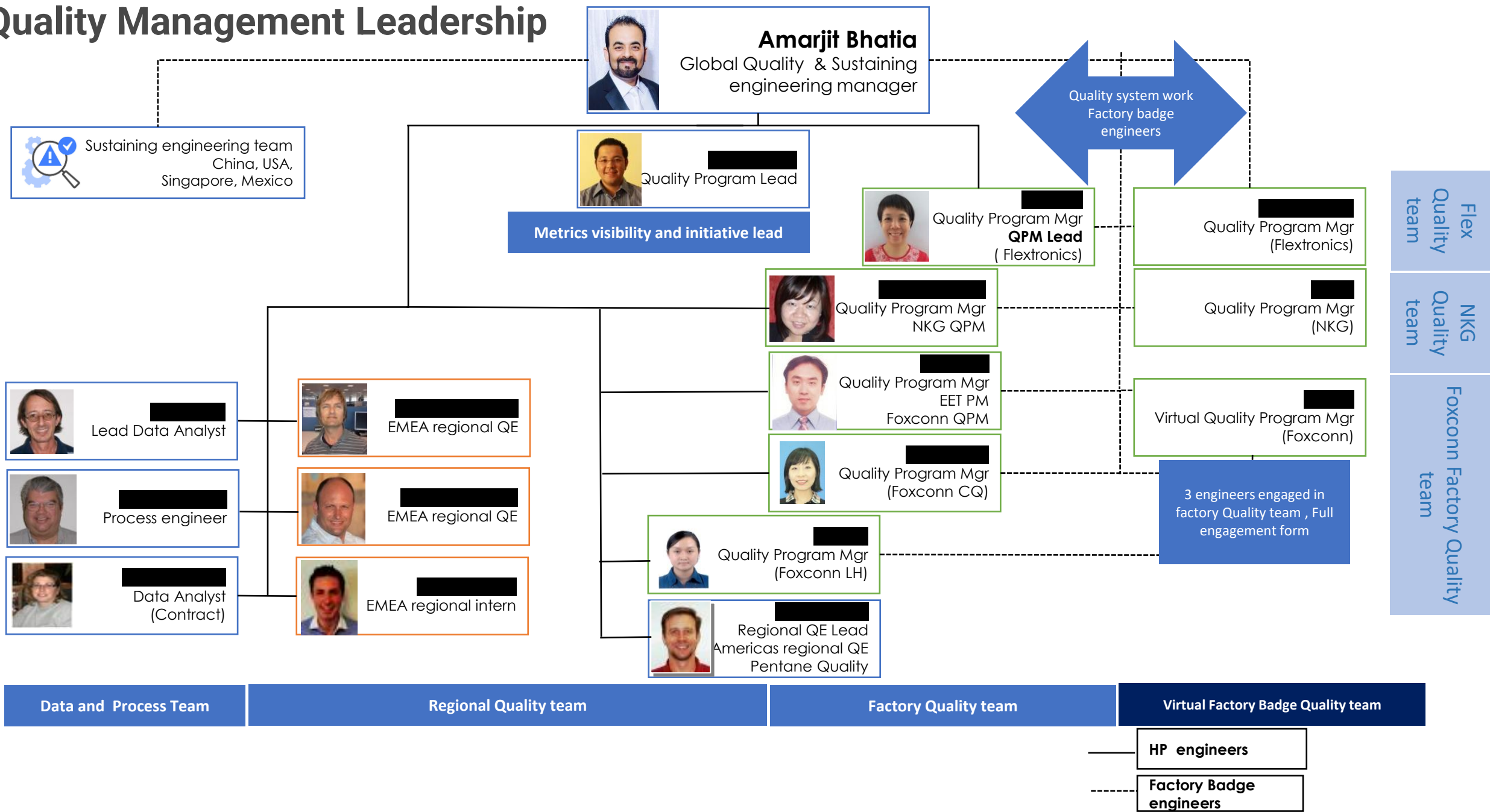


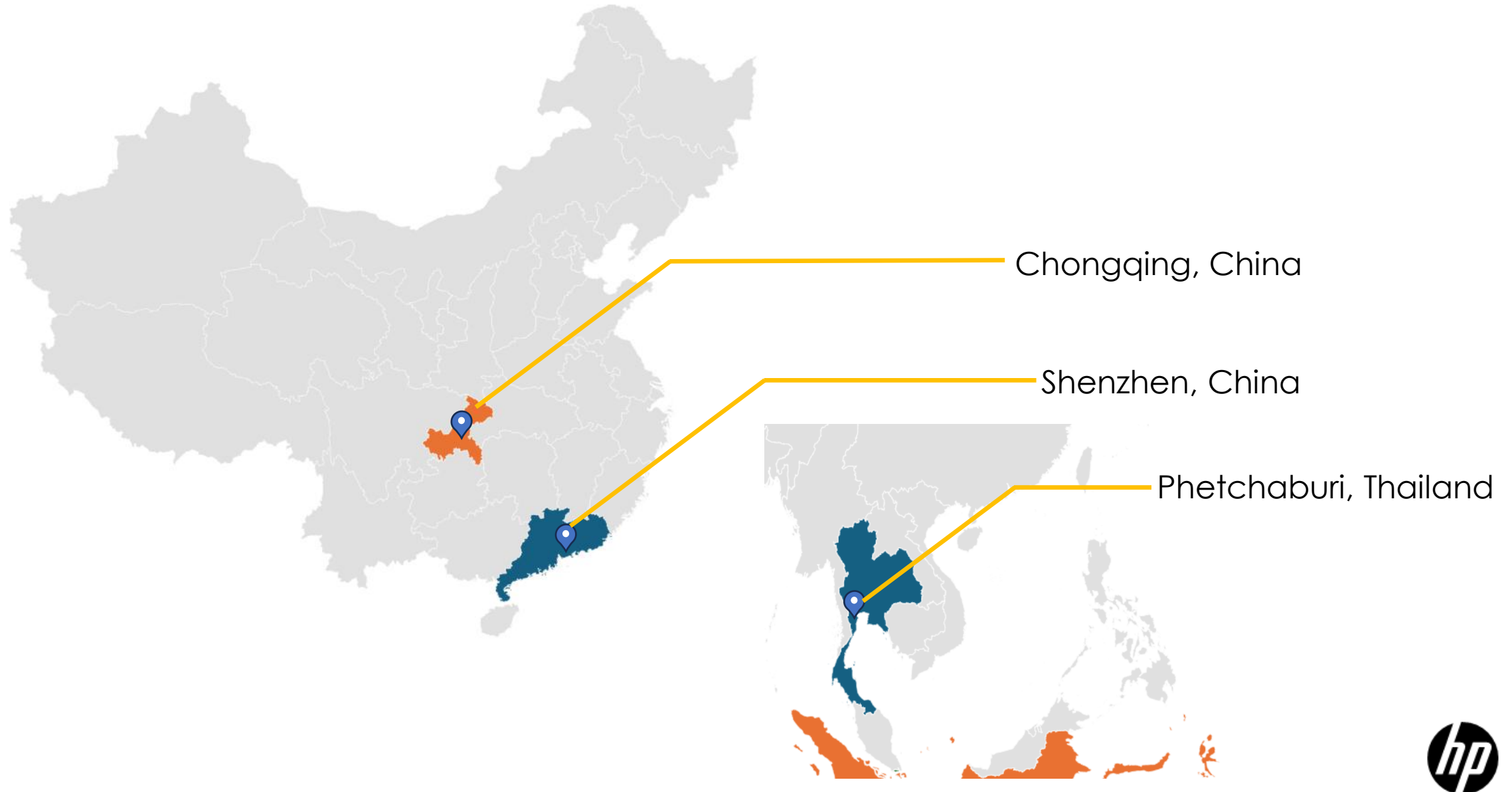
Global Hardware Quality & Sustaining Engineering

Amarjit Bhatia - Quality management leadership overview

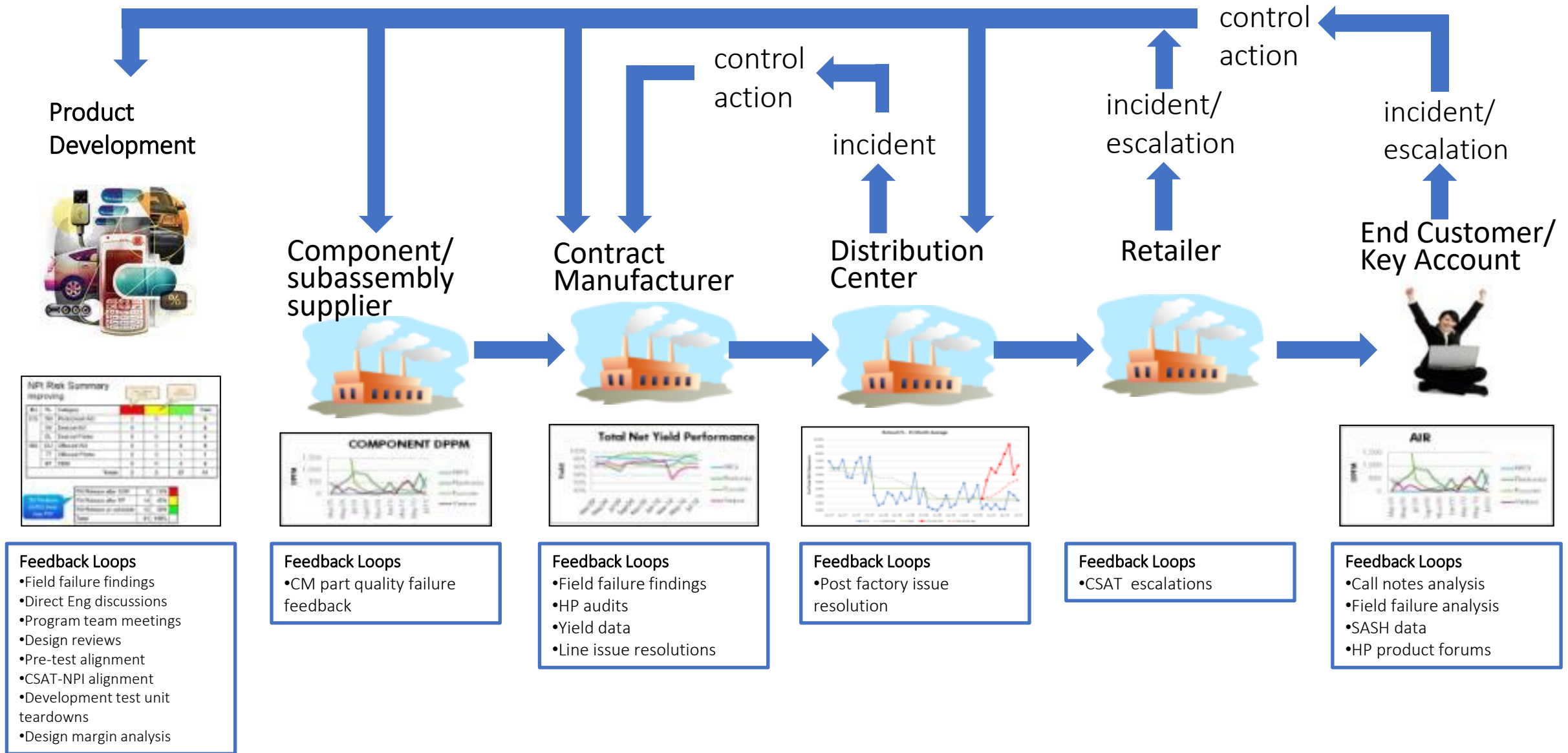
Quality Management Leadership



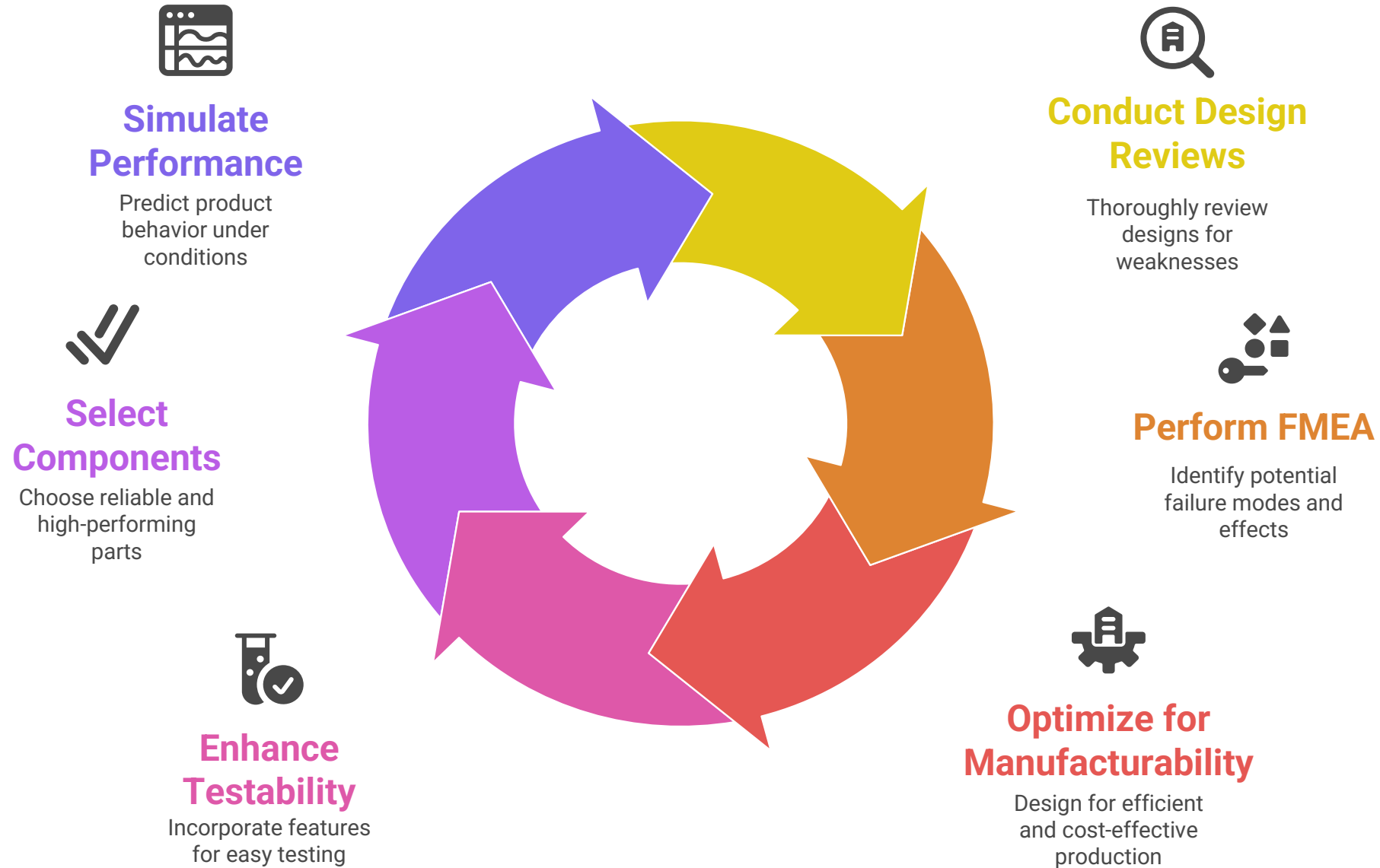
Global Supply Chain – Contract manufacturing partner locations



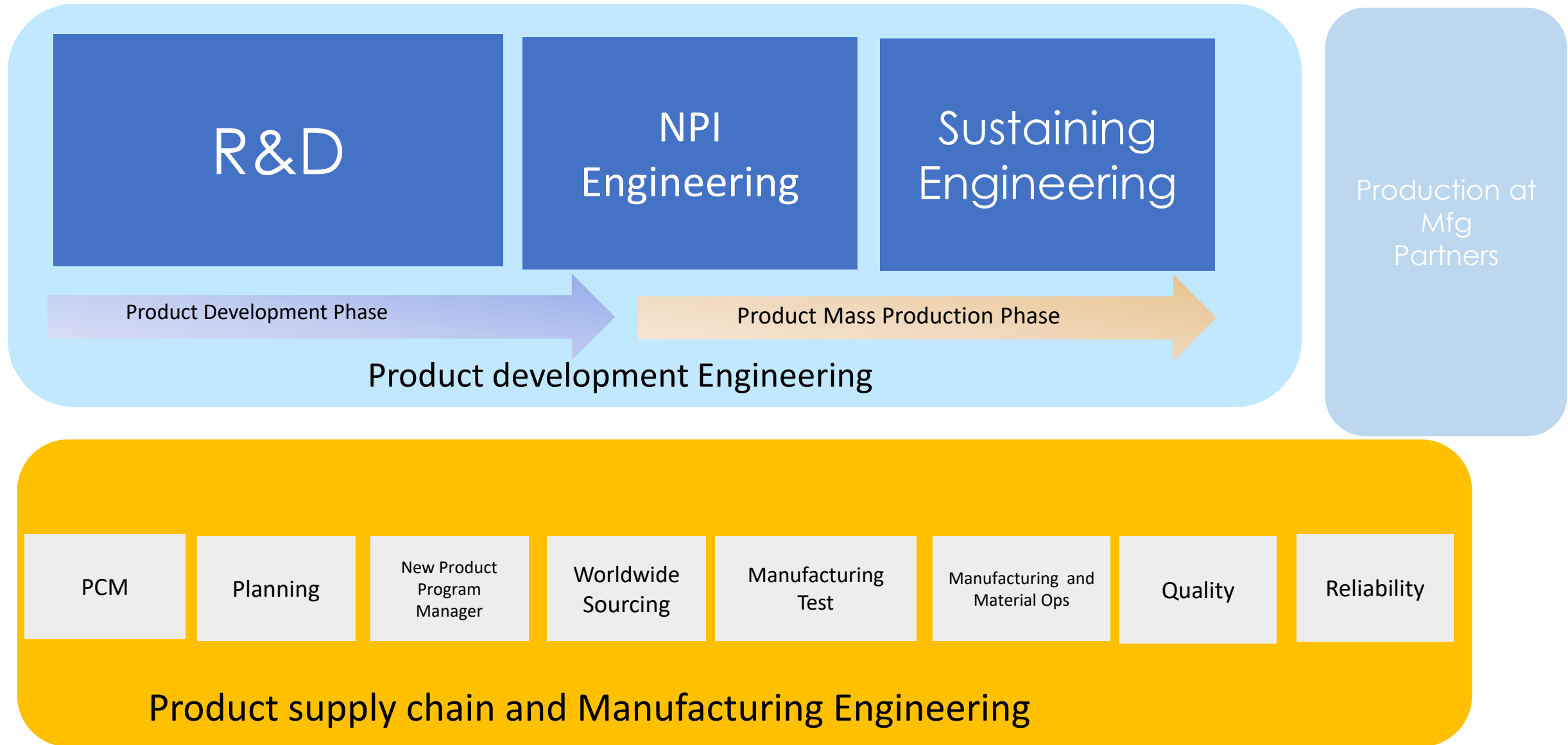
Product Quality & Sustaining management lifecycle



Design Quality Assurance Cycle



Development to Manufacturing



Organizational roles from Development to Manufacturing

R&D

- Product knowledge transfer
- Product Issue resolution
- Product design stability
- Critical processes

NPI Engineering

Bring design into mass production

- Stability
- Scalable
- Leverage & Reuse

Engineering collaboration with R&D.

- Design reviews
- Design for Manufacturing
- Development of manufacturability solution
- Drive CM's readiness in delivering on operation-excellence

Capacity mgmt and installation

- Parts & Lines qualification

Sustaining Engineering

Current Product Engineering

- Customer issue identification and resolution
- Factory issue resolution
- Field Failure Analysis data interpretation
- DFX input
- Issue resolution communication to generating organization

Factory/Process Engineering

- Factory support, yields, line stops, process issues
- CM common process setup

Assurance of Supply

- Assurance of Supply qualifications on current products, plans and execution

Budgeting

- Current product tooling and evaluation expense budgeting

PCM-Product Cost Management

- Evaluation & Operating Supply
- Direct Labor /Indirect Labor Head Count validation

Planning

- Scenario planning
- Nominal & strategic capacity plan
- Demand and supply forecasting

New Product Program Management

- NPI program management
- Proto Build/Schedule
- Ramp plan
- PLC build checkpoints

Procurement and Sourcing

- Tool qualification schedule
- Part First Article reporting
- Tooling budget management
- Part tool Capacity installation plan

Manufacturing and Material Ops

- PSL qualification
- AOS strategy
- Proto build material readiness
- Integrated capacity plan

Reliability and compliance Engineering

- Reliability and regulatory qualification and submission

Manufacturing Test Engineering

Manufacturing Test Strategy

- Strategy elaboration
- Manufacturing test plan

Manufacturing Test Engine

- Test engine maintenance and enhancement

NPI Program team support

- Test script generation, a product development tool that evolves into the main manufacturing test

Factory Support

- Test changes for yield improvements and/or new failure mode detection

Asset Support

- Test and development support by asset

Quality Engineering

Quality System

- Quality Assurance Plans
- Factory Audits
- Quality System monitoring and corrective actions

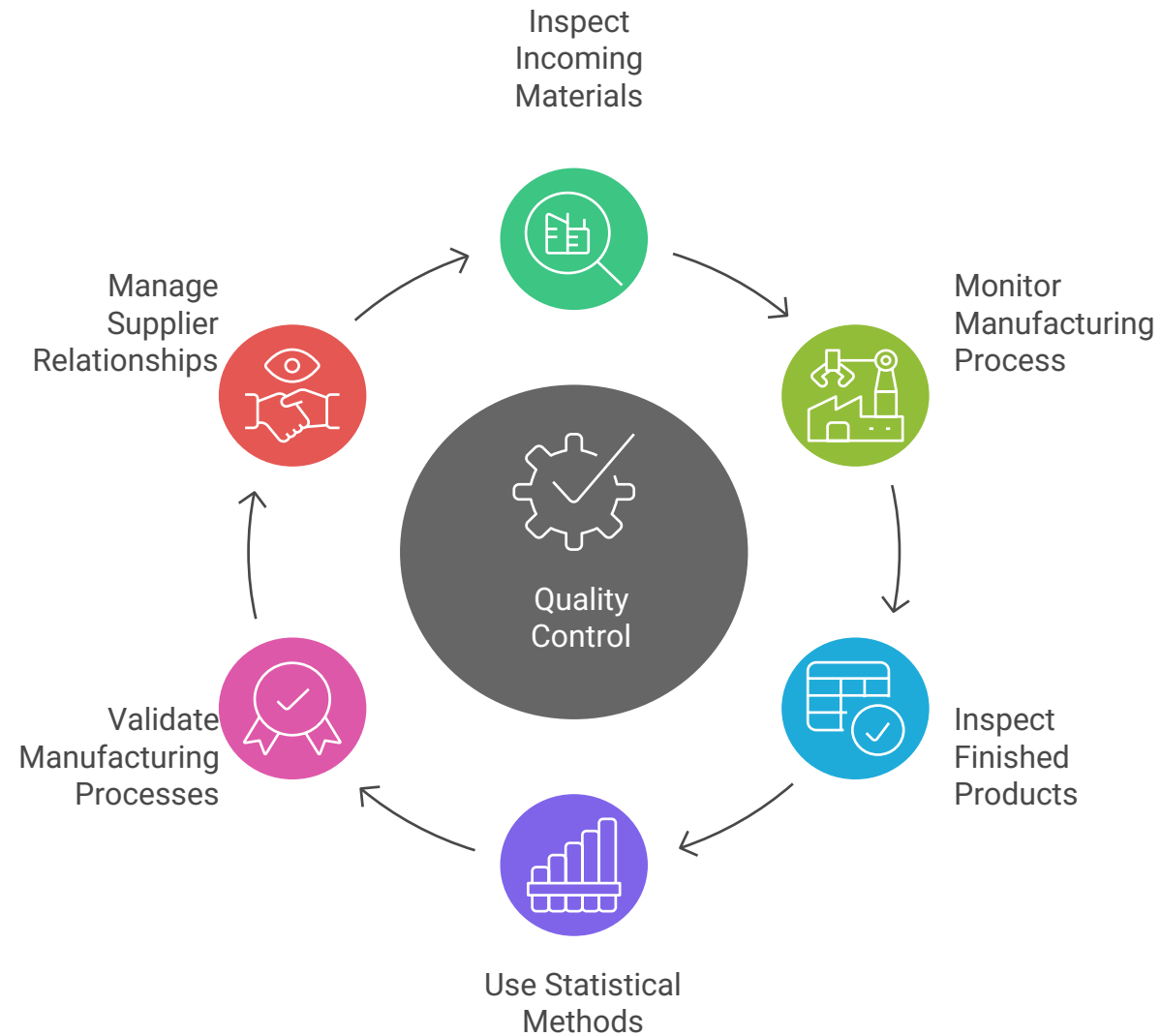
Regional Retouch

- Rework Procedures
- Technical Management
- Rework monitoring and reporting

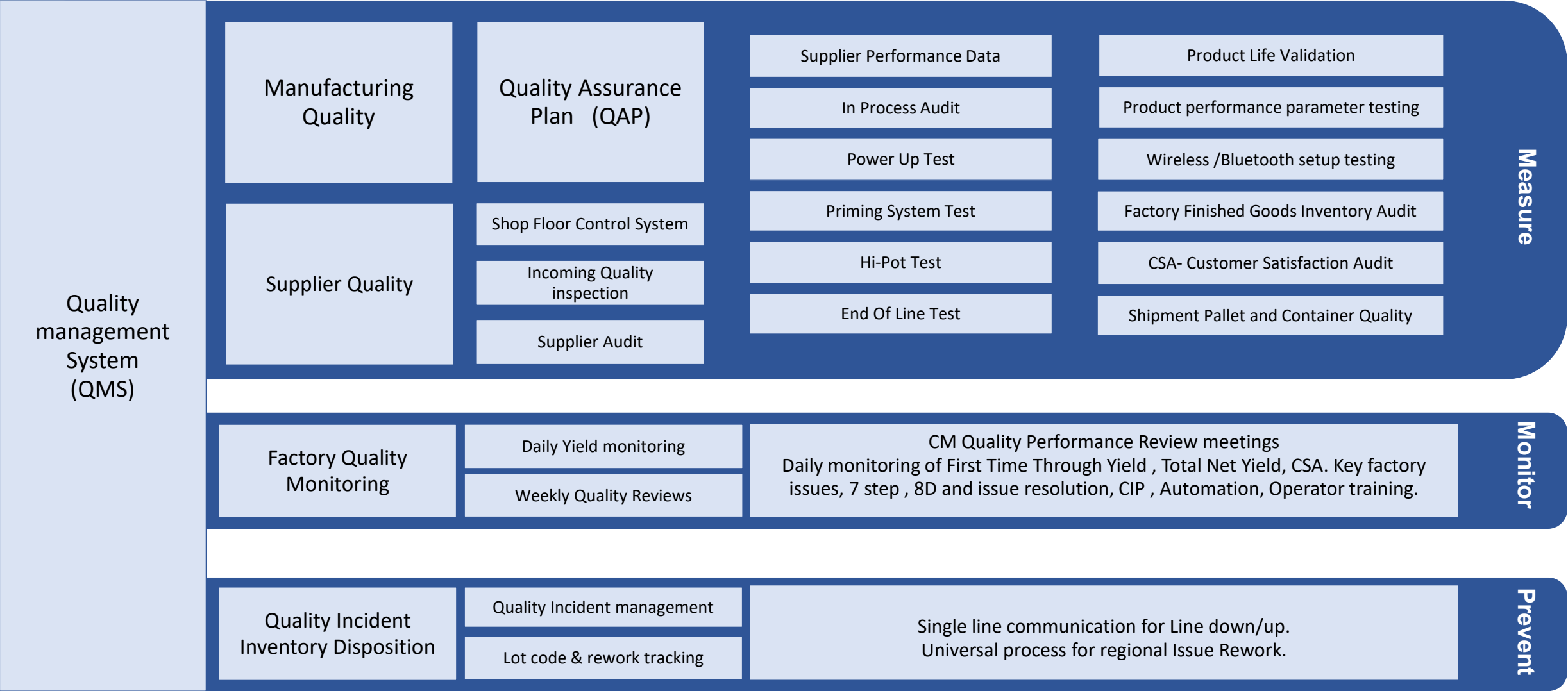
Data acquisition & management

- Customer data acquisition and transformation
- Field Failure Analysis data management

Quality Control Cycle



Quality System implementation



TQM: Total Quality management system

Functional testing

Stress and reliability testing

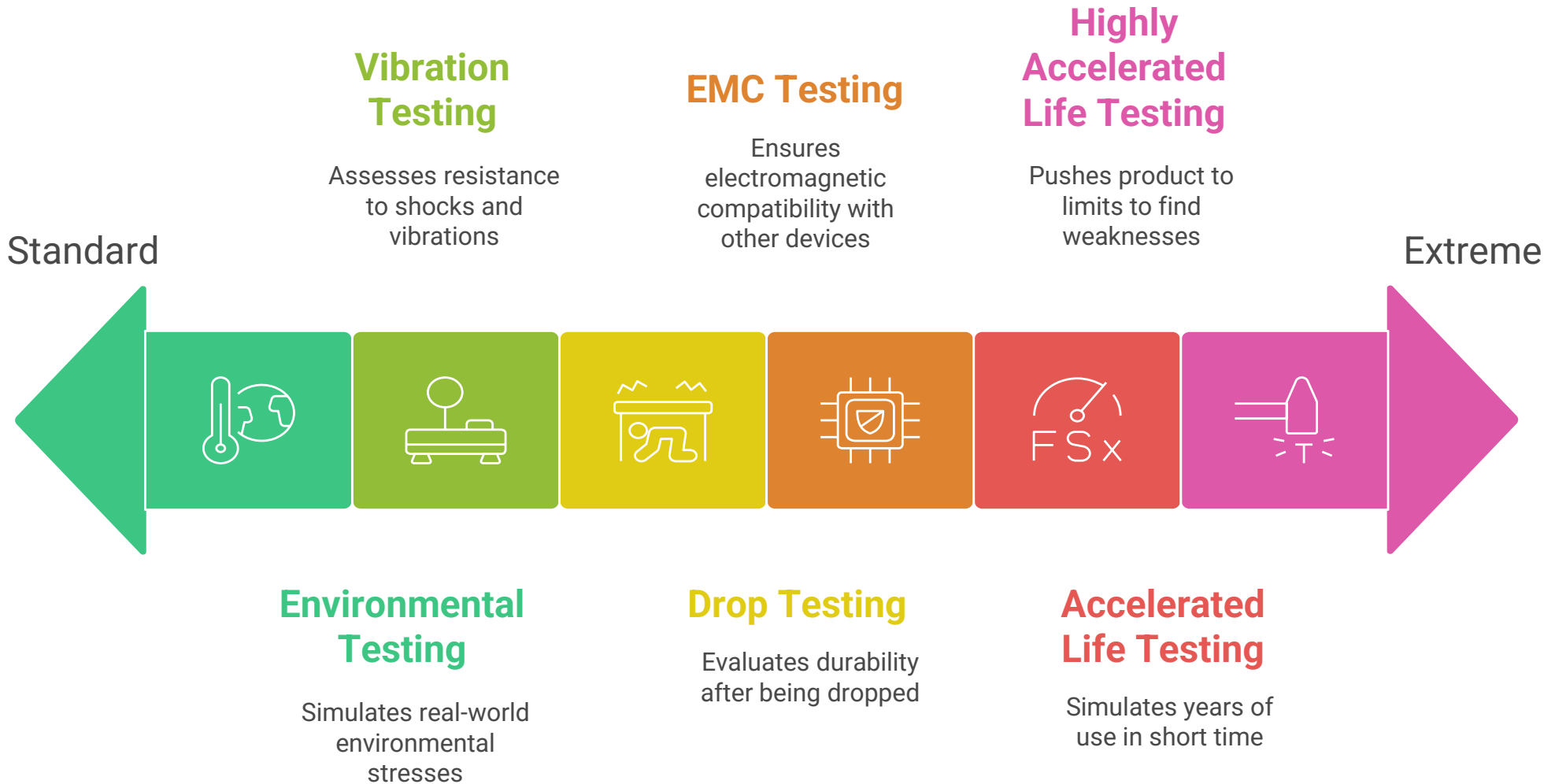
Production and supplier quality
management

Regulatory compliance testing

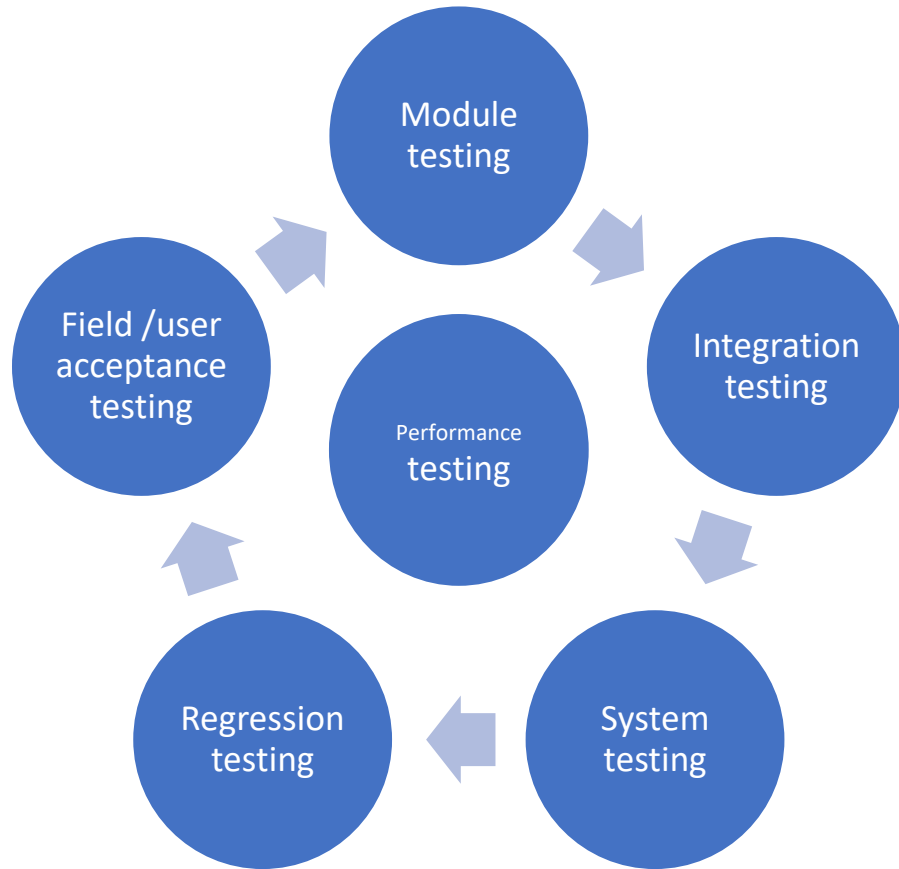
Factory testing

Field failure analysis and testing

Product testing methods range from typical to extreme conditions.



Product performance and functional testing



Module testing

- Test individual module for functionality

Integration testing

- Testing integration of modules

System testing

- Full product performance testing

Regression testing

- Repeated testing of system to uncover defects

Field testing

- Field performance testing , user acceptance testing

Testing product Reliability



Environmental testing

- Non operating temperature and storage test
- Operating humidity and 4 corner testing

Vibration testing

- Operating random vibration test
- Packaging random vibration testing

Shipping and logistics testing

- Packaging drop testing
- Bulk pack random vibration testing
- Packaging drop on hazard test

Altitude testing

- Operational testing at low temperature and low atmospheric pressure.

HALT testing

- Highly accelerated life testing

Regulatory and compliance testing

Country/Organization	Publisher	Standard
IEC	CISPR	CISPR 35
European Union	CENELEC	EN55024, EN55032
United states of America	FCC	FCC CFR47 PART 15
Japan	VCCI	VCCI 32
China	CCC	GB9254, GB17626
Safety	UL	Safety tested



Supplier management and component selection



Supplier contacts



Supplier management is an essential elements of seamless manufacturing and quality control

Critical component list

- Single source critical component list
- Find second source
- Leadtime analysis to meet schedule

Cat A components

- Critical custom components specified by R&D
- Can not be changed without R&D evaluation

CAT B components

- Can be second sourced after consulting R&D
- Will require qualification and performance review

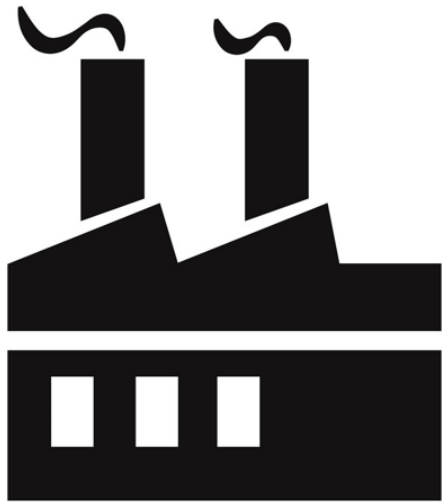
Cat C components

- CM can recommend second source
- Substitute parts can be sourced from alternate suppliers based on Paper spec verification
- Example BLC

Preferred component list

- List of preferred suppliers based on cost lead time availability

Factory and manufacturing testing



- ICT testing.

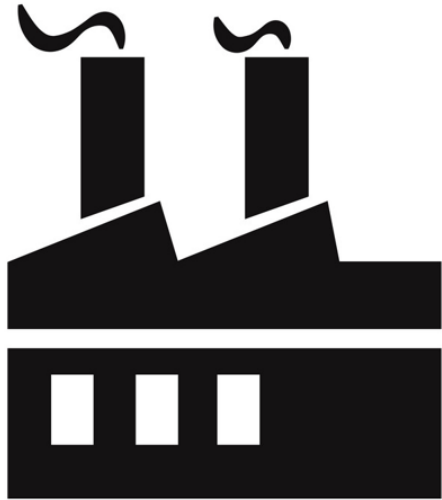


- FCT testing.



- Production testing.
- Pack and ship.

Factory Quality management system



- Incoming inspection



- Product assembly work instructions

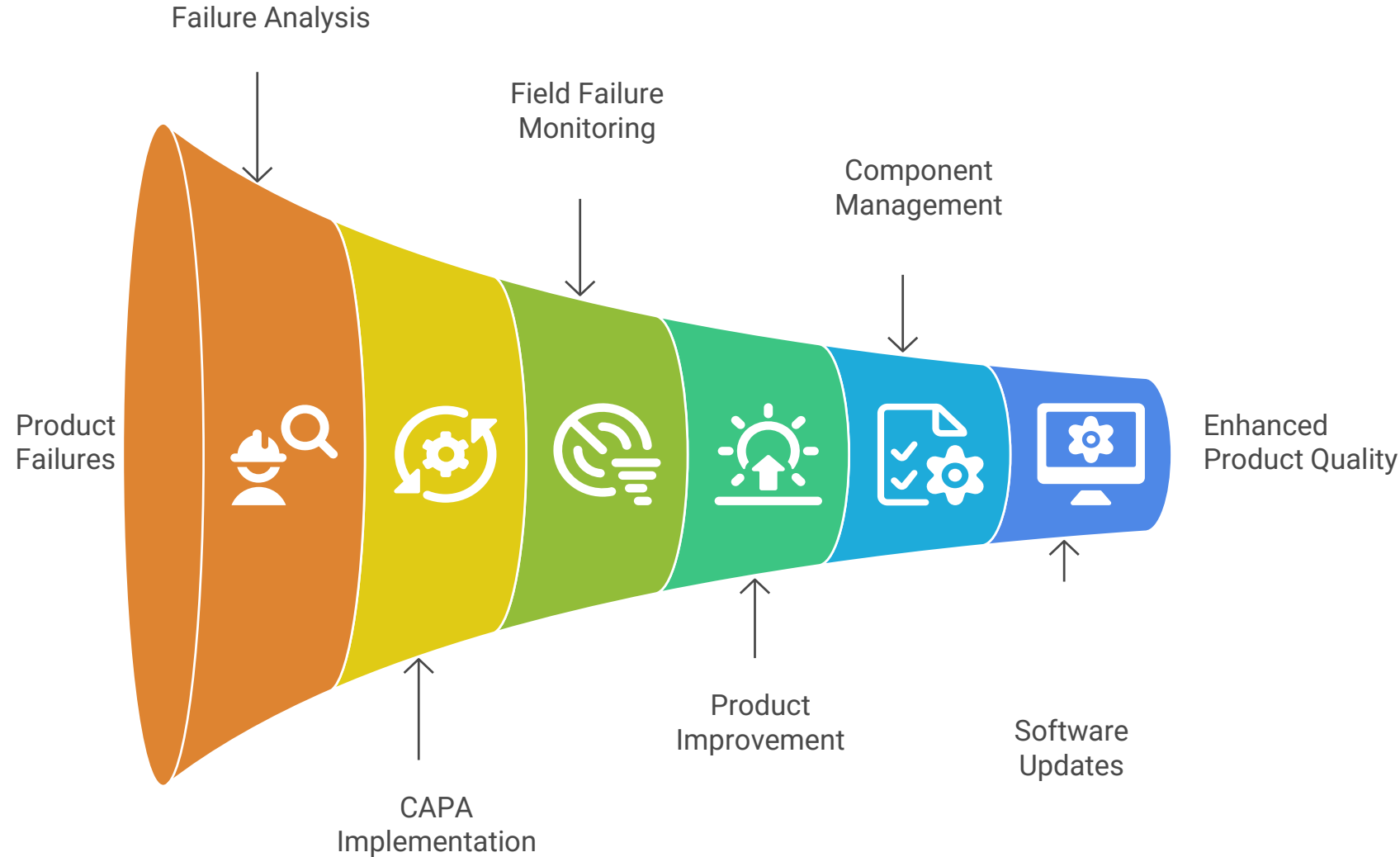


- Factory failure and root cause analysis



- Customer satisfaction sampling test

Product Quality Improvement Process



Customer Feedback Cycle



Monitor Results

Evaluating the impact of changes on satisfaction



Implement Changes

Making necessary improvements based on analysis



Collect Feedback

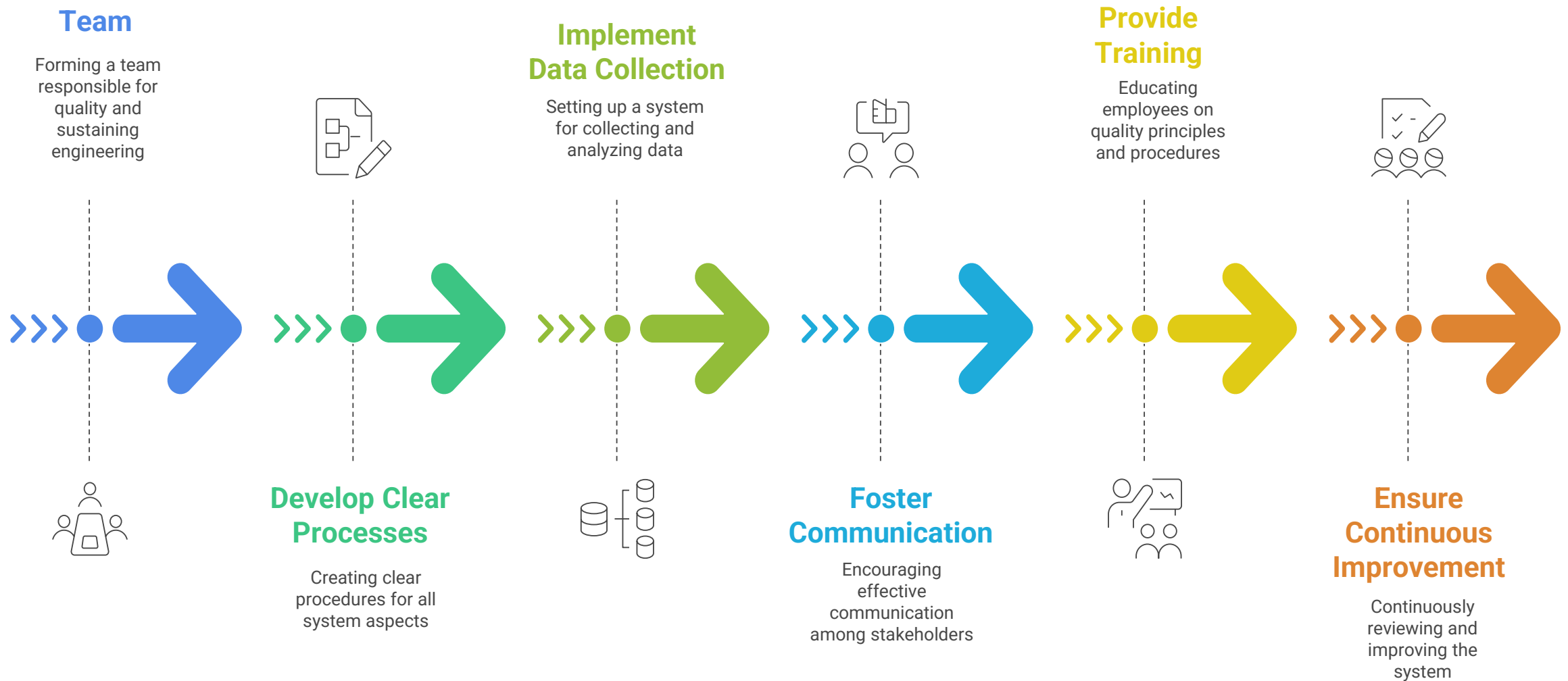
Gathering customer opinions and experiences



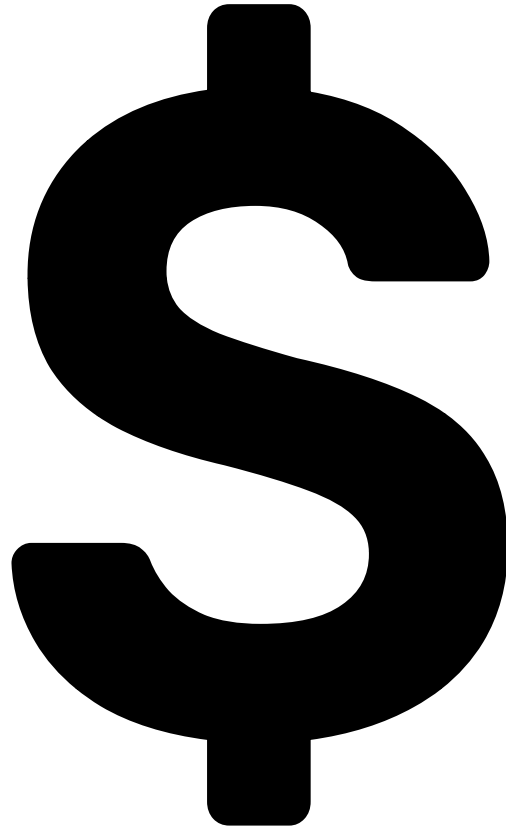
Analyze Data

Identifying trends and issues from feedback

Quality and Sustaining Engineering System Implementation



Key Product Quality Metrics



Defect Rate

The number of defects per unit produced



Field Failure Rate

The number of failures per unit in the field



Customer Satisfaction

A measure of customer satisfaction with the product



Warranty Claims

The number of warranty claims per unit sold



Mean Time Between Failures (MTBF)

The average time between failures



First Pass Yield (FPY)

The percentage of units that pass all tests on the first attempt

Quality and Sustaining Engineering Pyramid

