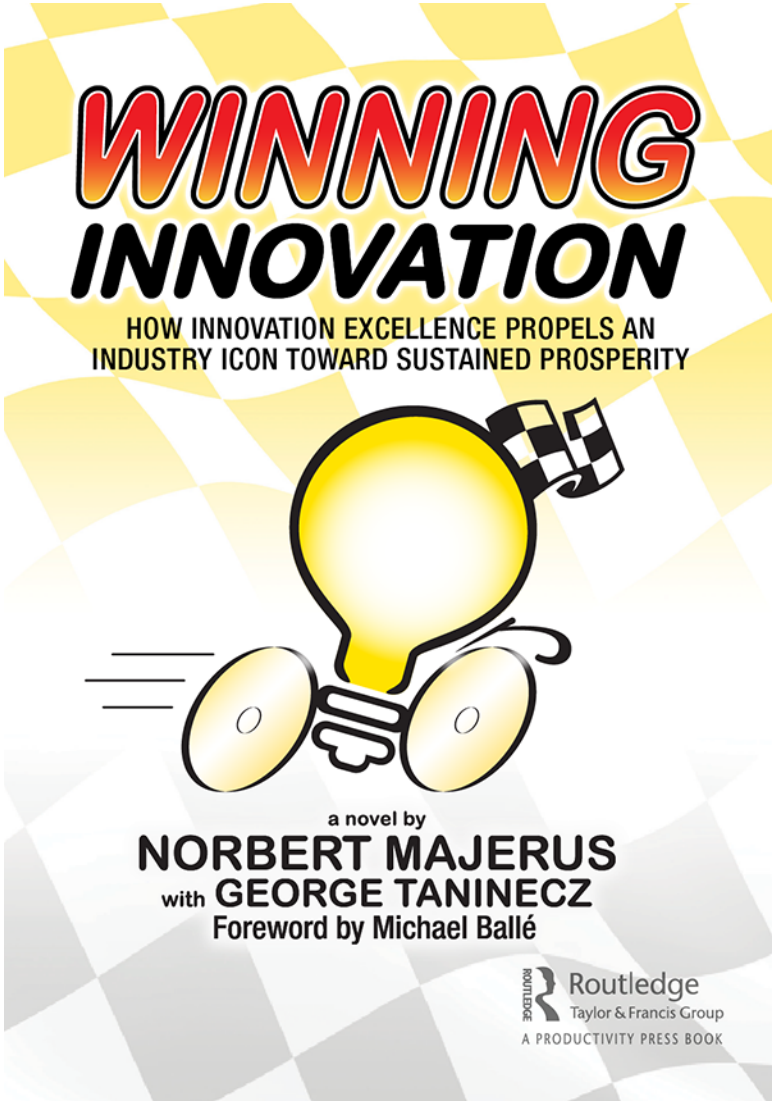
Building a Lean Culture of Innovation

Norbert Majerus



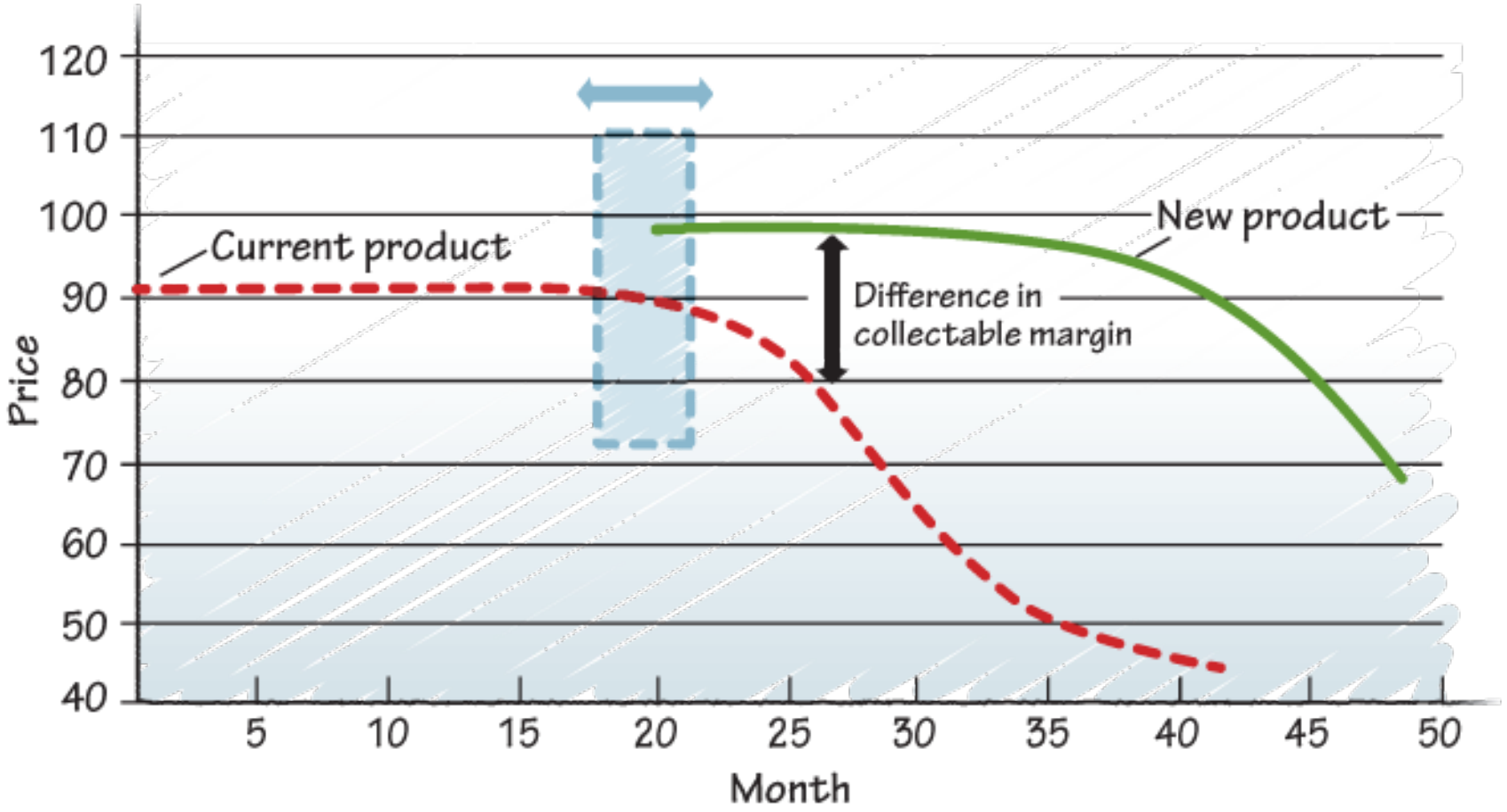
Survey (Results – Not Drivers – is it happening now?)

no yes

- Innovation is part of the corporate strategy ……..1 2 3 4 5
- Innovation talent is formally managed ……..1 2 3 4 5
- Courage to try new things is promoted ……..1 2 3 4 5
- There is a formal innovation process …… 1 2 3 4 5
- Initiative and entrepreneurship are rewarded …….. 1 2 3 4 5
- There are metrics to track innovation performance …….. 1 2 3 4 5
- Associates are empowered to create new things …….. 1 2 3 4 5
- There is early-on cross functional and diverse collaboration ……..1 2 3 4 5
- There is an environment that stimulates innovation ……..1 2 3 4 5

Total _____

Winning in Innovation



Other Examples of **NOT INNOVATING**

- Typewriter (Smith/Corona)
- **Blockbusters**
- **Xerox – PC**
- Large Steel Mills
- Nokia/Blackberry
- Stores – Kmart, Sears, ….
- Yahoo
- **Borders**
- Mechanical earthmovers

All had technology AND KNEW HOW TO

My Personal Experience

- Is it harder to sell a new idea for a product or for a new lean process?

- The “selling” is the same challenge in both cases
  - Disruptive innovation is hard
  - Disruptive new processes are even harder to implement
  - **But it is easy to sync innovation with lean**

- **Small kaizans and small innovation make small improvements – my leadership would not wait (and I am glad)**

Outline

- What is Innovation
- What is lean/opex
- What is Culture
- Cultural Elements Critical to Innovation
- Innovation Syatems
  - Industrial Creativity
  - Needs and Opportunities
  - Process
- Bringing it all together

Biggest Innovations in World History

The Greatest Inventions In The Past 1000 Years

	Invention	Year	Inventor	Notes
1	Printing Press	1450	Johannes Gutenberg	allowed literacy to greatly expand
2	Electric Light	1879	Thomas Edison	powered countless social changes
3	Automobile	1885	Karl Benz	increased personal mobility and freedom
4	Telephone	1876	Alexander Graham Bell	spread communication across wide areas
5	Radio and Television	1895 & 1926	Guglielmo Marconi & John Baird	made the world smaller
6	Vaccination	1796	Edward Jenner	protected people from disease
7	Computer	1939	John Atanasoff, et al.	transformed business world; predecessor to the Internet
8	Airplane	1903	Orville and Wilbur Wright	allowed people and products to quickly move
9	Gas powered tractor	1892	John Froelich	started agricultural mechanization
10	Anesthesia	1844	Horace Wells	provided a great leap forward for medicine

Most Innovative Companies TODAY (Fortune Mag.)

1. Salesforce.com
2. Amazon
3. Intuitive Surgical
4. Tencent Holdings (China/social media, games….)
5. Apple
6. google
7. Natura Cosmeticos
8. Bharat Heavy Electricals (China)
9. Monsanto (agriculture)

3M
P&G
Goodyear

Innovators

1. Jeff Bezos
2. Elon Musk
3. Mark Zuckerberg
4. Mark Benioff (salesforce.com)
5. Reed Hastings (Netflix)
6. Satya Nadelia (Microsoft)
7. Shantanu Narayen (adobe)
8. Tim Cook (apple)
9. Arne Sorenson (Marriott)
10. Larry Page/Sergey Brin (alphabet)

Well Intended Innovations That Flopped

- **Michelin PAX/ many Goodyear examples**
- Nintendo Virtual Boy
- Micosoft Zune
- Merck's Vioxx
- Metal on Metal Hip Implants
- Ford Pinto (Edsel)
- Colgate Lasagna
- Harley Perfume
- IBM PC
- **Google Glasses**
- ……..

When Was The Best Time For US Innovation

- It started with an event in 1957 ….
- **What did it create?**
- Government funding – Goodyear early 80ies
- Skunkworks
- Bell Labs
  - Laser, transistor, solar cells, UNIX, Windows …
  - Resources
  - Talent
  - Culture

What is Innovation

- Process from an Idea to the money in the bank
- Innovation is the effort to create purposeful, focused change in an enterprise’s economic or social potential
- **Create something new to make a difference for somebody**
- Not a flash of genius but the systematic exploitation of opportunities

Today’s Innovation Environment

- Much shorter cycles
- Multidisciplinary/global
- Increased market and technical complexity
- Less resources

What is Industrial Creativity

- Create a constant flow of new commercially successful products consistent with the company's objectives and goals
- Create a sustained culture of innovation

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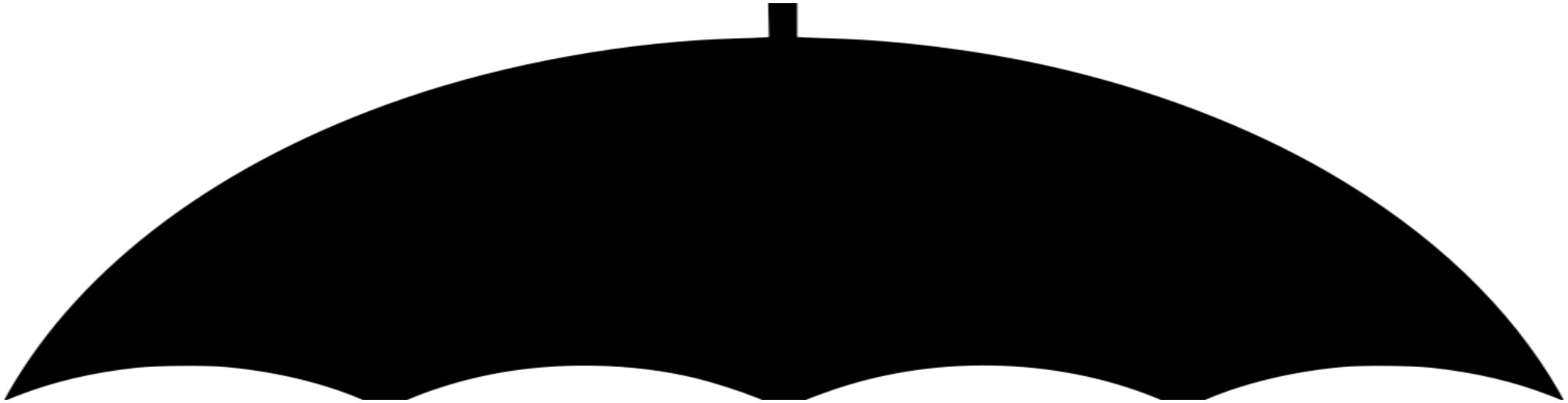
Lean and Innovation Today

- GLOBAL Economy
- Economic growth is largely a function of:
  - Population Growth
  - Market Growth
    - **Productivity/Efficiency >>> Lean Manufacturing**
    - **Innovation >>> Lean Innovation**

Why Innovate

- Company in trouble (nature)
- New stuff sells
- First mover advantages
- Often the easiest way to create large revenue/growth
- **To create a better future for everybody**

HOW???



Culture is an umbrella term which encompasses the social behavior, institutions, and norms found in human societies, as well as the knowledge, beliefs, arts, laws, customs, capabilities, and habits of the individuals in these groups. Culture is often originated from or attributed to a specific region or location.

What Is Company Culture?

- How we do things, how we have always done things, how we will always do things …. through changes in leadership
- Anybody can be assigned to a project - McKinsey
- BUT what about continuous IMPROVEMENT?

- **Combination of resources, processes, values, behaviors to achieve sustainable results**

Fact

- A lean culture does not automatically create a culture of innovation
- Sometimes it gets in the way
- But a lean culture can easily be enhanced to include innovation

My Personal Opinion

- If a company is successful with innovation or fails at it, always comes down to CULTURE
- Culture **(process and values)** is how we do things how we have always done things (how we all got to where we are) and how we set ourselves up to continue to do things (what we do to assure our [personal] future).
- This robustness is part of nature assuring survival ***IF*** things do not change. But nature has also provided (some of) us with an **ability to change and adapt and teaches us a lot about innovation.**
  - Quote Shigeo Shingo

Traditional Company

From

- Maximize shareholder value – anything goes
- DRIVE Results
- Layoffs drive share price – those laid off are not to blame

To

- Get the process right
- Treat the people right
- The results will follow

Lean Culture

The *Shingo Model*™ is not just another initiative; it is a new way of thinking.

Click on the links below to learn more.

Principles

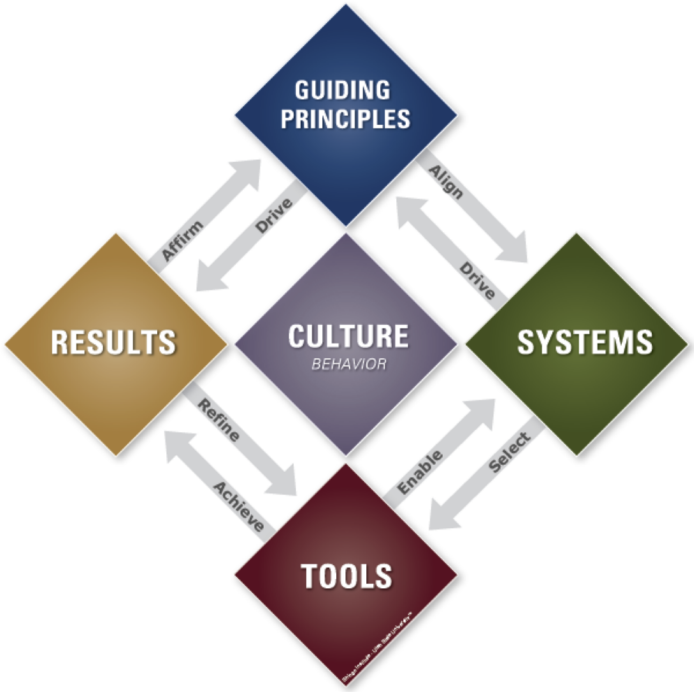
The *Shingo Guiding Principles* are the basis for building a sustainable culture of organizational excellence. In the Guiding Principles diamond, the principles are divided into three dimensions: Cultural Enablers, Continuous Improvement, and Enterprise Alignment. Each dimension and principle are presented in further detail below.

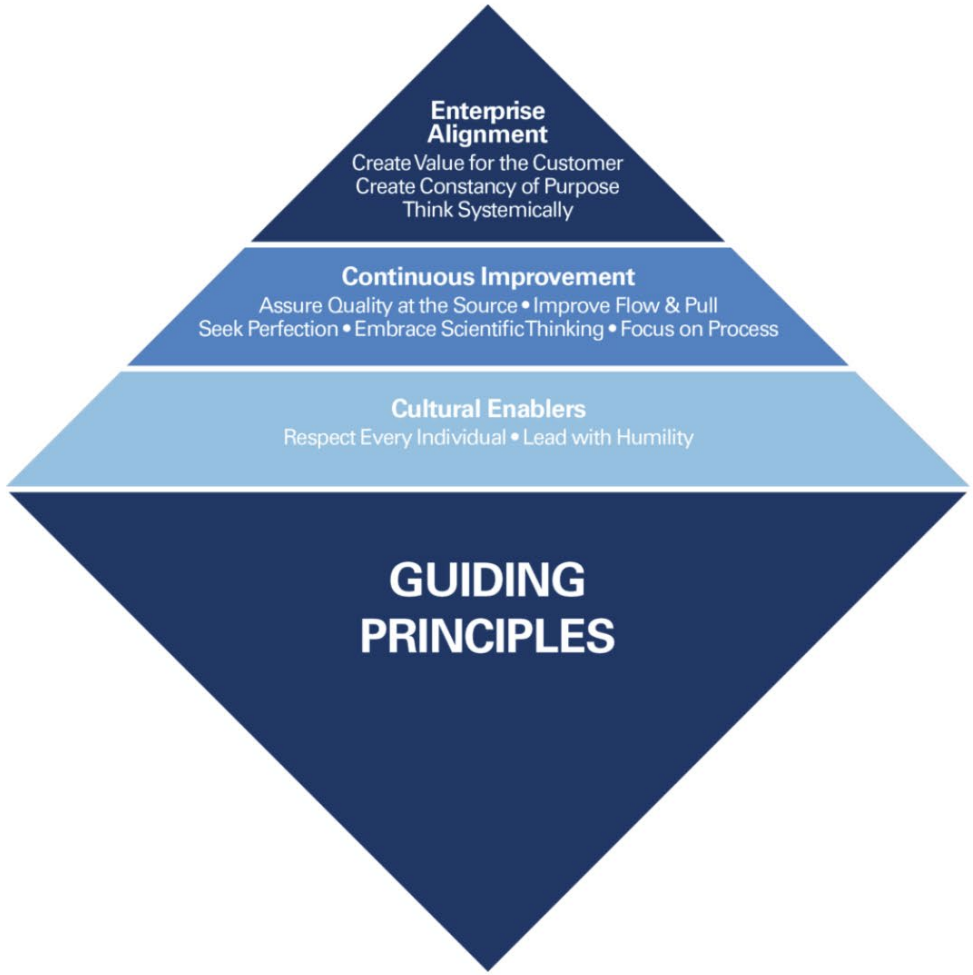
Tools

Systems

Results

Culture





Shingo Guiding Principles

Click on each principle for a detailed explanation.

- Respect Every Individual
- Lead with Humility
- Seek Perfection
- Embrace Scientific Thinking
- Focus on Process
- Assure Quality at the Source
- Improve Flow & Pull
- Think Systemically
- Create Constancy of Purpose
- Create Value for the Customer

READ

Three Insights of Organizational Excellence

Insight #1

Ideal Results Require Ideal Behaviors

The results of an organization depend on the way its people behave. To achieve ideal results, leaders must do the hard work of creating a culture where ideal behaviors are expected and evident in every team member.

Insight #2

Purpose and Systems Drive Behavior

Most of the systems that guide the way people work are designed to create a specific business result without regard for the behavior that the system consequentially drives. Managers have an enormous job to realign management, improvement, and work systems to drive the ideal behavior required by all people to achieve ideal business results.

Insight #3

Principles Inform Ideal Behaviors

Principles are foundational rules that govern consequences. The more deeply one understands principles, the more clearly he or she understands ideal behavior. The more clearly one understands ideal behavior, the better he or she can design systems to drive that behavior to achieve ideal results.

What is a lean culture?

(MY Definition)

- Operating system based on lean principles
- People centric organization
- Focus on continuous improvement (not how we always did things and will continue to do things)
- Creating right results
- Sustainable

From the Stories to the Principles

- Story – explains what happens and how it was done one time

- **Principles** = universal, timeless – work everywhere and always

Cultural Elements critical to Innovation

- Education (about innovation) – Here NOW
- Strategy/Metrics
- Collaboration
- Eliminate Fear
- Create the environment
- Talent Management
- Agility and speed - Later

EDUCATION - EVERYBODY

- **NOT another “better brainstorming”**
- **NOT all entrepreneurship (start up, patents, investments, raise capital …….)**

- How creativity works
- The BUSINESS rules of innovation
- The creation of the CULTURE

Strategy

- Innovation **MUST** be part of a corporate strategy (Hoshin Kanri)
- Properly deployed
- NOT a separate strategy – ONE strategy, including innovation
- Engage everybody in strategy and deployment

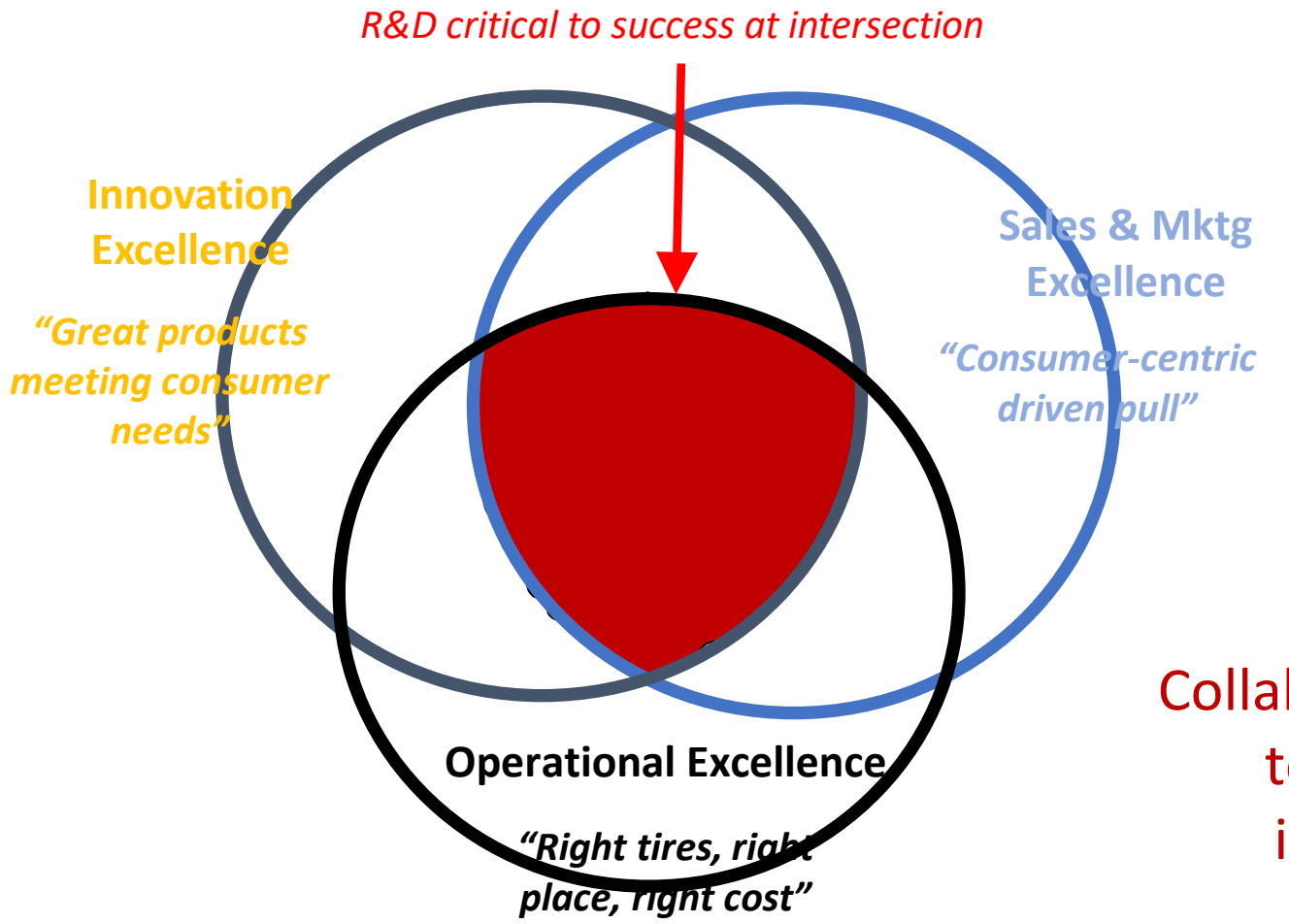
Challenge

Metrics

- % sales from products less than 3 years old
- % of dedicated budget actually **USED**
- Balanced

- # of ideas, patents, even implemented ….
- Brainstormings or other events held
- Etc …. Not very effective

Winning at the Intersections

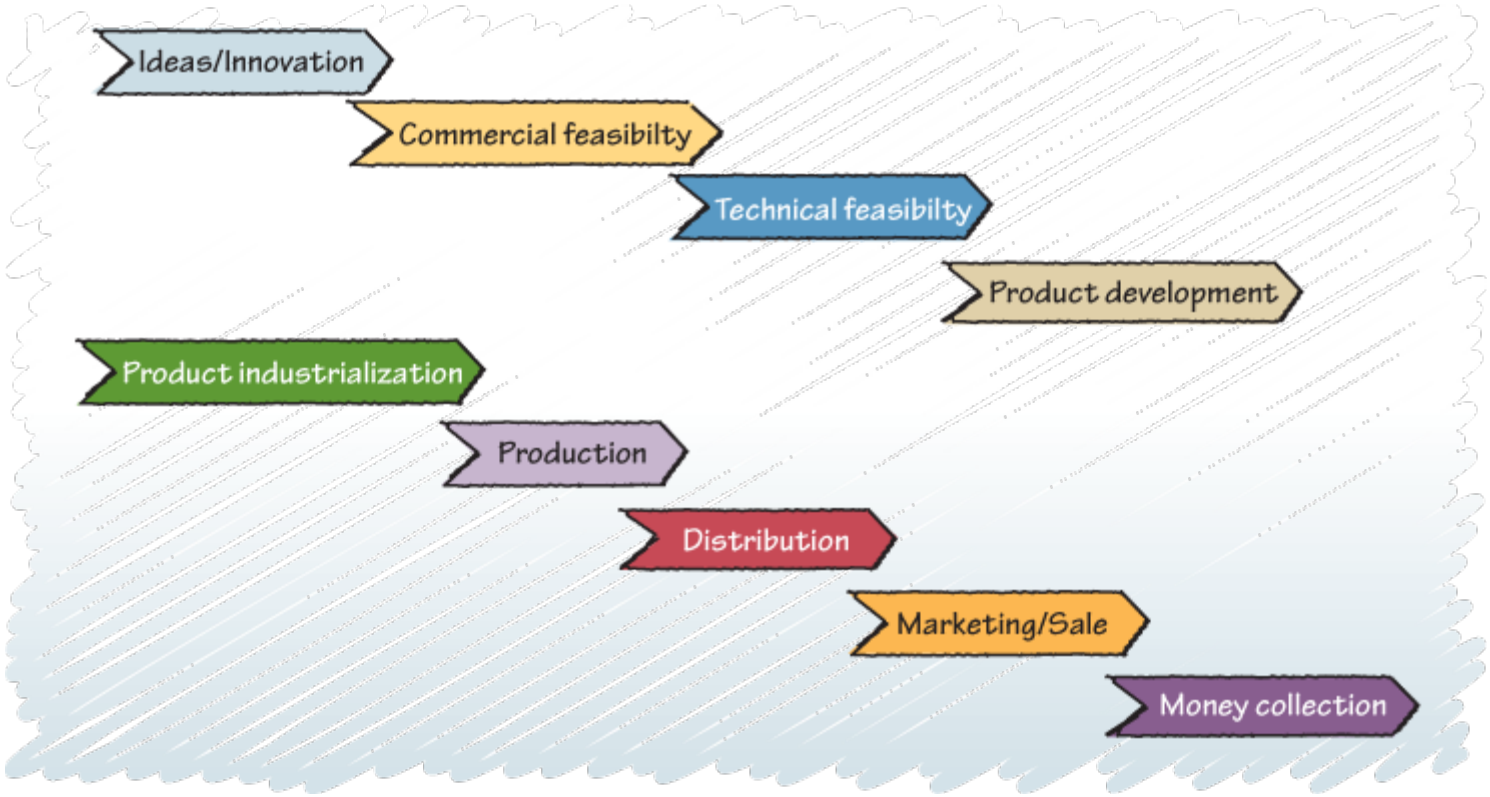


Collaborate and align to win at the intersection

Understanding Value Streams

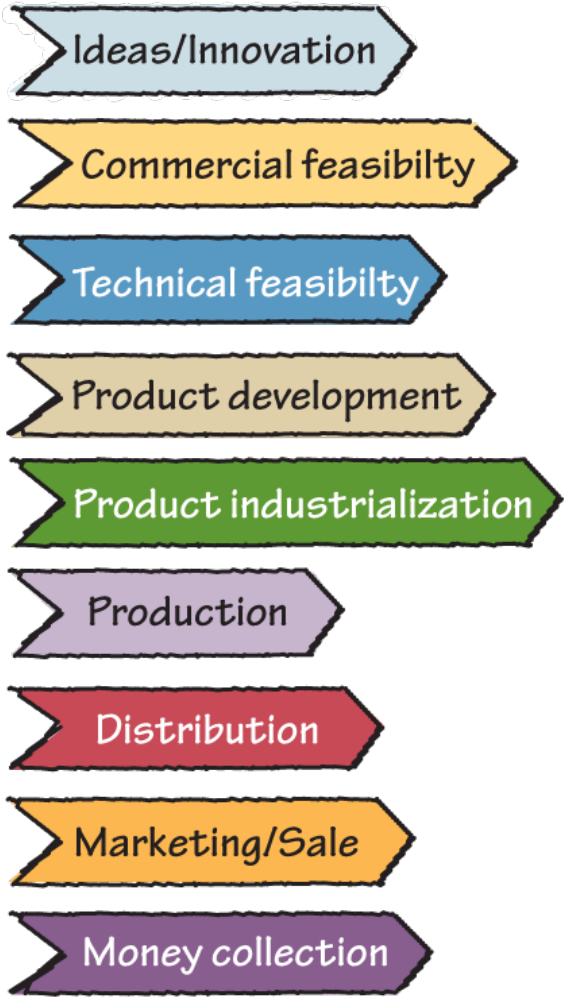
CUSTOMER

SUPPLIER



CUSTOMER

Value Stream Collaboration

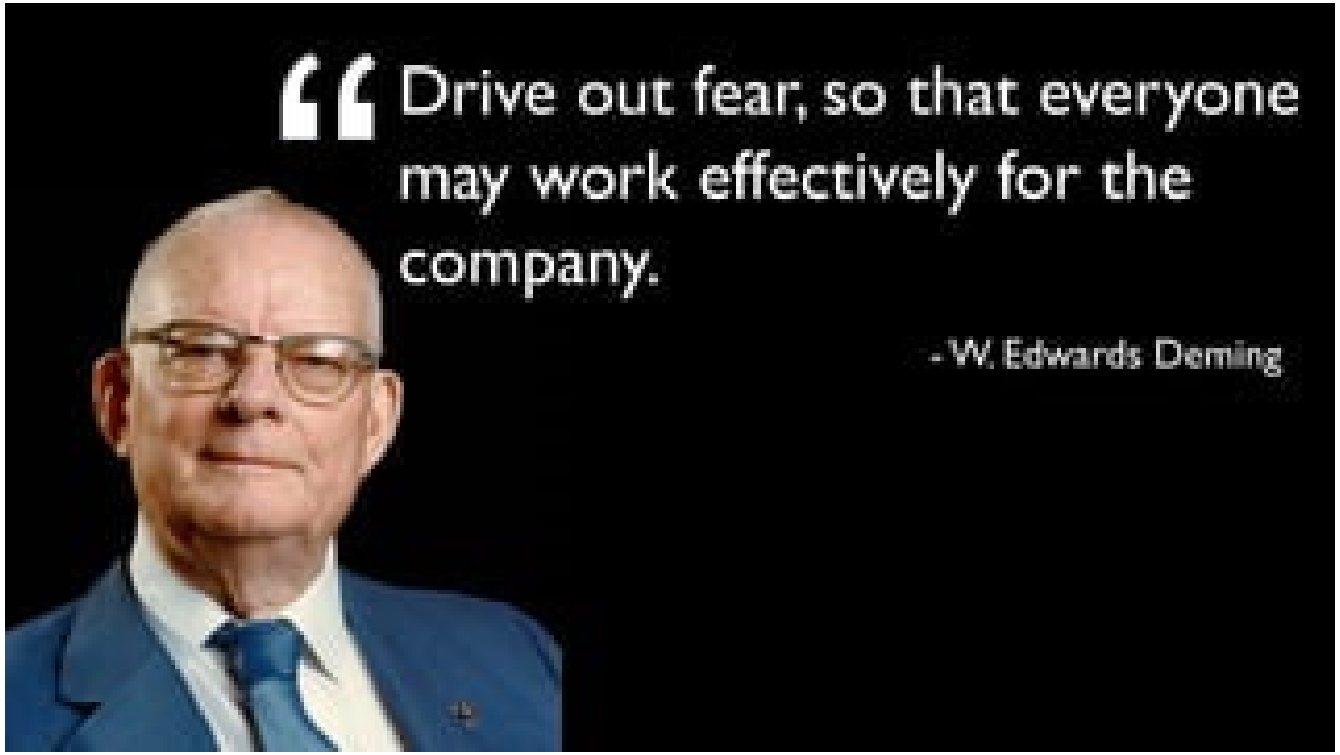


- Targets set JOINTLY – but they evolve
- Targets reflect value for customer and company growth
- CONCURRENT development
- Functional and personal agenda take a back seat to the value for the customer and the growth of the company

Lego over Ego

Cultural Elements Critical to Innovation

- Education (about innovation) – Here NOW
- Strategy/Metrics
- Collaboration
- Eliminate Fear – and what causes it
- Agility and speed - Later
- Create the environment for it to happen – do not force it
- Talent Management



Taking a risk or taking a chance

Known

Managed

Unknown

Gamble

Opposite of courage?

- Complacency
- Fear

What creates Fear

- **Effects on people's career**
- Shaking up status quo, comfort, even if things are not perfect
- ANY change, habits
- Little to gain and a lot to lose
- New ground with uncertainty
- PRESSURE – to meet targets, …
- …

The Fear of

READ

- The Unknown
- Chaos
- Change
- **Compromising the existing business**
- Too many projects
- Embarrassment
- Fear of drifting too far from the core business/cannibalization
- Fear of resource bleed
- Distraction
- INTIMIDATION
- Loss of identity
- Unquantifiable risk – sticking the head out
- **Missing PERSONAL objectives - Career**

How to DRIVE OUT FEAR?

- The right Hoshin Kanri
- **The right GOALS for behaviors**
- A process to manage the risk (and the money) - **AGILE**
- The right **reward** for “courage”
- Make the uncertainty visible
- Comfortable at being uncomfortable
- **Eliminate intimidation (Respect, humility, trust)**
- **ENGAGE PEOPLE**

How to reduce Fear

- Engage people in the change – “how would you do it” – “how would we have to do it, so you could support it?”
- Education, discussion ….
- **Changing behaviors changes the beliefs**
- Encourage/reward small actions for “prudent risk”
- Trust is an important part of a lean culture
- Consult industrial psychologist
- Making people comfortable at work – create joy

Do not FORCE innovation
Do not just let it happen
>>>Make sure it happens

Complete freedom is not the best setting for creativity
Different individuals have different needs for structure in order to be creative

Environment/Primers

- Stimulating. enabling, engaging environment, Google vs Goodyear offices
- The 20%. Goodyear discretionary funding
- D109 at Goodyear
- The Gym???
- Atrium – see the sky
- Skunkworks – does it work?
- The Innovation Office/department – does it work?
- Allow “stealth” work
- The “innovation kit”
- The “moonshine” lab
- Engage, empower associates
- Education on all levels
- Right Objectives, GOALS, strategy, rewards
- Appropriate behaviors on all levels
- A good lean culture helps a lot
- CREATE OPPORTUNITIES
- Remove Restrictions

Google

- Every room different
- Windows, sunshine
- Wall paintings
- Quiet
- All glass partitions
- Lots of social space
- Bikes
- Flexibility

Goodyear

- Everything looks the same
- Few windows
- Bare walls
- Noisy
- Carpeted partitions
- Little social space
- Controlled by accountants and lawyers
- Fixed hours

Best Innovation Primers

- Google – get it all from the outside
- Discretionary Funding (past @ Goodyear)
- 15-20% (3M) - the money will be spent???
- Give people the opportunity to experiment a little without approval - red box credit card
- The right metrics (30% sales from new products)
- **The right process**

Complete freedom is not the best setting for creativity
Different individuals have different needs for structure in order to be creative

(*Marty Wartenburg – Innovation consultant AME Irvine 2014)

*

Moonshine

The box in my book

Talent Management

- Education!!!
- Motivation
- Left/right brain
- The round peg in the square hole
- Engagement
- The corporate innovator
- Entrepreneurship/initiative
- Rewards/career
- Leadership Behaviors

Kids vs People at Work

- Conformity at **kindergarten**
- Grade school
- Highschool
- College
- WORK – break creativity first >>>the 5 behaviors at Goodyear
- Calderon Book

Richard Sheridan

INHERENT Motivation (at work)

- Autonomy
- Expertise
- Purpose

How to Grow Inherent Motivation

- Autonomy – Engagement and empowerment, innovation
- Expertise – People want to grow and leverage their expertise – let them >>> it will pay off
- Purpose – More than assembly line …People want to contribute >> suggestion system and many more

The Round Peg in the Square Hole

- Performance and behavior criteria
- Google, 3M
- Technical ladder – innovator ladder
- Corporate entrepreneurship
- Personal Experience

Engagement - Dialysis Company

- Terrible morale and turn-over
- New chairman creates an innovation initiative
- The improvement in people engagement and turn-over was remarkable
- What did they do?
  - Suggestion system – called INNOVATION SYSTEM
  - Supported people implementing the improvement ideas
  - Educated an internal expert
- What made the difference?
  - People had a voice - People were empowered to change what was wrong – AND THEY DID IT
  - People became engaged in improving THEIR company rather than finding another one

The Corporate Innovator

- Most successful innovations originate in R&D
  - Privilege?
  - Complicated
  - How many stay there?
- Rare people have their fingers in every innovation
- SOME companies recognize those people

The Corporate Innovator

READ

- **Balanced brain**
- Educated, versatile
- PASSION
- Open minded, playful, inquisitive, CURIOUS
- Has many hobbies
- Thinker and tinkerer
- Can sell ideas – does not give up
- Positive first – critical next
- Entrepreneur mindset – sticks with something worth while
- Can multitask – stopping work on something and picking it up again when appropriate – work in multiple boxes
- **Sometimes difficult**

Respect for All Individuals

READ

- My definition of respect
- ALL Diversity >>> Cultural Diversity
- Inclusion
- Engagement
- Empowerment

Humble Leadership

READ

- Respect
- You tell me
- HELP associates be successful
- Set example
- Trust – not control
- Ability to think right without all the facts

Leadership behaviors

READ

- Appreciation for diversity and being different – Quote Sam Landers
- Comfortable at being uncomfortable
- See the benefits first
- Manage radical ideas and people
- Tolerate Failure
- Patience
- Courage

Innovation SYSTEM

Innovation Principles

- How innovation works
- The Innovator's dilemma
- Innovation Killers
- Interference with Lean
- Accounting
- Risk Management - later
- The MOTHER of Innovation - later
- Principles of Industrial Creativity - later
- Opportunities - later
- Rethinking Customer Value – combind with dilemma

Principles of Industrial **Creativity – not covered in this workshop**

Read

- MAKE IT WORK!!! (charging stations etc….) innovators are luck makers…
- Must make money on traditional products to fund innovation
- Sometimes the second mouse gets the cheese
- Focus on your strengths **and** weaknesses
- Must be simple and intuitive
- Start Small – even grandiose ideas must start small – BUT big vision aim for dominance – if not it is not worth it

Others not Covered in this Workshop

Read

- Wasted ideas is NOT wasted time
- Stealth is ok but Isolation rarely works
- 1000 ideas is NOT = thousand projects
- Open innovation
- The COST of delay or of not doing it
- Manage features
- Break all the rules
- Kids have unspoiled brains but no knowledge

Innovation Principles – not covered

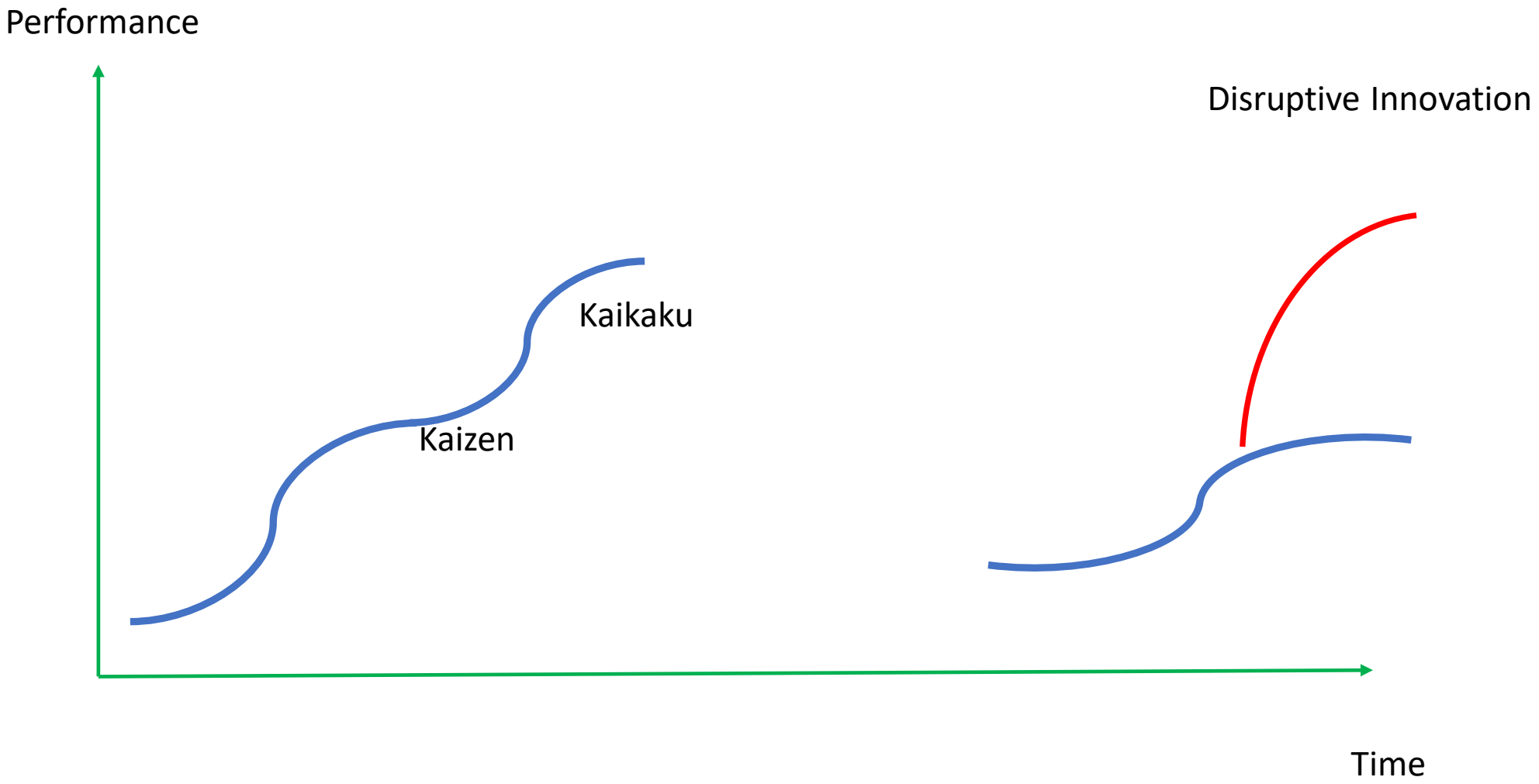
Read

- Hard work, not genius
- Requires knowledge and focus
- The Chasm
- Morphing

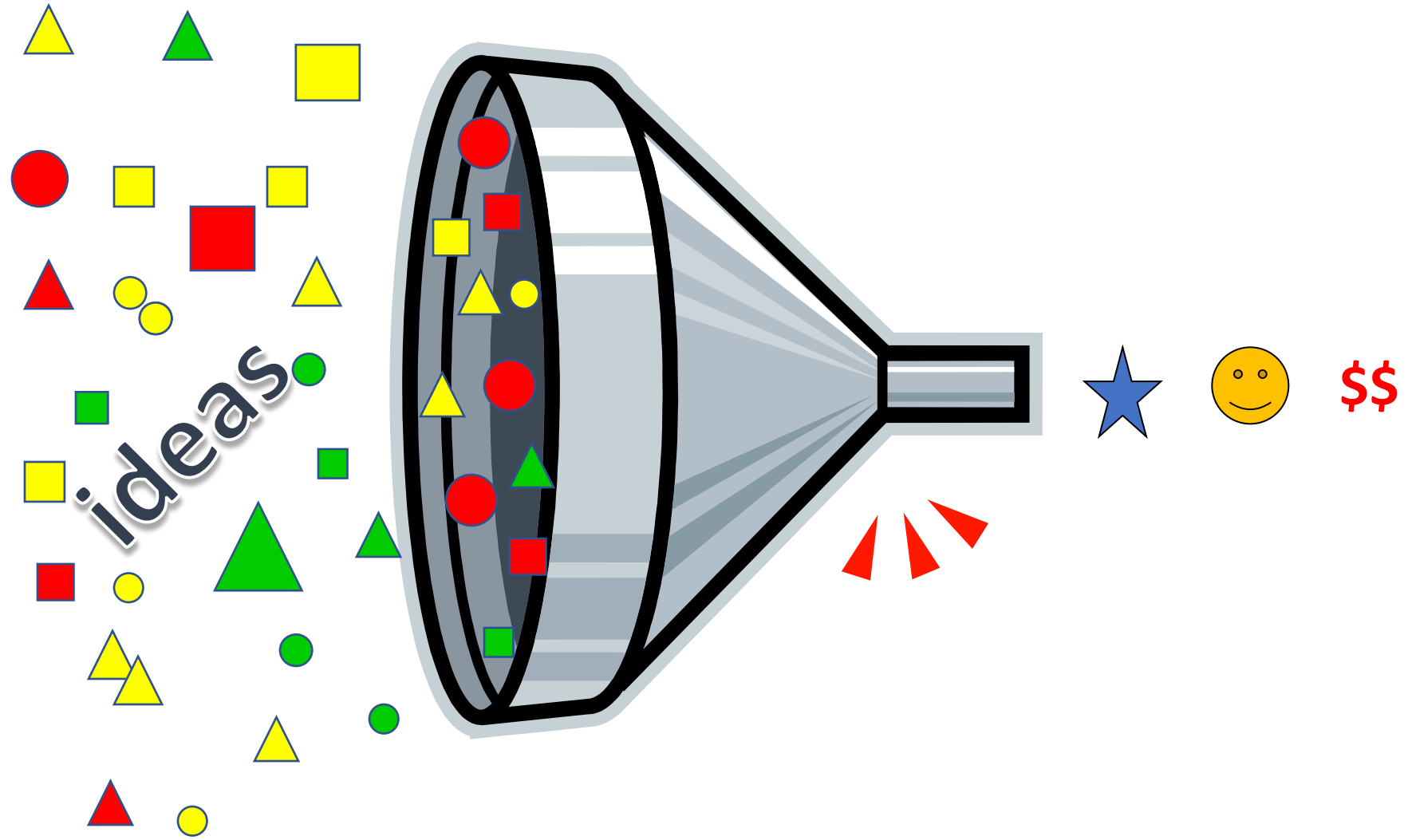
Innovation Principles

- How innovation works
- The Innovator’s dilemma
- Innovation Killers
- Interference with Lean

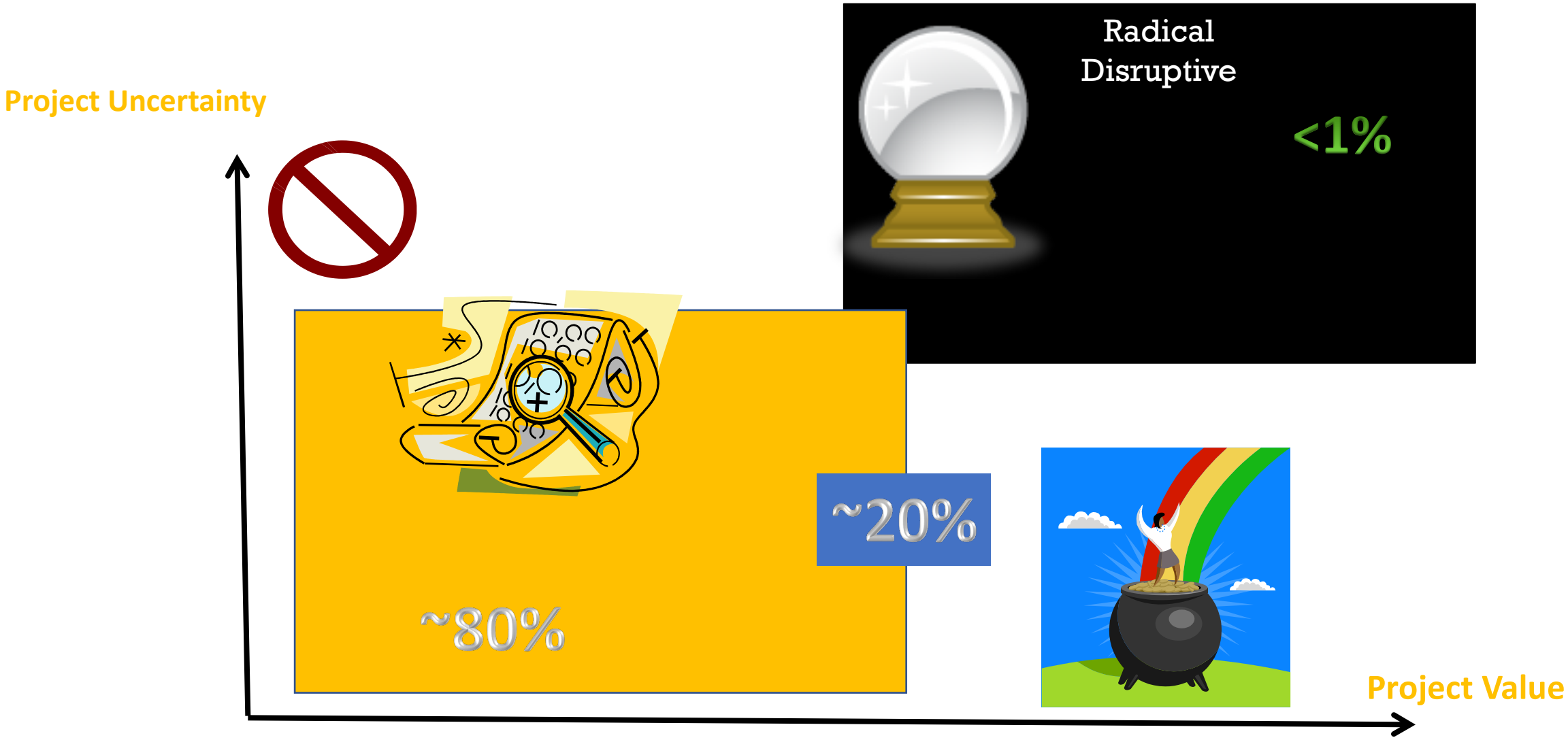
Kaizen, Kaikaku, Disruptive Innovation



Generic Product Innovation Process



Innovation Grid



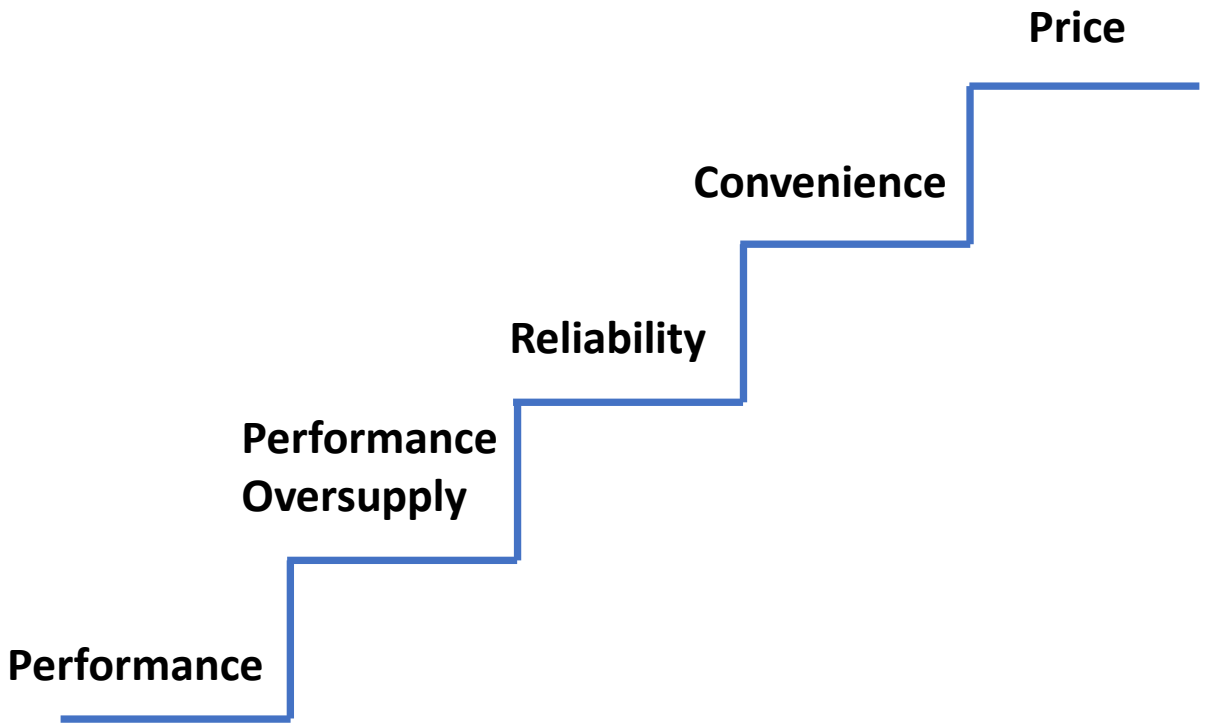
Examples of RADICAL/disruptive innovation (Goes beyond current business model)

- i-phone
- Tesla cars
- Netflix
- Amazon
- Small Steel Mills
- Hydraulic excavators
- Blockchain
- Bitcoin

Challenges With Disruptive Innovation

- Companies depend on customers and investors for resources
- **Small markets do not solve the growth needs of large companies**
- Markets that don’t exist cannot be analyzed
- An organization’s capabilities define its disabilities: Processes and values are not flexible
- Technology supply may not equal market demand
- **Plans must serve the purpose to learn, not to make money = discovery driven planning (agnostic marketing)**

Disruptive Hierarchy



- How did Tesla do???
- The lower on this, the more a breakthrough is needed
- What makes the disruptive product worthless in the mainstream makes it attractive in the emerging market
- Disruptive products also tend to be simpler and cheaper

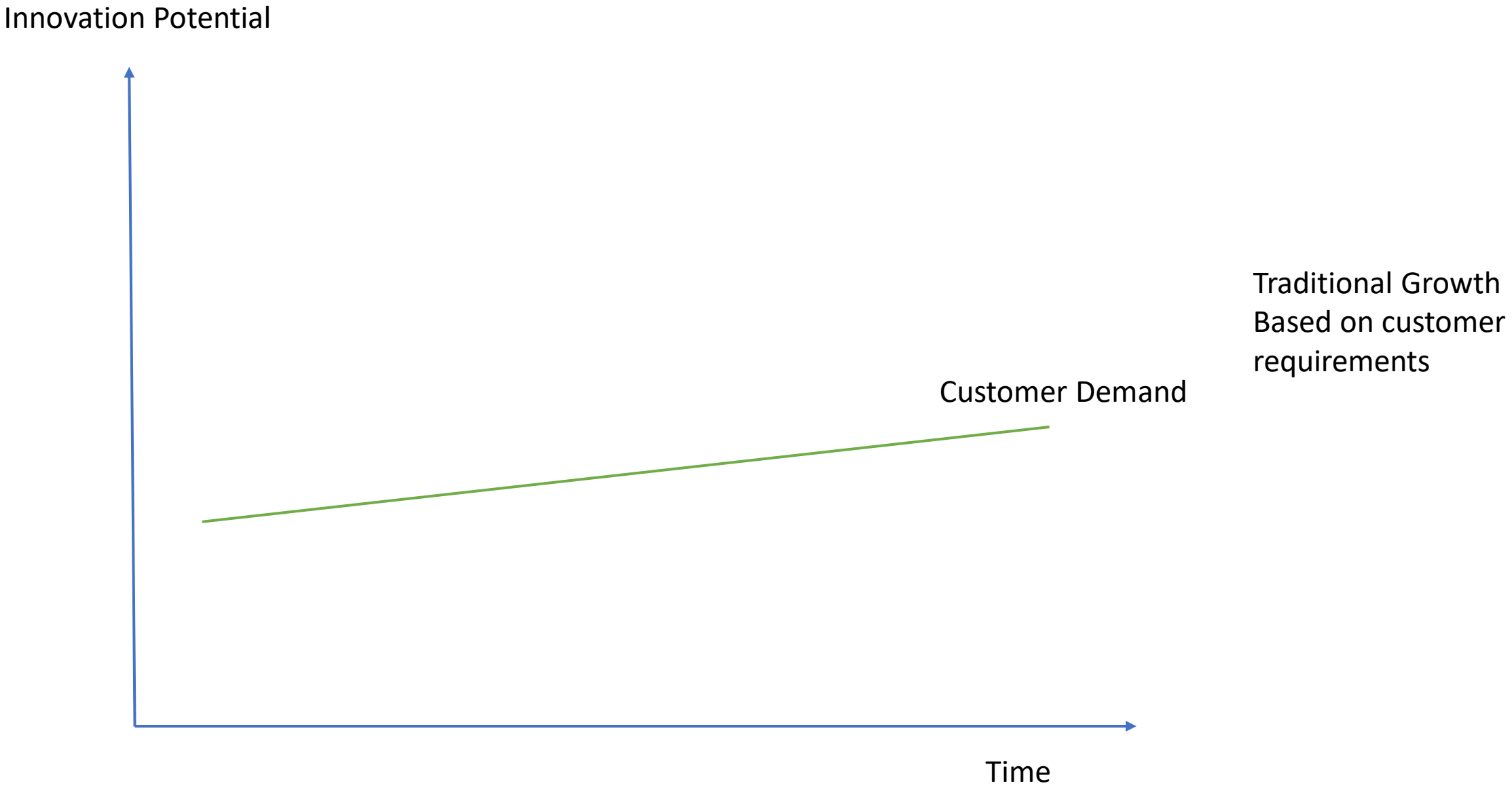
Innovation Principles

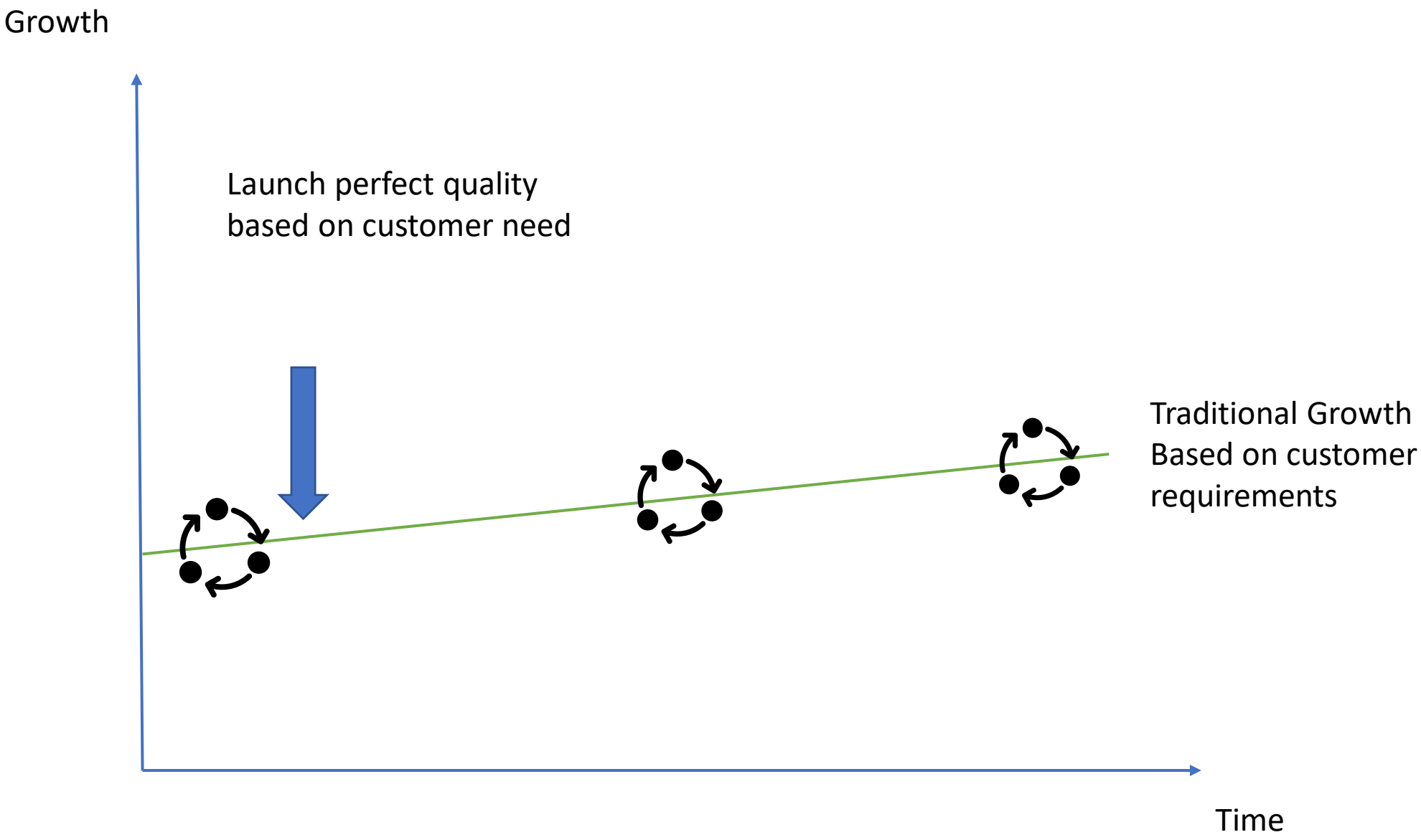
- How innovation works
- The Innovator’s dilemma
- Innovation Killers
- Interference with Lean

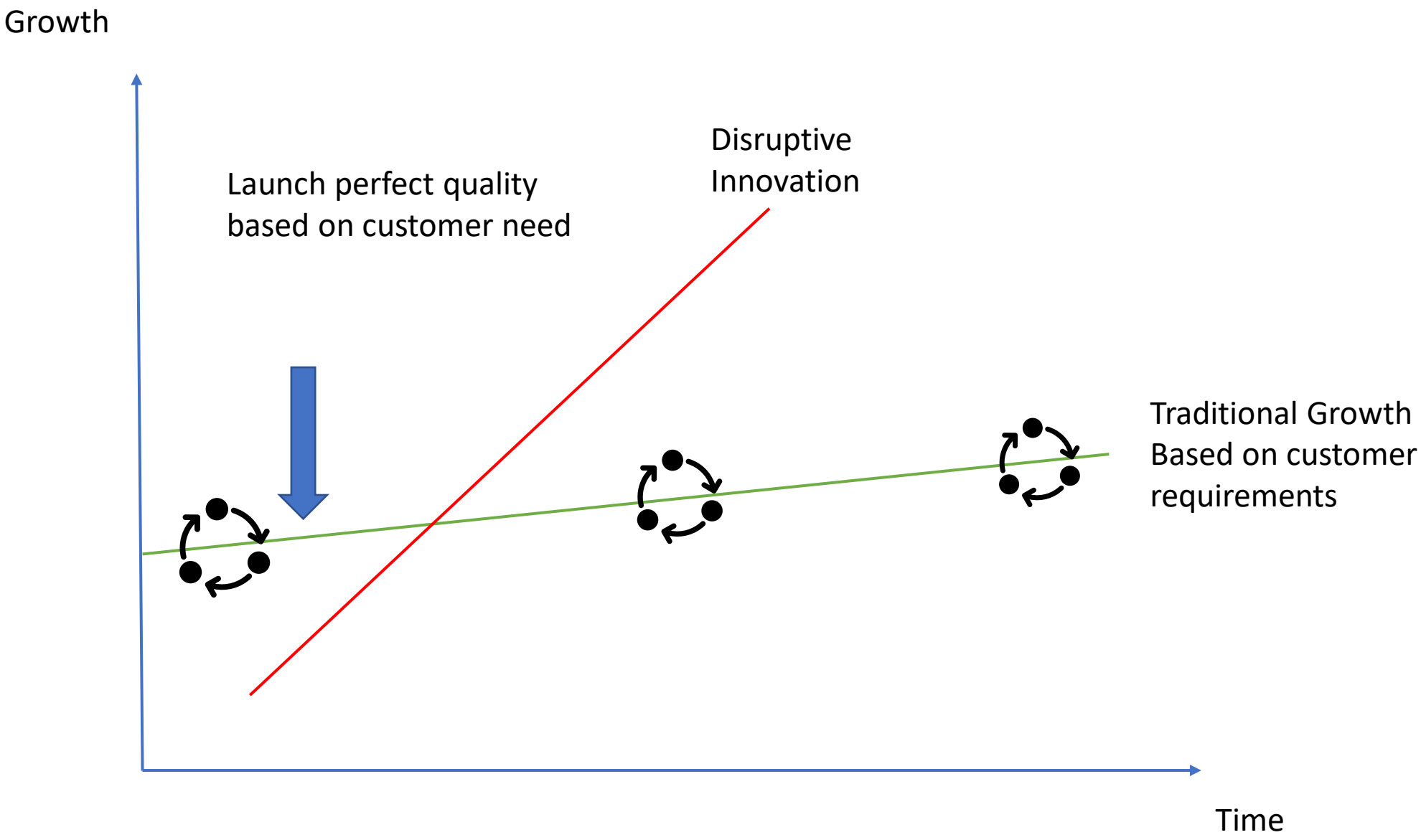
Innovator Dilemma

- Well researched/documented (Clayton Christenson)
- Successful companies least likely to succeed with disruptive innovation
  - They are comfortable with their current position and afraid to change
  - They invest in what their **current customers** want – even if they want faster horses
  - They rely on facts and data which are not available for disruptive innovation. Same for internal processes

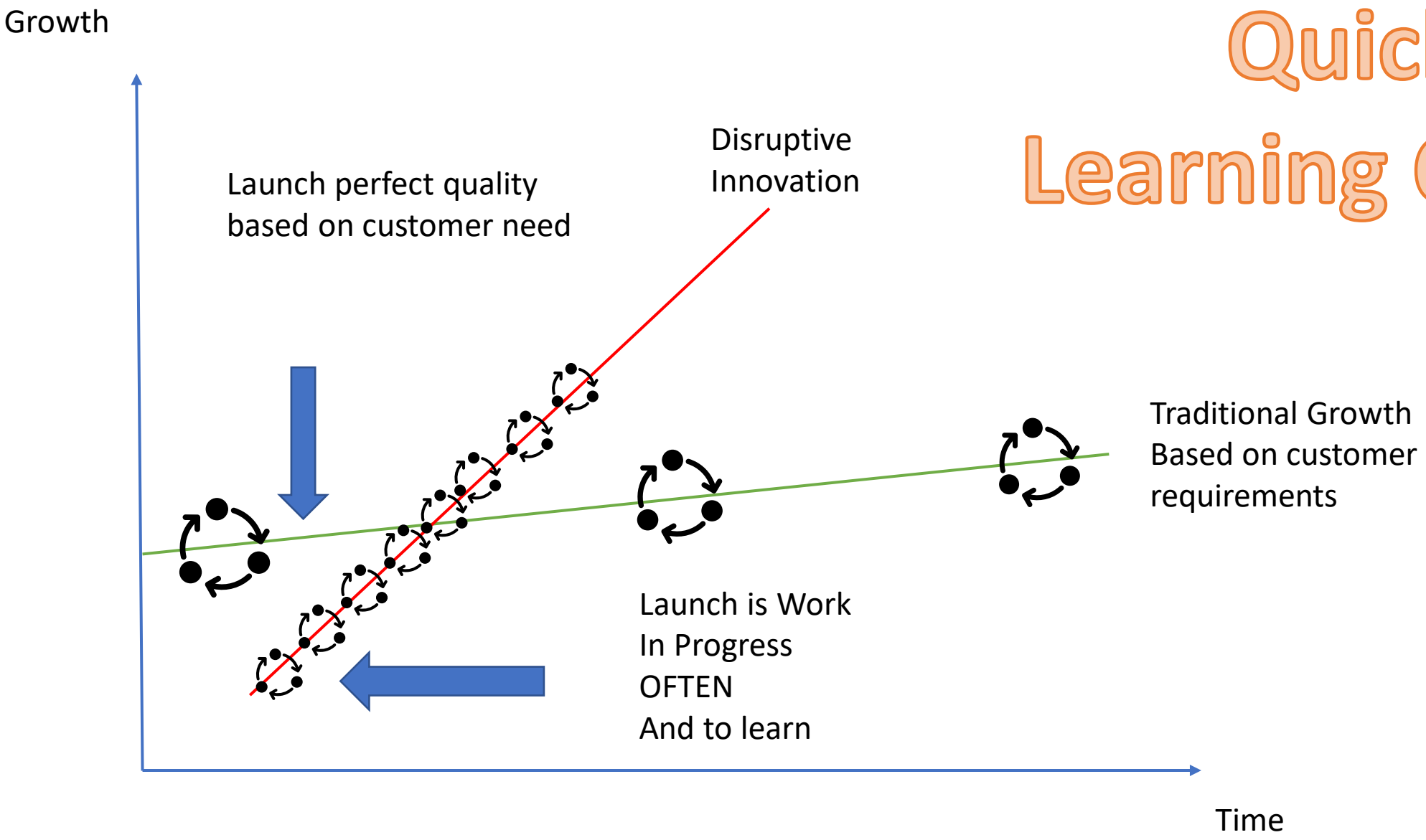
Could this be the reason for the Toyota/Tesla gap

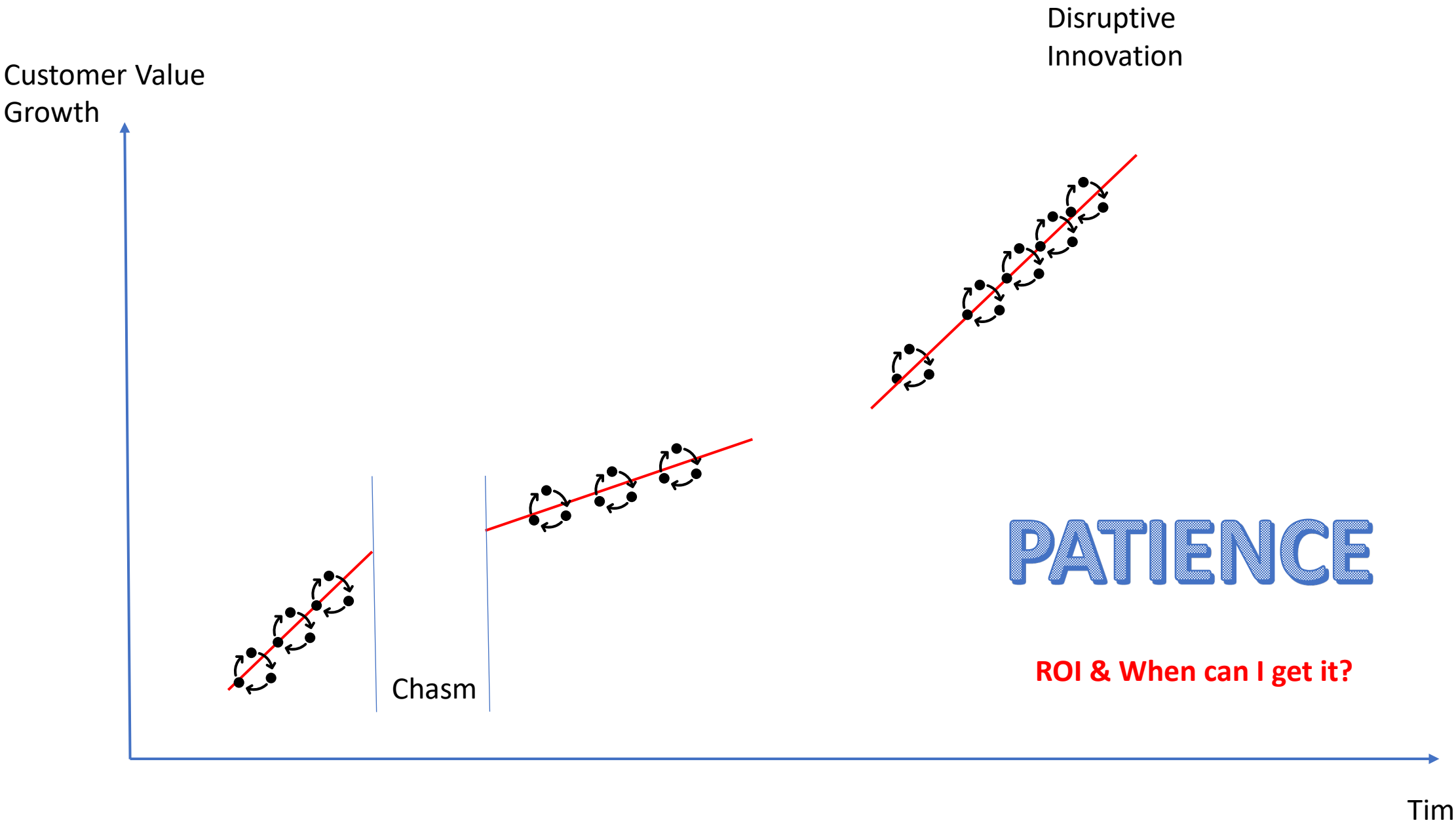






Quick Learning Cycles





Christensen's point

- The most respected companies in the world listened to their customers and invested in the best value.
- There are instances where you cannot listen to your customers and
  - Develop lower performance products
  - With lower margins
  - Aggressively pursue smaller markets
- Disruptive technology
  - Simpler/cheaper
  - Start in small markets
  - Established customers do not like the products

Cristensen's points

Read

- Innovation may not be perceived as useful today BUT tomorrow. Current customers lead companies to sustaining innovation, not disruptive innovation
- Funded innovation succeeds – starved innovation fails. Even if executives provide funds, managers have a hard time to keep them focused on disruptive innovation
- Companies know how to match market and technology for sustaining innovation. Forcing disruptive innovation onto current markets and customers always fails. Disruptive technology is a marketing challenge, not a technological one.

Cristensen's points

Read

- Companies have their culture and specialized processes locked in and lack the flexibility to take technology to market another way. Failure is not tolerated and they cannot handle different margins from different volumes. Product cycle times and industrialization are set for their network
- Exact numbers to justify investment are non existent and risk must be managed by an agile process different from the mainstream. Companies are unable to simultaneously tolerate and not allow failure.
- There is no blanket technology strategy: lead, follow, … There are first mover advantages, especially with disruptive innovation. Historically correct sustaining innovation has also done well for some companies.

Cristensen's points

Read

- The economic model of big companies (scale, proprietary technology, manufacturing efficiency …) does not fit disruptive technology. Start-ups take advantage of that

Christensen's Conclusion

- Managers must understand the conflicting demands for sustaining and disruptive innovation.
- Then they need to create a context in which market position, economic structure, development capabilities and values are aligned so their customers can be engaged in the very different work of sustaining and disruptive innovation.

Read

- Specialty organized companies (functional) often lack the collaboration needed for innovation

- When the customers needed the radical innovation even large companies mustered to do them but when the customers did not demand it – they did not do it

Christensen Root Cause

- Manager's careers are biggest motivator in pursuing innovation (Christensen)
- Managers consistently make the wrong decisions when it comes to disruptive innovation
- BUT good management in the current culture is the root cause – they played the game the way it was supposed to be played.
- Those are the very processes that reject disruptive innovation – listening carefully to customers, tracking competitors, investing resources into higher margin products

Lessons

- Forecasts and initial strategies are almost always wrong
- Fail ideas NOT BUSINESSES
- Initial plans almost always fail
- **Plans must serve the purpose to learn, not to make money = discovery driven planning (agnostic marketing)**

AGILE

Knowledge Management

Create Value for the Customer

- Remains valid
- “value” may change but people do not
- Customers will leave in an instant for the better and cheaper product
- Even established companies do radical innovation if there is an explicit customer demand

Re-thinking value for the customer

- The customer may not tell you
- The information may not be available in the surveys you are used to
- **Focus on opportunities not only gaps**
- **Focus on strengths and weaknesses**
- Have a good scouting system

ROI
When can I get it?

Innovation KILLERS

- **FEAR**
- Pirating ideas
- **NIH = Not invented here (or by ME)**
- Inability to manage risk
- Environment
- NEGATIVITY
- **Restrictions**
  - **Lean –** (waste, solution to everything, Millican …)
  - Legal
  - ….
- **Uncreative AI**
- Secrecy agreements/contracts

“Lean is Bullshit – It Kills Innovation!”*

*CTO - Major consumer hand tool company

- Conference Product Development
- Everybody in the room was convinced you cannot implement lean and be innovative
- Based on 3M experience with six sigma and a GE CEO

LEAN - Caution

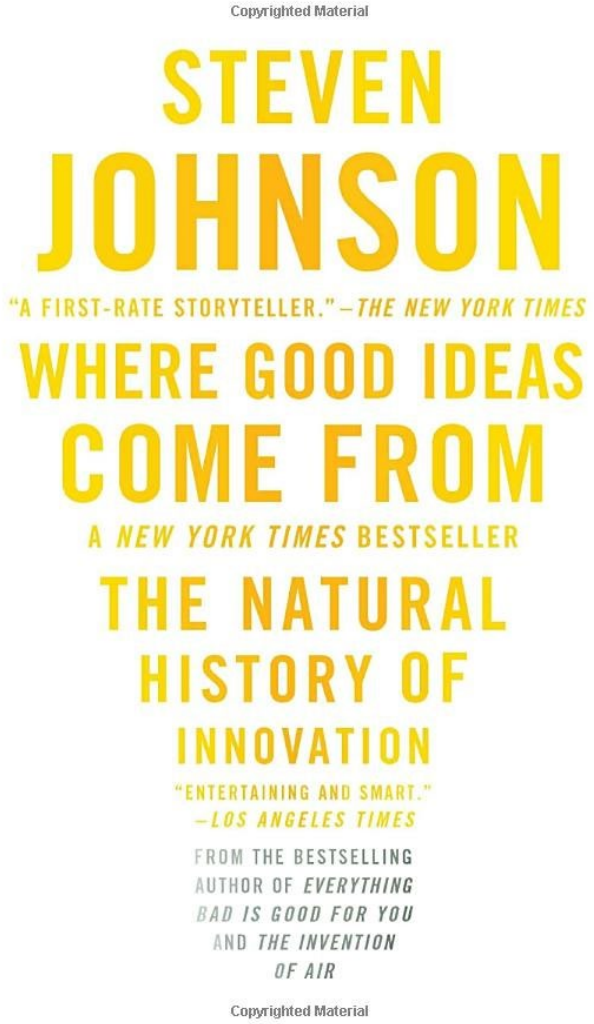
- Failed ideas are NOT waste
- Considering many alternatives is not waste
- Late decisions are good – so is late start
- The customer focus can mislead
- Lean/opex is not the magic for everything

Standards or Not

- Standards are the basis for improvement
- BUT
- Autopilot
- Guard dog
- AND
- **Experiment OUTSIDE the Standards**

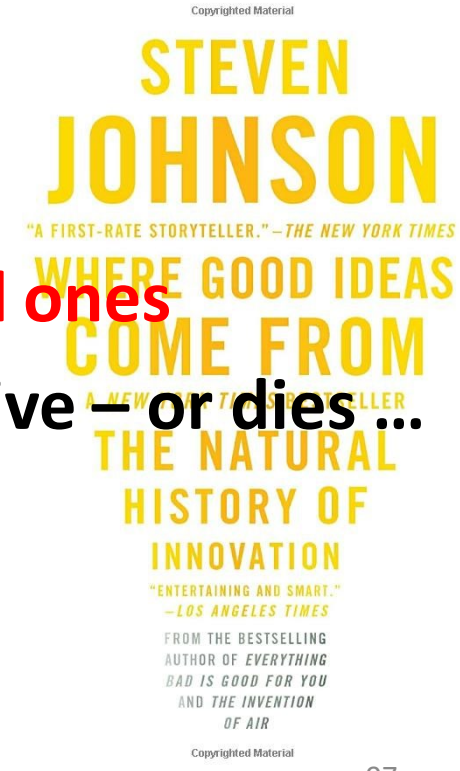
Principles of Industrial **Creativity**

- Industrial Creativity Basics
  - Where good ideas are coming from
  - How to make people creative
  - Idea Generation techniques/tools
  - How to deal with ideas that do not look so good
- The more you try the more successful you can be – it takes many to find a good one >>> overloading the system



Where Good Ideas Come From – The Natural History of Innovation – Steven Johnson

- Darvin's Paradox – The Coral Reef. 25% of all species live in 10% of the earth
- From the 10/10 rule to the 1/1 rule
- Challenges competition as a motivator
- **Open environments create more innovation than closed ones**
- **When it is about survival, nature becomes very innovative – or dies …**



7 (Industrial) Creativity Principles - CONNECTED

- The Adjacent Possible
- Liquid Networks
- The Slow Hunch
- Serendipity
- Error
- Exaptation
- Platforms

The Adjacent Possible

- You can only use what you have easy access to
- Incubators from Paris to the third world, Sandals from tires in Africa, evolution of life … **Apollo 13**, growing up on a farm …
- Big cities vs small villages
- **GROW THE ADJACENT**

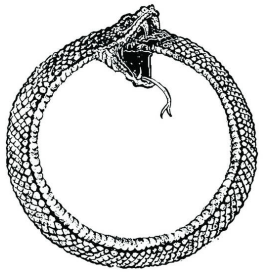
Liquid Networks

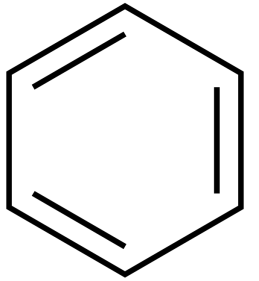
- Solids are frozen, gas molecules are too far apart liquids have proximity and mobility to explore adjacent possible
- Ideas are about connections made in the brain
- They are made by putting your brain in a stimulating situation/environment
- From villages to cities, European civilizations vs Mid Americas - European Renaissance
- **More ideas in the conference room than the lab**
- Combinations, brainstorming, build on other ideas …
- Social media
- **MIT building 20 (WW2), MS building 99**
- Spillover and leaks
- Organic chemistry diversity based on carbon connectivity

The Slow Hunch

- Phoenix memo – 9/11
- All great ideas start as hunches – must connect to succeed - Minnesota flight school (9/11)
- Narrative of breakthroughs, insight … **EUREKA – connecting the dots**
- Sustaining hunches is difficult - Internet hunch took a decade
- **Snap judgements of intuition – NO significant contribution to innovation**
- Google asks for reports on time off – google ads, gmail, google news result from it

Serendipity





- = power of accidental connections (The Three Princes of Serendip) – **Happy accidents (find missing puzzle piece)**
- Dreams – scientific breakthroughs, Archimedes, Mendeleev, Kekule - Ouroboros
- Scientifically proven – **random** activity around what is high on the “usage” list – explains epiphany (unconscious)
- Associated with disorganized brain …. **RANDOM** connections
- Nature – asexual reproduction vs diversity – industry “nepotism”. **When nature needs new ideas it strives to connect, not protect**
- Needs unlikely connections AND anchor
- Legal and secrecy walls kill serendipity – although lawyers think they enhance creativity – **innovation increases with removal of restrictions**
- **Brainstorm, Hackathon…. Open Innovation**

Error

- Pacemaker invented by Gratebatch… grabbing the wrong resistor when building a prototype for another purpose
- Vacuum tube invention through a mistake building something else, penicillin invented due to contamination in the lab… photography due to a spill in the lab … cured rubber, radiography …
- Error brings inventors out of their comfort zone and makes them re-think and explore
- Errors are often brushed off as noise and remain unexplored
- Good ideas are more likely to come from an environment with noise and error (and tolerance for that)
- Mutations – mistakes >>> more likely under stress (Russian Innovation)

Exaptation (borrowing)

- **From the wine press to the printing press.** Bird feathers were for warm keeping (down)….. Punch cards for weaving, triode for noise amplification, …
- **European civilizations vs Mid-American**
- 148 same inventions in same decade –
- MUST connect the dots, arrange the puzzle pieces
- Whole concepts mutate or morph
- Today every innovation needs MANY different disciplines
- Big cities vs villages – big cities are an environment for exaptation because of specialized skills and interest cultivation, liquid network, leaked information, influence on neighbors, diversity ….
- “Mo”, professor in NYC: “I live in NYC because it is the most stimulating place in the world”
- UK 18th century coffee houses, Freud 19, Bergstrasse, computer clubs, quality circles ….
- Not only collaboration >>> **COLLISIONS - sparks fly**
- **OPEN INNOVATION**
- Diverse horizontal social networks 3X more innovative than uniform vertical networks
- Weak ties from different context (Gutenberg, DNA structure, … long playful coffee breaks …)

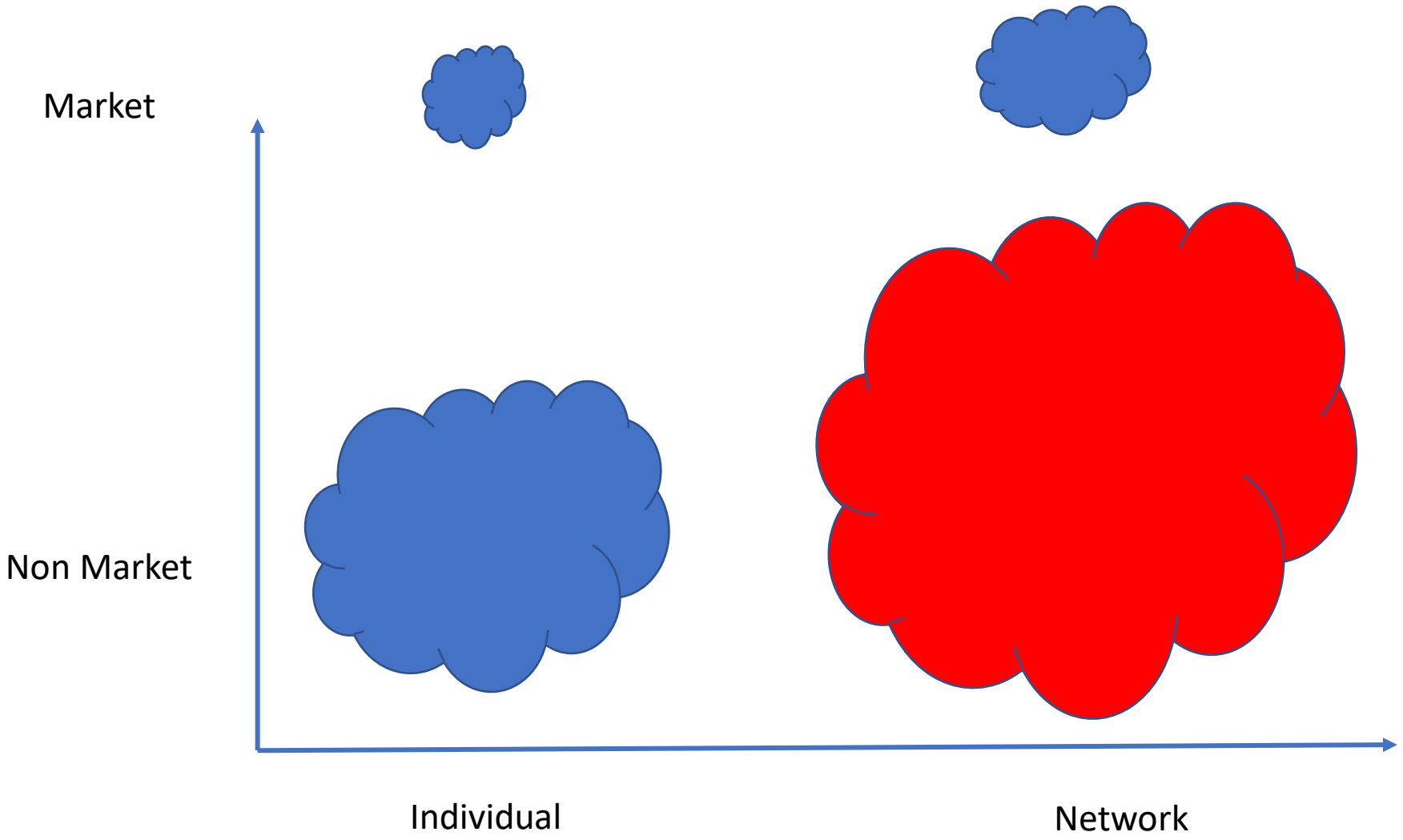
Linear Chain Development Process

- Design>>Manufacturing>>Marketing has a disastrous effect on creativity because the idea gets chipped away in each step
- Apple approach messy at the beginning – apple calls it concurrent, parallel … ALL meet continuously as a diverse group keeping all aspects alive
- Apple is/was a fortress towards the outside NOT INSIDE – but have coffee house development process – will it demo well?... concept car
- I developed the same process/culture at Goodyear **and it WORKS!**
- **More Later**

Platforms

- GPS, Bell Labs, Goodyear …
- Very popular in IT
- Success of YouTube 6 months – combined work from 3 platforms (Web, Flash Player, Javascript) ---HDTV took 20 years
- Twitter platform created dozens of innovations
- Open API (application programming interface)
- **Discarded/reused information** – old buildings in cities
- Use without permission and knowledge stays in the platform

Innovation Evolution



Competition

- Less of a factor ??? Really?
- **Openness – a big factor >>> open innovation**
- It is as if you put the ideas out there, they work better for you than if you build walls around them (Tesla – patents)

How to Make People Creative

- EDUCATION
- Stimulating environment
- Freedom to think (including time)
- Social part
- Do something DIFFERENT
- Displays, visits
- FUN
- Exercise, outdoors,
- Google examples (walls, conference bike …)
- RIGHT incentives
- Show and tell – go to conferences …

Idea Generation Techniques

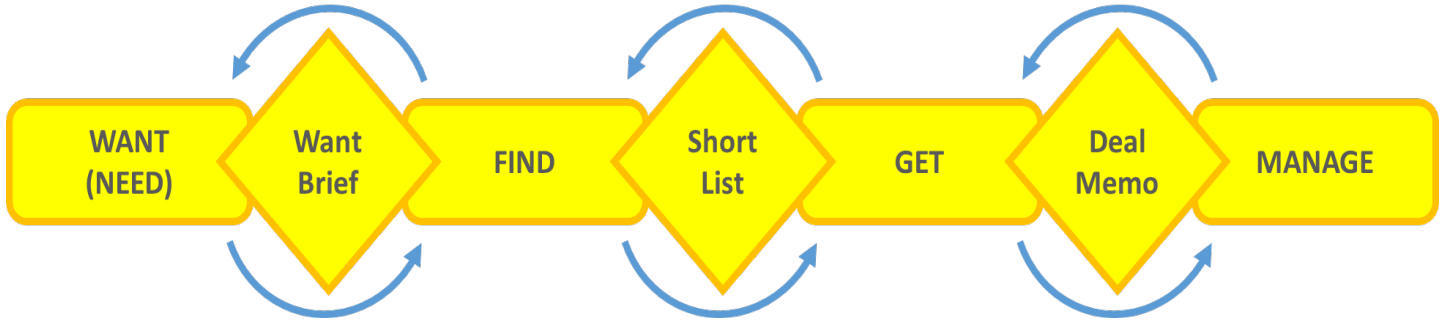
- Brainstorm, Brain-Write, Web – event ….
- TRIZ, SCAMPER
- Hackathons
- Tame the wild
- Open Innovation

Good Ideas About Idea Storming

- NOT Random
- Stimulate each other
- Experts – fresh thinking
- Remove restrictions
- Do not criticize
- Educate first
- Go wild (with education and focus)
- Computer tools
- Displays
- Rewards??

Open Innovation

- 10 people vs a Million
- Technology scouting



TRIZ and SCAMPER

- TRIZ
- TIPS (Theory of inventive problem solving)
- SCAMPER
  - Substitute
  - Combine
  - Add
  - Multiply/Modify
  - Put to another use
  - Eliminate
  - Reverse

Eliminate First

- GE – Eliminate the whole thing
- What is really needed? Eliminate waste
- Re-build with the minimum needed

Radical First

Taming the most radical idea is more effective than making a conservative idea more innovative

Hackathon

The More You Try ….

- Success is proportional to the
  - Number of things tried
  - Diversity of options explored

- Many People believe that it takes 1000 ideas to get a good one
- Exploring the full design space
- What is worse:
  - Too Many Ideas?
  - Not enough Ideas?

Necessity is the mother of invention

Invention is the mother of necessity

Examples

- Synthetic Rubber
- Gasoline from coal
- Rockets
- Paper diapers
- ABS/stability control (elk test)

Examples

- Post-it
- Honey Nut Cheerios
- I-phone
- Tagaderm
- Scotch tape
- Synthetic detergents
- Chemical sterilization
- Novocain
- Hydraulic Earthmovers

Ideas

- What is worse – not enough or too many
- Chick FilA = Need to kill ideas
- Goodyear's attempts at killing ideas
- Leaders always want ideas – better ones and bigger ones

Ideas must connect with needs and opportunities

Customer Need

Industrial Anthropology

Richard Sheridan – Menlo Innovations

‘Swim in the Fishbowl’ to Better Define Customer Value

- If customer needs are ambiguous, then direct observation and direct dialogue with customers and potential customers are excellent means of gaining insight.
- Toyota is known to do this. Examples:
  - The Toyota Chief Engineer for the minivan lived with a family and a soccer mom in California for 12 months
  - The same Chief Engineer for the minivan drove through all 50 states, visiting customers and dealers and simply observing. At a Midwest do-it-yourself store, he watched people load 8’x4’ plywood into a minivan. This and other observation led to design changes.

“Swim in the fishbowl” is how Professor Shoji Shiba, MIT, described the importance of seeing and understanding the customer. The idea is to “jump into the water” – don’t just conduct surveys and analyze data.

Many Programs focus on CUSTOMER NEED

- Industrial Anthropology
- Design Thinking
- Follow the customer home - Intuit
- Personas
- Etc ….

Opportunity = Needs + Value + Conditions

Opportunities

- When you see a need
- When you see where you could apply something you already know
- Know where to look
- **CREATE** the opportunity

Goodyear Fuelmax

Look For

- Changes in
  - Economy
  - Business
  - Culture
  - Fashion
  - ……
- NEEDS
  - Immediate customer
  - Industry
  - Environment
- Knowledge, know-how, technology
  - What you have
  - What you need
- Demographics
  - Change fast
- Perceptions
- Unexpected
- Incongruities

Jump

Capture

Change

Innovation Opportunities

- **Conditions**
  - **Covid**
  - **Economy**
    - **Fuelmax Tire**
- **Business**
  - **Goodyear**
  - **Dialysis company**
  - **3M**
- **Follow your STRENGTH**

Innovation Opportunities

- **Demographics**, population, education, boomers, millennials … no longer a slow change
- Changes in **PERCEPTION** – modern news, selling FEAR, modern medicine achievements, change in mood defies quantification, ignoring science …
- **KNOWLEDGE**
  - **Scientific, technical** … **EV Batteries**
  - Market, customer …
  - Economical, political, ….
  - **Hardest, slowest, most casualties**

Innovation Opportunities

- **Unexpected** Occurrences (Novocain, scotch tape, Ford Mustang …) >>> Spread bad news – celebrate the red
- **Incongruities** – stuff that does not fit
  - Alcon case (dissolve the ligament, not cut it)
  - Companies growing but not making much money (Steel industry mini mills, airlines, ship builders …)
- Consumer Need: Fischer/Tropsch, rockets, ….synthetic rubber, ABS/stability control – moose test ….
- Market and Industry Needs – EV, telecommunications, internet, healthcare, modern investing, credit cards ….

Innovation Opportunities

- Focus on STRENGTH
  - Colors at mixing company
  - Tesla
  - Technical, Knowledge
    - My book
  - Marketing
  - Financial
  - LEAN

Innovation Opportunities

- Demographic Changes
  - Robots developed in Japan
  - Club Med – affluent and educated young adults
  - Population statistics do no longer change slowly – education, occupations, relocations …

Innovation Opportunities

- Changes in Perception
  - Modern news – Covid and Trump – Twitter and Walter Cronkite
  - Selling FEAR
  - Example: Achievenents in modern medicine and fear of people for their health – too much information, too many tests
  - Change in mood defies quantification

Innovation Opportunities

- Knowledge
  - Scientific
  - Technical
  - Social

  - Take longer
  - More casualties
  - Predictability
  - Challenging
  - temperamental, capricious
  - Hard to direct
  - **Longest Lead Times**

Innovation Opportunities

- Unexpected Occurrences
  - IBM – from NY public library to payroll
  - Unexpected failures as important as successes – Ford Edsel leading to Mustang – from income segmentation to lifestyle
  - Novocaine targeted at amputations – loved by dentists despite the inventor's campaign
  - Why do companies only spread good news – celebrate the red

Innovation Opportunities

- Incongruities – stuff that does not fit
  - Alcon case (dissolve the ligament, not cut it)
  - Steel industry growing but losing money >> minimills, same for airlines, large hubs, large planes and large discounts >> Southwest. Shipbuilders, large ships, good operation but less margin >> faster turn-around ….

Innovation Opportunities

- Process Needs
  - Ottmar Mergantaler's Linotype – produce newspapers in large volumes
  - Modern advertisements – produce newspapers for free – apps ….
  - Look for other examples ….
  - BANDAG, Fischer Tropsch process

Innovation Opportunities

- Industry and Market changes
  - 1960 – Institutional investing- negotiated commissions (DL&J)
  - American Healthcare - independent centers and HMO’s
  - Telecommunications – AND ATT survived!!
- 40% growth in 10 years changes a firm from aggressively pursuing to defending and they leave innovators alone in small and growing markets – Innovators have a great chance of being left alone

Innovation Opportunities

- Knowledge
  - Modern Banking – Napoleon Area = investment banking. 1825 first entrepreneurial bank (credit mobilier)/entrepreneurial and UK/commercial . JP Morgan and founder of Deutsche Bank combining French and UK model
  - Computer needed 6 strands of knowledge and was ready in 1918 but did not appear until 1946 (what was it??)
  - **EV Batteries**

Innovation Opportunities

- Knowledge
  - Real knowledge is needed
  - Goodyear experience
  - Careful analysis and lots of work – Wright brothers

- Knowledge about the users
  - Persona
  - How …
  - Observation
  - Intuit example
  - First passenger jet

To find/develop/grow … an opportunity may need….

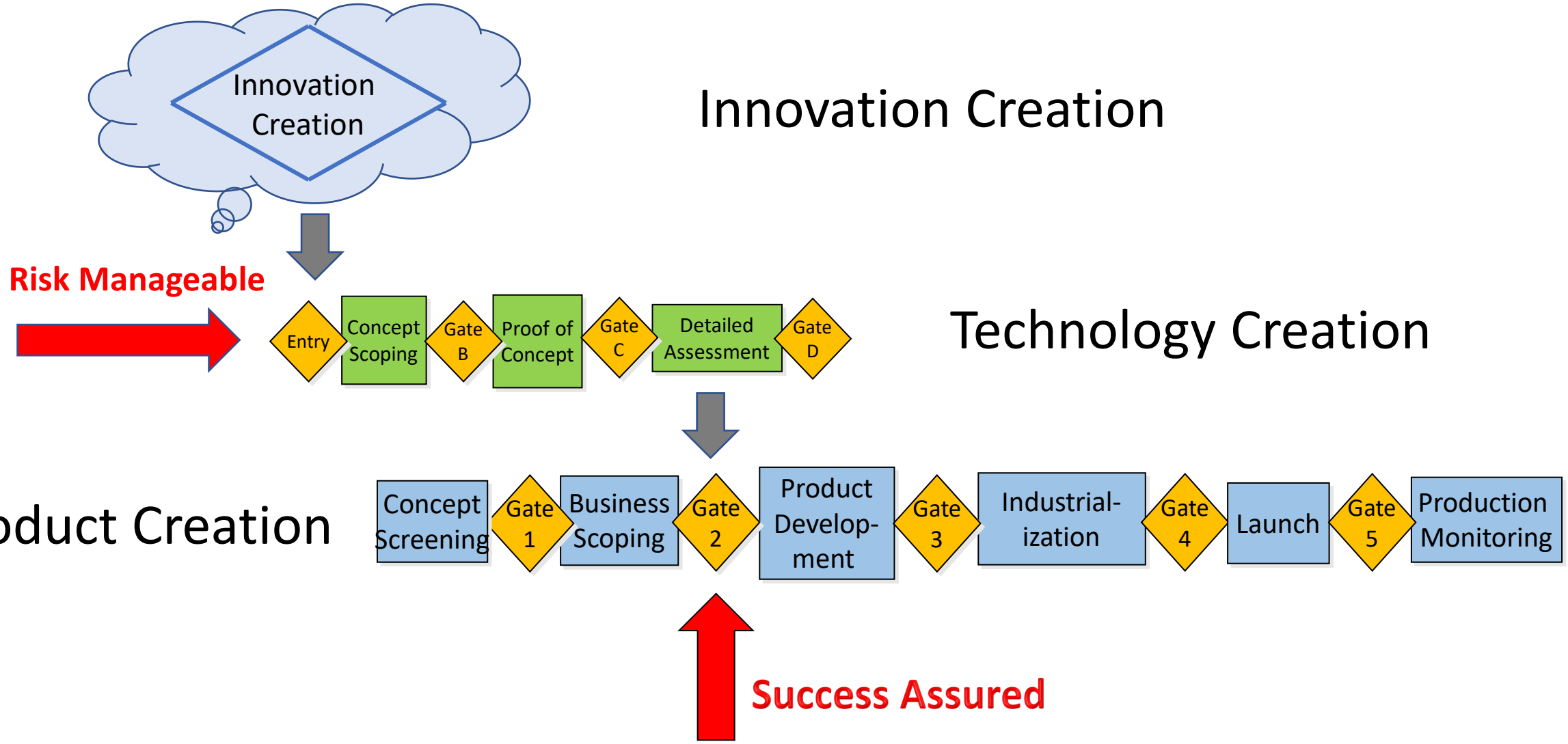
…..more out of the box thinking than the idea itself

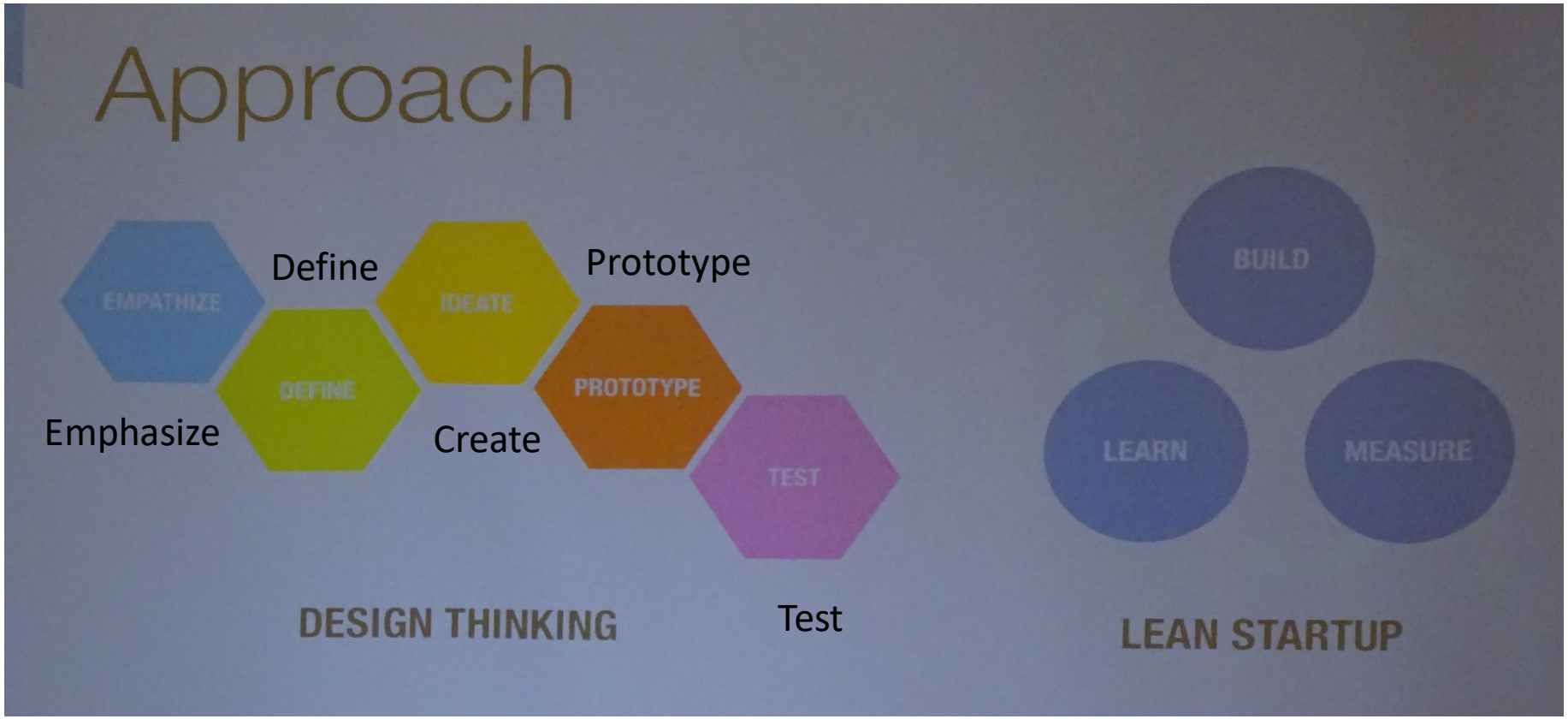
Process

- YES – Innovation can have a process (AND standards)
- Process and standards are the basis of improvement
- BUSINESS process – not just R&D
- Speed and agility matter

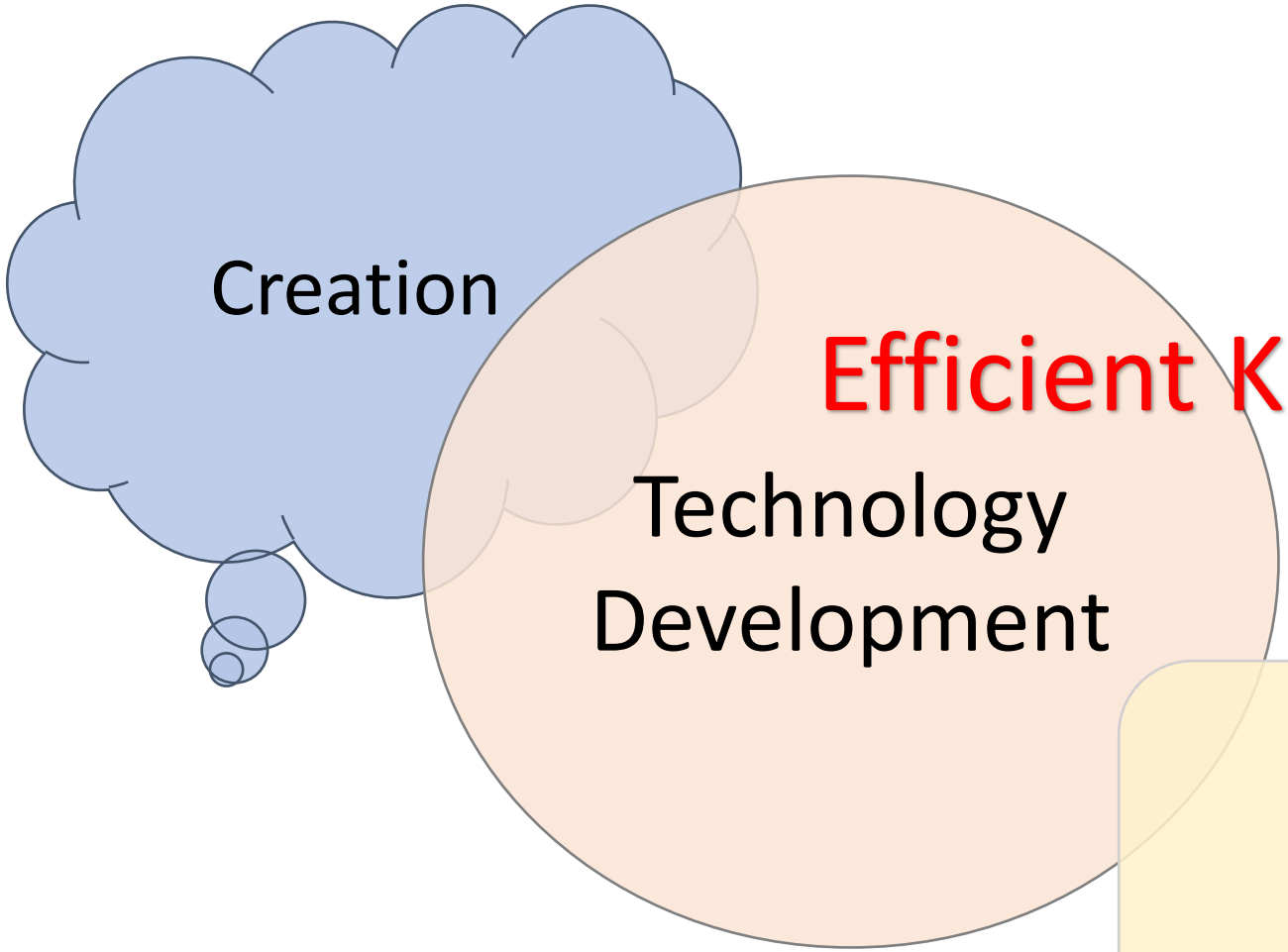
- There are Soooooo many

Can Innovation Have a Process?




Approach
EMPATHIZE
Define
IDEATE
Prototype
DEFINE
PROTOTYPE
Emphasize
Create
TEST
DESIGN THINKING
Test
BUILD
LEARN
MEASURE
LEAN STARTUP

Fail fast and often



Efficient Knowledge Creation

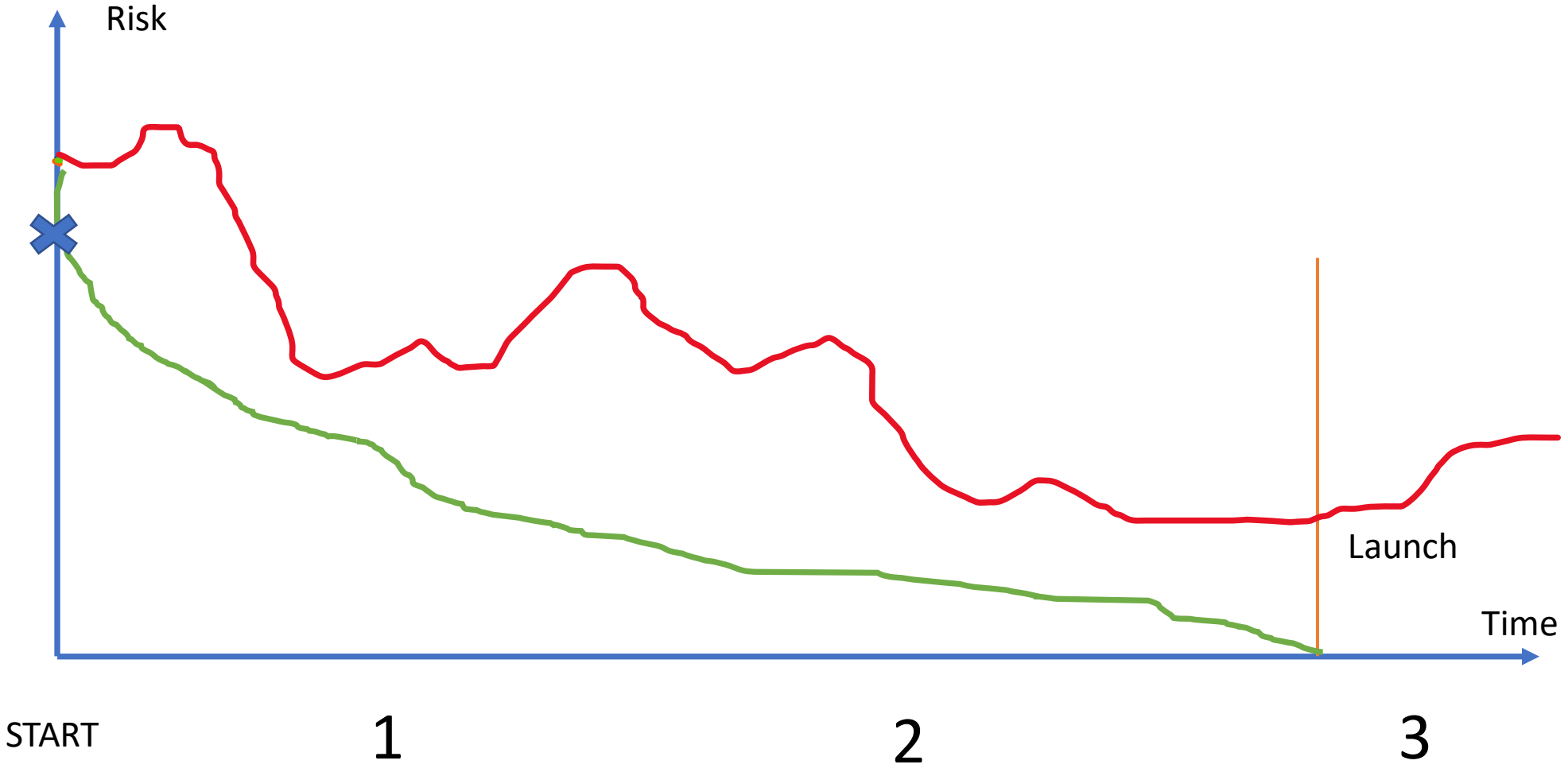
Mass Design

Failure is not an option

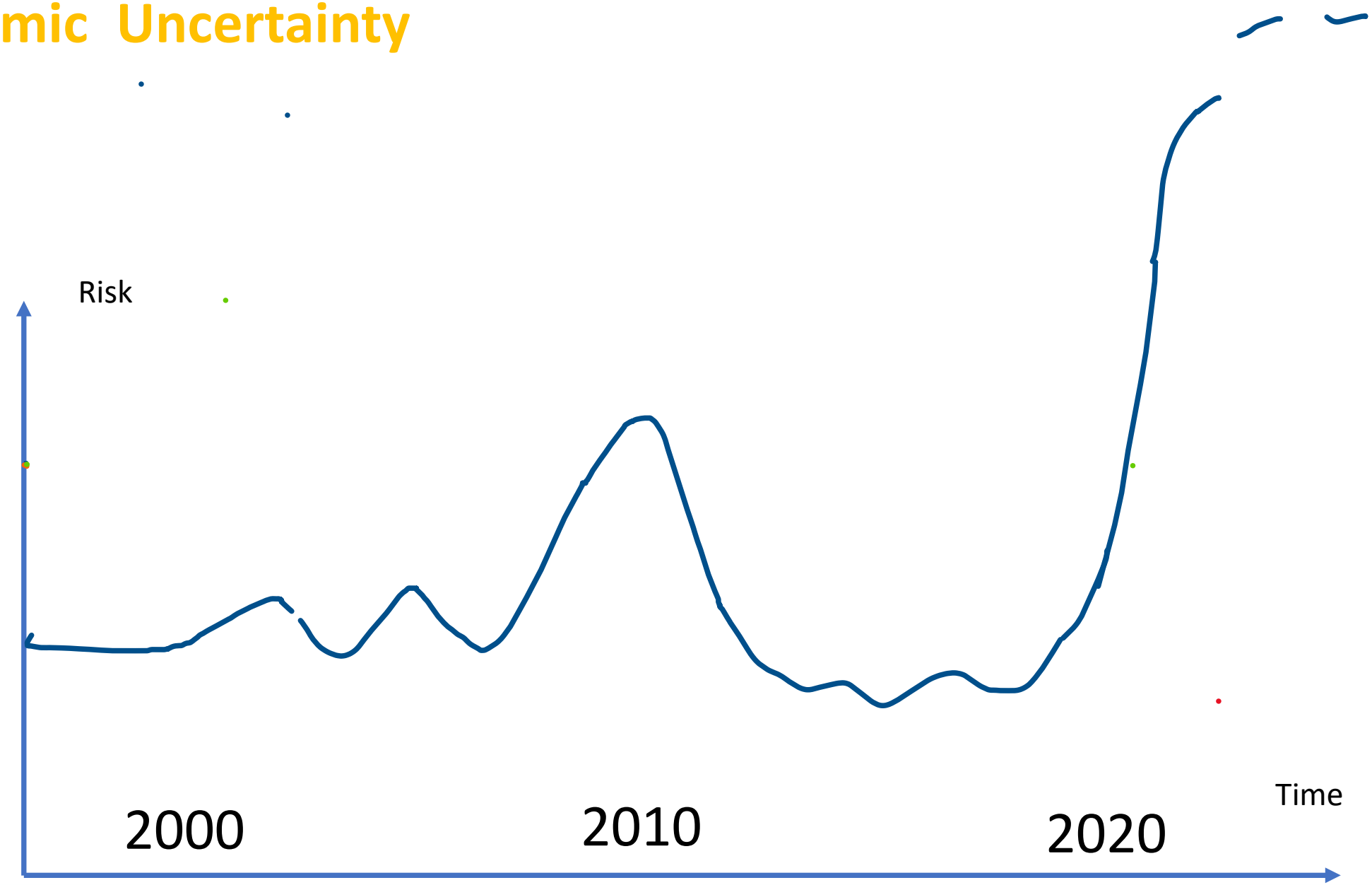
Not a one size fits all ……..

- Developed at Goodyear and fits well into a lean culture

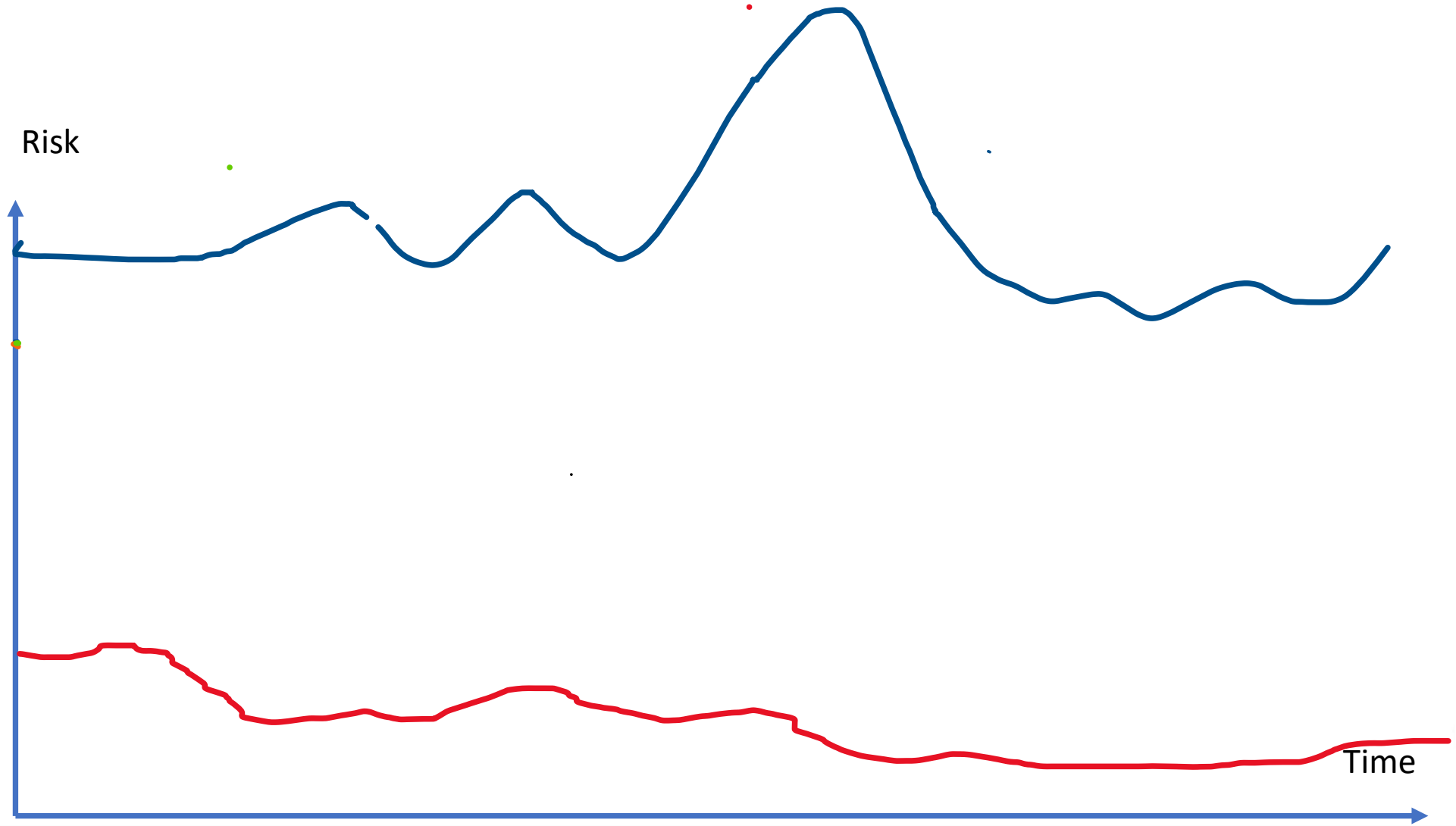
Project Uncertainty/Risk



Economic Uncertainty



Project Risk



How to mange a rollercoaster?

- It is hard to quantify and manage in the conventional way
- BUT there are good principles and tools to deal with it

My Dream Process

H&M

1,000 PROJECTS

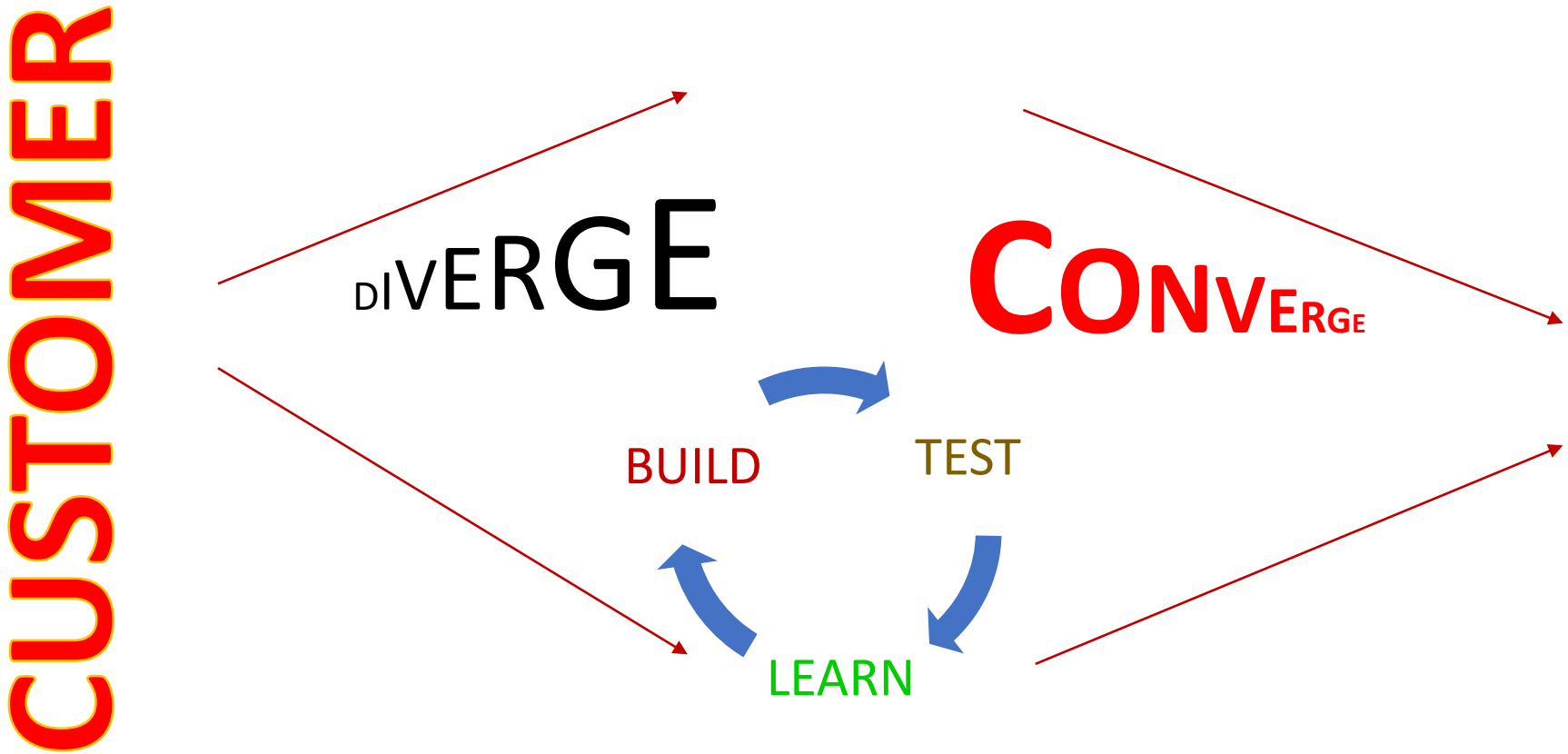
How do you kill 999 Projects

- Stage Gate
- Fire the inventors
- 3M
- Goodyear

Apple – no joke – from an ex employee

- Will Steve like it
- Will it demo well

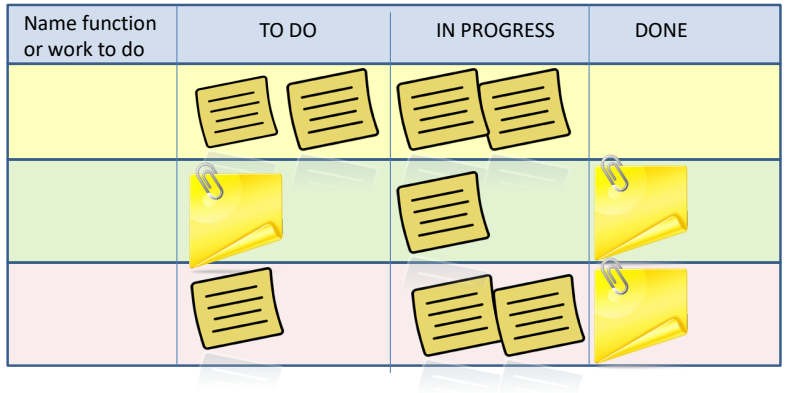
MY Innovation Cycle



Quick Learning Cycles – SCRUM, sprints, agile …

Time Period

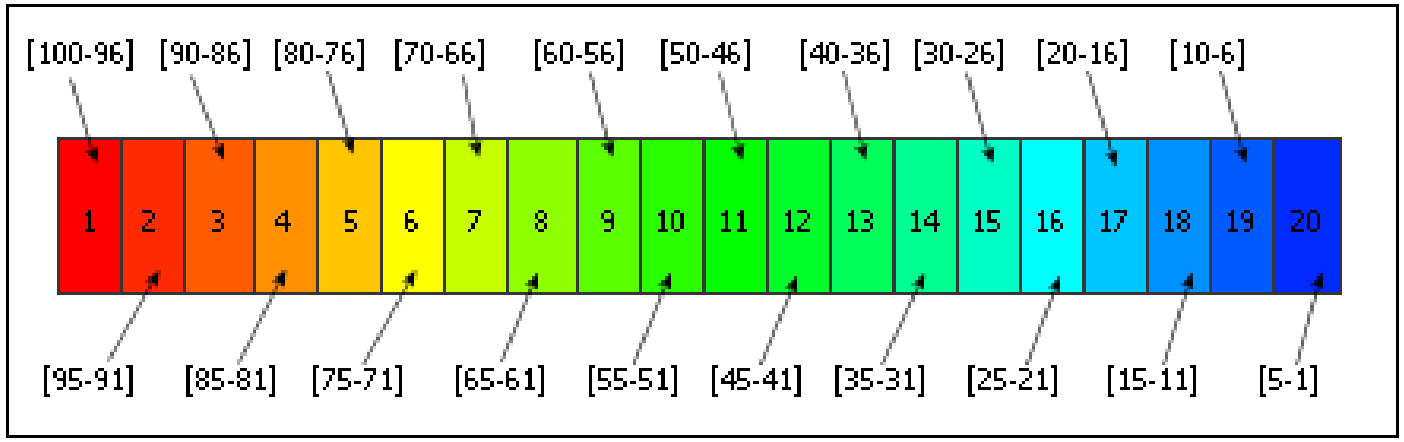
Goal, deliverable ….



Potentially Shippable Product after every cycle

- Work in very small steps, FAST – often time limited steps
- Cross functionally from the beginning
- Retain flexibility through the process – launch or pivot at any time
- And
  - In the right order
  - With the minimum effort

Follow the Risk Scale With Critical Questions



How can I know after the first experiment if it is worth continuing the project?

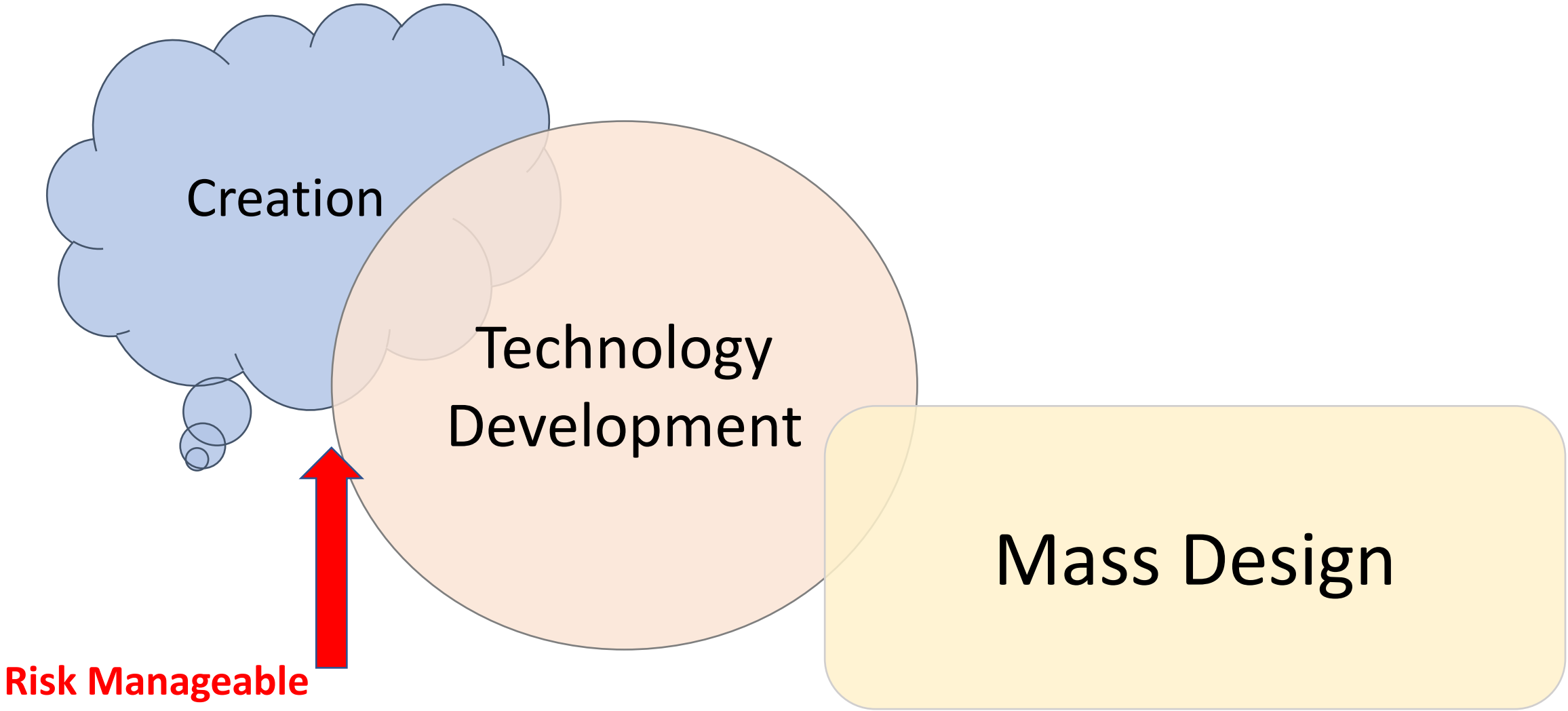
How to Manage Innovation Risk?

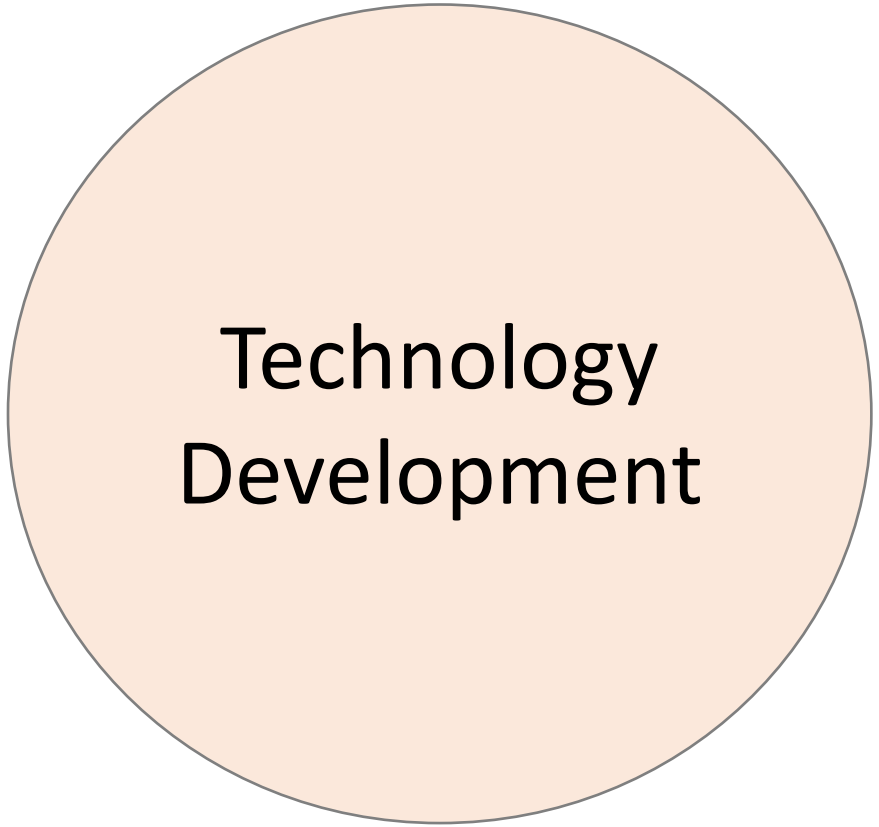
- Investment in R&D is made to reduce the risk until investment into launch can be made
- The right process and tools - standards
- A culture that understands it and manges/awards it appropriately
- Understand and follow the curve
- PRUDENT steps – AGILE
- **Invest in small pieces at a time**
- Lean start-ups know it well
- The culture must allow some risk and tolerance for failure

Start-up vs Corporation

- Start-up – humble means – nothing to lose
  - Succeed or fail
- Corporation – sufficient means but a lot to lose
  - Effective risk reduction
  - No reason to spend any more than a start-up
  - Can afford to look at a multiple of ideas

Start 100 projects for the cost of 1





Scientific

- Define area of research
- Literature search/assessment
- Hypothesis
- Experiments
  - One variable at a time
  - DOE
  - ….
- Confirm/Refute/Adjust
- Report
- Recommendations

LEAN Technology Development

Focus on Knowledge Gaps – NOT Product

ONE Practice:

Set Based Concurrent Engineering

Set Based

- 6 compounds
- 10 tread patterns
- 15 constructions

ELIMINATE

- 3 compounds
- 8 tread patterns
- 9 constructions

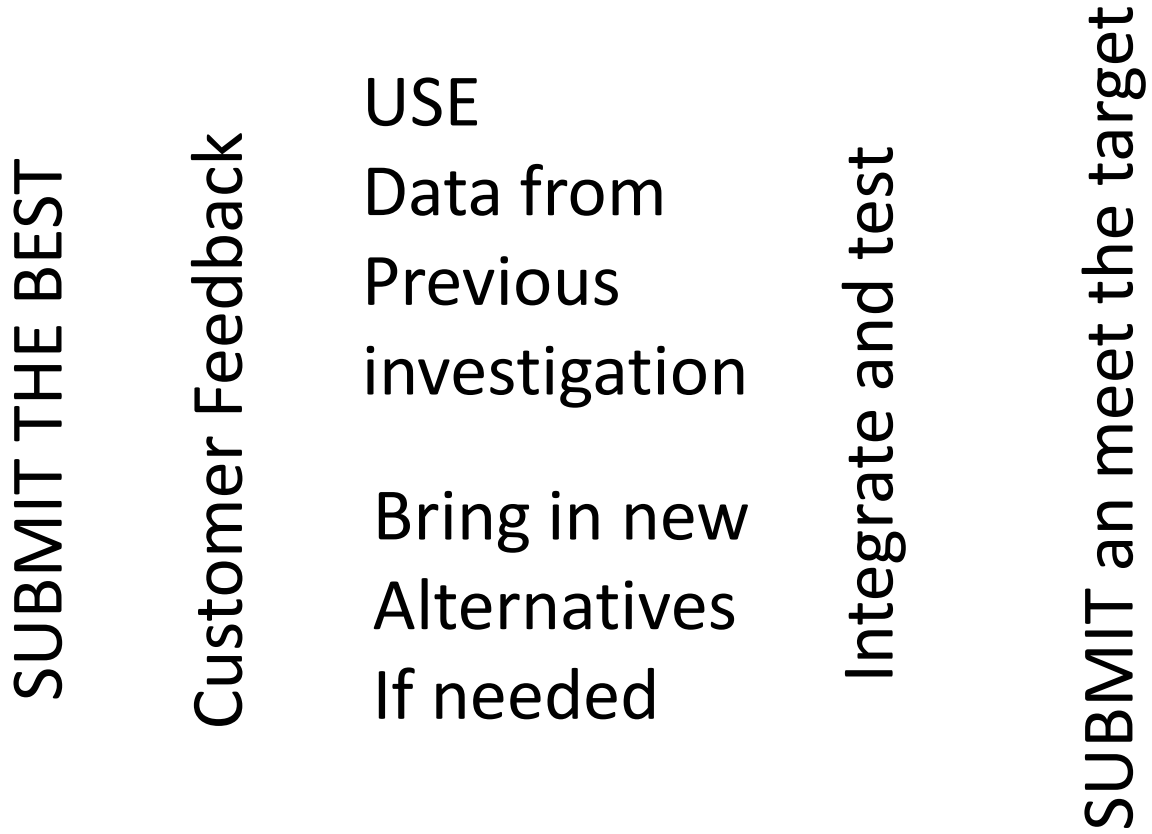
Integrate and test

- 3 compounds
- 4 tread patterns
- 4 constructions

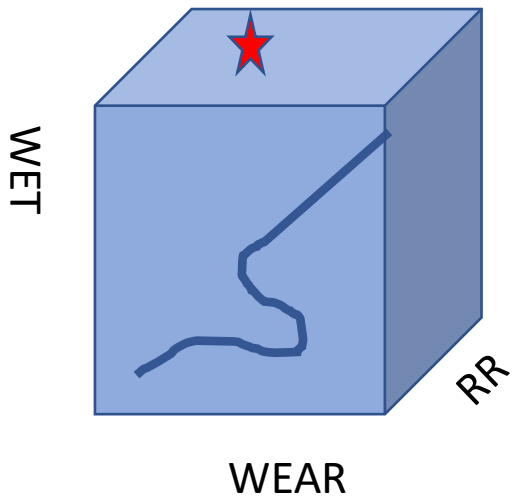
Integrate and test

SUBMIT THE BEST

Set Based

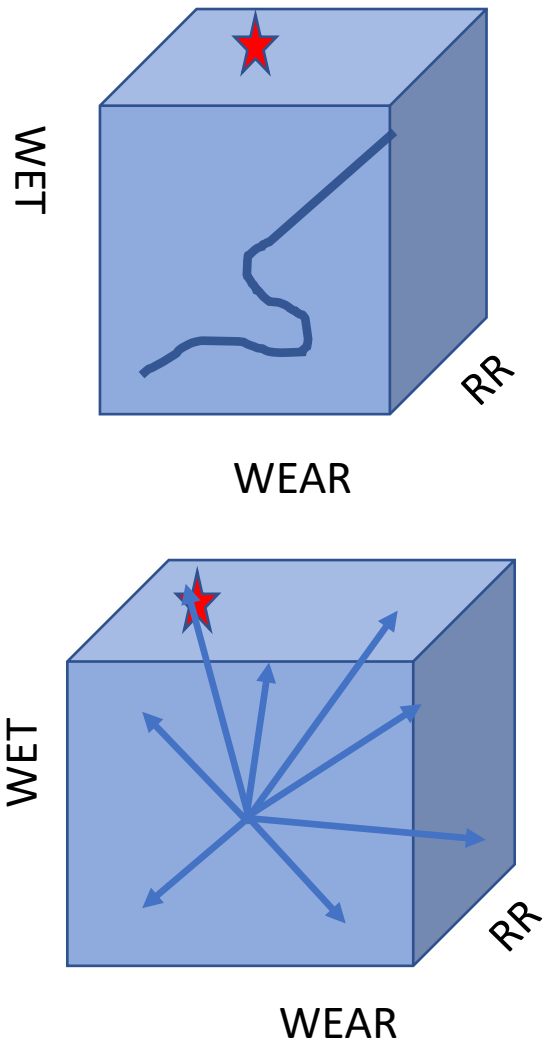


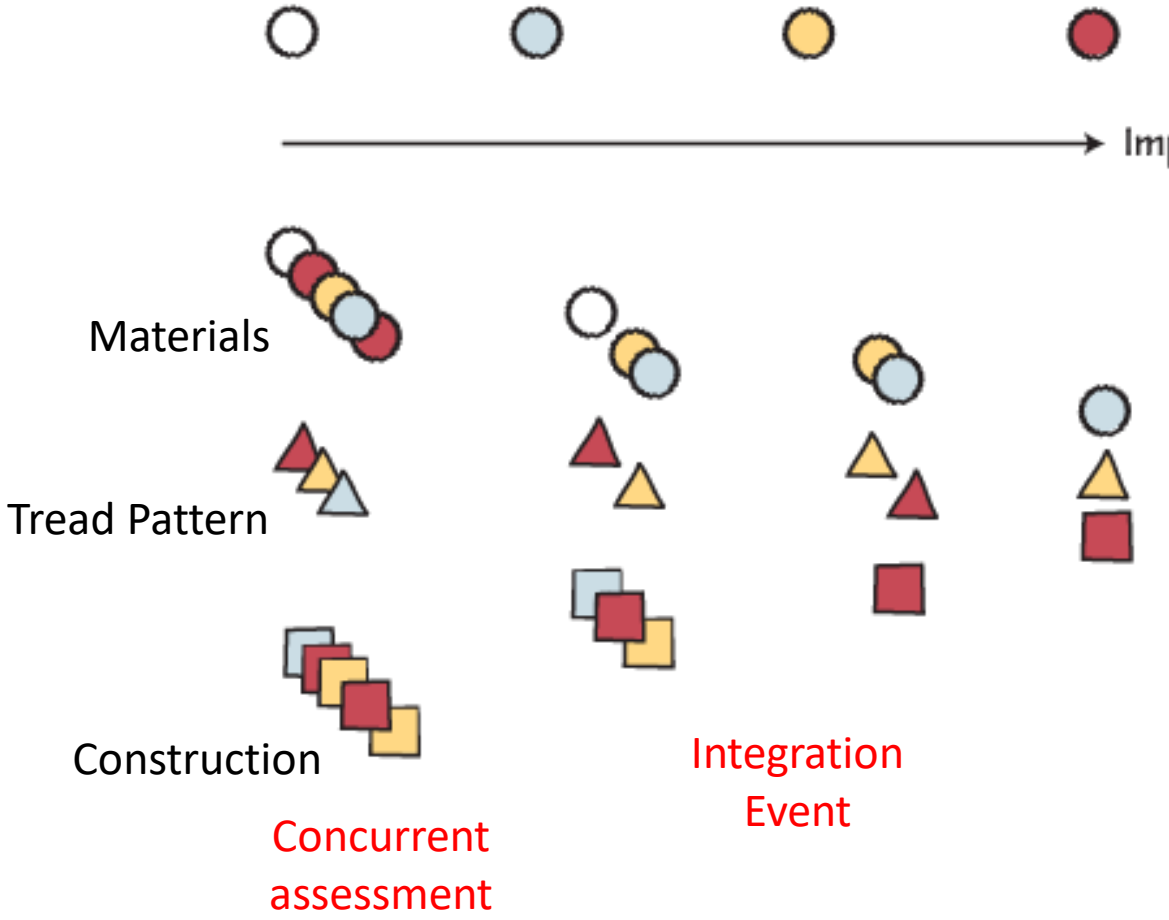
Set Based Concurrent



Product

Set Based Concurrent





Product

Knowledge

Maybe Equation or use of visible knowledge

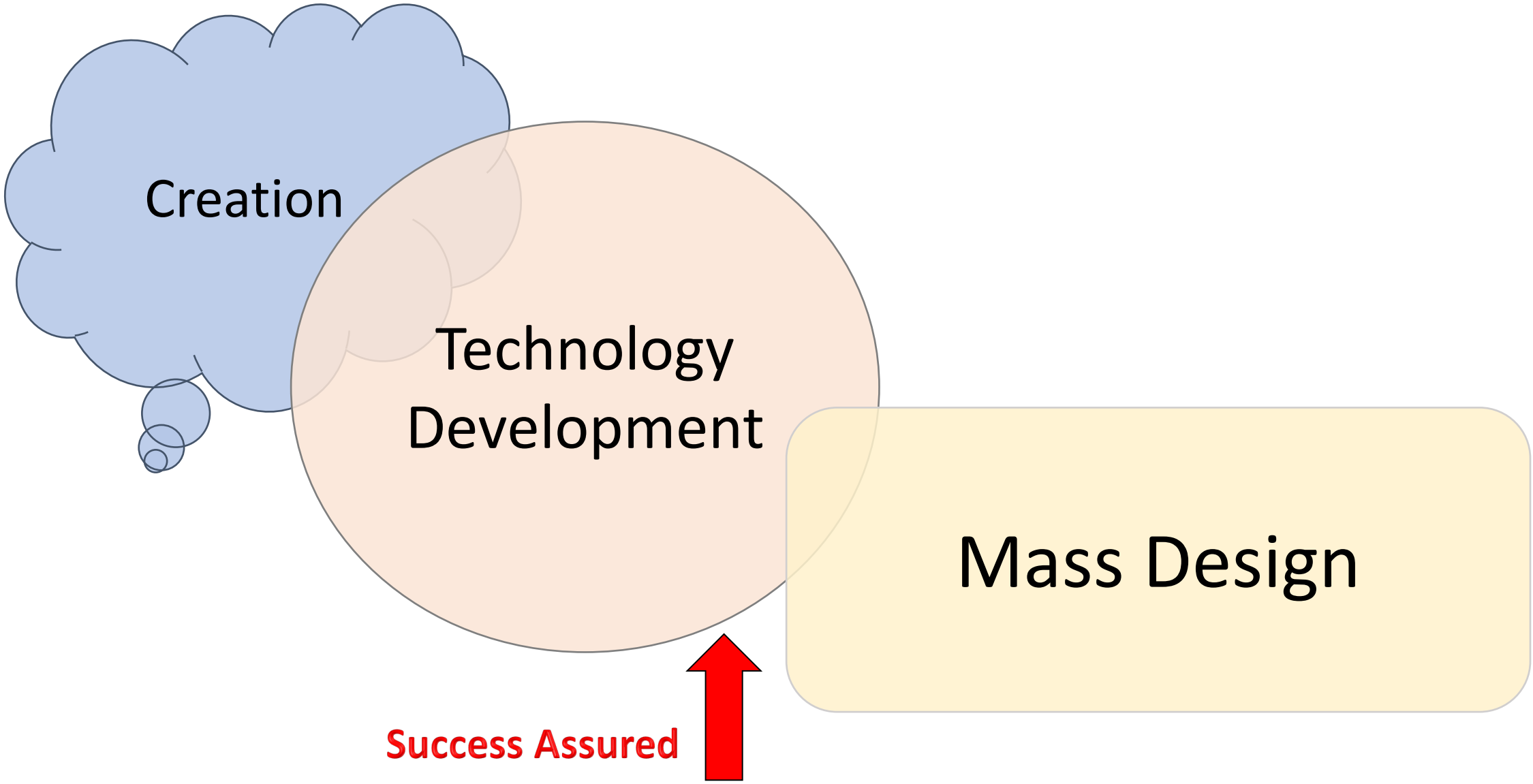
Principles

- Focus on knowledge gap(s) – not the product
- Start with a wide space
- Work concurrently on sets
- Eliminate as **appropriate**
- Retain options as long as possible
- Study interactions at integration events

Maybe not good enough for college thesis but very successful for industrial research

IMPORTANT

- MUST start with large design space – Most common mistake
- Integration events are critical – they synthesize best options and evaluate interactions
- Only non working options are discarded
- It is desirable to have many options at the end
  - Trade-offs can be managed
  - Many different options can result
- This process is very effective for the development of robust platforms



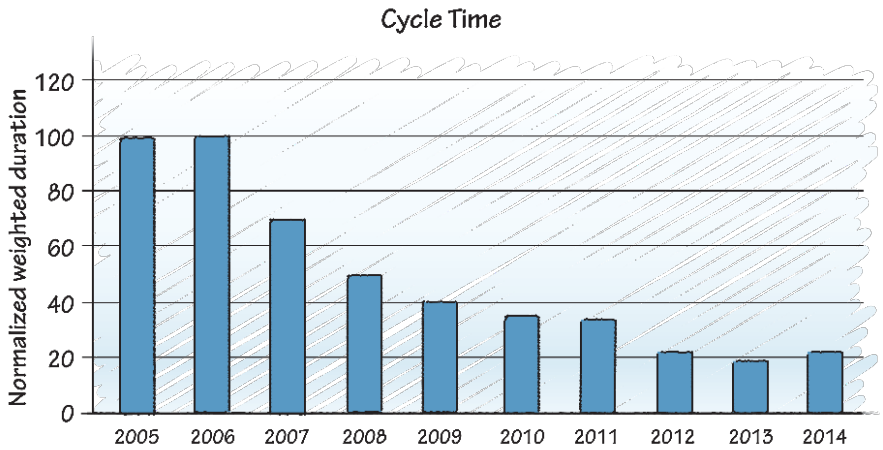
Execution Phase

- Generates company income – and platform for launching innovation
- Inspired by lean manufacturing
- Goodyear 2016 AME Excellence Award - Innovation Center
- 100% delivered on time/target – 75% faster
- Fast is better than slow

Innovation Speed

If I had only one thing to focus on, it would be SPEED

- Competitive advantage
- Faster learning, better risk management
- Better cash flow
- **Collaterals of efficiency**



Some Goodyear iterations require more time than others. In order to track cycle time across all iterations, regardless of the varying time, Goodyear established a measure of normalized weighted duration, establishing a base of 100 in 2005.

At Goodyear we were always fast and on time …. When we dropped everything and only ran one program …..

- Standard – Fight over which product would be elevated to the prime status
- Ambulances
- Everything else on huge priority list

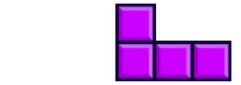
“LEAN”

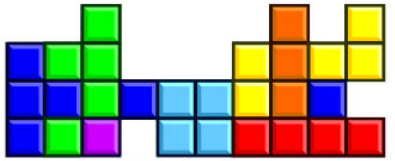
- What would it take to run EVERYTHING at the same speed and on time delivery?

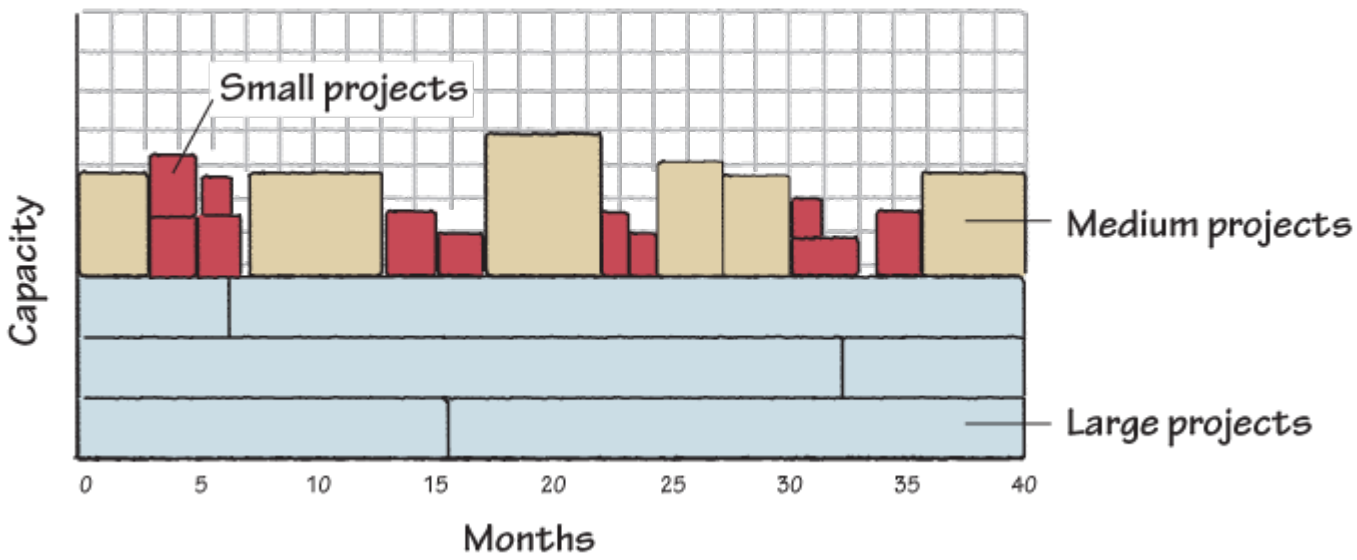
- WE WERE ABLE TO DO IT – AND THEN SOME – with the proper application of lean principles

  - 100% on time
  - 75% faster
  - 3x more efficient

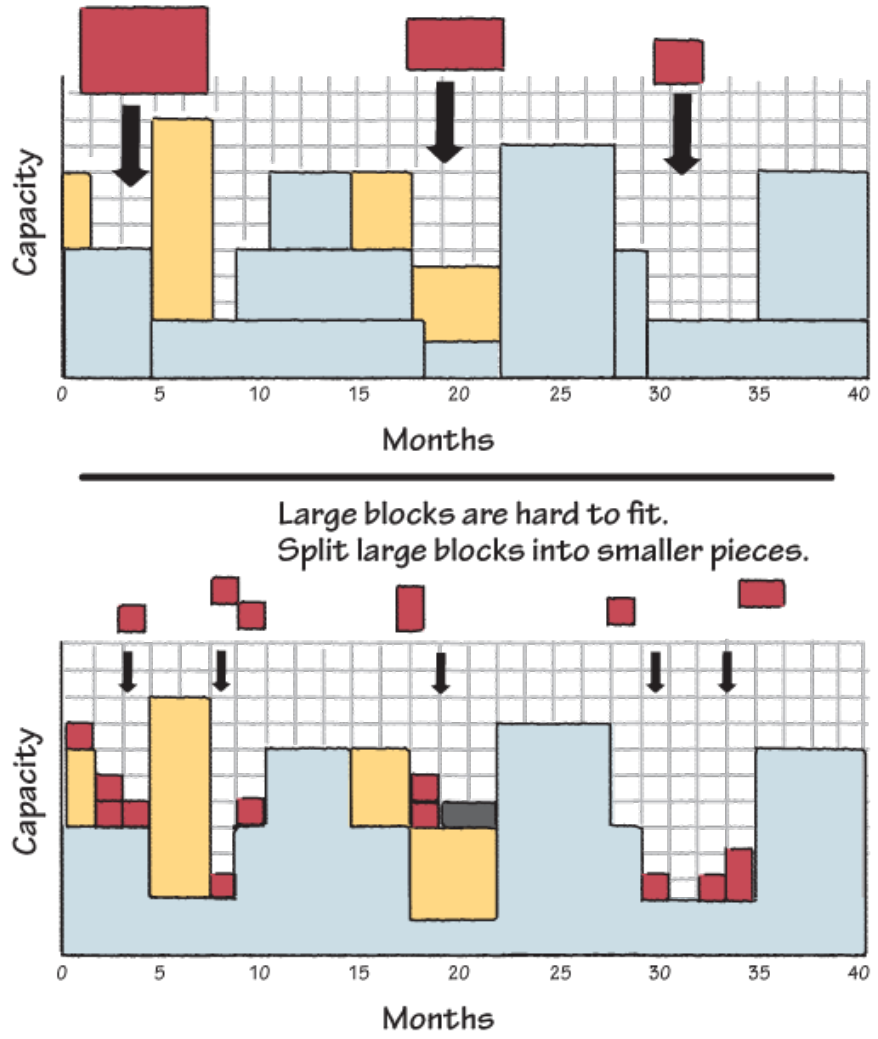
Tetris Principle



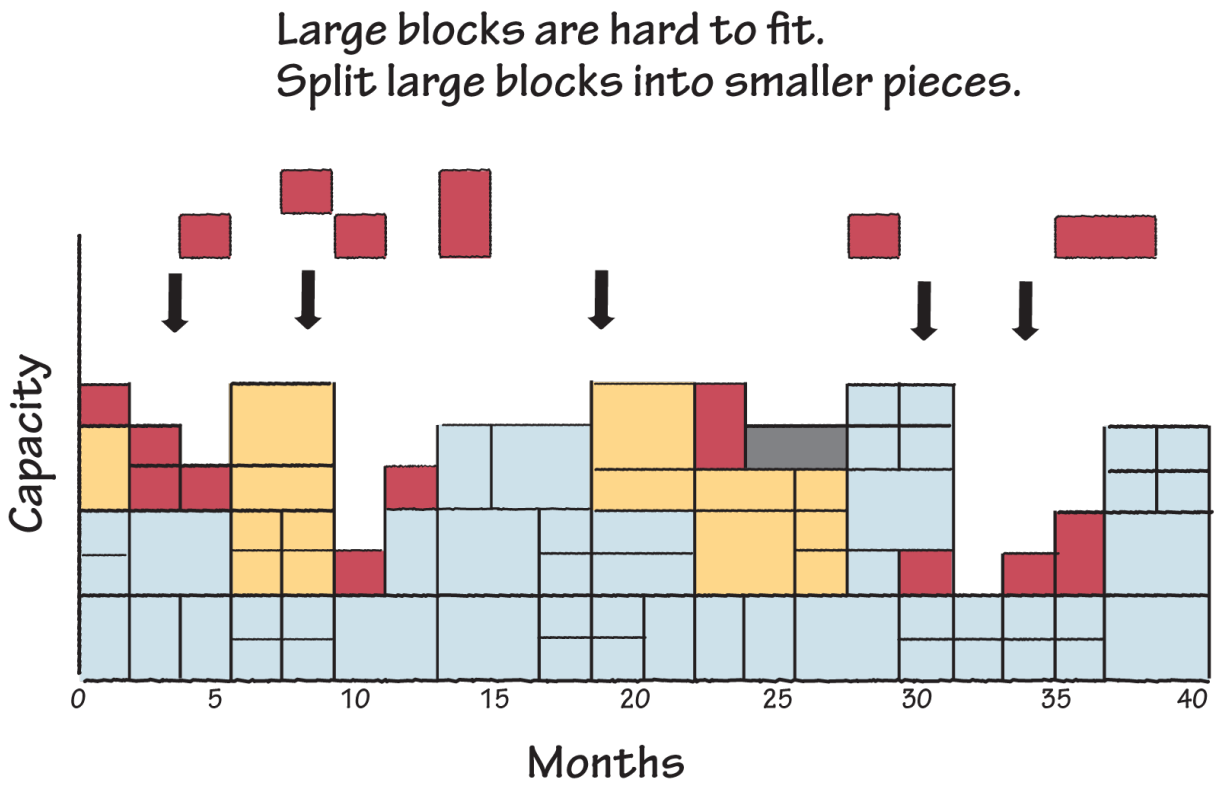




Tetris Principle

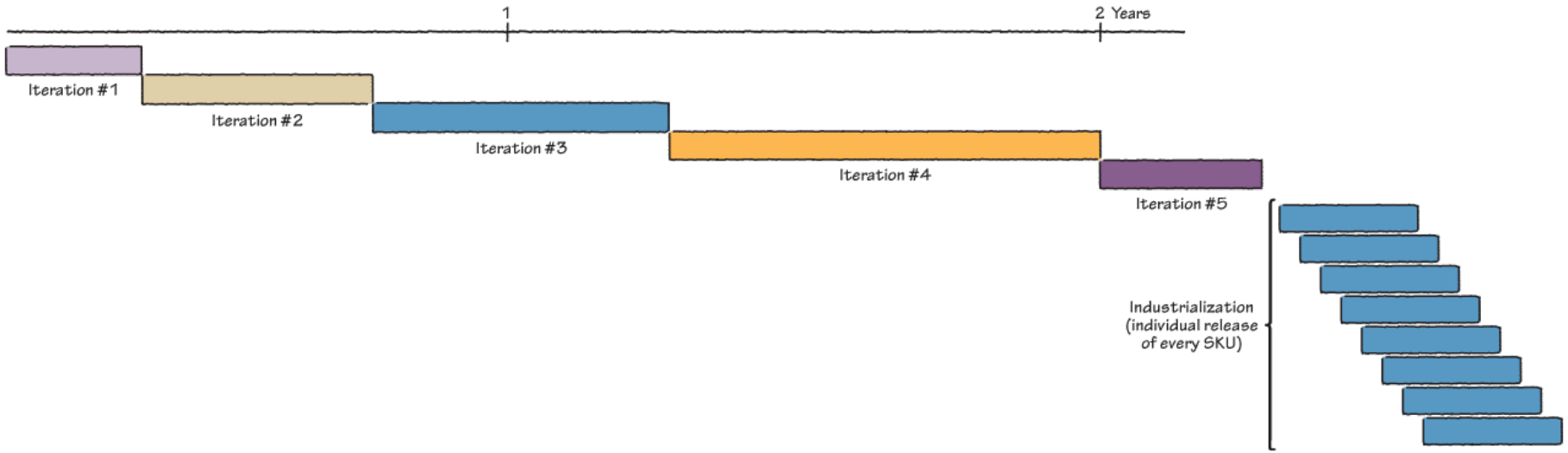


Managing Projects in Small Steps

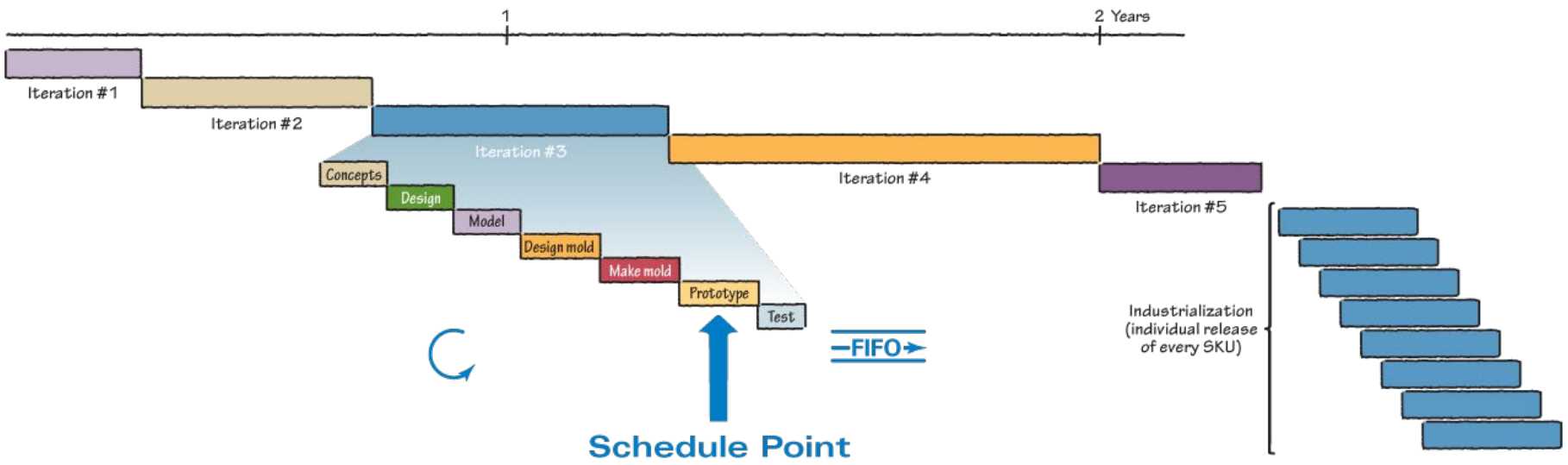


- They are easier to schedule
- Allow better risk management
- Create knowledge faster
- Create agility

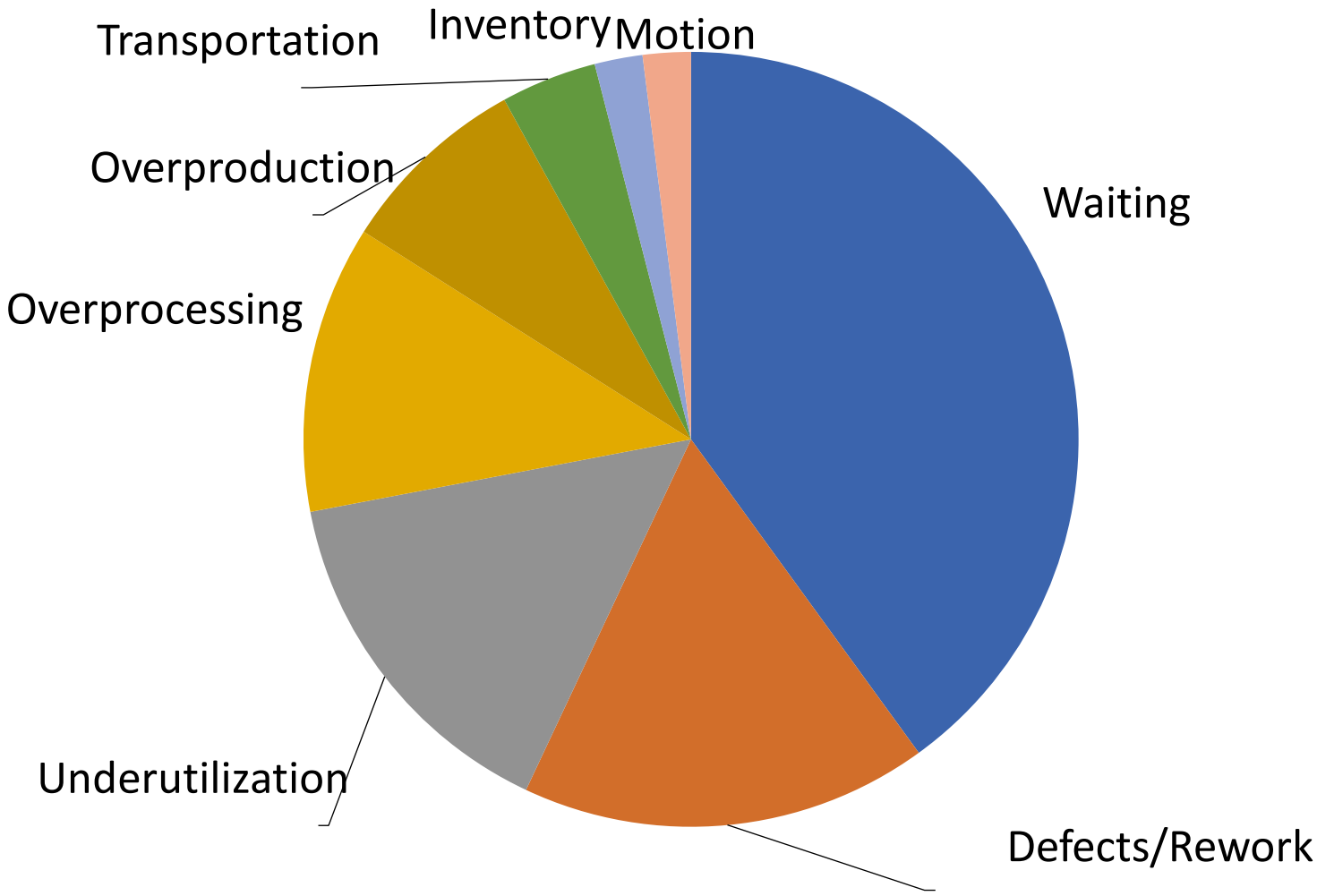
Goodyear Iterations



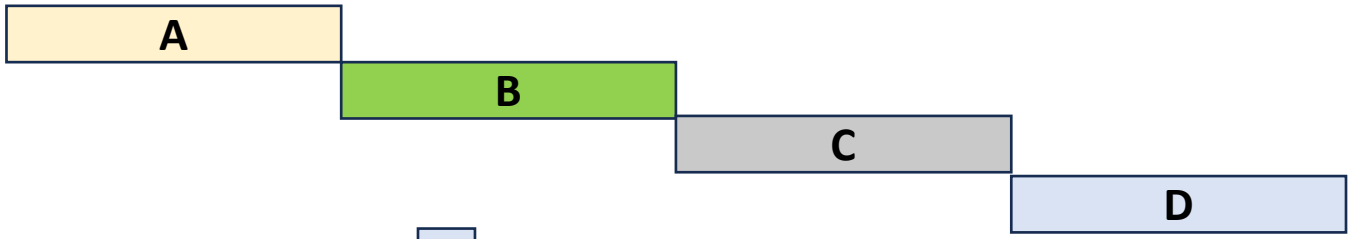
Goodyear Iterations

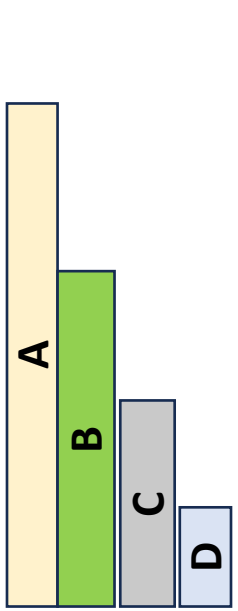


Waste

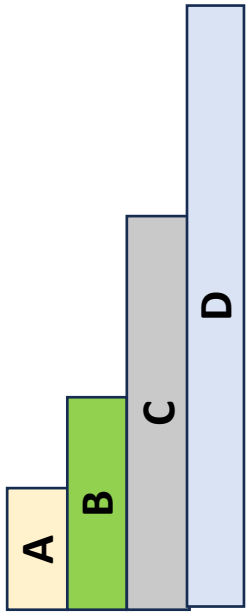


How do you eliminate WAITING?





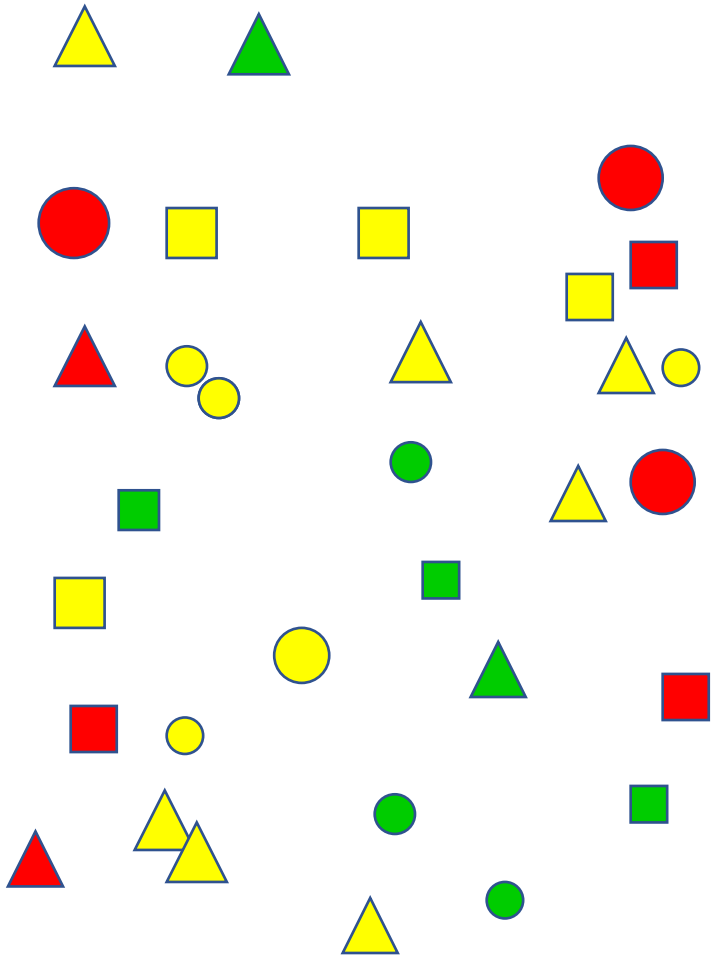
Throughput

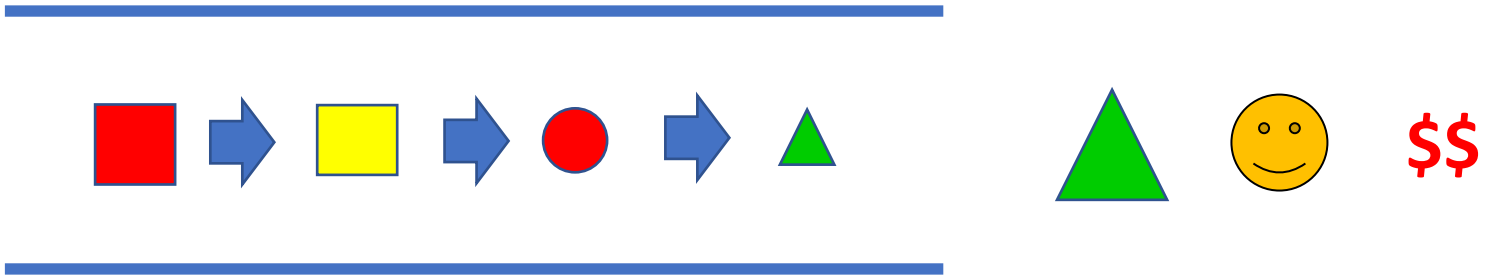


Waiting

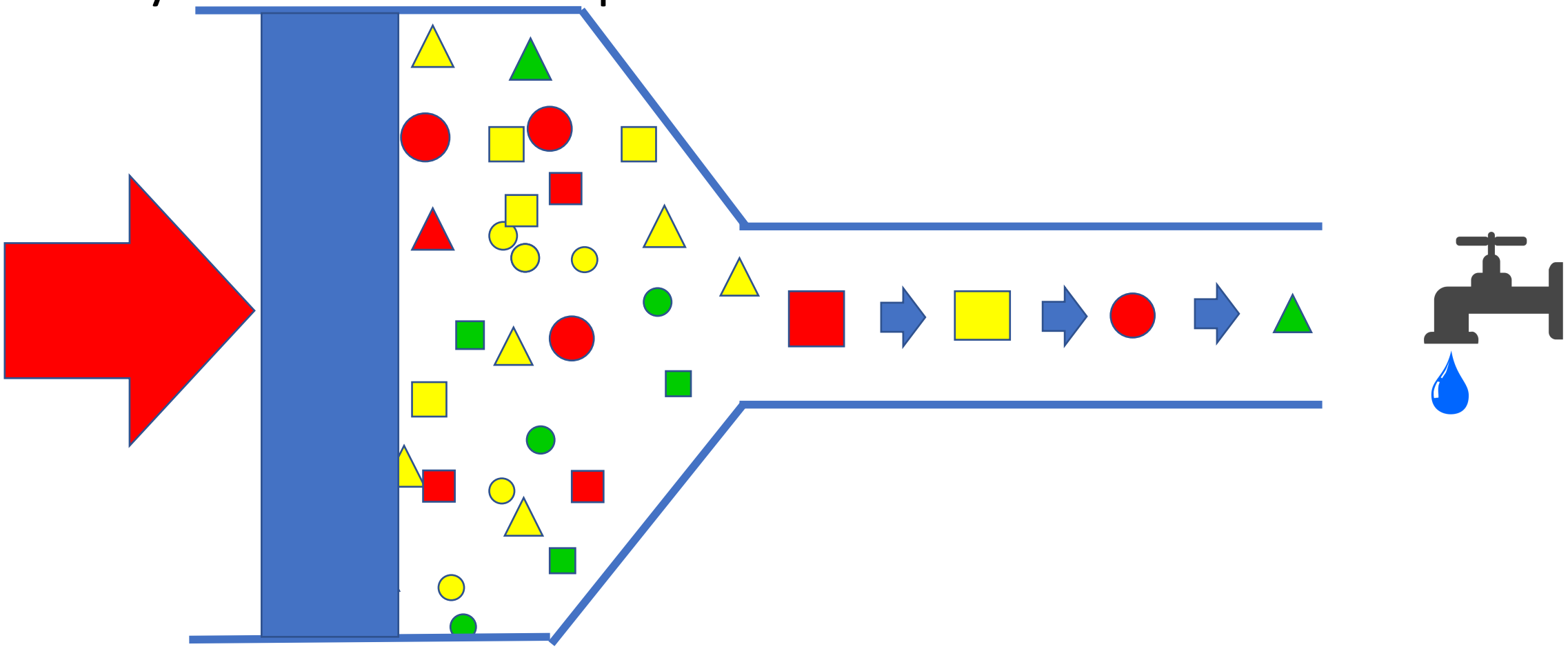
The overall process cannot produce more than the bottleneck

Schedule For Flow



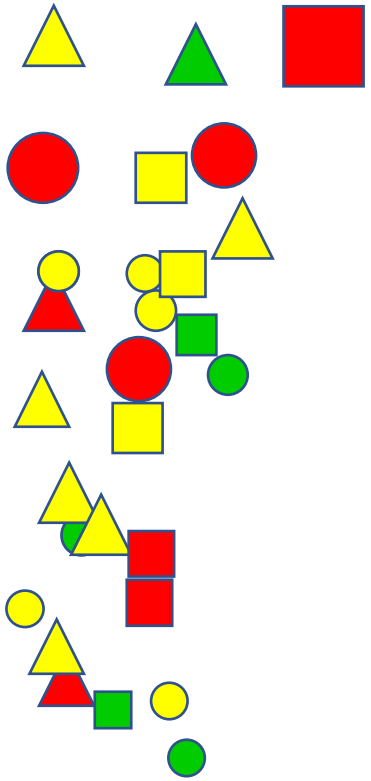


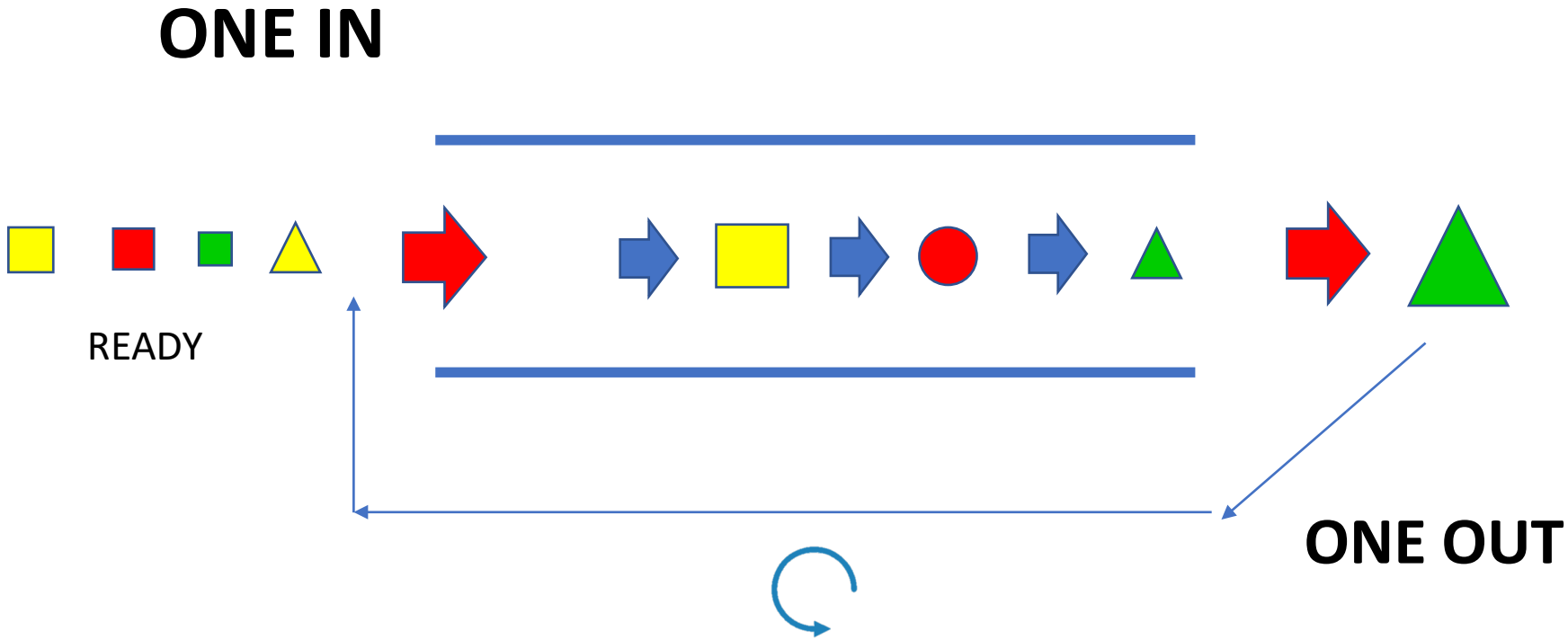
Hydraulic Principle



Pull

Virtual
Queue

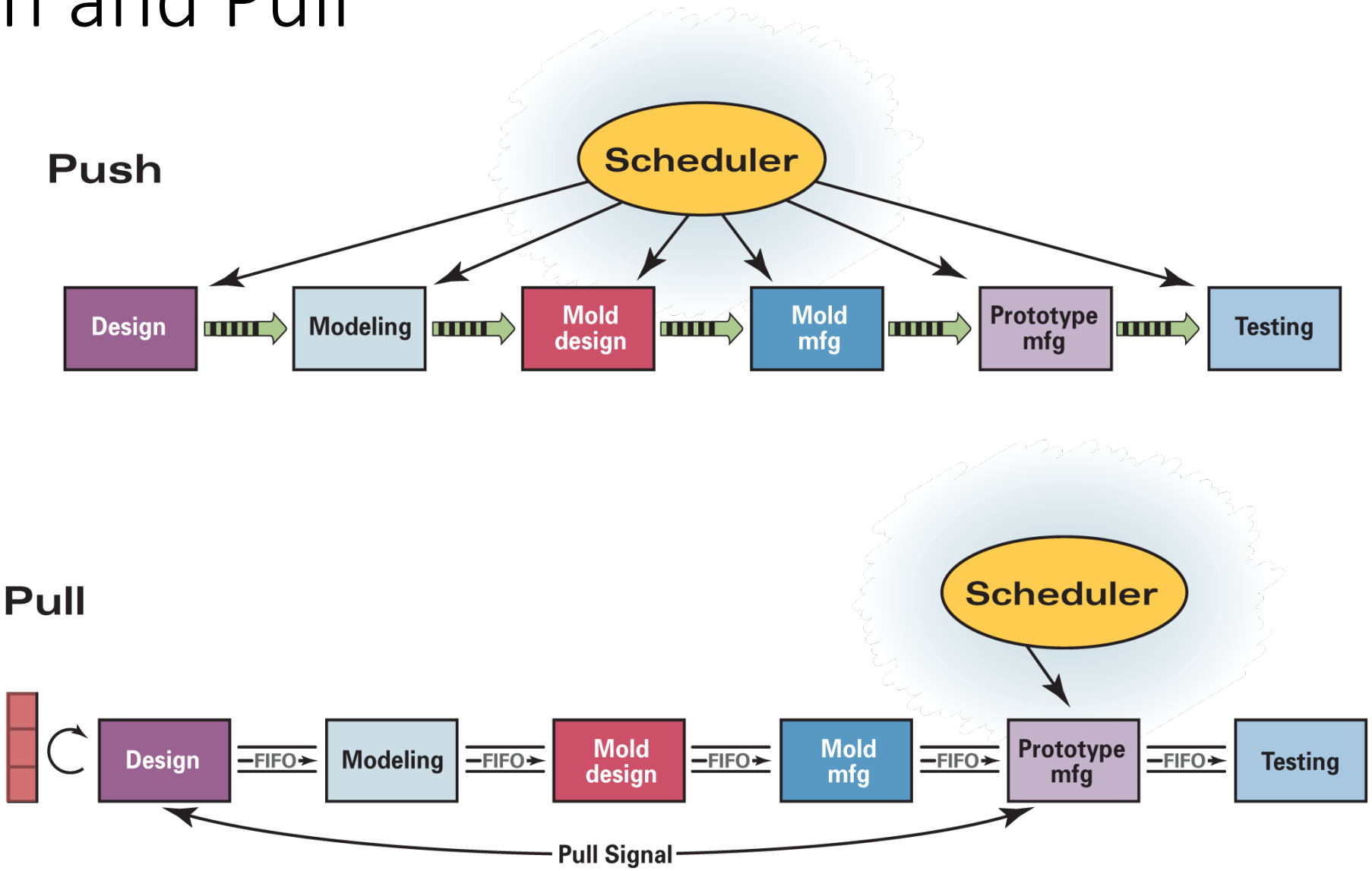




They can have anything but not everything

Set Cadence to Market Need

Push and Pull



Other Useful Principles

- SPF – Little's Law
- Schedule at 75% of capacity
- Overlapping activities
- Late Start

A culture of innovation goes along with a lean culture

- If a company has not implemented a lean culture – innovation should be included in the culture change
- If a company demonstrated its ability to change with the creation of a lean culture – including innovation is only a small step
  - Many lean behaviors support innovation
  - It is not so hard to recognize (and avoid) what inhibits innovation in a lean culture
  - There are just a few key elements that will be new
- And obviously a company who has lean in their DNA can fail with innovation – but for other reasons than the lean DNA

MY Roadmap to a Lean Culture

After 40+ years in Innovation and Lean…

- If done right, there is a lot of synergy between a lean culture and an innovation culture
- A lean culture is an excellent foundation for successful innovation
- And like the building of the culture, the process and the people change at the same time

My Personal Opinion

- For process innovation and product innovation, the small stuff only goes so far
- There is a time when most companies/organizations flatten out or hit a wall both in process and product development
- A little out of the box thinking goes a very long way
- It does not cost a lot of money to lecome more innovative AND it can have huge payback (I said the same thing about my first lean transformation)
- Lean/opex creates a lot of wealth – innovation does the same or more

Summary

- If you have a good lean culture, you are half way there
- In addition to the lean culture:
  - Remove fear
  - Motivate
  - Educate/Engage
  - Enable and avoid killers

Thanks

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

-- Mario Andretti

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