

# Infuse Solutions Presents

## Design of Manufacturing

*the engineering guide to development without walls*

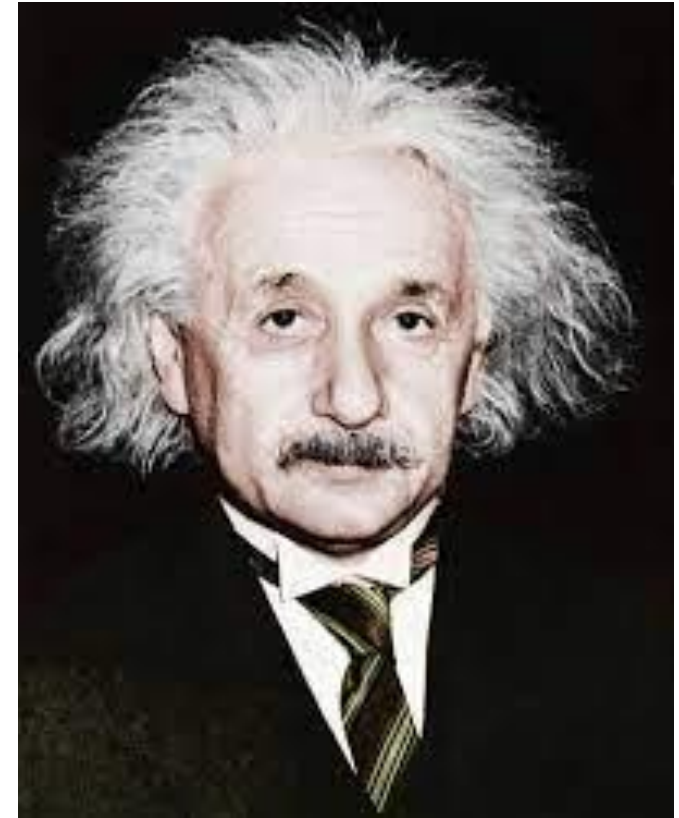


# In Theory...

In theory, theory and practice are the same.

In practice, they are not

- Albert Einstein





# Why do they include a picture with the puzzle?



So you know what it is supposed to look like when you are done



# What kind of puzzle is this?



Design activities create recipes that contain ingredients and methods

## PREPARATION



When either ingredients or methods are not available  
– hilarity ensues





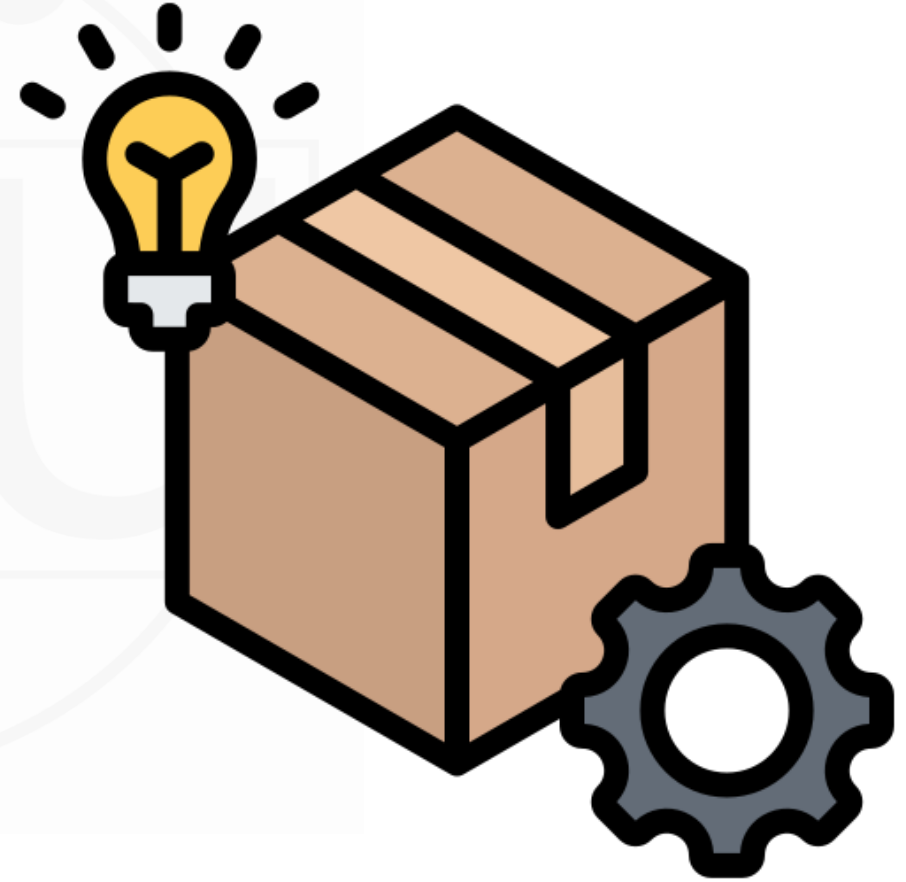
# Understanding the problem



## First – the theory

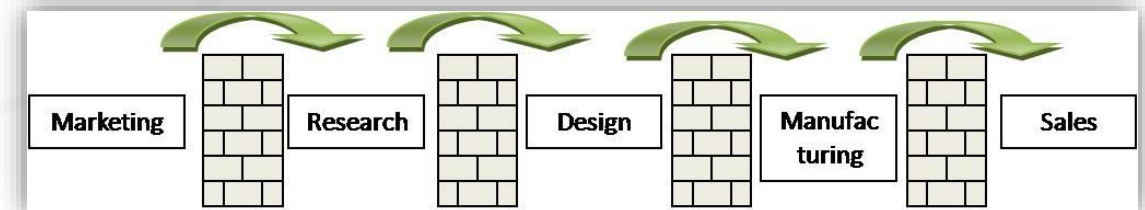
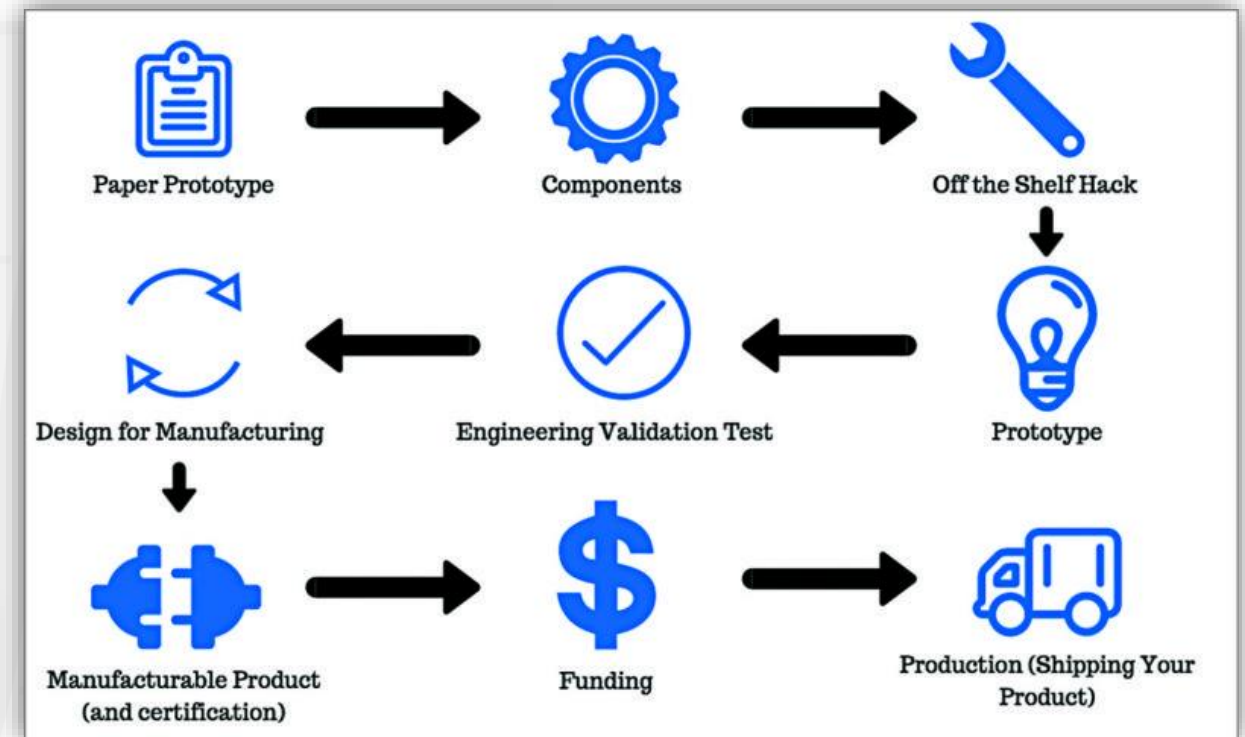
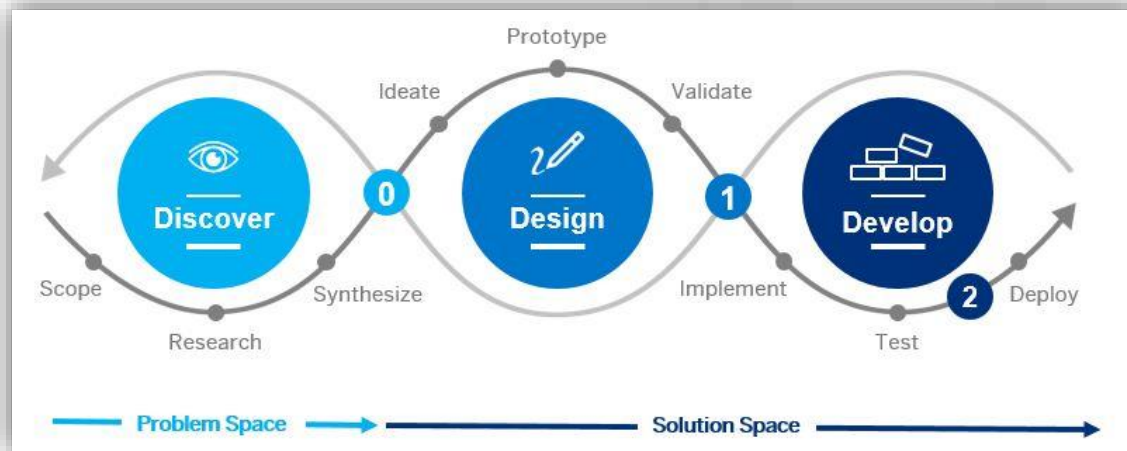
What we learn about product development

Mostly as we go.....





# Product Development Process - on Google





# Entrepreneurial product development model\*

\* From Hollywood



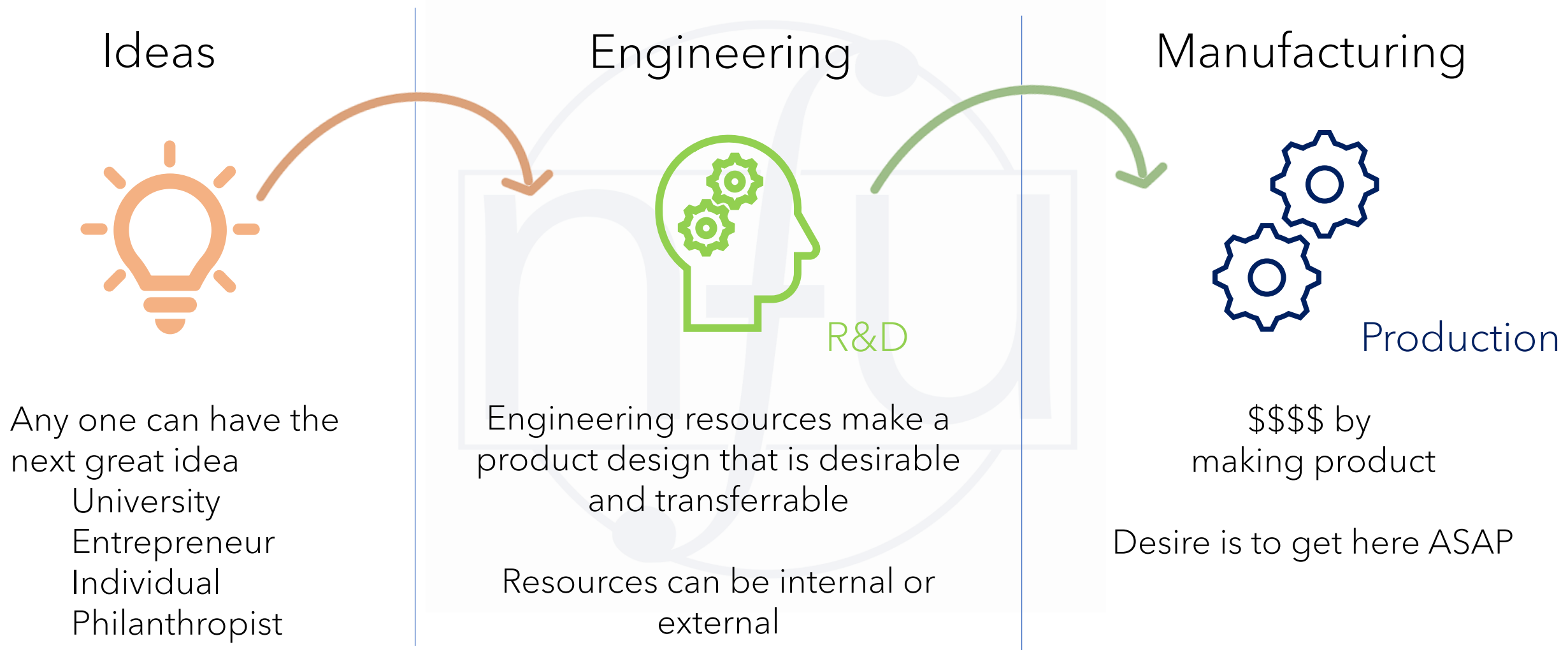
“They’re combat ready...I may have done a few miscalculations, rushed the prototype – sue me – I’m enthusiastic”

- Justin Hammer (IronMan 2)



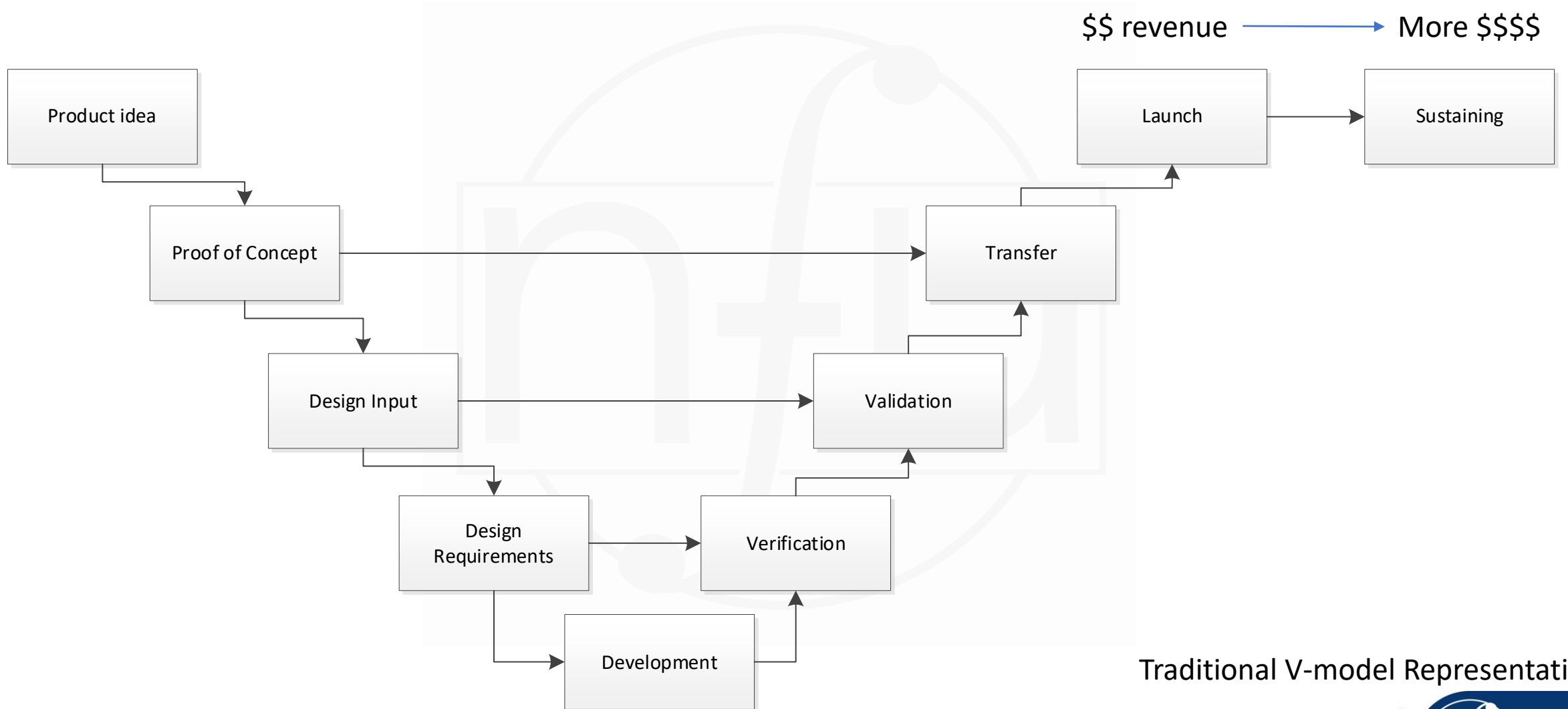


# Product Development Process We Envision





# The Basic V Model – Most Common Visual





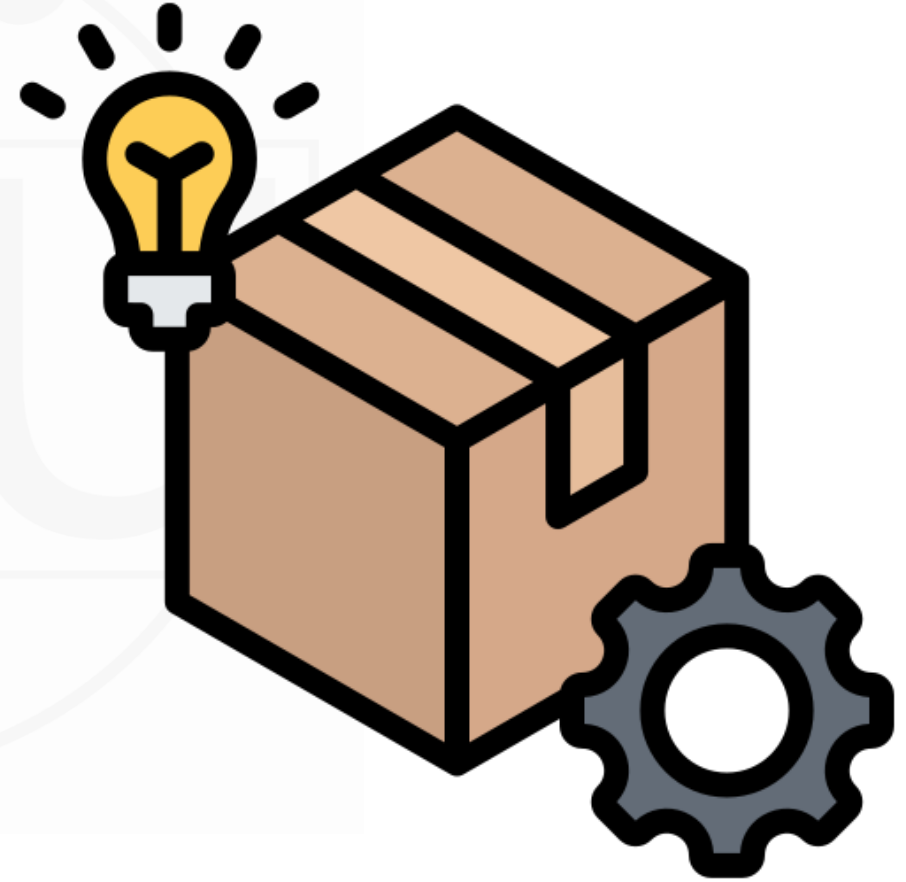
# Understanding the problem II



## Second – the practice

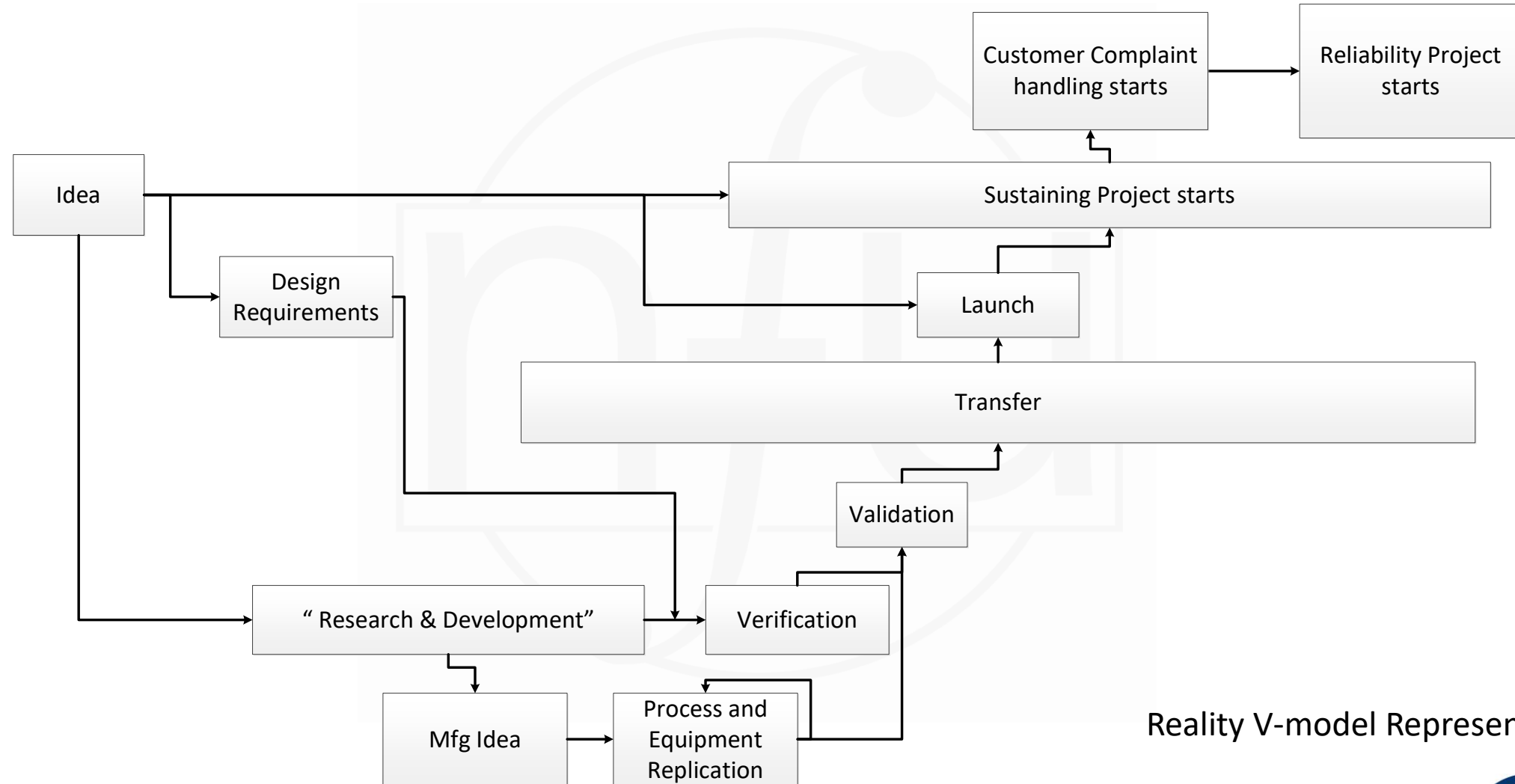
Implementation and experiences with the theory

*Asking for a friend...*





# Product Development We Experience



Reality V-model Representation



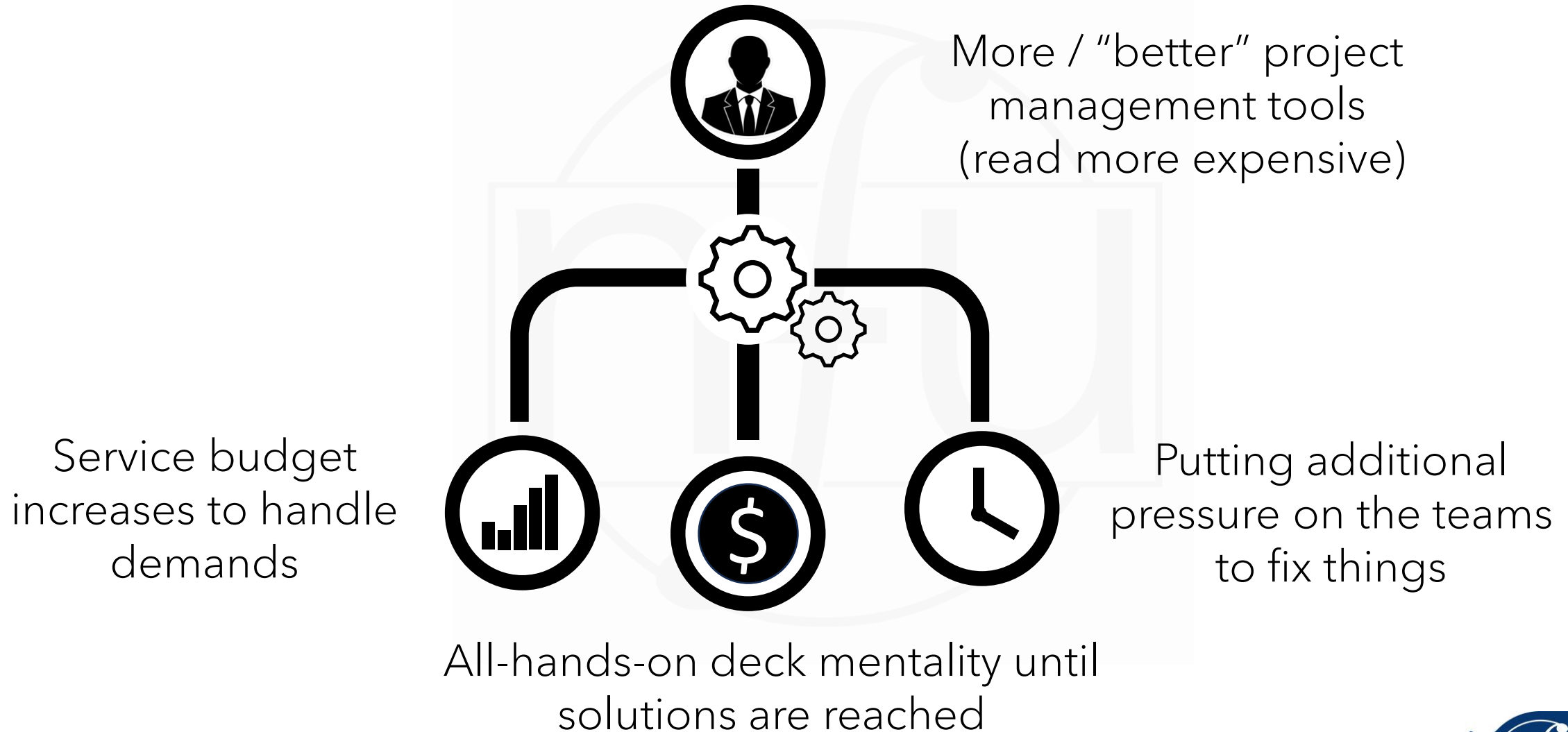
# Product Development We Experience

Why do we always seem to release to the market "too early" and spend the next several years:





# Product Development Recovery Attempts



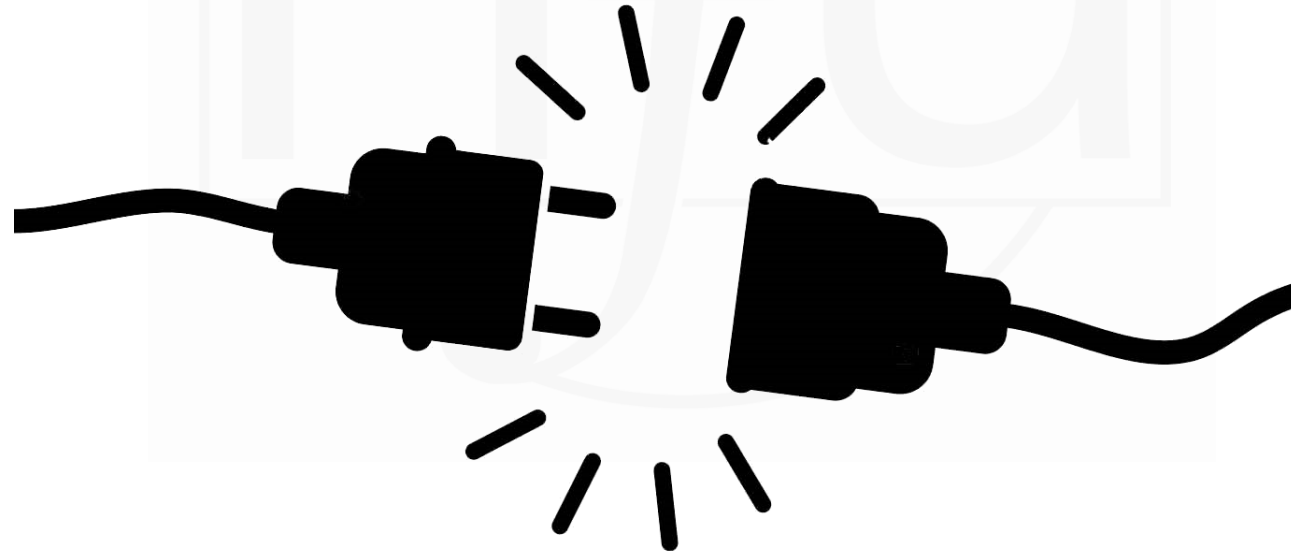


# Product Development Disconnect

How did we get to this implementation?

Where / how did we get off course to making \$\$\$\$\$\$?

*"We were simply following the 'Plan'...."*

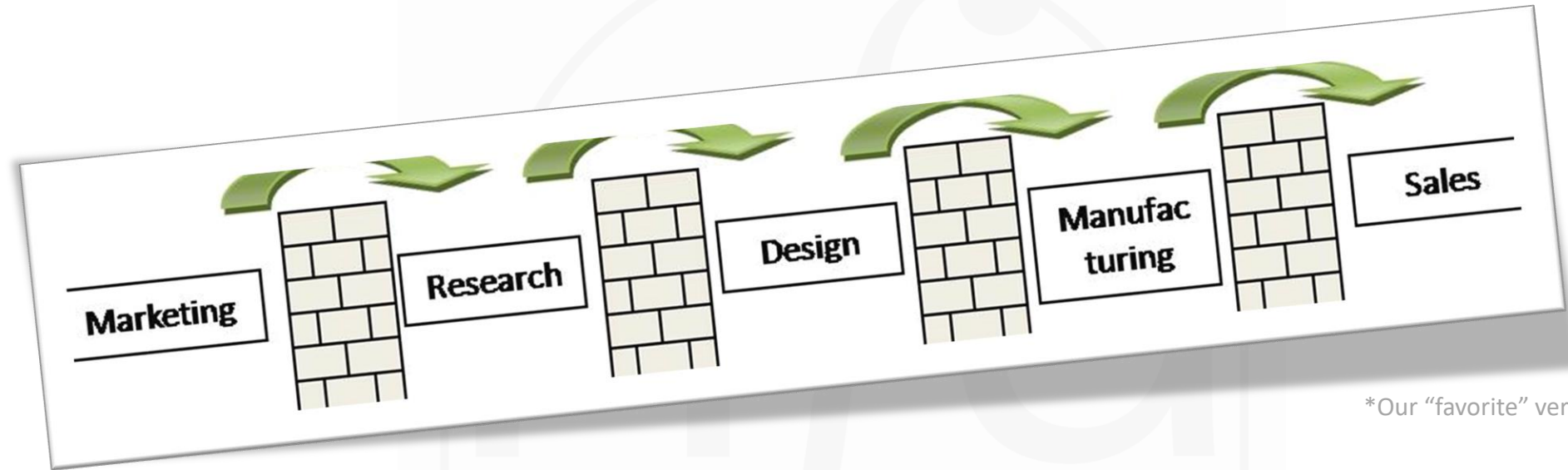


Where is the disconnect?



# Product Development Disconnect

## The Wall



\*Our "favorite" version of the process

#1 Disconnect: "transfer" to production - "the wall"

- just throw it over and *start making money....*
- *"We designed it and tested it, it works, now you can make it"*



# Product Development Disconnect



The Wall

Research Project

Variation = GOOD



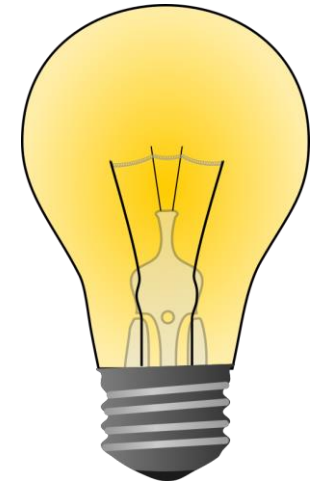
Can it be done?  
Make a prototype



*PDP here stands for  
"Prototype Delivered to Production"*

Released Product

Variation = BAD



Repeatable solutions  
Continuous Improvement Projects



# Product Development Disconnect



Why “the Wall” doesn’t work



The outcome of the research phase is a functional prototype

Because it functions, we think the design is ready for the market.

We make the customer our beta testers



# Product Development Disconnect



What “the Wall” effect looks like



10 years – 24,322 NCRs

2400/yr -> 200/mo -> 10 / day

@1000 parts / NCR -> 10,000 parts / day

Real costs associated with production



# Product Development Disconnect



What “the Wall” effect looks like



Prototype “released to production” only to end up requiring the engineers to build the first 60 units

Had to pull design back “out of production” to finish designing things that production could do

Re-rolled out 4 months later



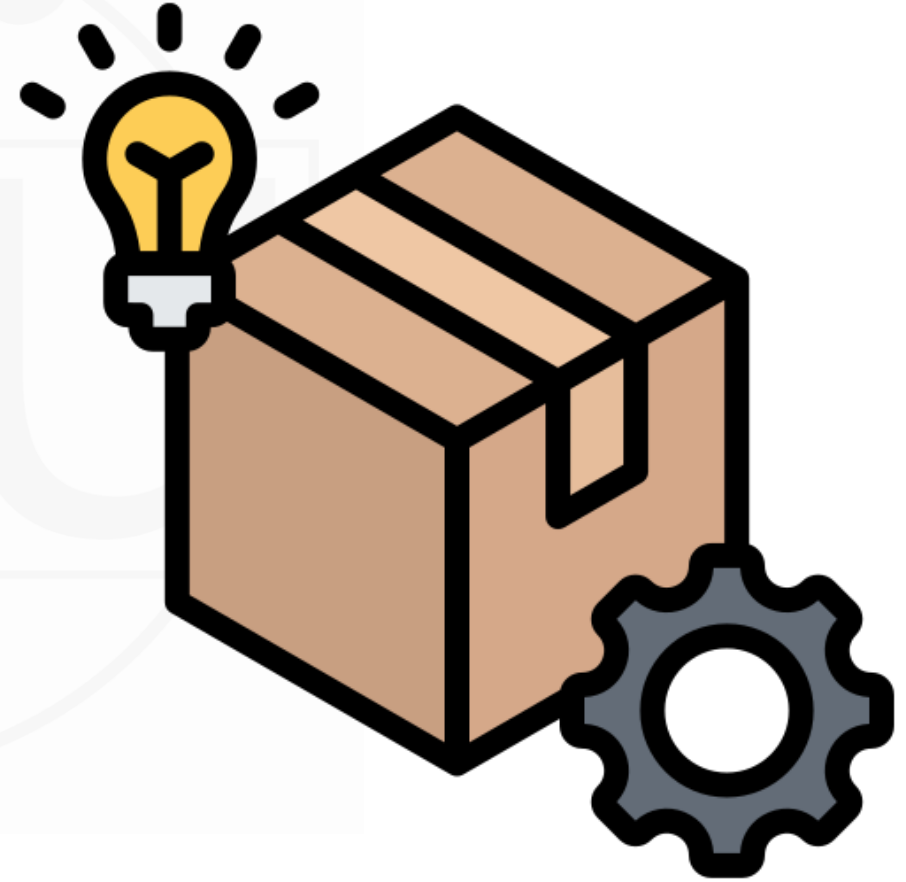
# Solving the problem with PDP



## Third – the problem

Solutions and experiences with the practice

Telling a friend



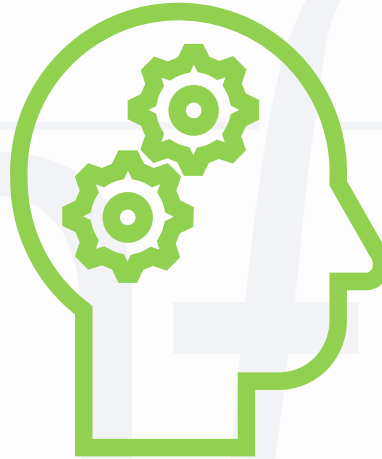


# Product Development We Experience

Ideas

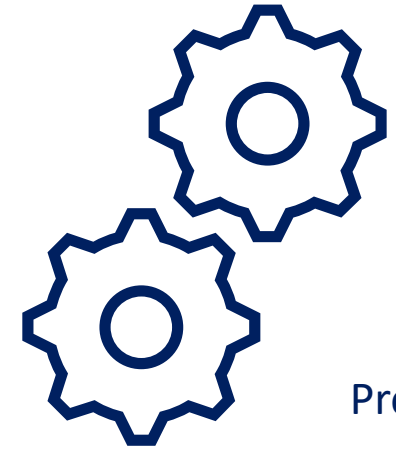


Engineering



R&D

Manufacturing



Production

Engineering designs the product

*Engineering builds the product*

*Engineering tests the product*

*Engineering shows the bosses the product*

*Engineering claims victory*

Engineering documents part of product

Engineering hands off to production

Everything is good (in engineering)

Manufacturing struggles to build

Mfg engineering has to figure out why

Mfg engineering works to fix parts

Mfg is somewhat better at making thing

Customer failures / complaints

Mfg engineering completes CAPAs

Mfg updated

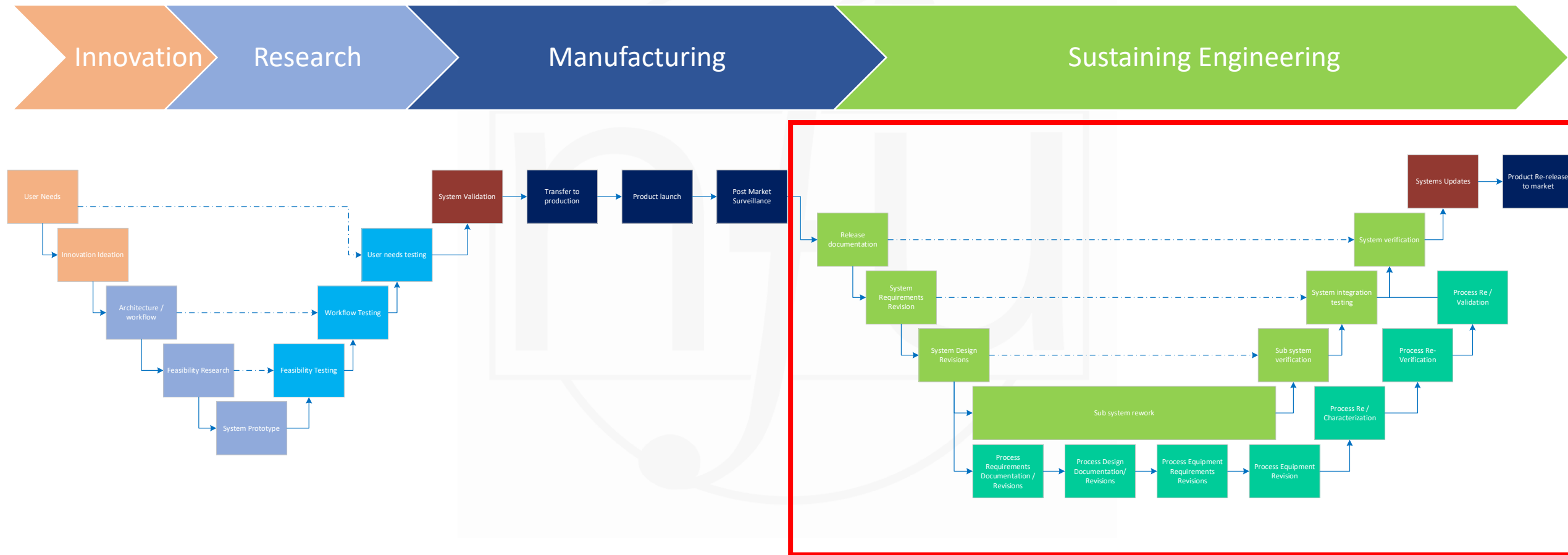
Repeat

Great idea / innovation

**The real problem**



# Product Development We Experience





# Product Development Solution

## Research Project

Variation = GOOD



Can it be done?  
Make a prototype

*The Development Project makes the solution repeatable*



All the documentation to buy,  
build, and deliver quality

## Released Product

Variation = BAD



Repeatable solutions  
Continuous Improvement Projects



# Product Development We Need to Understand

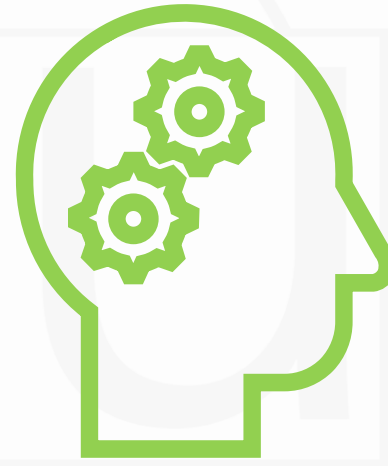


Innovation

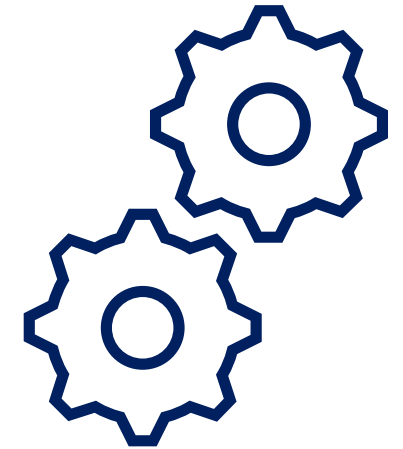


Research

Uncovering the hidden pieces



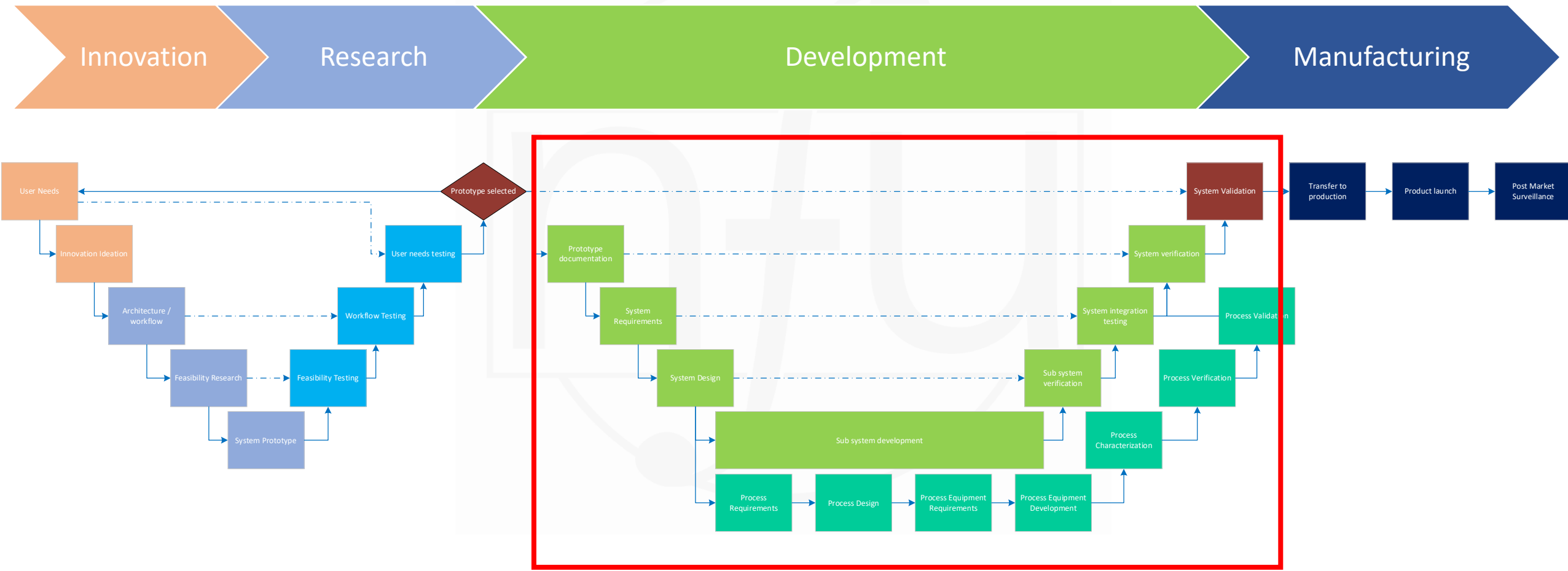
Development



Manufacturing



# Product Development We Need to Understand





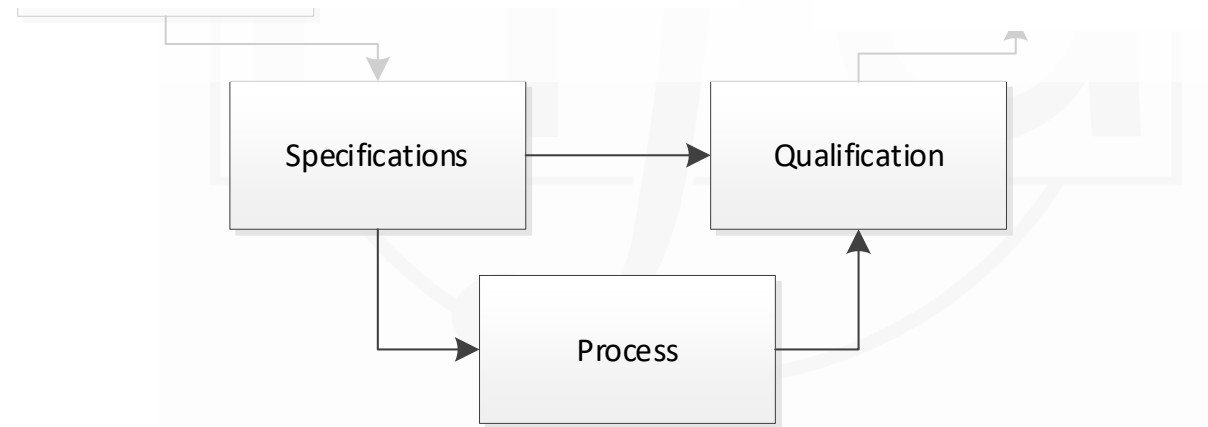
# The Overlooked Step

## Key Questions:

1. Does a process exist for making things?
2. What is the capability of this process?
3. Do we need to make our own process?

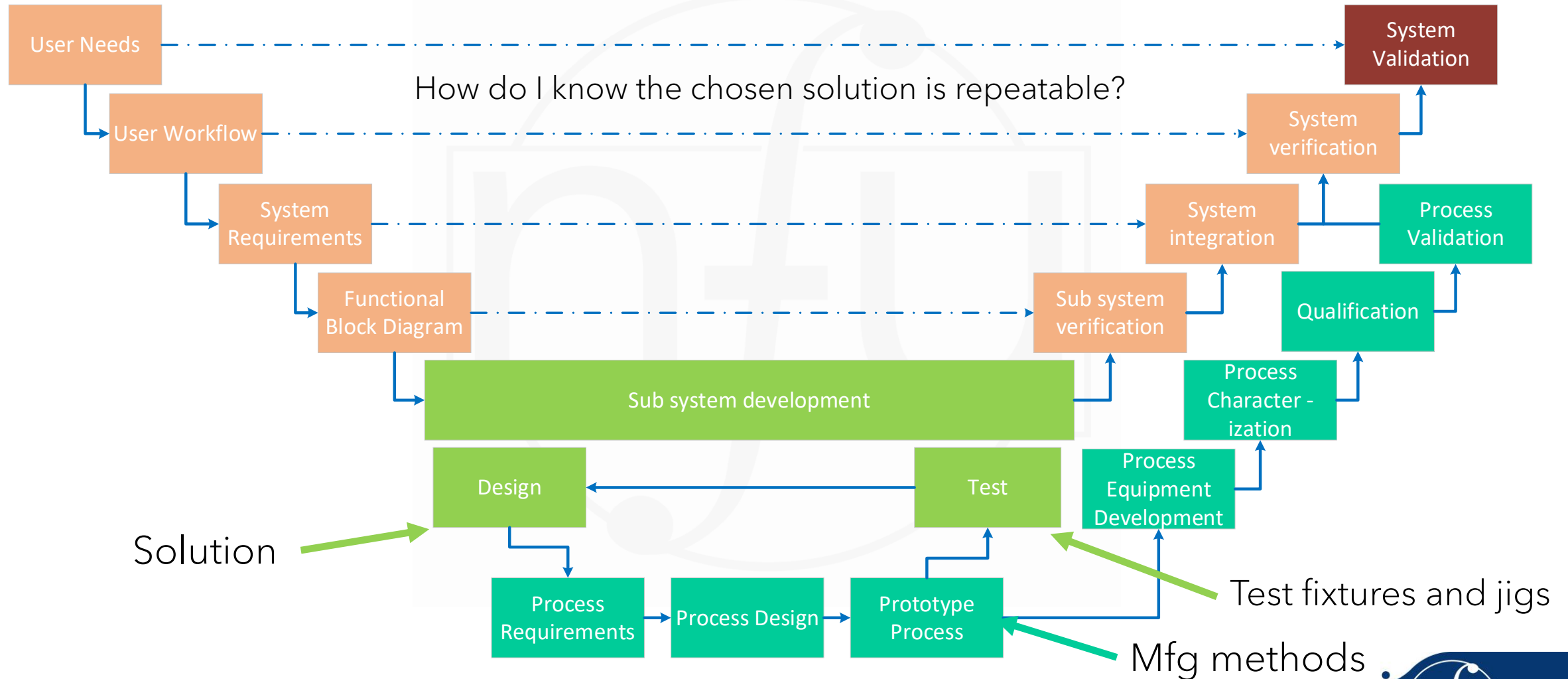
## Key Contributors:

1. Design / Test / Mfg Engineering
2. Purchasing / supply chain
3. Operations





# Design of Manufacturing





# Transfer to Manufacturing: Build in Collaboration

## Operations

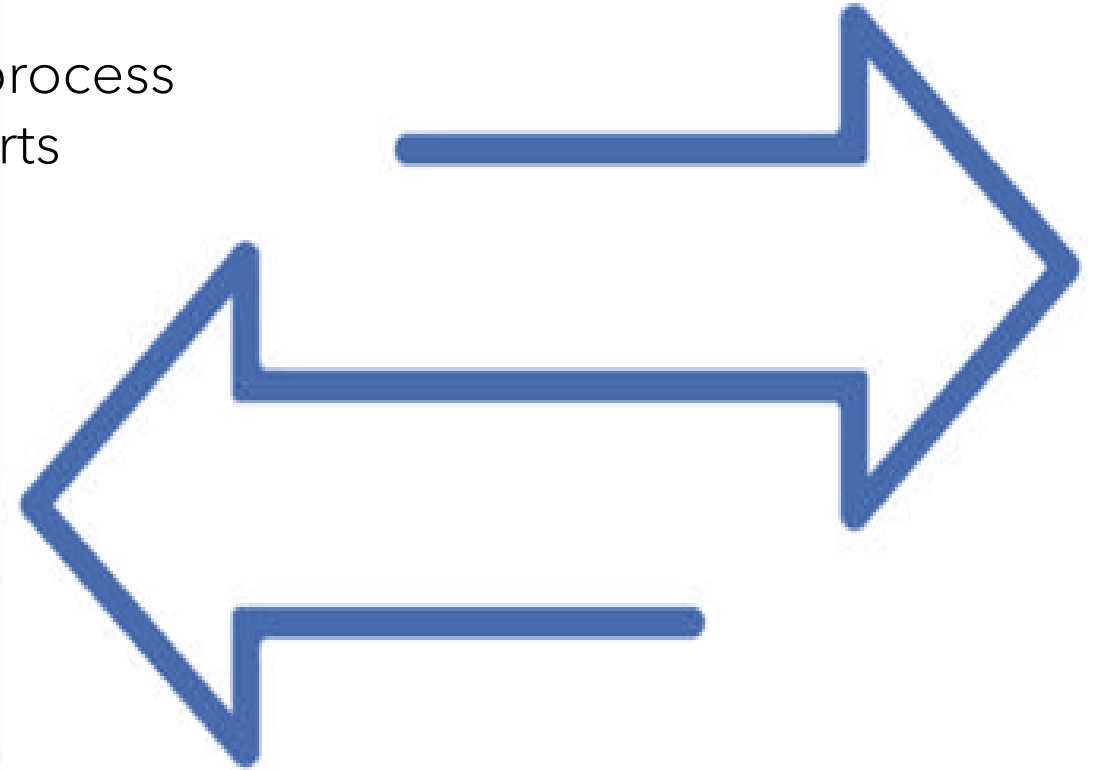
Already been a part of the *buy-build-test* process  
Mfg processes used to build Validation parts

## Procurement

Already been ordering from  
production qualified vendors

## QA

Already tested out the  
incoming inspection protocols





# Transfer to Manufacturing: Key Documents Help

## Specifications turn into:

- design control limits (definition of good) -> proper mfg capability
- key to be able to outsource work

## DFMEAs turn into:

- troubleshooting guide for field services
- QA categories for failure analysis / track and trend -> NCRs / CAPAs

## Verifications

- Quality criteria
- EOL testing

## Qualification tests

- manufacturing test fixtures and jigs
- incoming inspection CQAs





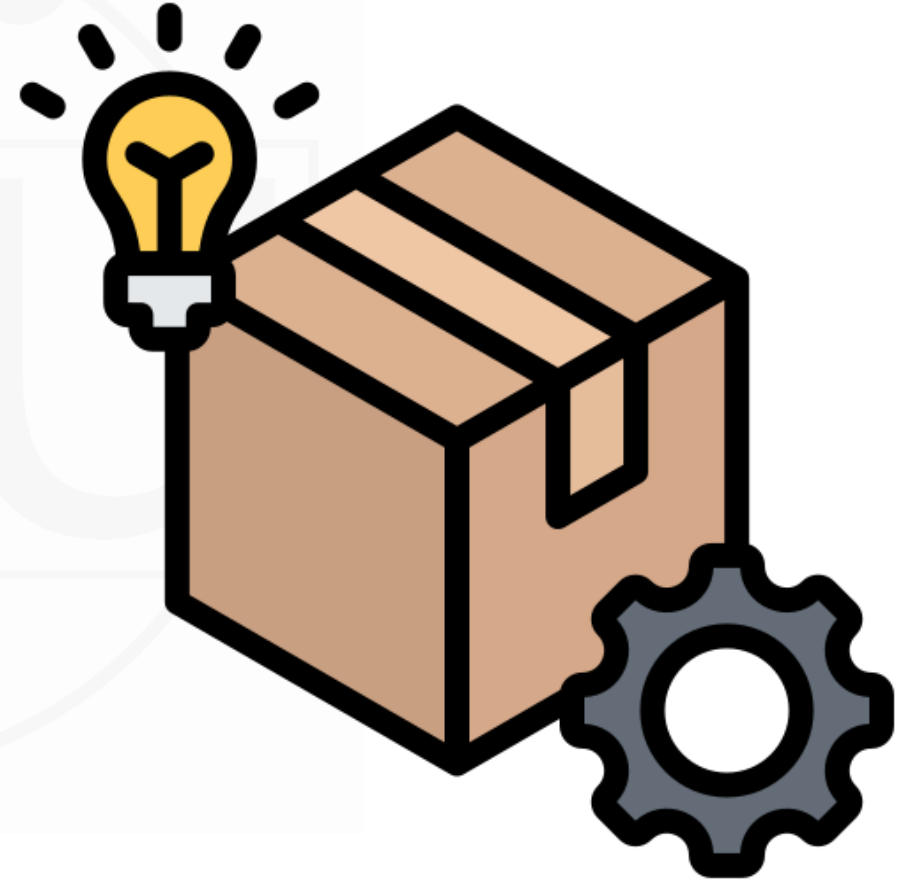
# Solving the problem with PDP



## Fourth – the solutions

Solutions and experiences with the practice

Telling a friend





# Solution 1: Documentation Practices

## Key:

Knowing how to write the documentation to allow for more than one possible solution

## Resolves Wall:

Correctly structured documentation allows for quick pivots without a lot of documentation rework and approvals





# Solution 2: Use key documents that transfer

## Key:

Writing design documents with an eye toward what they become next

## Resolves Wall:

Takes out the naturally occurring wall by including key team members up front

Specs -> incoming inspection qualification criteria

FMEAs -> troubleshooting guides for operations

Verifications -> specifications for testing jigs and fixtures for vendors





# Solution 3: Design of Manufacturing

## Key:

Define *PRODUCT* development to include *PROCESS* qualification

## Resolves Wall:

Highlights Engineering's "secret recipes"

Engineering, manufacturing, procurement work together earlier to determine how well a given design idea is reproducible by others





# Solution 4: Know what a good one is

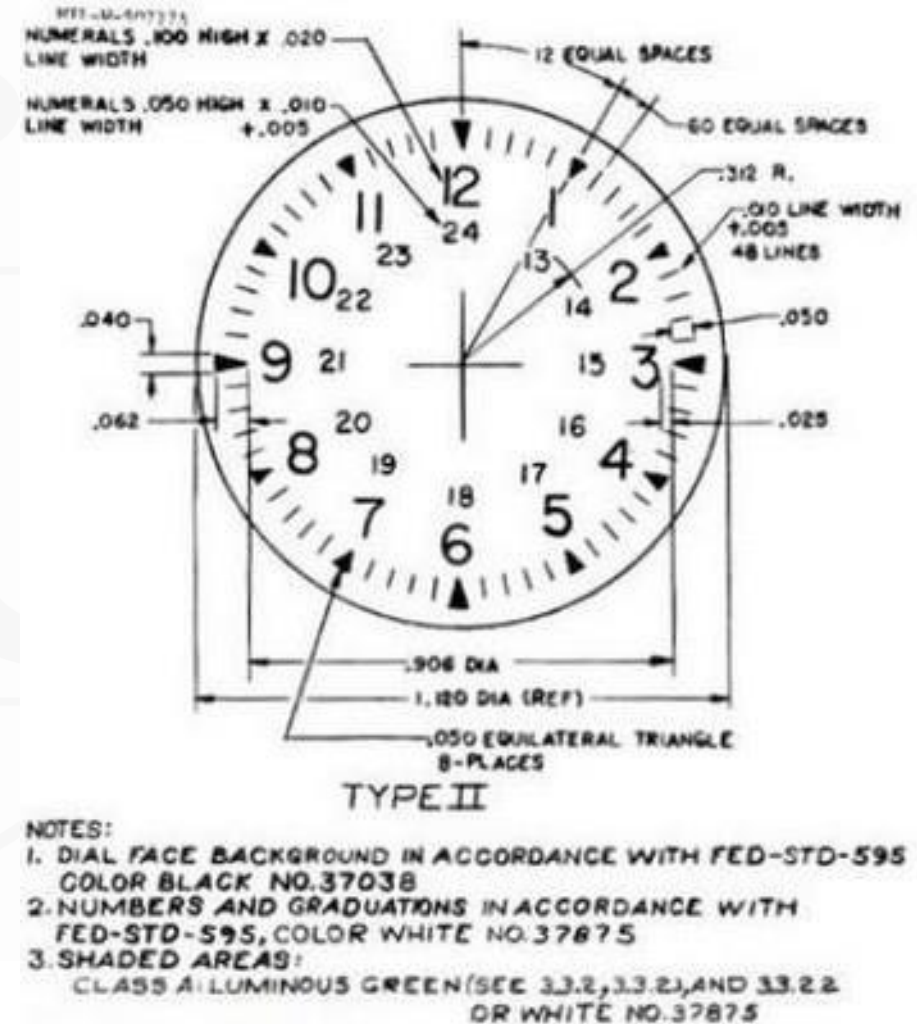
## Key:

If you can describe a good one, you help others know what success looks like

## Resolves Wall:

Describing for all to know what a good one is makes sure that everyone can make it correctly....

And know that they did







# Questions?





LEAD  
CONVEY  
ARCHITECT  
IMPLEMENT  
SHARE

Lead People – Manage Processes – Change Lives

Inspiring People, Processes, & Products (IP)<sup>3</sup>