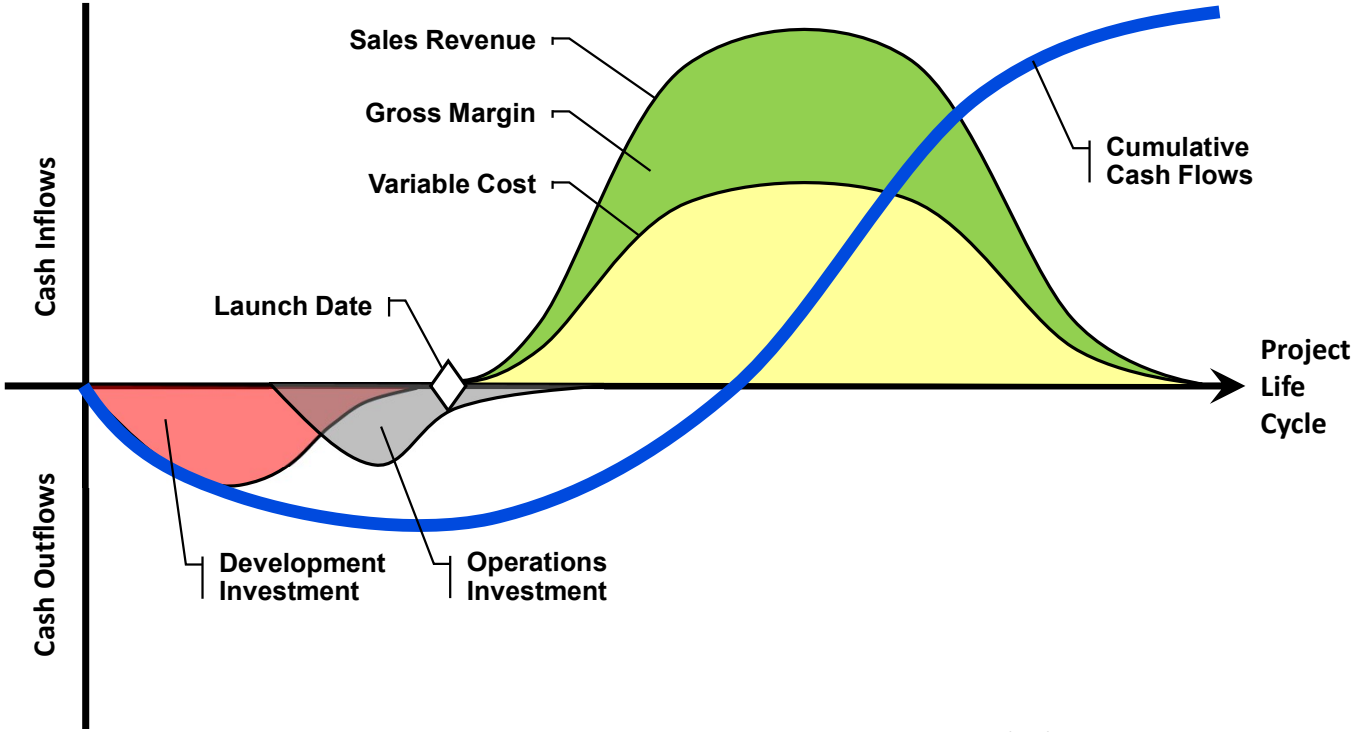
Innovation Economics

Principles of Economic Analysis

- What is Economic Evaluation?
  - An analytical procedure to evaluate the financial worth of a project which has its origin in the discipline of financial management
  - Many different disciplines utilize economic analysis, yet they all have their roots in foundational finance principles
  - No mysteries, just math… and a lot of judgment

Innovation Economics

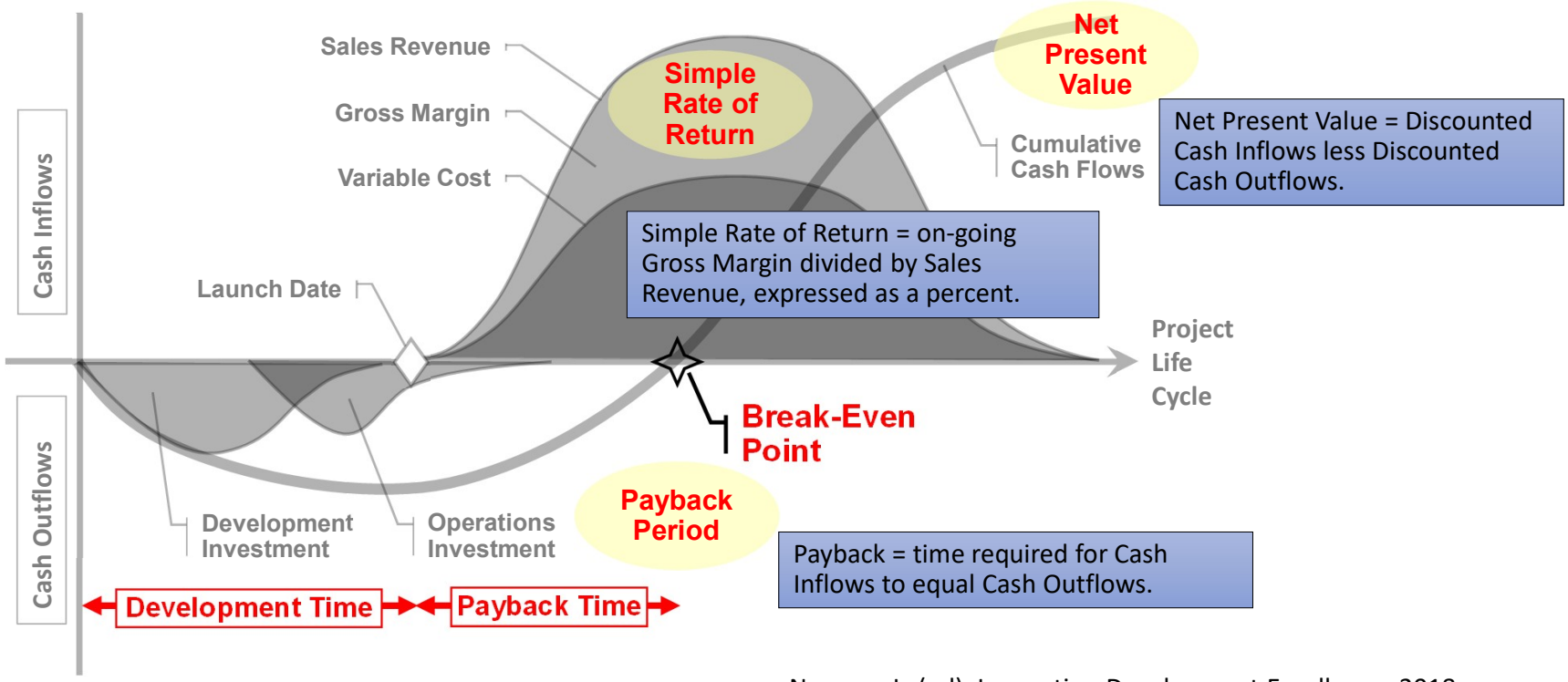
Typical Development Cash Flows



Navarre, L. (ed), Innovation Development Excellence, 2018

Innovation Economics

How to Evaluate the Economic Benefit of Development Projects?



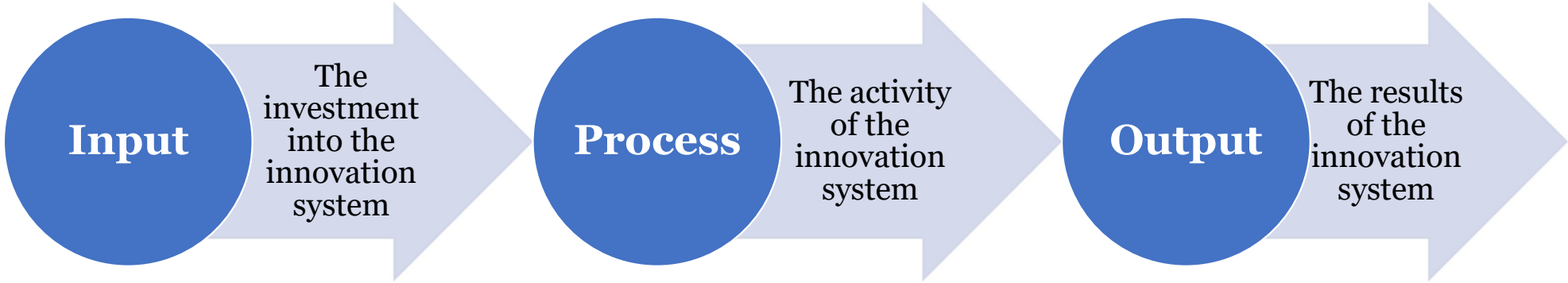
Navarre, L. (ed), Innovation Development Excellence, 2018

Innovation Economics

- Development NPV Process
  - Decide on time periods
    - Months, Quarters, Years
  - Decide on Discount Rate
    - For-Profit, Non-Profit, Government
  - Design and Development
    - Engineering and design talent cost
  - Prototyping and Testing
    - Prototype construction and testing cost to close the knowledge gaps
  - Production Equipment and Setup
    - Process development cost needed to produce the product or deliver the service
  - Marketing Communication Materials
    - The cost to develop marketing materials such as videos, literature, advertisements
  - Marketing Communication Program
    - The cost to use the communication media in advertising, printing, placement
  - Sales volume (in units) per period
    - The quantity of products sold per period
  - Sales Price per unit
    - The price to the customer per unit
  - Gross Margin
    - A variable margin percent appropriate for the innovation, company, and industry

Defining Your Critical Few Innovation Measurements

- Categories of Innovation Performance



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Defining Your Critical Few Innovation Measurements

- Input Metrics (Investment)
  - Percent of Sales Budget
    - Most firms budget development expenses by as a percent of sales
    - 2-4% of sales for a typical industrial firm
    - Up to 10+% for high-tech firms with short product life cycles
  - Development is not investment!
    - At least to accountants
    - R&D is an expense of the current period
    - The temptation to cut R&D to improve short-term profit is hard to resist

Navarre, L. (ed), Innovation Development Excellence, 2018-2023

Defining Your Critical Few Innovation Measurements

R&D Percent of Sales

Company or Source	R&D Percent of Sales
Average of 2003 APQC Study (1)	**5.2%**
A typical industrial firm (est.)	**2%**
Apple Inc.	**5%**
Alphabet (Google)	**15%**
Amazon.com	**12%**
Intel Corp.	**21%** (not a typo)
3M Corp.	**5%**

(1) Cooper, R., Edgett, S., *Benchmarking Best Practices: Performance Results and the Role of Senior Management*, 2003 and 2021 Public Financial Data of Representative Firms

Defining Your Critical Few Innovation Measurements

- Process Metrics (Project Management)
  - Project Budget and Expense Variance
  - Schedule Task Completion
  - Schedule Adherence
  - Project Cycle Time
  - Completion of Deliverables (Project Plan/Goal)
  - Benefits of Deliverables (Post-Project Tracking)

Defining Your Critical Few Innovation Measurements

Some Data on Innovation Performance

Project Metric	Average Companies	Best Companies
3-Year Percent of Sales from New Products	**27%**	**38%**
Percent Launched On Schedule	**51%**	**79%**
Time Late (average % of schedule)	**35%**	**17%**
Percent Completed On Budget	**57%**	**79%**
Percent Meeting Sales Objectives	**55%**	**74%**
Percent Meeting Profit Objectives	**56%**	**77%**
Percent Commercially Successful	**60%**	**79%**

Cooper, R., Edgett, S., *Benchmarking Best Practices: Performance Results and the Role of Senior Management*, 2003

Defining Your Critical Few Innovation Measurements

- Output Metrics (Sales Revenue)
  - Percent of Sales from New Products
    - The most common measure of new product sales performance
  - Timeframe for a "New" product
    - 1 to 5 years is typical, depends on the industry
  - Performance Goals
    - 10% - 80% of Sales
    - Depends on the company, industry, etc.
    - Very challenging to maintain consistent performance

Defining Your Critical Few Innovation Measurements

- Output Metrics (Profit)
  - Breakeven Period
    - Number of months of sales margin necessary to payback development expense
    - Good for balancing expenses with projected benefits
  - Gross Margin
    - Price is typically determined by market
    - Cost must be evaluated throughout development
    - The Cost is Determined in Design
  - Return on Investment (ROI)
    - Financial measurement to estimate overall financial success
    - Net Present Value (NPV), Internal Rate of Return (IRR)
    - Based on discounting cash flows (DCF) and preferred by financial managers

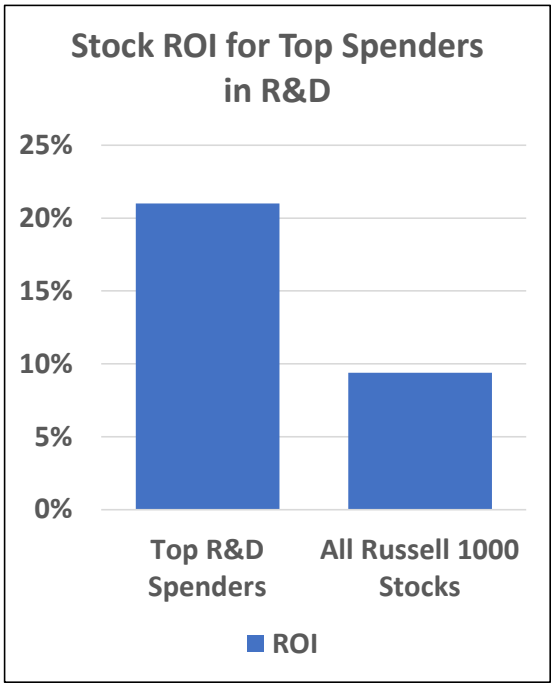
Defining Your Critical Few Innovation Measurements

Some Data on Innovation Performance

For Strong Returns, Try Stock in Top Spenders on R&D

- Barron's Magazine

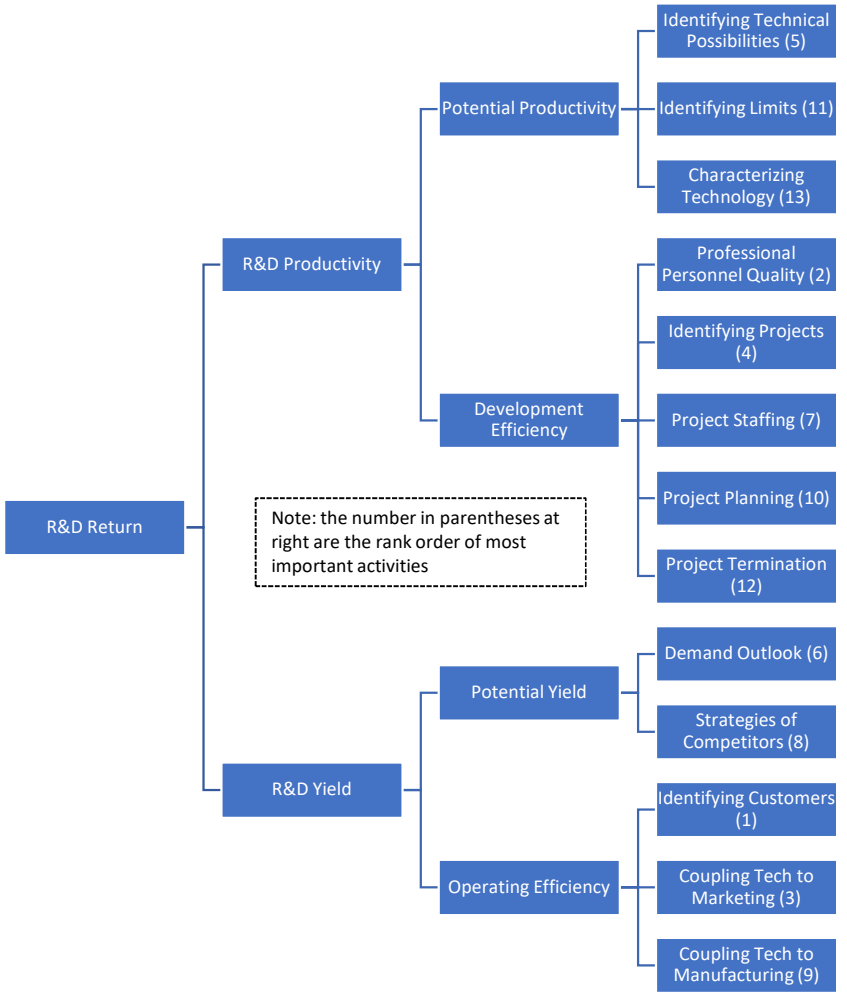
- Study of Russell 1000 stocks from 1990-2017
  - Top 10% spenders on R&D have 21% stock ROI
  - Russell 1000 as a group has only 9.4% ROI
    - Study conducted by Joseph Mezrich, quantitative strategist, Instinet



Liu, E., *For Strong Returns, Try Stock in Top Spenders on R&D*, Barron's, January 11, 2019

The Worthy

- How do we demonstrate value in Innovation?
  - Research and experience consistently demonstrate two basic themes:
    - Efficiency
    - Effectiveness
  - We should measure the innovation system accordingly

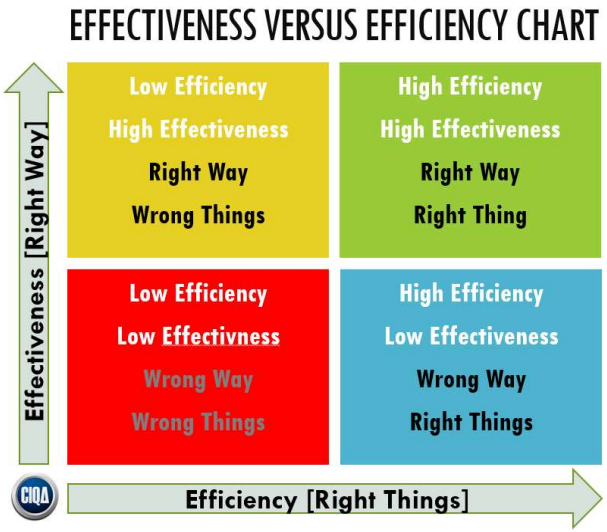


Adapted from: Foster/Linden/Whiteley/Kantrow, *Improving the Return on R&D - II*, R&D Return Framework – High Return Activities, The Journal of Science Policy and Research Management, Vol.2(4), (1987)

The Worthy

- Efficiency Defined
  - Classic Economics:
    - Using the least amount of inputs to achieve highest amount of output
  - Innovation:
    - From Dantar Oosterwal: The amount of change an organization can affect in a period of time. This is generally measured as the number of projects of a particular type an organization can deliver in a year.
- Effectiveness
  - Classic Marketing:
    - Increasing revenue while decreasing customer acquisition cost
  - Innovation
    - From Dantar Oosterwal: The 'lift' a company realizes from development as measured in terms of revenue, profit, market share, etc. What ever 'lifts' the organization.

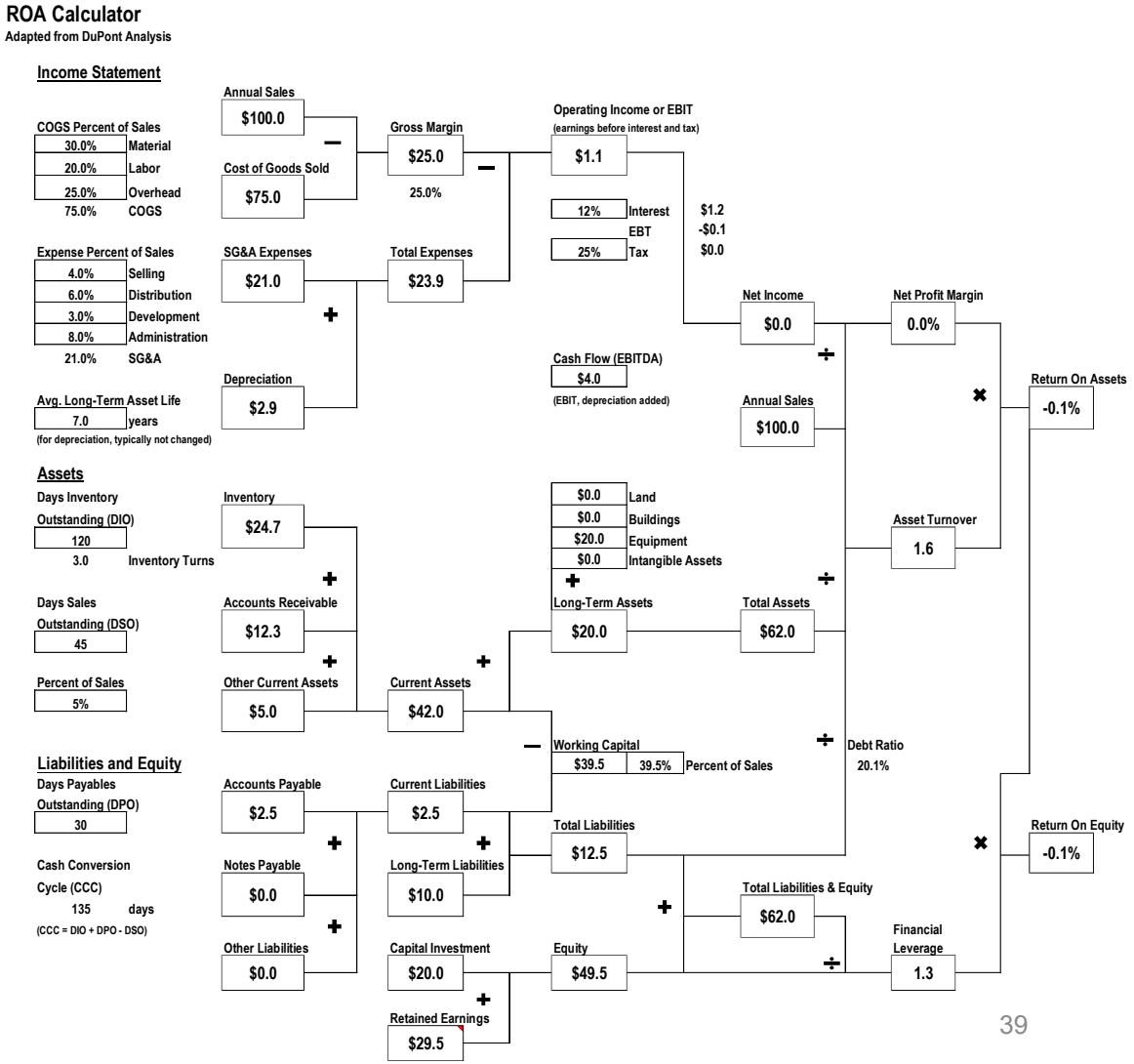
$$Efficiency = \frac{Output}{Input}$$



https://ciqa.net/what-is-effectiveness-versus-efficiency-according-to-lean-six-sigma/

The Worthy

- How do we demonstrate value in Innovation?
  - DuPont Analysis provides a guide
  - Tie your improvements in Innovation to the value of the firm



Building a Measurement and Monitoring Process

- Step 1: Select Metrics that align with the Organization Strategy
  - Have Discussions with the Stakeholders of Innovation

Step 1	
Stakeholder	**Discussion Questions**
Enterprise Leadership	What are the key strategic objectives?
Functional Leadership	What are the key operational objectives?
Other Stakeholders	What measures can Innovation affect?

Adapted from: Gartner, Designing Your Supply Chain Performance Dashboard, https://www.gartner.com/en/supply-chain/trends/designing-supply-chain-metrics-performance-dashboard

Building a Measurement and Monitoring Process

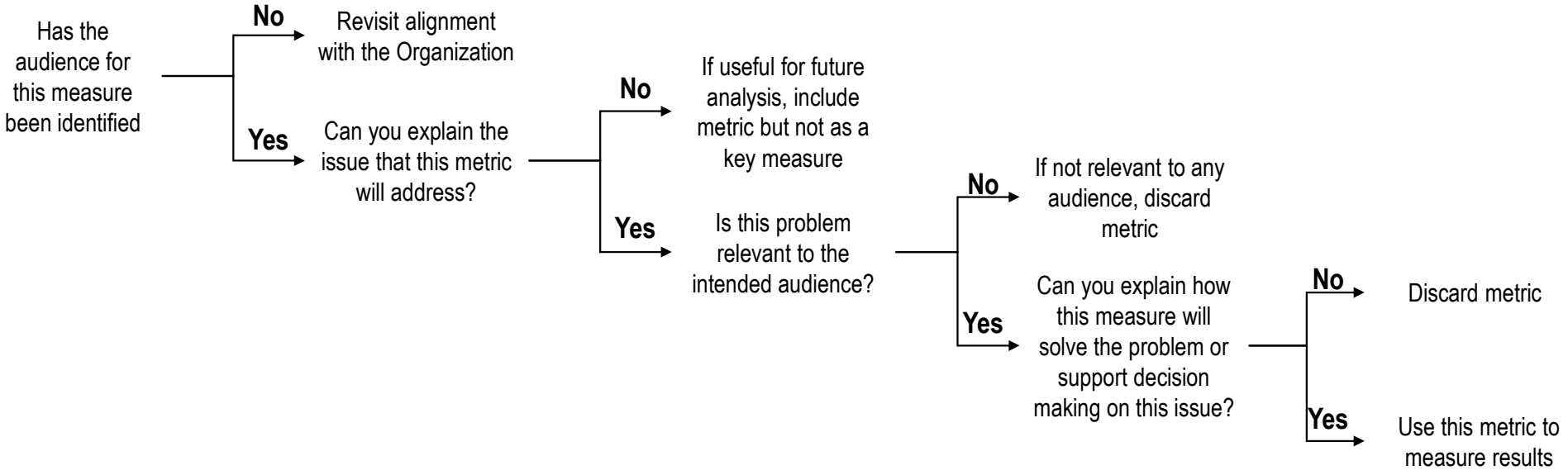
- Step 2: Map the Innovation Objectives to Organization Goals
  - Evaluate the Organization Objectives and Connect to Innovation

Step 2					
Organization Objective	**Margin Improvement**	**Working Capital Improvement**	**Market Share**	**Growth**	**Return on Investment**
Innovation Objective	Innovation Gross Margin	Innovation Project Expenses in Process	Innovation Project Time to Market	Innovation Revenue Percent of Sales	Innovation Project Return on Investment
Innovation Initiative	Improve Innovation Gross Margin by x.x% Percent	Improve Innovation Projects in Process by x.x Turns	Improve Innovation Time to Market by xx Days	Improve Innovation Revenue by x.x % of Sales	Improve Innovation ROI by x.x%

Adapted from: Gartner, Designing Your Supply Chain Performance Dashboard, https://www.gartner.com/en/supply-chain/trends/designing-supply-chain-metrics-performance-dashboard

Building a Measurement and Monitoring Process

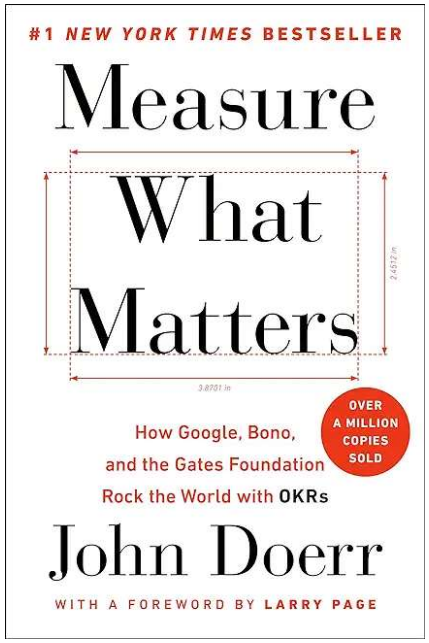
- Step 3: Decision Rules for Metric Selection
  - Evaluate the metrics for driving the desired behaviors and outcomes



Adapted from: Gartner, Designing Your Supply Chain Performance Dashboard, https://www.gartner.com/en/supply-chain/trends/designing-supply-chain-metrics-performance-dashboard

Building a Measurement and Monitoring Process

- Step 4: Prioritize Metrics and Define Thresholds
  - Thresholds include minimum, current expected, and future target performance
  - Consider the use of the OKR method – Objectives and Key Results



Objectives
- the "What"
- A mission-supporting goal
- The highest priorities your team needs to accomplish in the next 30-90 days
- Milestones to achieve

Key Results
- the "How"
- Benchmarks to measure and track progress toward the objective
- Define actions to be taken
- Typically, 3-5 per objective

Example Objective:
Improve Gross Margin on Innovation Projects by 5% of Sales

Example Key Results:
- Achieve 2% GM improvement on next project
- Implement Cost Management on next project and track cost rollup
- Use Design for X on next project to reduce assembly hours by 10%
- Achieve 3% GM on project after next

Building a Measurement and Monitoring Process

- Exercise: Add to your A3 Analysis to identify OKR's

Part 3: Implementing Improved Innovation Performance

- Pulling Performance by Leveraging Lean Processes
- Leading Like a Chief Entrepreneur
- Defining Your Innovation Performance Improvement Plan

Pulling Performance by Leveraging Lean Processes

- 12 Countermeasures and The Why
  1. Opportunity Identification
  2. Project Justification and Selection
  3. Pipeline Management with Load Leveling
  4. System Architecture
  5. Project Requirements with the Concept Paper
  6. Identify Unknowns and Close Knowledge Gaps
  7. Set-Based Innovation
  8. Prototyping with DOE and Extreme Testing
  9. Integration Events
  10. Cost Management
  11. Process Development
  12. Knowledge Management

Pulling Performance by Leveraging Lean Processes

- #1 Opportunity Identification
  - Every organization needs a structured process to collect, evaluate, and select ideas for development
- The Why:
  - Efficiency:
    - ↑ ROI by choosing best projects
  - Effectiveness:
    - ↑ Sales by selecting the best projects
    - ↓ Errors by avoiding projects with weak justification
- Breakdown:
  - Structured simply mean organized and regularly implemented
  - Collection is cataloging an idea that comes to the organization
  - Evaluation is a systematic, but simple, means to score potential of the idea
  - Select is the choice to start a project, or discard the idea

Pulling Performance by Leveraging Lean Processes

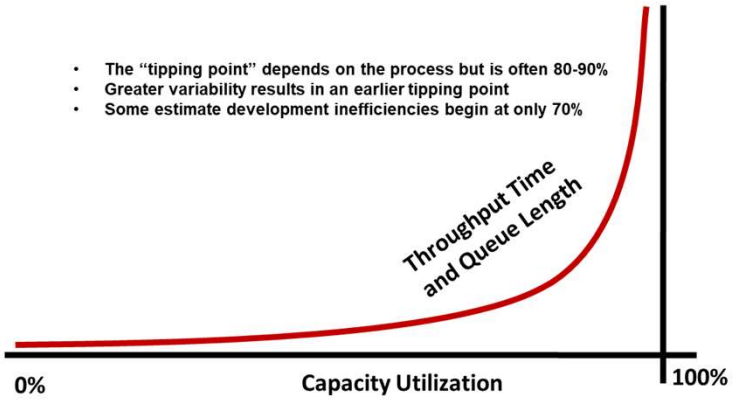
- #2 Project Justification and Selection
  - Select projects that justify your strategic goals
  - Use financial methods that demonstrate value to the enterprise
- The Why:
  - Efficiency:
    - ↑ ROI by choosing best projects
    - = Input data to balance capacity
  - Effectiveness:
    - ↑ Sales by selecting the best projects
    - ↓ Errors by avoiding projects with weak justification

Real – Win – Worth-It is a good start

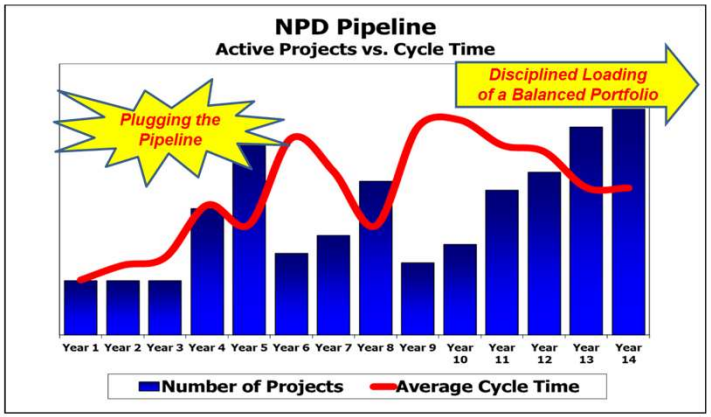
Is it real?	Is the market real?	Is there a need or desire for the product?
		Can the customer buy it?
		Is the size of the potential market adequate?
		Will the customer buy the product?
	Is the product real?	Is there a clear concept?
		Can the product be made?
		Will the final product satisfy the market?
Can we win?	Can the product be competitive?	Does it have a competitive advantage?
		Can the advantage be sustained?
		Can it withstand competitor response?
	Can our company be competitive?	Do we have superior resources?
		Do we have appropriate management?
		Can we understand and respond to the market?
Is it worth doing?	Will the product be profitable at an acceptable risk?	Are forecasted returns greater than costs?
		Are the risks acceptable?
	Does launching the product make strategic sense?	Does the product fit our overall growth strategy?
		Will top management support it?

Pulling Performance by Leveraging Lean Processes

- #3 Pipeline Management with Load Leveling
  - Development is a Queueing System
  - Require Reasonable Capacity Utilization
  - Pull projects into the system with a ConWIP signal
- The Why:
  - Efficiency:
    - ↑ Development output flow
    - = Balance capacity
  - Effectiveness:
    - ↑ Project completion reliability
    - ↓ System Dynamic costs



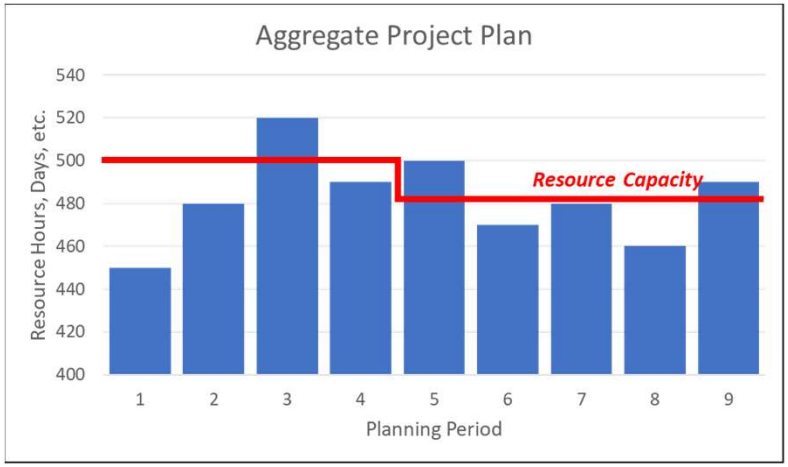
Navarre, L. (ed), Innovation Development Excellence, 2018



Navarre, L. (ed), Innovation Development Excellence, 2018

Pulling Performance by Leveraging Lean Processes

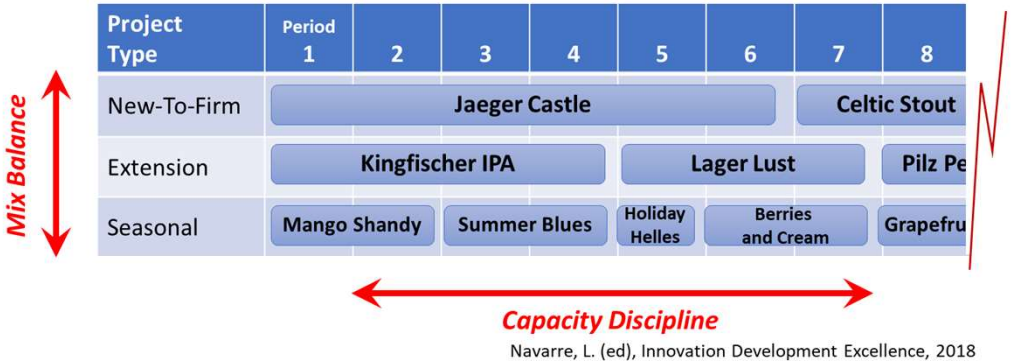
- Strategies to Mitigate Innovation System Dynamics
  - Load Leveling
    - Scheduling a balanced mix of work with the capacity available by time period
      - A well-established technique of Lean manufacturing



Navarre, L. (ed), Innovation Development Excellence, 2018

System Dynamic	Countermeasure
Structure	• Simplify process structure, fewer steps • Increase concurrency, overlapping of steps
Delays	• Increase information sharing, cross-functional teaming • Avoid "decision batching", make daily decisions • Minimize "hand-offs", encourage concurrency • Make project work visible, self-managing
Amplification	• Manage capacity utilization, avoid overloading • Understand dynamics, avoid decisions that compound problems

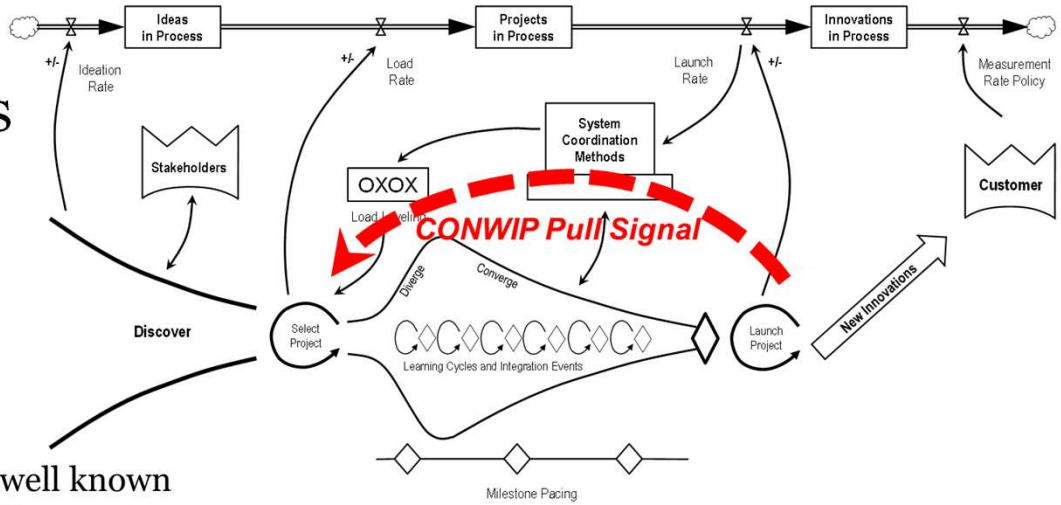
Navarre, L. (ed), Innovation Development Excellence, 2018



Navarre, L. (ed), Innovation Development Excellence, 2018

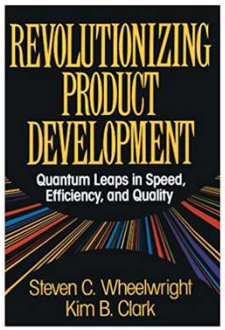
Pulling Performance by Leveraging Lean Processes

- Strategies to Mitigate Innovation System Dynamics

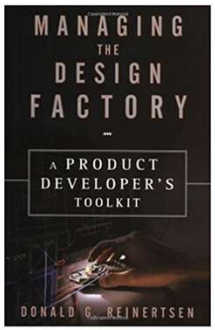


Navarre, L. (ed), Innovation Development Excellence, 2018

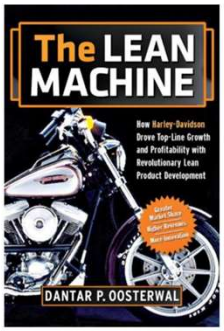
Systems Thinking in development is documented, but not well known



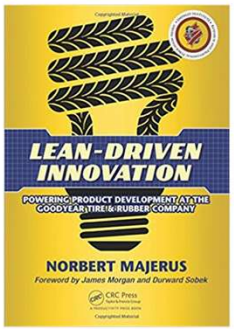
Wheelwright/Clark is the classic explanation of aggregate project planning



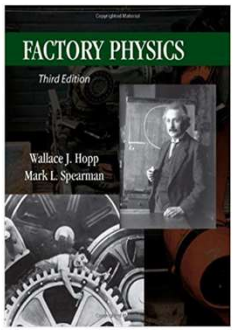
Reinertsen explains development as a queueing system



Oosterwal explains system dynamics of development and the "bin mix" method at H-D



Majerus explains the transformation to capacity planning at Goodyear

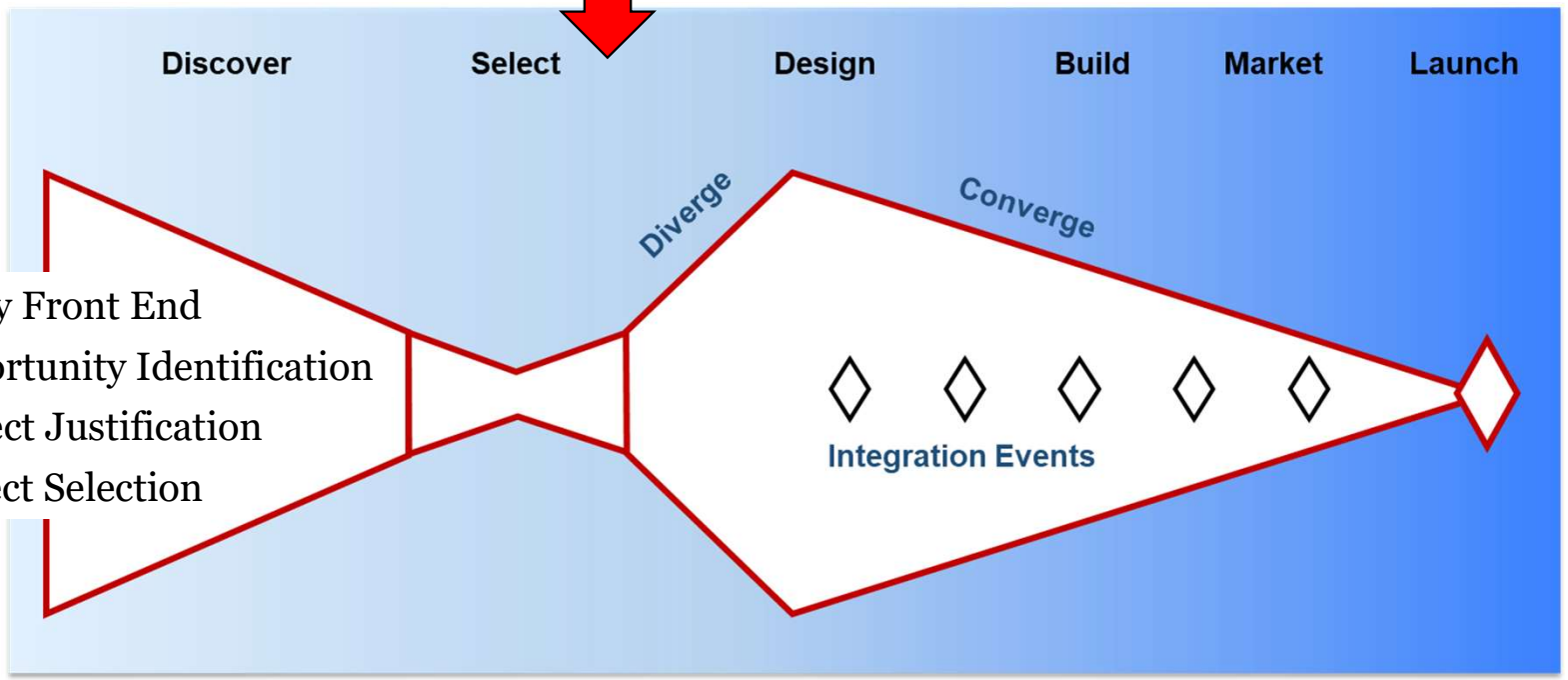


Hopp/Spearman calculate queueing system performance and countermeasures

Pulling Performance by Leveraging Lean Processes

You are here:

You are at the end of Select. Now you need to define the Project Requirements to begin Design.



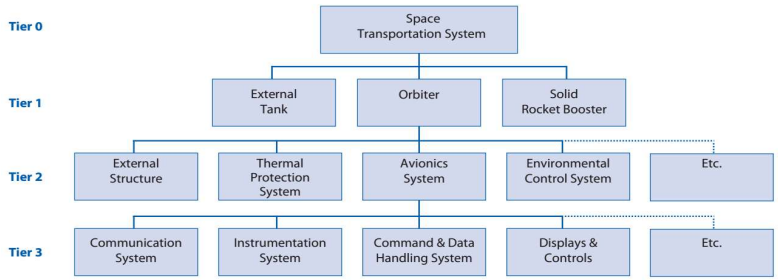
Fuzzy Front End
Opportunity Identification
Project Justification
Project Selection

Navarre, L. (ed), Innovation Development Excellence, 2018

Pulling Performance by Leveraging Lean Processes

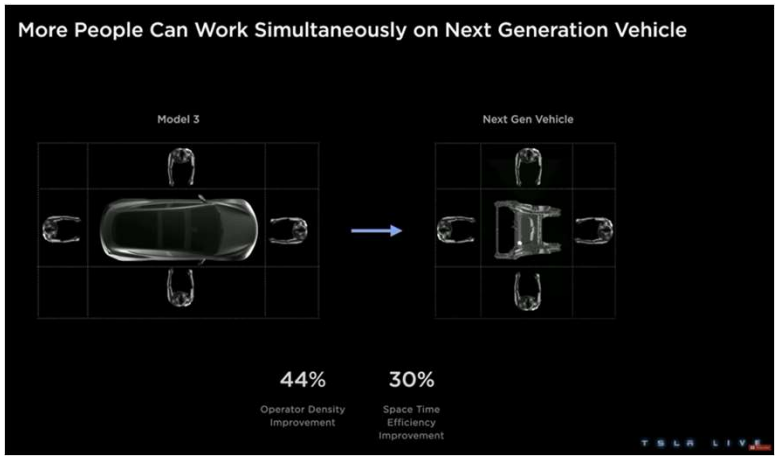
- #4 System Architecture
  - The objective is to divide the system into sub-systems for decomposition and integration
  - Architecture is the system plan of the development project
- The Why:
  - Efficiency:
    - ↑ Parallel development by sub-system
    - = Basis for Set-Based Innovation
    - ↑ Project Management
  - Effectiveness:
    - ↑ Modularity for product flexibility and improvement
    - ↑ Flexibility to meet future customer needs
    - ↑ Productivity in production

Hierarchal Diagram example



NASA, *NASA Systems Engineering Handbook*

Tesla Unboxed Design



Tesla 2023 Investor Day presentation 2023-03-01, as extracted from Tesla Daily YouTube video https://youtu.be/eIQ20RyhUhg?t=839

1) Extreme Modularity attributed to Joe Justice workshop presentations

Pulling Performance by Leveraging Lean Processes

- #5 The Concept Paper?
  - A document that translates customer needs into clear, consistent requirements for innovation development
    - Must-Haves
    - Nice-to-Haves
    - Must-Not-Touch
    - Statement of Is/Is-Not
- The Why:
  - Efficiency:
    - ↓ Delays waiting on information
    - = Basis for Set-Based Innovation
  - Effectiveness:
    - ↑ Innovation fit to customer needs
    - ↑ Innovation fit to market competition
    - ↑ Achievement of innovation goals

- Elements of the Concept Paper
  - Product/Service Vision
    - Definition of customer needs, market analysis
  - Product/Service Scope
    - Outline of architecture, content
  - Targets and Ranges
    - Feature/specification best/worst cases
  - Timeline and Milestones
    - Outline of key events and schedule

Sub-System	Innovation Feature or Performance	Unit	Best Case	Worst Case
Sub-System				
	Feature Requirement (name the feature)			
	Feature Requirement (name the feature)			
	Performance Requirement (identify)			
	Performance Requirement (identify)			

Ferro, José, *The Concept Paper for a New Product, The Kickstart of a Development Project in the LPPD Environment*, Lean Enterprise Institute, 2016

Pulling Performance by Leveraging Lean Processes

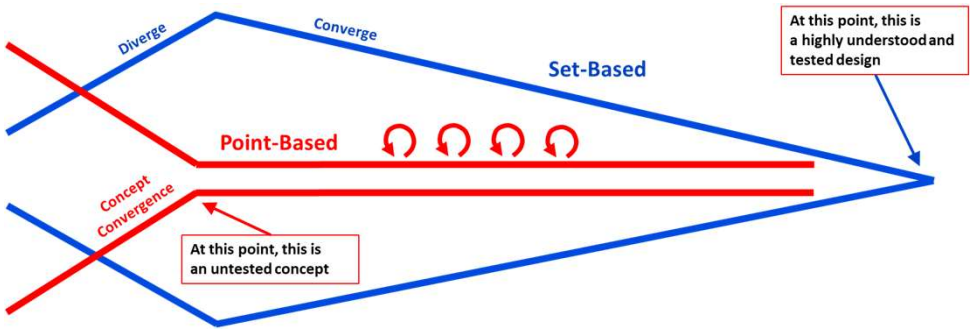
- #6 Identify Unknowns and Close Knowledge Gaps
  - Project Unknowns = Project Risk
    - Project Unknowns slow the development process at critical moments
    - The missing part is knowledge gained from learning
- The Why
  - Efficiency:
    - ↓ Design rework late in development
  - Effectiveness:
    - ↑ Knowledge to outperform competition
    - ↑ Knowledge to identify best solution given trade-offs

- Knowledge Gaps
  - an unknown is a gap in knowledge
  - knowledge is the value of development
- Inventory Knowledge Gaps
  - Find them by brainstorming, listing, past failures, design assumptions, new design needs, etc.
  - Visibly post them for resolution
- Closing Knowledge Gaps
  - Use the Scientific Method – run experiments, learn the knowledge needed to design
  - Start early, create a "time box", prioritize closure

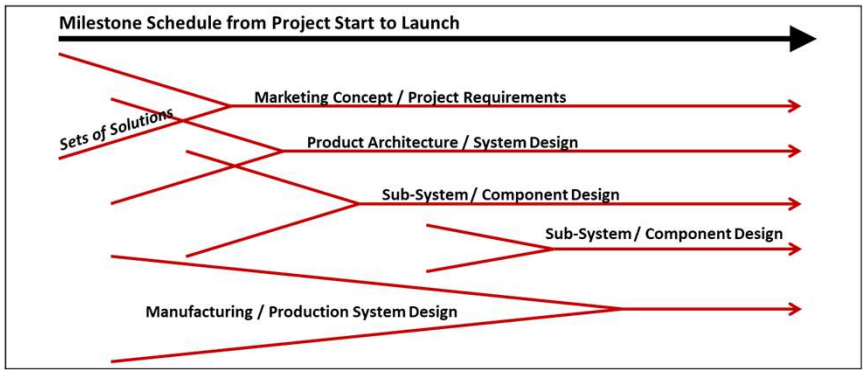
Radeka, K.; *Knowledge Gaps – The Known Unknowns in Your Innovation Program*, November 2020

Pulling Performance by Leveraging Lean Processes

- #7 Set-Based Innovation
  - Testing solution sets then converging by the milestone deadline for each sub-system
  - If you rapidly converge to a concept, then test,
  - How do you know you have a feasible concept, let alone the best concept?
- The Why
  - Efficiency:
    - ↓ Design rework late in development
    - ↑ Parallel sub-system development
  - Effectiveness:
    - ↑ Optimality of design performance
    - ↑ Knowledge to identify best solution given trade-offs



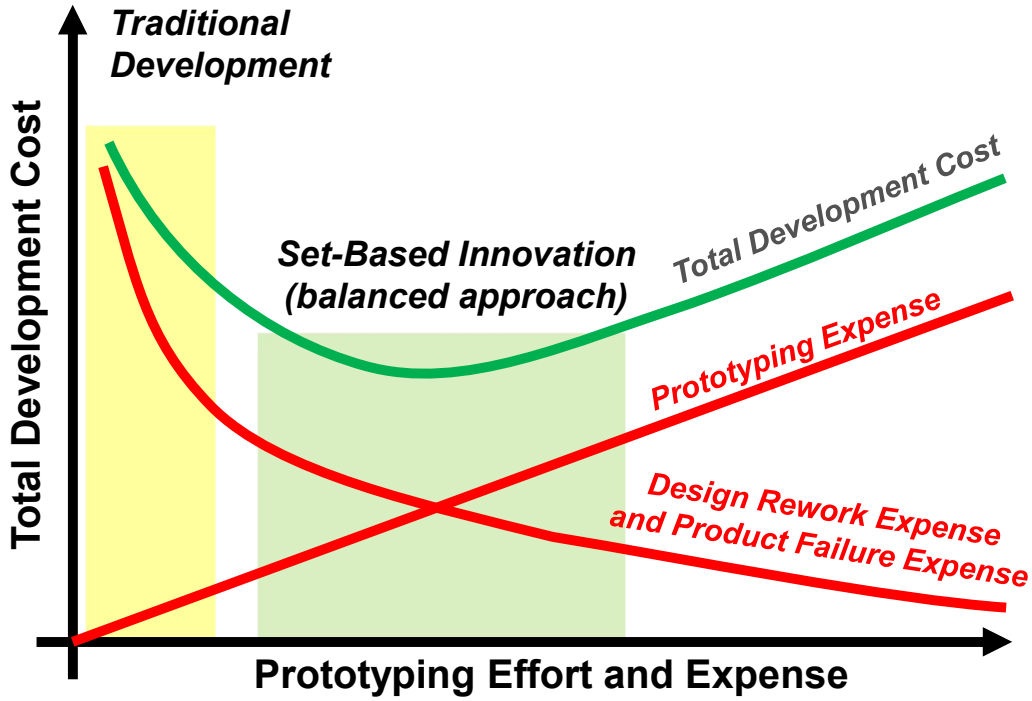
Navarre, L., *Innovation Development Excellence*, 2021



Adapted from: Ward, Liker, Cristiano, Sobek; *The Second Toyota Paradox: How Delaying Decisions Can Make Better Cars Faster*; , MIT Sloan Management Review, April 15, 1995

Set-Based Innovation

Trade-off of Traditional Development versus Set-Based Innovation



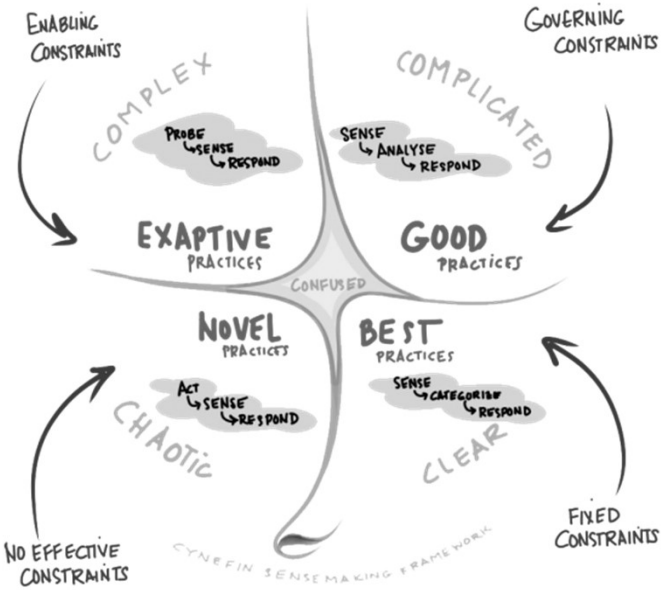
Navarre, L. (ed.), *Innovation Development Excellence*, 2020

Set-Based Innovation

- Asymmetric Gains in Innovation

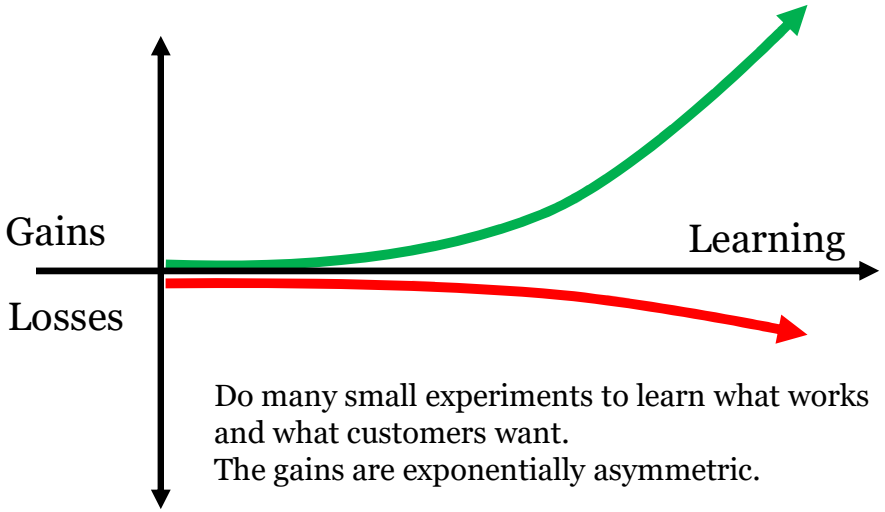
"People aren't dumb. The world is hard."
– Richard Thayler, behavioral economist

Cynefin



https://thecynefin.co/about-us/about-cynefin-framework/

Convexity



Do many small experiments to learn what works and what customers want.
The gains are exponentially asymmetric.

https://www.edge.org/conversation/nassim_nicholas_taleb-understanding-is-a-poor-substitute-for-convexity-antifragility

Pulling Performance by Leveraging Lean Processes

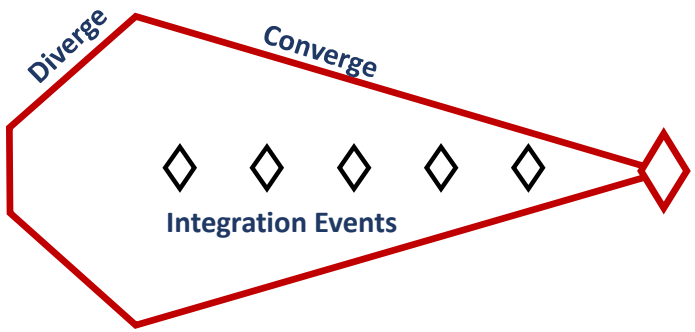
- #8 Prototyping
  - Prototyping quickly, cheaply, and with low risk implements the benefits of:
    - System Architecture
    - Closing Knowledge Gaps
    - Set-Based Innovation
    - and much more
- The Why
  - Efficiency:
    - ↓ Design rework late in development
  - Effectiveness:
    - ↑ Optimality of design performance
    - ↑ Knowledge to identify best solution given trade-offs
- Design of Experiments (DOE)
  - Testing every combination is waste
  - DOE generates knowledge with fewer tests
- Extreme Testing
  - Testing well beyond the intended limits of the product or service
  - Benefits
    - Knowledge, Safety, Reliability

Pulling Performance by Leveraging Lean Processes

- #9 Integration Events
  - A meeting of representatives of the entire development team to balance interfaces and interdependencies of sub-systems
- The Why
  - Efficiency:
    - ↑ Project Management
    - = Basis for Set-Based Innovation
    - ↑ Reliability of Time to Market
  - Effectiveness:
    - ↑ Commitment of Responsible Experts

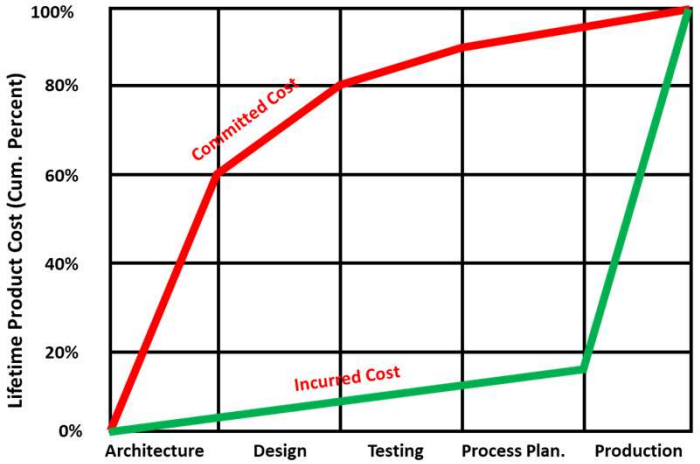
- Interfaces
  - the connections between subsystems
  - flows, communication, assembly, alignment
- Interdependencies
  - The output of one sub-system is an input to another
  - The input for a sub-system is an output from another

Morgan, J., *The Crucible of Innovation*, Lean Enterprise Institute Newsletter, July 2016

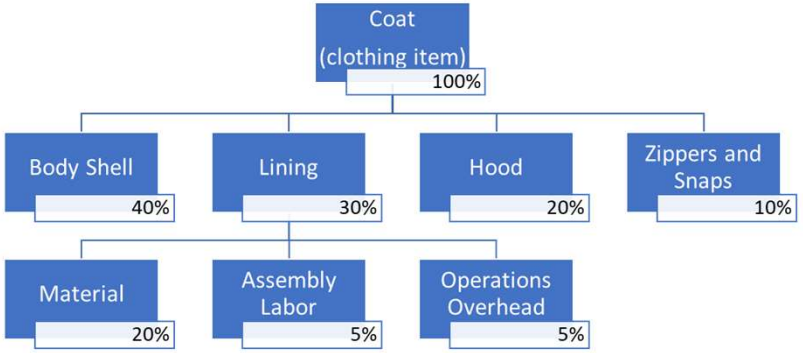


Pulling Performance by Leveraging Lean Processes

- #10 Cost Management
  - An integrated approach to targeting and designing product costs on the basis of product attributes
  - Cost is the constant counterpoint to all design decisions
  - The Cost is determined in design
- The Why
  - Efficiency:
    - ↓ Design rework late in development
    - = Basis for Set-Based Innovation
  - Effectiveness:
    - ↑ Gross Margin
    - ↓ Price and ↑ Volume



adapted from: Anderson, David, *Design for Manufacturability*, 2020

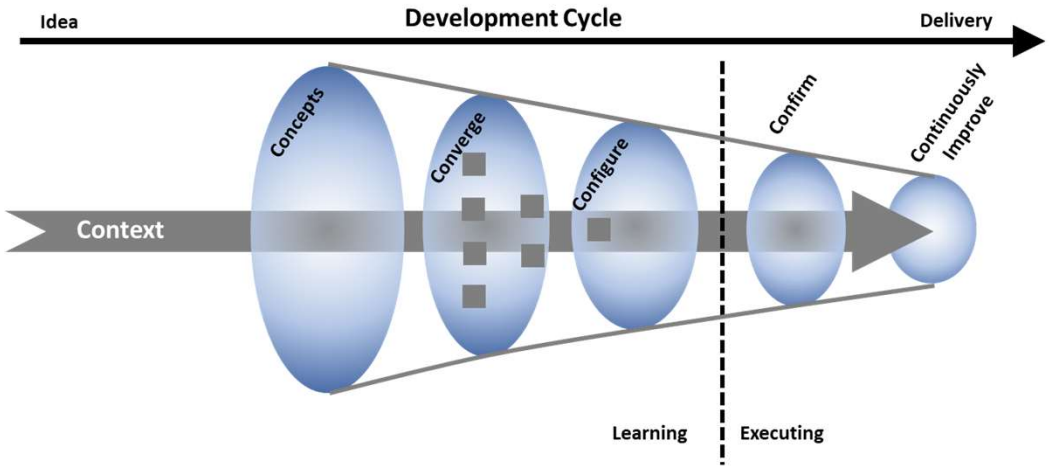


Navarre, L. (ed), Innovation Development Excellence, 2018

Pulling Performance by Leveraging Lean Processes

- #11 Process Development
  - Developing the capability to deliver the innovation
  - Like LPPD, the emphasis is on Learning by experimentation
- The Why
  - Efficiency:
    - ↑ Concurrent process development
    - ↑ Reliability of Time to Market
    - ↑ Productivity
    - = Capacity balance and flexibility
  - Effectiveness:
    - ↑ Gross Margin
    - ↓ Price and ↑ Volume

The Six Cons Model



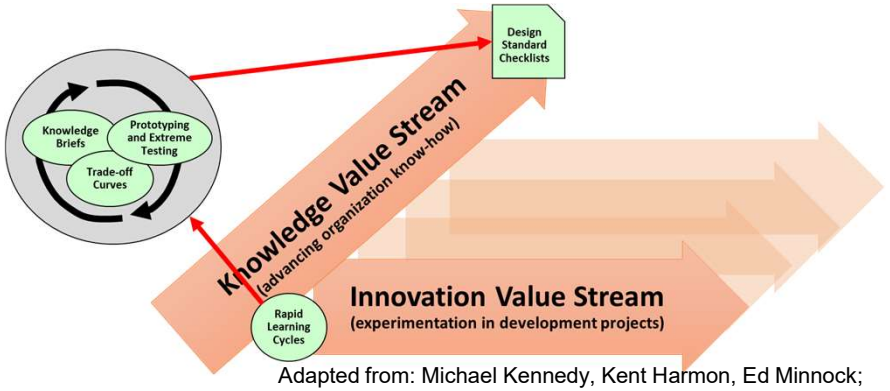
Zayko, Matthew J., Ethington, Eric M.,
The Power of Process, a Story of Innovative Lean Process Development, 2022

Pulling Performance by Leveraging Lean Processes

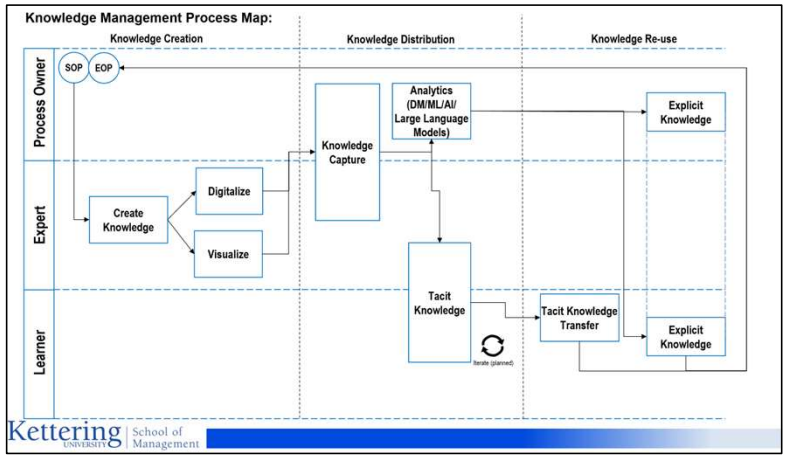
#12 Knowledge Management

- Explicit Knowledge
  - Example: A bicycle design, features, and performance
- Tacit Knowledge
  - Example: How to ride a bicycle
- A process for recall and knowledge transfer

- The Why
  - Efficiency:
    - ↑ Design Productivity
    - ↓ Design rework late in development
  - Effectiveness:
    - ↑ Optimality of design performance
    - ↑ Knowledge to identify best solution given trade-offs



Adapted from: Michael Kennedy, Kent Harmon, Ed Minnock; Ready, Set, Dominate – Implement Toyota's Set-Based Learning for Product Development; 2008



Navarre, L. (ed), Innovation Development Excellence, 2022

Nonaka, Ikujiro; *Dynamic Theory of Organizational Knowledge Creation*, Organization Science, 1994

Leading Like a Chief Entrepreneur

- Entrepreneurial System Designer (Chief Engineer)
  - A "heavyweight" project leader with strong market and product knowledge who is accountable for project success
  - Breakdown:
    - Entrepreneurial – a person with a mindset for business, and technology
    - System – the product system, and the process system to develop the product
    - Designer – a person with a mindset for design, the creation of something new
- Responsible Experts
  - Functional representatives that develop deep expertise through learning and knowledge management

Ward, Sobeck; *Lean Product and Process Development*, Lean Enterprise Institute, 2014

Leading Like a Chief Entrepreneur

Why do we need Agile Project Management?

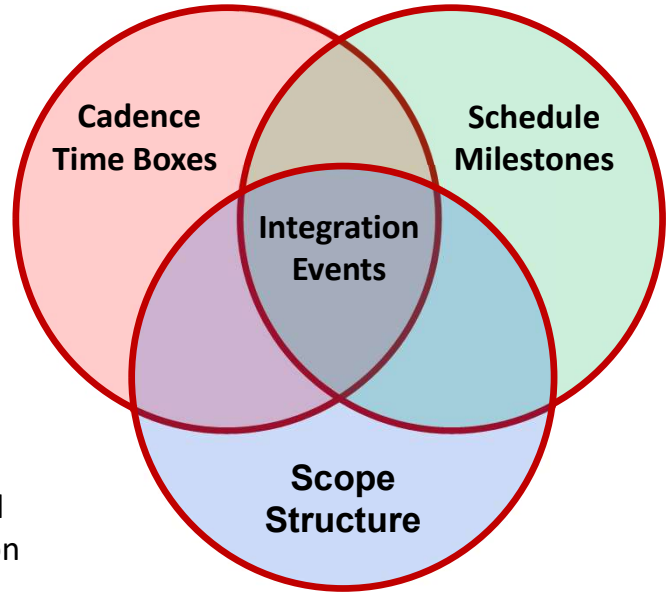
Reason	Why Agile PM ?
Uncertainty – development, by its characteristics, is the process of creating something new, a work environment of uncertainty	Formal PM is based on scheduling work given a carefully defined work breakdown of tasks that can be reasonably well estimated. Agile PM defines general scope objectives and allows the details to form in design.
Flexibility – given innovation, the details of the scope will change as innovative solutions are discovered	Formal PM is based on a strict scope and changes are discouraged. Agile PM flexibly adapts the project to meet the scope.
Responsibility – given uncertainty and flexibility, responsibility should be delegated to the people that are best positioned to know the work	Formal PM places great responsibility on the project manager by expecting strong control of task completion. Agile PM places great responsibility on the team to deliver superior results in the time available.

Navarre, L. (ed), Innovation Development Excellence, 2019

Leading Like a Chief Entrepreneur

Elements of Innovation Project Management in a Lean way

Cadence Time Boxes
- A pace, or Takt Time
- Minimizes "time batches"
- Structures learning cycles



Schedule Milestones
- Pull signal for project deliveries
- Firm deadlines
- Tie to multi-project Load Leveling

Scope Structure
- System architecture structure
- Decompose work to distribute load
- Flexible to accommodate innovation

Integration Events
- Demonstrate knowledge learned
- Eliminate weak options
- Integrate interdependencies

Navarre, L. (ed), Innovation Development Excellence, 2019

Leading Like a Chief Entrepreneur

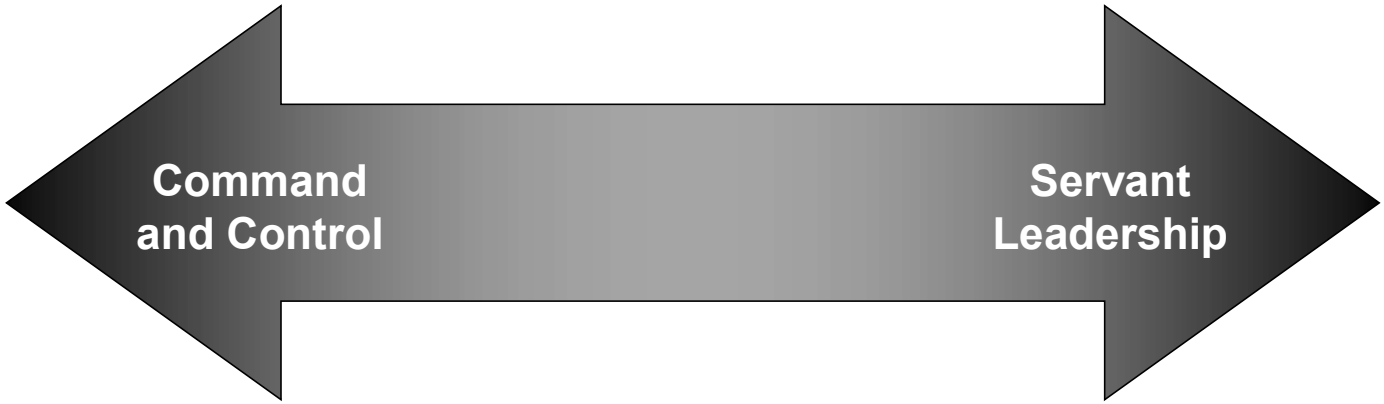
- Visual Management
  - Obeya Spaces
    - A physical space first, but some digital tools can be used
    - Walls of the room contain visual elements of the project
    - Collaboration is expected and visualized in displays
  - Common Elements of VM

Photo credit: *Obeya: The Brain of the Lean Enterprise*, Industry Week Magazine, September 30, 2016

Element	Description
Project Objectives	Goals and measures to target project success
Project Organization	Display of the team members, their project roles, skills matrix
Customer Wall	The "voice of the customer" displayed visually
Design Requirements	Elements of the Concept Paper, or similar definition of customer needs
Timeline	Visual schedule of major milestones and tasks, with issue board for urgent work
Problem Solving Wall	Share Sub-system Problems, Observe Other Sub-system solutions
Performance Measurements	Key performance indicators for project success, with progress "glide paths"

Leading Like a Chief Entrepreneur

Which leadership style is appropriate for innovation?



- **Leader is ultimate authority**
- **Power comes from position in the organization**
- **Clear position responsibilities**
- **Rigorous processes focused on management control**

- **Leader is first among peers**
- **Power comes from service to the organization**
- **Clear vision of direction**
- **Flexible processes focused on team accomplishment**

Navarre, L. (ed), Innovation Development Excellence, 2018

Leading Like a Chief Entrepreneur

- The leadership philosophy of Servant Leadership tends to be successful in innovation
  - Servant Leadership
    - Leaders are listeners first, and humble about their responsibility
    - Leaders serve the needs of the system
    - Leaders build the capabilities of people and resources
    - Leaders provide aligning vision, or foresight, the central ethic of leadership
    - Followers implement the vision of the organization

Summarized from: Greenleaf, Robert K., *Servant Leadership*, (1977/2002)

Leading Like a Chief Entrepreneur

- Servant Leadership is preferred by Innovators
  - Innovators tend to be talented, creative, and inspired people
  - Innovators want a leadership environment that supports their capabilities
  - Responsible Experts (followers, team members) do not need to be told what to do – they only need to ask which direction to go

Navarre, L. (ed), Innovation Development Excellence, 2018

Leading Like a Chief Entrepreneur

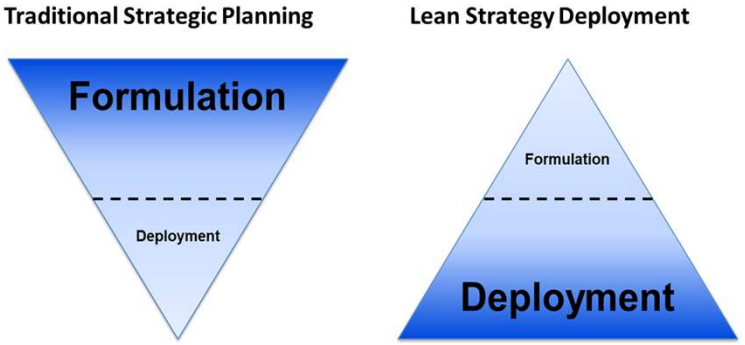
- The Basic Secret of LPPD
  - Traditional development is about following a formal process
    - Formal steps in a sequential order with regular management approvals
  - Lean Development is about *Learning*
    - Learning fast how to make good products
    - Allow the design to form by prototyping and testing
    - A knowledge-based approach is the key to success

- My observations
  - An organization that pursues a set-based approach to innovation will have an insurmountable advantage over lesser competitors

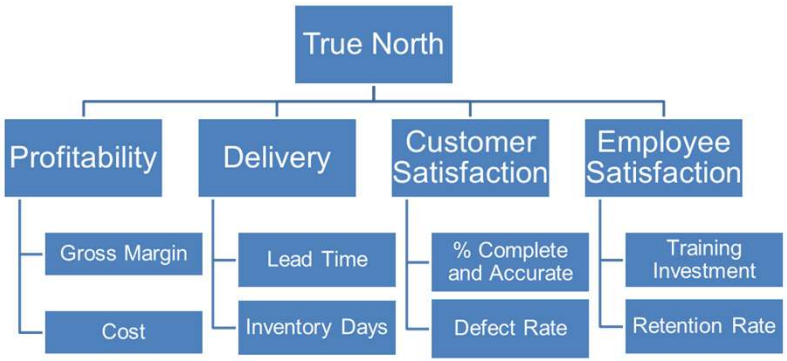
Ward, Sobeck; *Lean Product and Process Development*, Lean Enterprise Institute, 2014

Defining Your Innovation Performance Improvement Plan

- Lean Strategy Deployment
  - Using the Hoshin Kanri Method to Implement Strategy
    - The identification of strategic objectives
    - Emphasis on Implementation
  - Cascading the objectives through the organization
  - Implementation of improvement projects to achieve the objectives



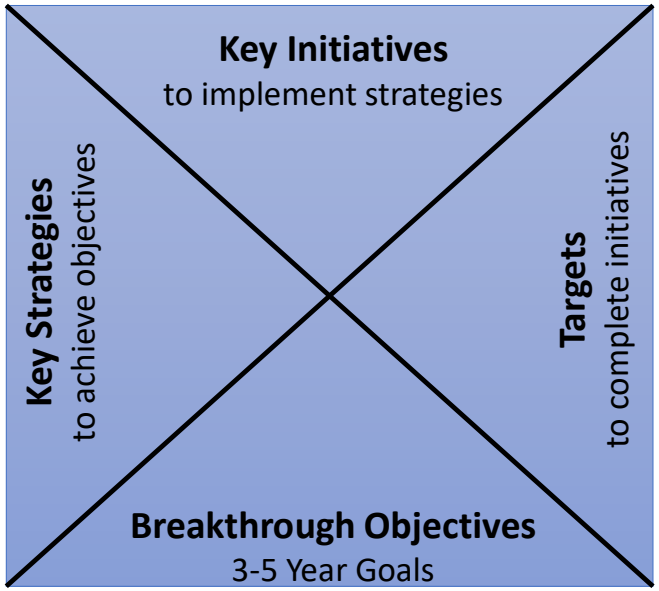
adapted from: Pascal Dennis, *Getting the Right Things Done*, Lean Enterprise Institute, 2009



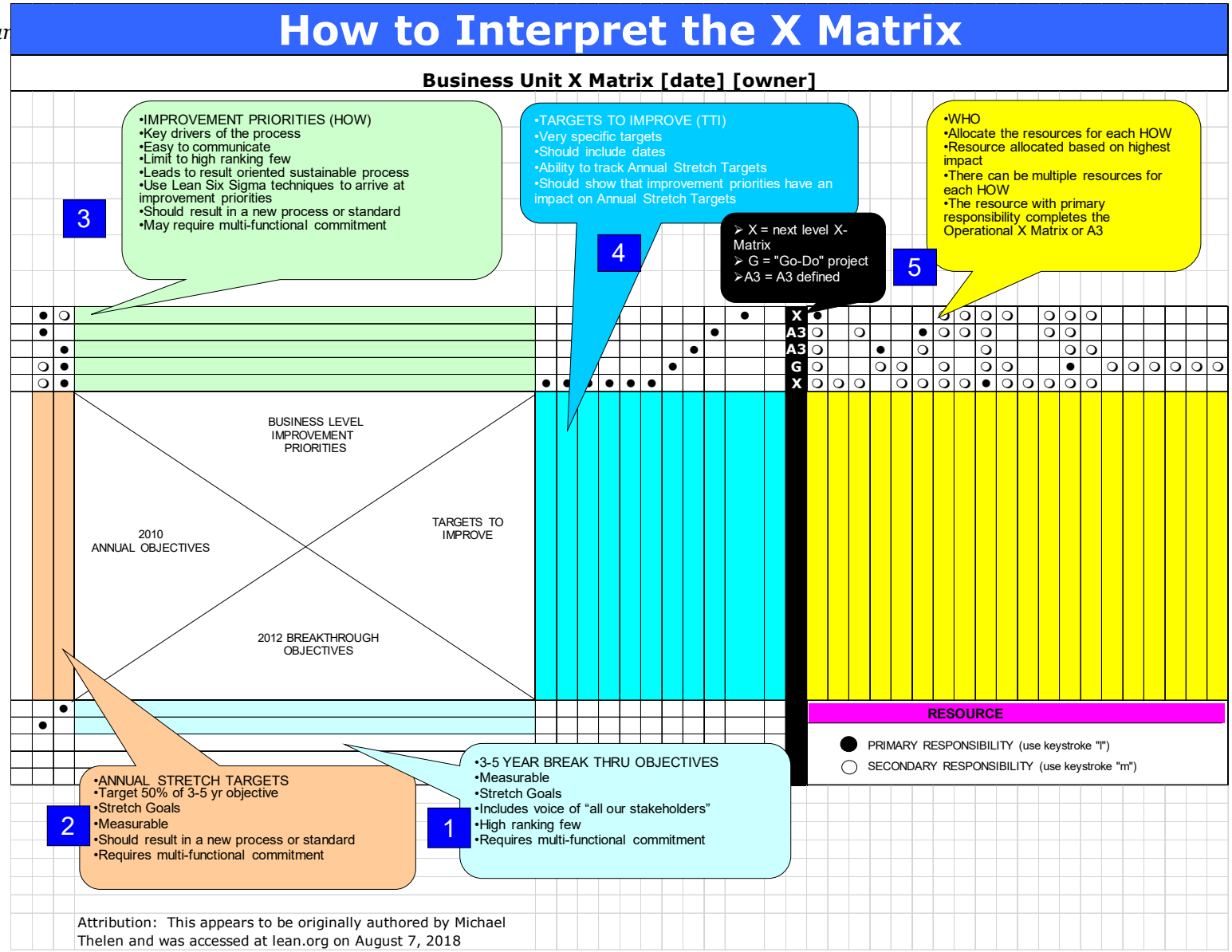
adapted from: Pascal Dennis, *Getting the Right Things Done*, Lean Enterprise Institute, 2009

Defining Your Innovation Performance Improvement Plan

- X-Matrix
  - Visual Management method for Strategy Deployment



How to Interpret the X Matrix



Attribution: This appears to be originally authored by Michael Thelen and was accessed at lean.org on August 7, 2018

Defining Your Innovation Performance Improvement Plan

- Exercise: Strategy Deployment Matrix
  - Create an X-Matrix for your enterprise
  - Use the Breakthrough Objectives and Key Results from your prior work
  - Identify Strategies, Initiatives, Targets and Assignments

Summary

1. The Ugly – No. New product failure is NOT 80%.
2. The Bad – We can, and must, do better.
3. The Good – Exceed an 80% success rate.
4. The Worthy – Demonstrate the value of innovation.

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