

ESA-CNES SPACE COST ENGINEERING CONFERENCE 2026 • ESTEC

# Cost Engineering as a Lever for **Product Industrialisation**

*Bridging the gap between Technology Readiness (TRL) and Manufacturing Readiness (MRL) through cross-industry best practices.*

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Stefano Patisso | MeC Srl • Turin, Italy

TODAY'S

# Agenda

1 | About Us

2 | The New Space shift

3 | Automotive levers for industrialisation

4 | Conclusion & take aways

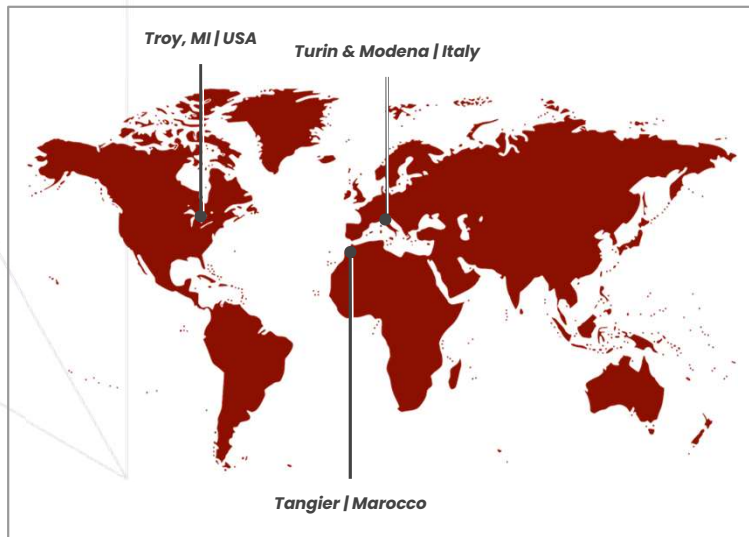


WHO WE ARE

## About *Us*

MeC is a **Consultancy Company** specialized in Cost Analysis, Cost Benchmarking and Value Optimization across industries.

**+125** Consultants Full Cost-Oriented



In-house developed Tools and Cost Models

Benchmark Facility

Automotive & Mobility

Agriculture

Aerospace & Defence

Construction & Commercial Veh.

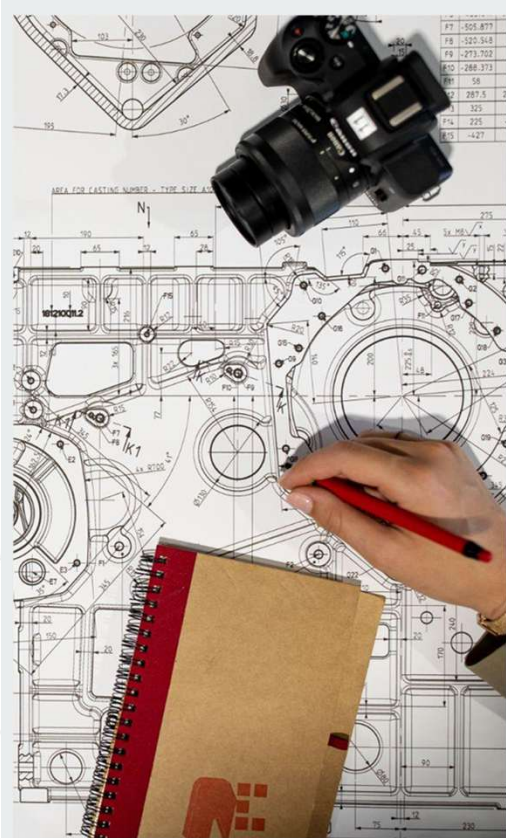
Home Appliances

Energy Infrastructure



WHO WE ARE

# About *Us*



**Should Cost**

**Cost Benchmarking**

**Value Optimization**

**Design to Cost/Value**

**Cost Management**

**Cost Modelling**

**Target Setting**

**Cost Education**

**CO2e Analysis**

## **50 | SHOULD COSTING TEAM**

**21** Metal  
**9** E&E

**18** Chemical  
**2** Assembly

## **18 | VALUE OPTIMIZATION TEAM**

## **6 | BENCHMARKING TEAM**

## **36 | COST MANAGEMENT TEAM**

## **15 | OTHERS**

## THE PROBLEM



# The New Space shift: from prototype to *series*

Space is moving from a few, bespoke, mission-centric units toward higher-rate, repeatable, and commercially-driven production.

### YESTERDAY · DESIGN-TO-SPEC

#### The bespoke unit

- One-off or very low volume
- Performance & reliability above all
- Cost is an outcome, measured late
- Craftsmanship & highly skilled labour
- Programme-funded, mission-centric



### TODAY · DESIGN-FOR-VALUE

#### The industrialised product

- Constellations: hundreds to thousands of units
- Reusability & recurring production
- Cost is a design driver from day one
- Series assembly lines
- Market-funded, commercially competitive

*The engineering challenge is no longer only “can we build one?” but “can we build many, profitably and repeatedly?”*



# The gap between *maturity and readiness*

**TRL** tells you the technology works. **MRL** tells you it can be produced at rate. New Space lives in the gap between them.

## TRL

Technology Readiness Level

“Does it work?” — proof of function,  
from idea to qualified prototype.  
Program-centric.

## THE INDUSTRIALISATION GAP

## MRL

Manufacturing Readiness Level

“Can we make it at rate?” — proof of  
production: yield, cadence, cost,  
supply chain. **Market-centric.**



*Cost Engineering is the bridge  
across this gap*



# Why automotive and where the analogy *ends*

## WHY LEARN FROM AUTOMOTIVE

- ✓ **A century of high-rate production**  
Millions of units/year: the reference for series manufacturing
- ✓ **Cost as an engineering discipline**  
Target costing, should-cost and DtC are standard practice
- ✓ **Platform & carry-over culture**  
Modular architectures, re-use of validated solutions
- ✓ **A mature, competitive supply chain**  
Tiered sourcing, make-or-buy, risk management

## WHERE THE ANALOGY ENDS

- ! **Volumes differ by orders of magnitude**  
Even a large constellation can be niche vs a car line
- ! **Reliability & qualification dominate**  
Space cannot trade away mission assurance
- ! **Environment & traceability**  
Radiation, vacuum, full part traceability
- ! **Regulatory & export constraints**  
A different compliance landscape

*We transfer the method, not the acceptance criteria: automotive shows how to industrialise; space keeps its assurance bar.*



# Four automotive levers for *industrialisation*

01



Advanced target setting

Technical & cost targets fixed early, anchored on reference-project data.

02



Platform & BOM optimisation

Modular architectures, complexity reduction, carry-over of validated parts.

03



Standardisation & Design-to-Cost

Common standards, early supplier involvement, technology scouting.

04

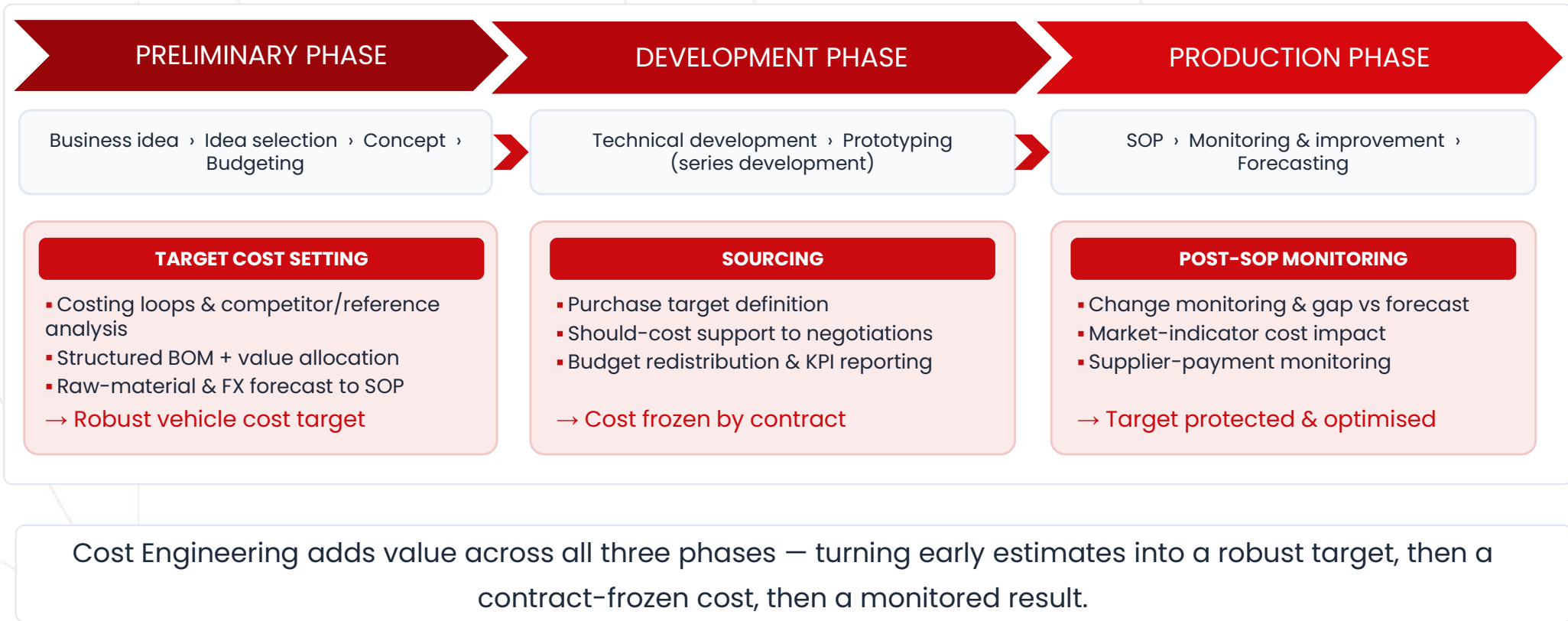


Industrial & supply-chain strategy

Make-or-buy, vertical integration, sourcing risk by criticality.



# The vehicle *development cycle*



LEVER 1



# Advanced *Target Setting*



- 1 Set technical targets**  
Mass, function, process — as hard constraints, not wishes
- 2 Reference data**  
Mine cost & performance from comparable past projects
- 3 Decompose the target**  
Cascade a top-level cost target down to sub-systems & parts
- 4 Track & steer**  
Re-cost each design iteration against the target



# Understanding where allocating *cost and value*

| ATTRIBUTE                           | VEHICLE A |            |                        | VEHICLE B |            |                        |
|-------------------------------------|-----------|------------|------------------------|-----------|------------|------------------------|
|                                     | Score     | € cost     |                        | Score     | € cost     |                        |
| Exteriors style & perceived quality | 2         | €50        | <div><div></div></div> | 4         | €50        | <div><div></div></div> |
| Interiors style & perceived quality | 3         | €60        | <div><div></div></div> | 4         | €80        | <div><div></div></div> |
| Driving dynamics                    | 4         | €20        | <div><div></div></div> | 2         | €40        | <div><div></div></div> |
| <b>Driveability</b>                 | <b>5</b>  | <b>€10</b> | <div><div></div></div> | <b>3</b>  | <b>€60</b> | <div><div></div></div> |
| Infotainment                        | 3         | €40        | <div><div></div></div> | 1         | €50        | <div><div></div></div> |
| Active safety                       | 4         | €80        | <div><div></div></div> | 3         | €20        | <div><div></div></div> |
| NVH                                 | 3         | €30        | <div><div></div></div> | 4         | €60        | <div><div></div></div> |
| Occupant comfort                    | 2         | €50        | <div><div></div></div> | 5         | €80        | <div><div></div></div> |
| Climate / HVAC                      | 3         | €30        | <div><div></div></div> | 5         | €30        | <div><div></div></div> |
| Functionality / ergonomics          | 4         | €80        | <div><div></div></div> | 3         | €60        | <div><div></div></div> |
| Passive safety                      | 3         | €50        | <div><div></div></div> | 2         | €70        | <div><div></div></div> |
| Fuel economy / emissions            | 3         | €10        | <div><div></div></div> | 3         | €20        | <div><div></div></div> |

## Method:

- 1) Score (from 1 to 5) reference/competitor vehicles attributes based on customer perceived quality.
- 2) Cascade vehicle cost across these attributes.

## Driveability:

- 1) **Vehicle B** scores **3**, while **Vehicle A** scores **5**
- 2) **Vehicle B** is **6 times more** expensive



# Understanding where allocating *cost and value*



## Answering strategic questions...

- 1) "Which features the customer is willing to pay for?"
- 2) "Are we allocating cost and value on the right attribute?"
- 3) "Which areas of the product can be optimized without disrupting the market?"

...allow Cost Engineering to support the transition from "Design to Spec" to balancing four fundamental parameters: customer value, cost, performance and price.

## LEVER 1 – METHODOLOGY

# Levering the data gold mine *fastly and accurately*



**Drill Here to VO Ideas**

☐ Front Bumper

Material x Finishing x Model x

Front Bumper  
29.629,60 €

Country: Italy Volumi: 1500 Modello: Tutte

**Reference Cost**  
**29.630 €**

**Cost New Country & New Volumes**  
**27.308 €**

| Description             | Qty             | M/B      | Ref Country | Ref Volumes   | Ref Cost           | Ref Tooling         | New Country  | New Volumes  | New Cost           | Ref Model    | SubSystem           | Link                 |
|-------------------------|-----------------|----------|-------------|---------------|--------------------|---------------------|--------------|--------------|--------------------|--------------|---------------------|----------------------|
| New Front Bumper        | 1,00            | B        | Italy       | 200           | 7.000,00 €         | € 105.000           | Italy        | 1.500        | 6.367,52 €         | Veh 1        | Front Bumper        | <a href="#">Link</a> |
| Paraurti Ant.Inf.       | 9,00            | B        | Italy       | 35.000        | 5.917,48 €         | € 0                 | Italy        | 1.500        | 5.805,78 €         | Veh 1        | Front Bumper        | <a href="#">Link</a> |
| New Front Bumper Grille | 1,00            | B        | Italy       | 200           | 4.000,00 €         | € 67.500            | Italy        | 1.500        | 3.638,58 €         | Veh 1        | Front Bumper        | <a href="#">Link</a> |
| New Front Splitter      | 1,00            | B        | Italy       | 200           | 2.500,00 €         | € 45.000            | Italy        | 1.500        | 2.274,11 €         | Veh 1        | Front Bumper        | <a href="#">Link</a> |
| Paraurti Ant.           | 15,00           | B        | 0           | 55.000        | 2.201,90 €         | € 0                 | Italy        | 1.500        | 2.151,62 €         | Veh 1        | Front Bumper        | <a href="#">Link</a> |
| Spoiler Ant.            | 3,00            | B        | 0           | 55.000        | 1.190,03 €         | € 2.023.400         | Italy        | 1.500        | 1.189,97 €         | Veh 1        | Front Bumper        | <a href="#">Link</a> |
| Fascia Front            | 4,00            | B        | China       | 20.000        | 1.068,79 €         |                     | Italy        | 1.500        | 1.644,70 €         | Veh 1        | Front Bumper        | <a href="#">Link</a> |
| <b>Totale</b>           | <b>2.484,25</b> | <b>B</b> | <b>0</b>    | <b>65.000</b> | <b>29.629,60 €</b> | <b>€ 23.350.200</b> | <b>Italy</b> | <b>1.500</b> | <b>27.308,30 €</b> | <b>Veh 1</b> | <b>Front Bumper</b> | <a href="#">Link</a> |

## LEVER 2



# Platform thinking & *BOM optimisation*

Fewer, re-used, validated building blocks beat bespoke every time you scale. Complexity is the hidden cost driver of series production.



### Modular architecture

Common structural & avionics modules across a product family — one design, many missions.



### Carry-over

Re-use qualified parts instead of re-qualifying. Every carry-over part is cost and risk already retired.



### Complexity reduction

Fewer part numbers → simpler supply chain, higher purchasing leverage, lower setup cost.



### Commonality targets

Set a re-use % as a KPI, tracked like mass or power budgets.



# Scaling up by optimising *variance and cost*

The VW Group is the industry benchmark for cross-brand carry-over: the same validated part can serve a €40k SUV and a €200k luxury SUV.



## CARRY-OVER

### HVAC Compressor

#### SHARED ACROSS

Audi A1, A3, Q2, Q3 · VW Caddy, Golf, Passat, Tiguan

OEM SPARE PART P/N — 5Q0816803H



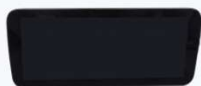
## CARRY-OVER

### Door Command ECU

#### SHARED ACROSS

Audi A3 · VW Touareg · Lamborghini URUS · Bentley Bentayga

OEM SPARE PART P/N — 4N0907410D



## CARRY-OVER

### Central Display

#### SHARED ACROSS

Fiat 500 · Fiat Tipo · Maserati MC20

OEM SPARE PART P/N — 522051310

## WHY CARRY-OVER PAYS

- 1 Tooling & NRE amortised**  
dev + tooling cost spread across every model that shares the part
- 2 Validation reused**  
already homologated & field-proven — no re-qualification
- 3 Supply-chain leverage**  
combined volume → better price, stable dual-sourced supply
- 4 Faster to market**  
proven parts skip the design-test loop

Automotive programs can count between **70% and 35%** of carry over components in a BOM, covering between **60% and 40%** of the cost the vehicle.

*New Space:* reuse qualified units across missions — the same recurring-cost and de-risking logic.



# Carry-over and similarities across *European launchers*

Europe's launcher family runs on carry-over: one qualified building block flies on different vehicles — the same de-risking of cost and schedule, applied to space.



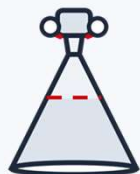
## CARRY-OVER

### P120C solid rocket motor

#### SHARED ACROSS

Ariane 6 (2–4 strap-on boosters) · Vega-C (first stage)

**PRIME / HERITAGE** — Avio · evolved from Vega P80



## CARRY-OVER

### Vinci upper-stage engine

#### SHARED ACROSS

Ariane 62 · Ariane 64 (shared upper stage)

**PRIME / TYPE** — ArianeGroup · re-ignitable LOX/LH2



## CARRY-OVER

### Common avionics suite

#### SHARED ACROSS

Ariane 6 · Vega-C (shared building blocks)

**PRIME / SCOPE** — ArianeGroup / Avio · common flight chain

## WHY CARRY-OVER PAYS

- 1 Tooling & NRE amortised**  
dev + tooling cost spread across every launcher that shares the block
- 2 Qualification reused**  
flight-proven heritage — no new qualification campaign
- 3 Supply-chain leverage**  
combined cadence → stable suppliers, lower recurring cost
- 4 Schedule de-risked**  
proven blocks shorten the development path

The P120C alone flies as *Ariane 6 boosters* and the *Vega-C first stage* — one motor, two launchers.

*New Space*: reuse qualified units across missions — the same recurring-cost and de-risking logic.



# Design-to-Cost & *Technology Scouting*



## Process standardisation

Common technical standards simplify the supply chain and cut the setup cost of moving from prototype to series.



## Design-to-Cost

Cost is a requirement, cascaded and steered like any other — not discovered at the end.



## Proactive technology scouting

Systematically assess alternative processes and materials (e.g. additive vs machining) already proven in high-volume sectors.



## Early supplier involvement

Engage technology partners in the concept phase to align design with real production capabilities.

### THE SCOUTING QUESTION

“Given this requirement and this volume, which process technology gives the lowest total cost?”

Answering it needs a repeatable method:

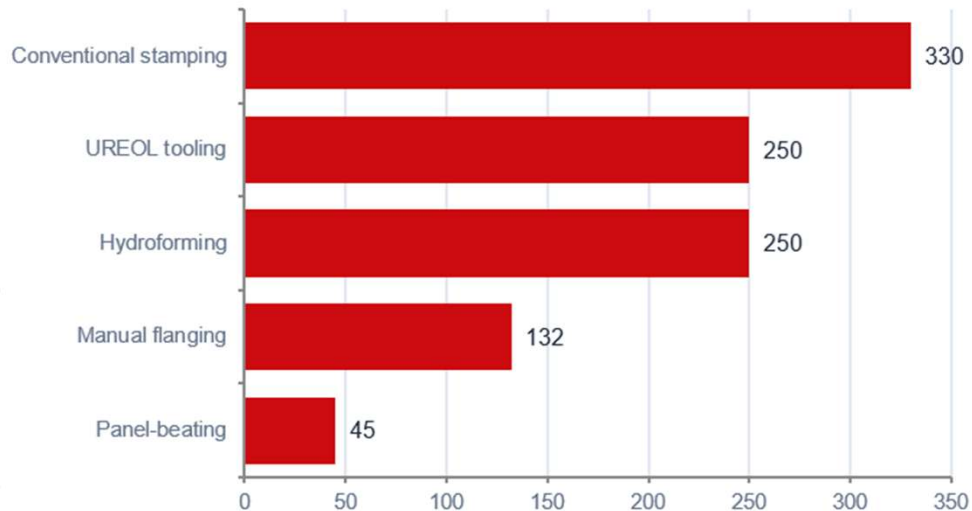
- Define candidate technologies for the part
- Cost each early via Directional Cost
- Map tooling vs unit cost vs volume
- Read the crossover points → recommend



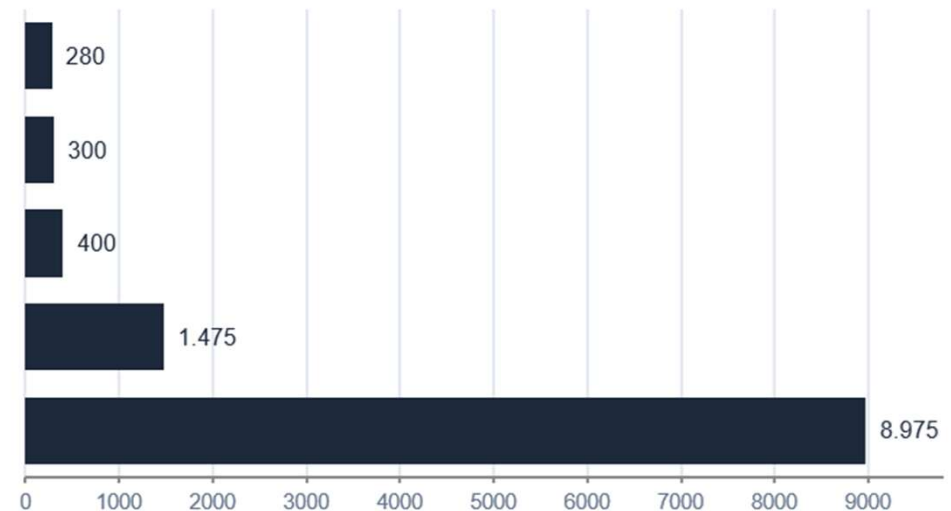
# Aluminum fender, costed *six ways*

As target volume rises, the cost-optimal technology changes; tooling and unit cost move in opposite directions.

Tooling investment (k€)



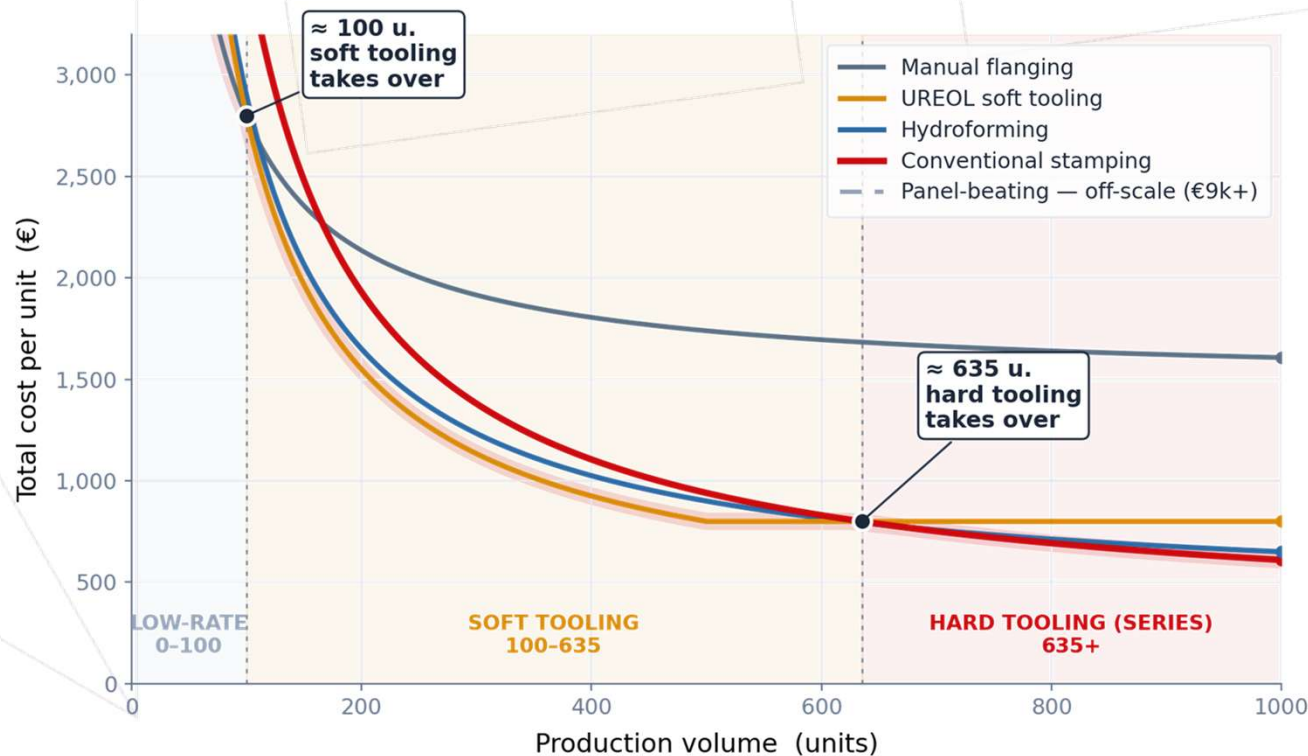
Unit (variable) cost (€)





# Where the curves *cross*

Combine tooling and unit cost into one number (total cost per unit) and plot it against volume, with the cheapest technology changing as you scale.



## HOW TO READ IT

Each curve = variable cost + tooling ÷ volume. The highlighted band is the cost-optimal choice at each volume.

**≈100**

units

Low-rate manual flanging gives way to soft (UREOL) tooling.

**≈600**

units

Soft tooling stops improving; hard tooling for series takes over.

*This is where “how do we scale?” becomes a number through cost engineering.*



# From artisan to industrial: *the same journey*

Plotting the cost-optimal technology against volume traces the exact path of industrialisation...and it maps directly onto New Space.



## THE NEW SPACE MAPPING

### Today's bespoke hardware

= the "panel-beater" regime: high skill, low tooling, very high unit cost, non-scalable. Fine for 1–100 units.



*invest in tooling · find the crossover*

### A constellation at rate

= the "conventional-stamping" regime: heavy up-front tooling, low unit cost, mature and repeatable.

**TRL→MRL** = the distance between these two regimes. Cost engineering finds the crossover volumes before capital is committed.



# Industrial & *Supply-Chain Strategy*

Choosing the technology is half the answer. The other half is who builds it, where, and how the risk is shared.



## Make-or-buy

Objective comparison of direct and indirect cost to decide insourcing vs outsourcing — not habit or capacity.

*Directional Cost gives the number both sides trust.*



## Vertical integration

Assess the strategic & economic value of owning key processes: control over cost and production lead time.

*Integrate where cost & control justify it.*



## Sourcing risk

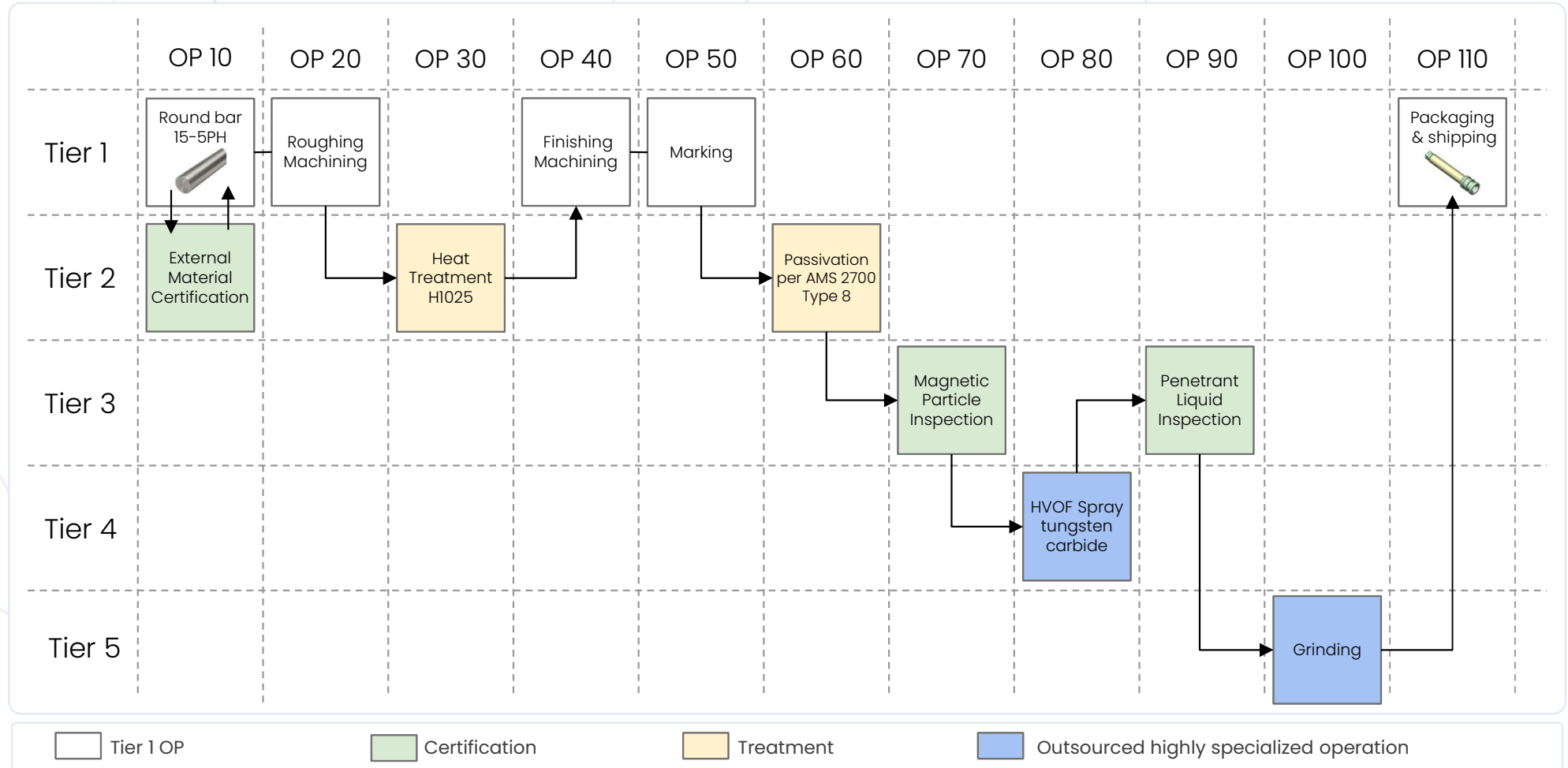
Single vs double sourcing decided by component criticality and supplier capacity — not by default.

*Match sourcing strategy to criticality.*

Space translation: *a New Space supply chain is being built right now — these decisions set its cost structure for a decade.*

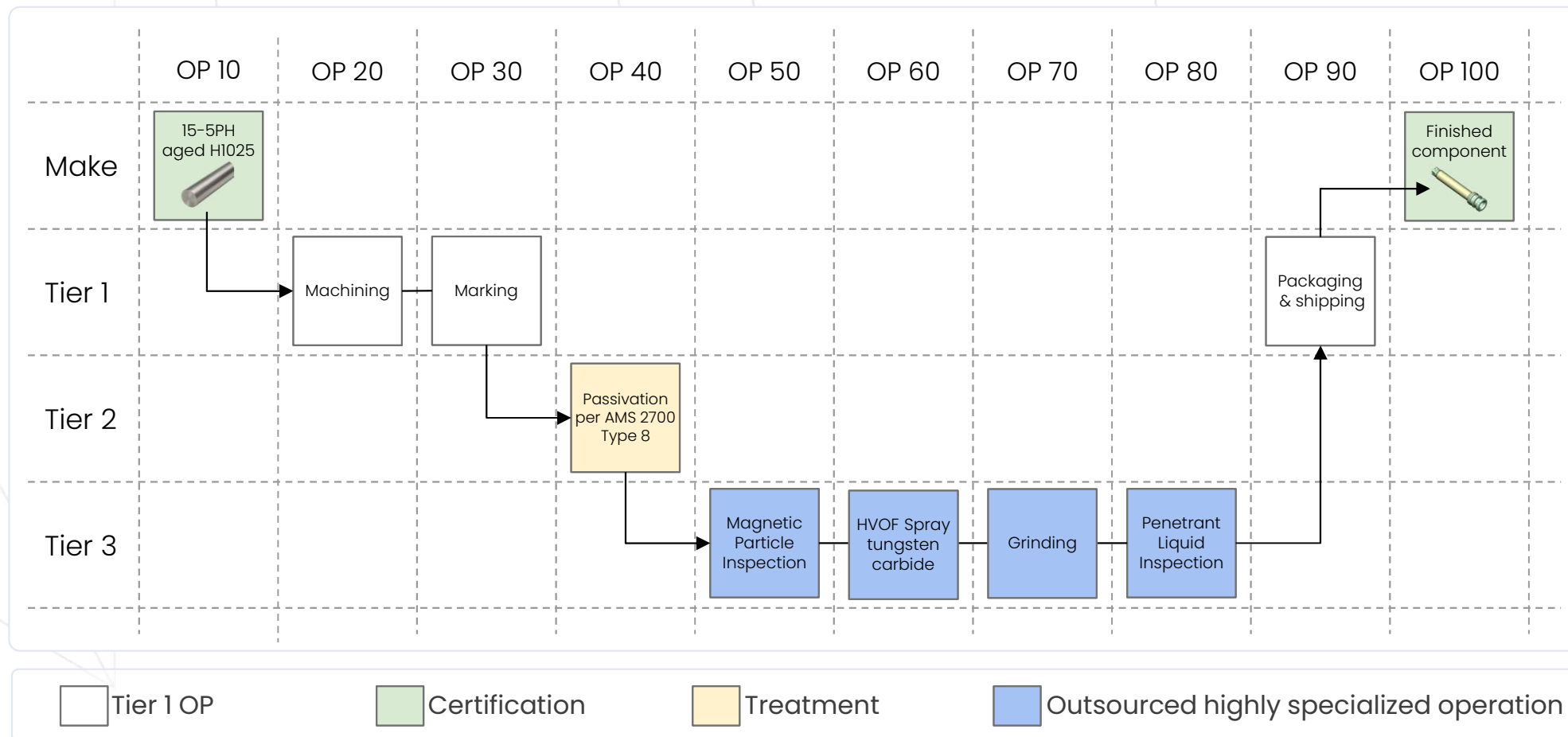


# Analyze current *Supply-Chain & Integration*



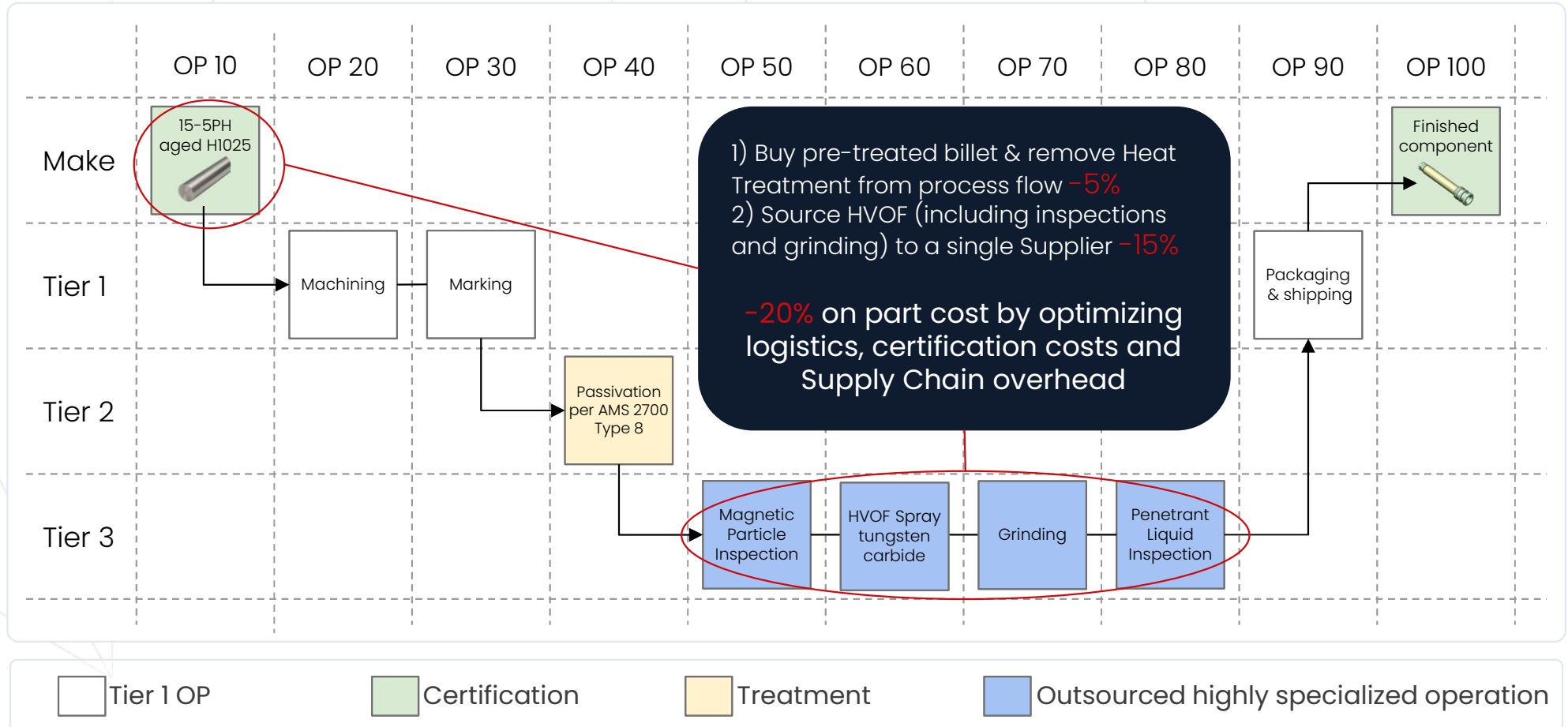


# Optimize new *Supply-Chain & Integration*





# Optimize new *Supply-Chain & Integration*





# Cost engineering is the *multiplier* of industrialisation

1

## Industrialisation is a cost-volume problem

Pick the process for the rate, not the prototype — and know the crossover points.

2

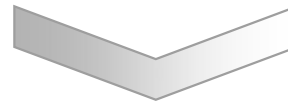
## The automotive method transfers

Target setting, platforms, scouting and sourcing apply directly; the assurance bar stays yours.

3

## Decide early, decide on evidence

Accurate Cost in the concept phase, where 70–80% of cost is still yours to shape.



## What's next



### Skills & Role Evolution

Develop new skills for higher-rate processes & evolve role from mission centric to manufacturing centric.



### Methods

Continue cross-sector benchmarking & evolve acceptance criteria for a series-market bar.



### Tools

Leverage legacy data and develop new tools to scale the analysis & iterations.