

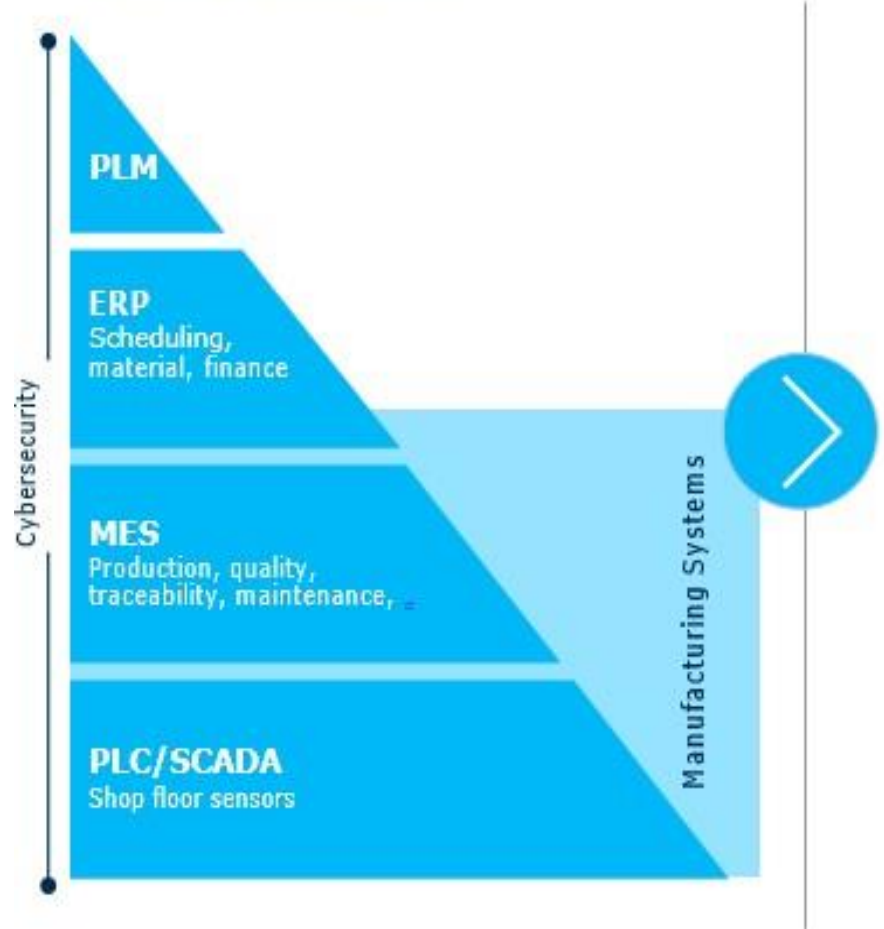


MANUFACTURING

OEE - Engagement Playbook

Performance That Matters

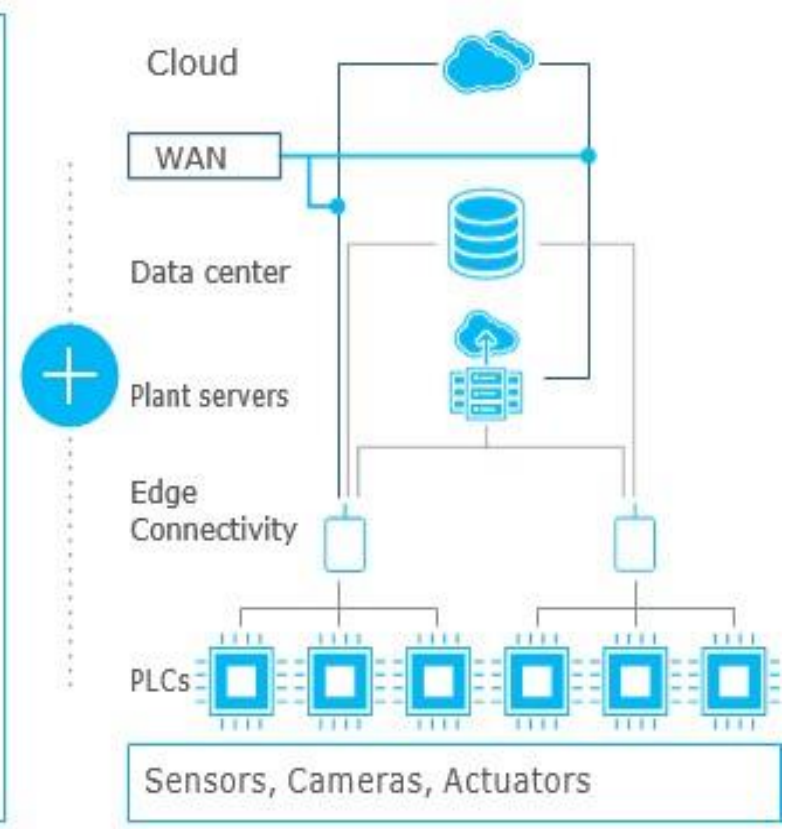
Current ISA-95 architecture



Future Software Design

Next Gen Apps & Micro-services	Mobile applications, SaaS	Cybersecurity
	Proprietary and standard apps	
IIoT platform	Advanced analytics and Machine Learning	
	Agile application development	
	Big data aggregation and storage	
	Device management: Discover, connect.	
Edge compute	Real-time, processing, quality control	
Edge platform	Development, data management, connectivity management	

Future Infrastructure Architecture





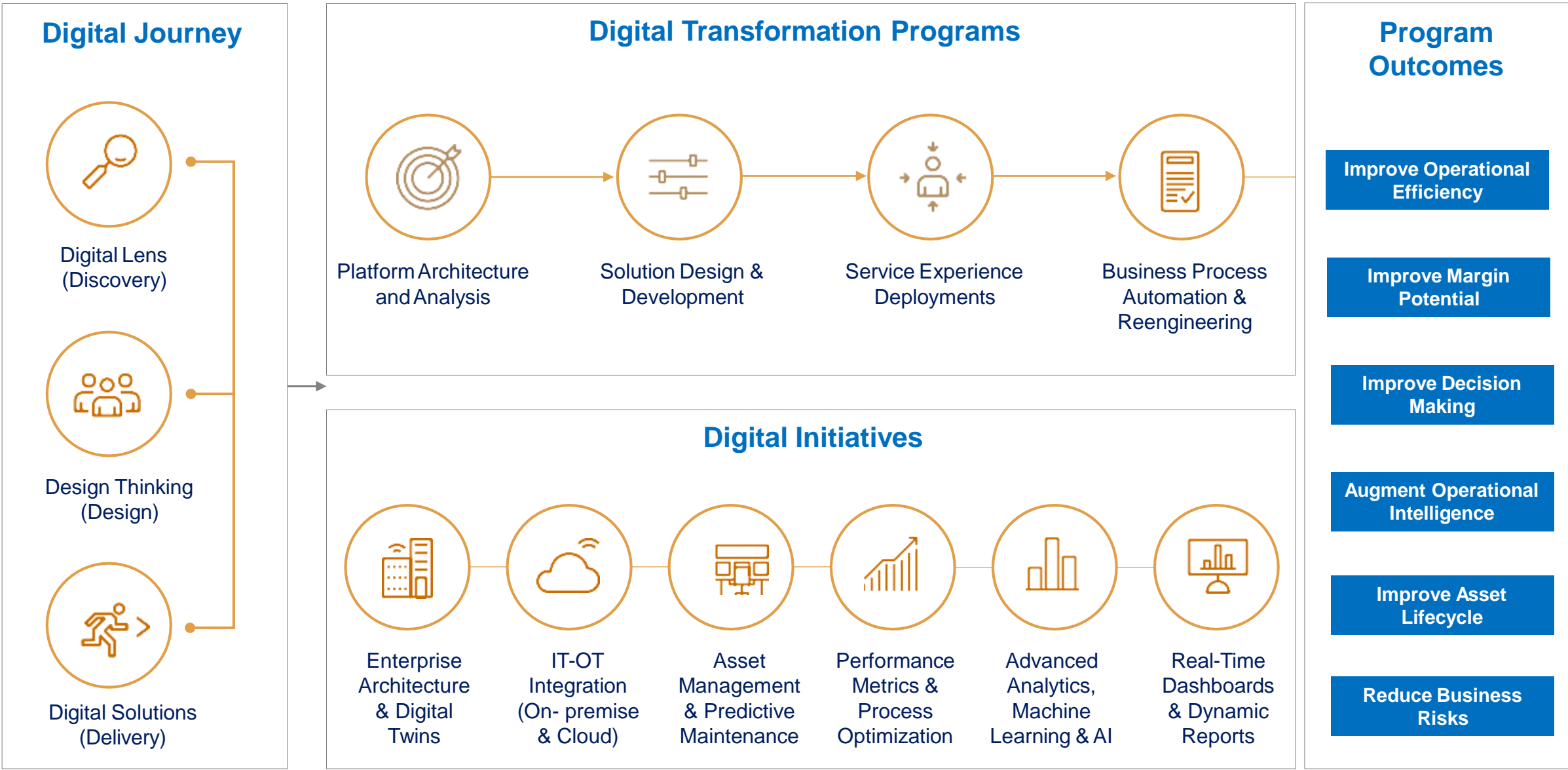
ENGAGEMENT PLAN

**Digital Lens
(Discovery)**

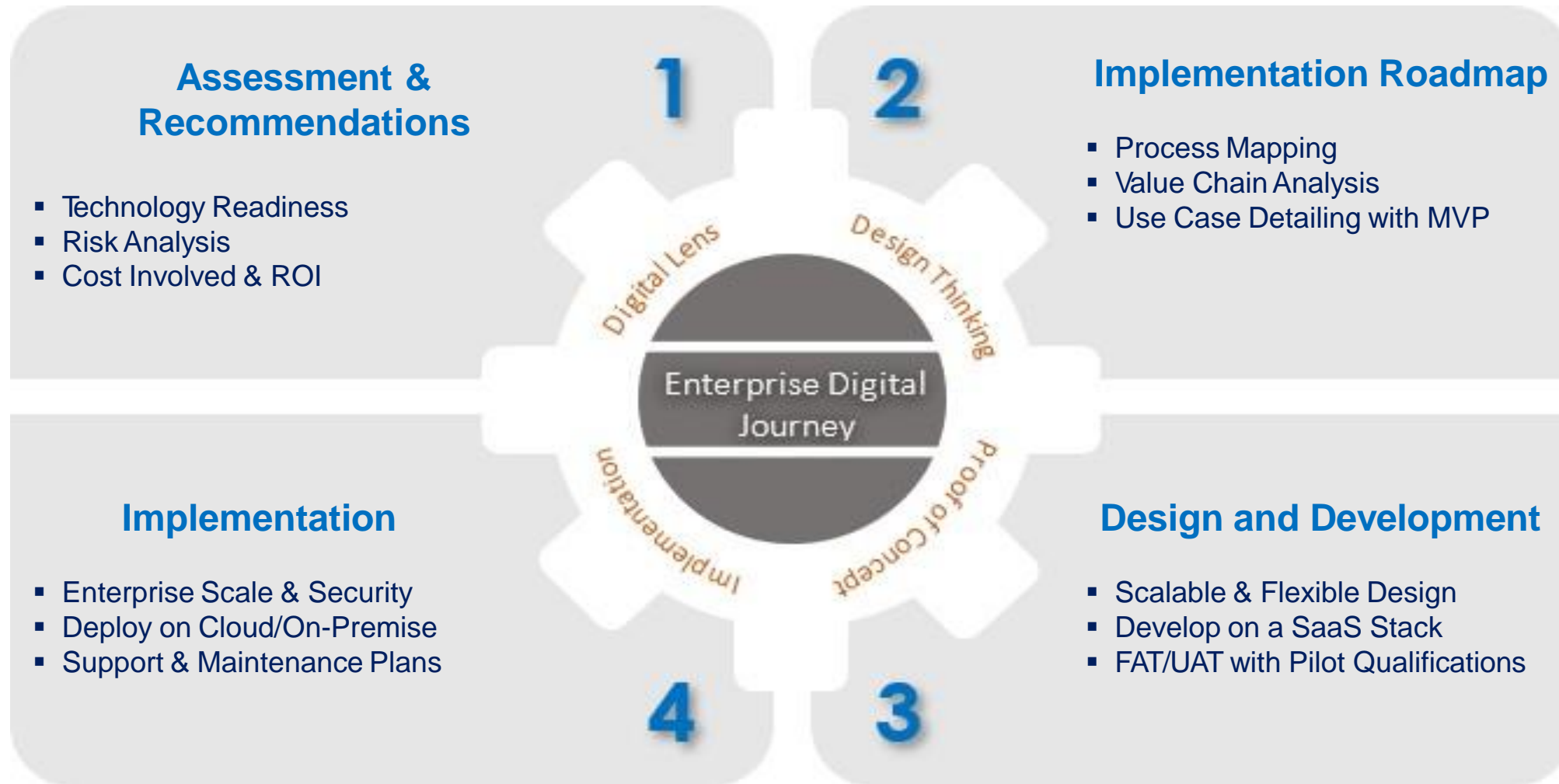
**Design
Thinking
(Design)**

**Digital
Solutions
(Delivery)**

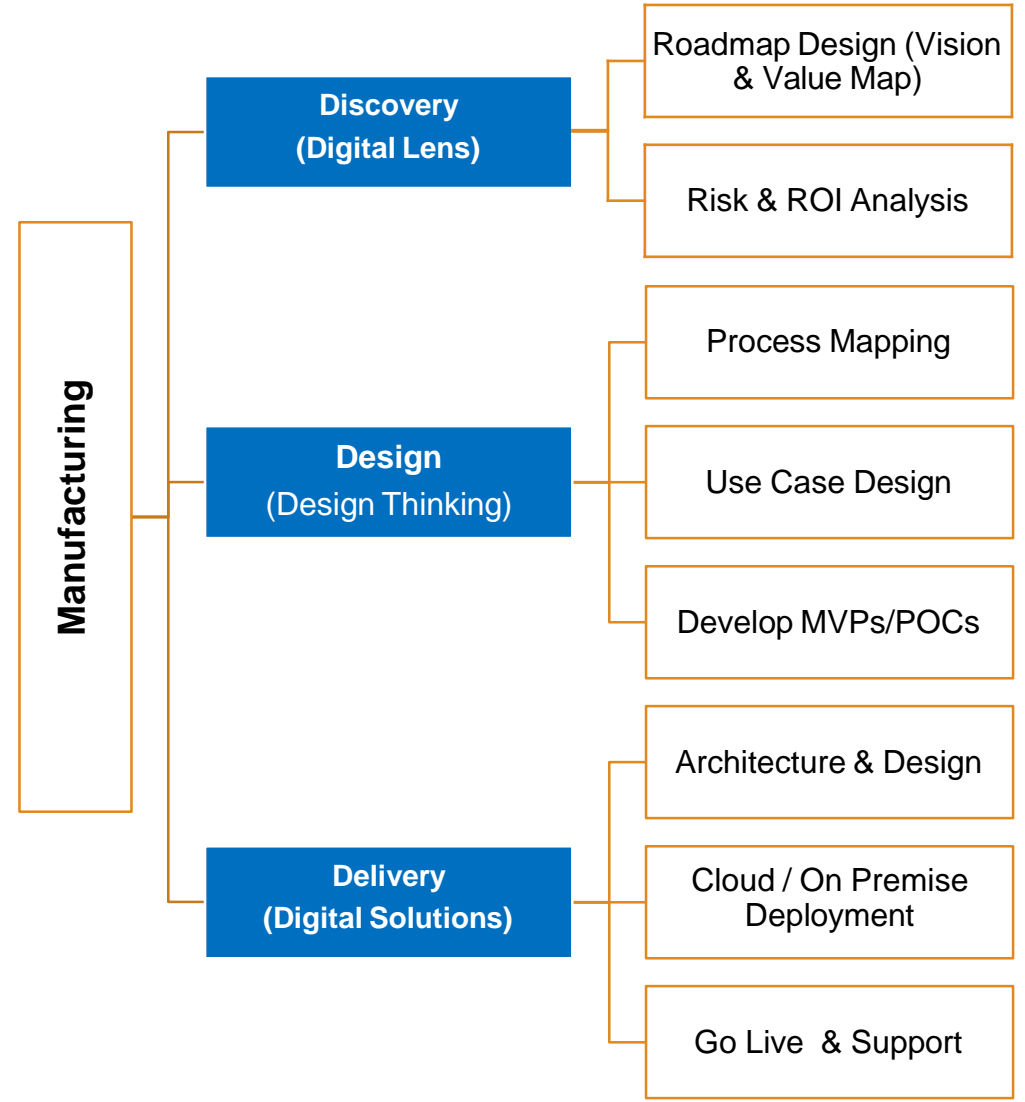
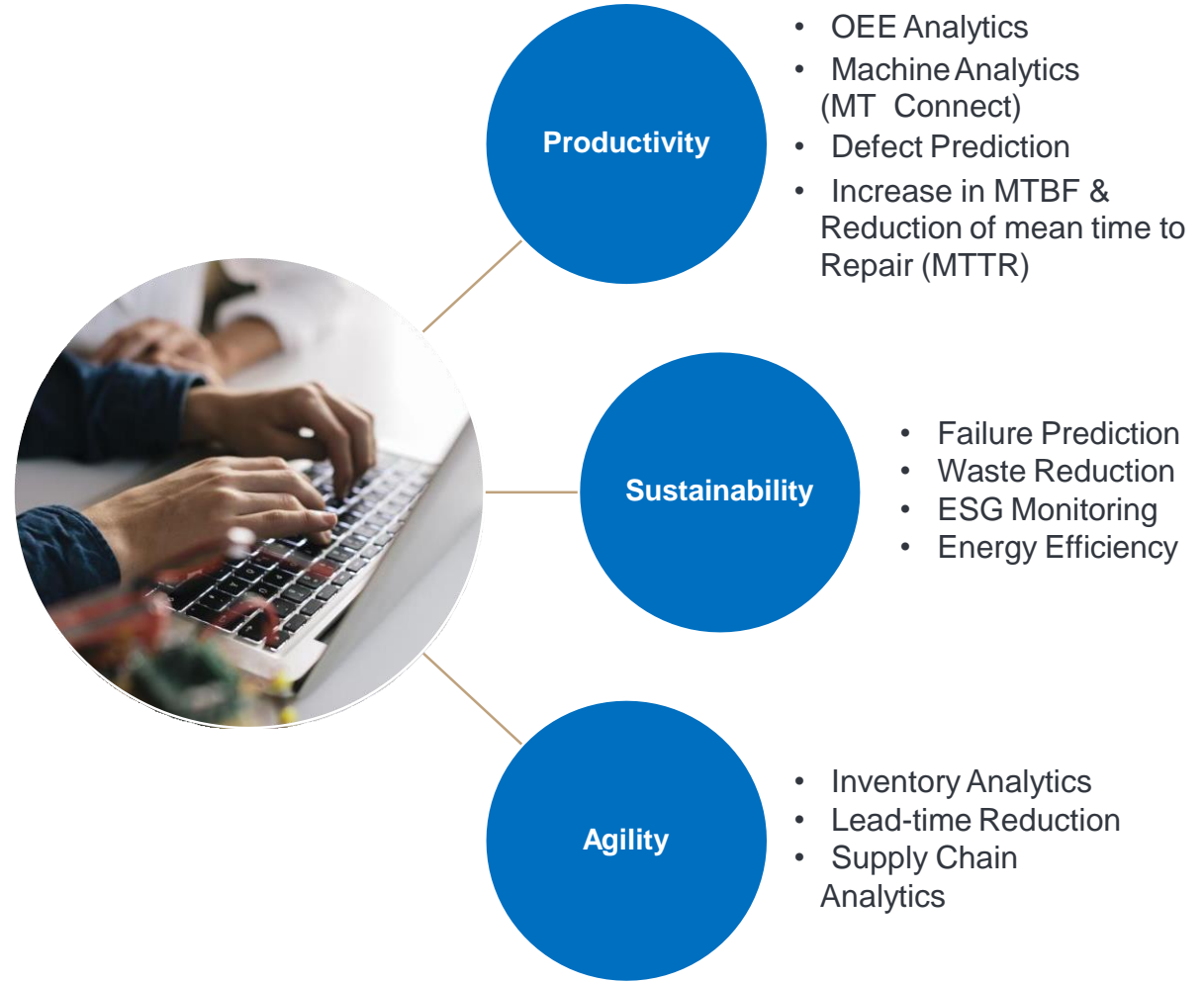
PLAYBOOK



ENGAGEMENT AREAS



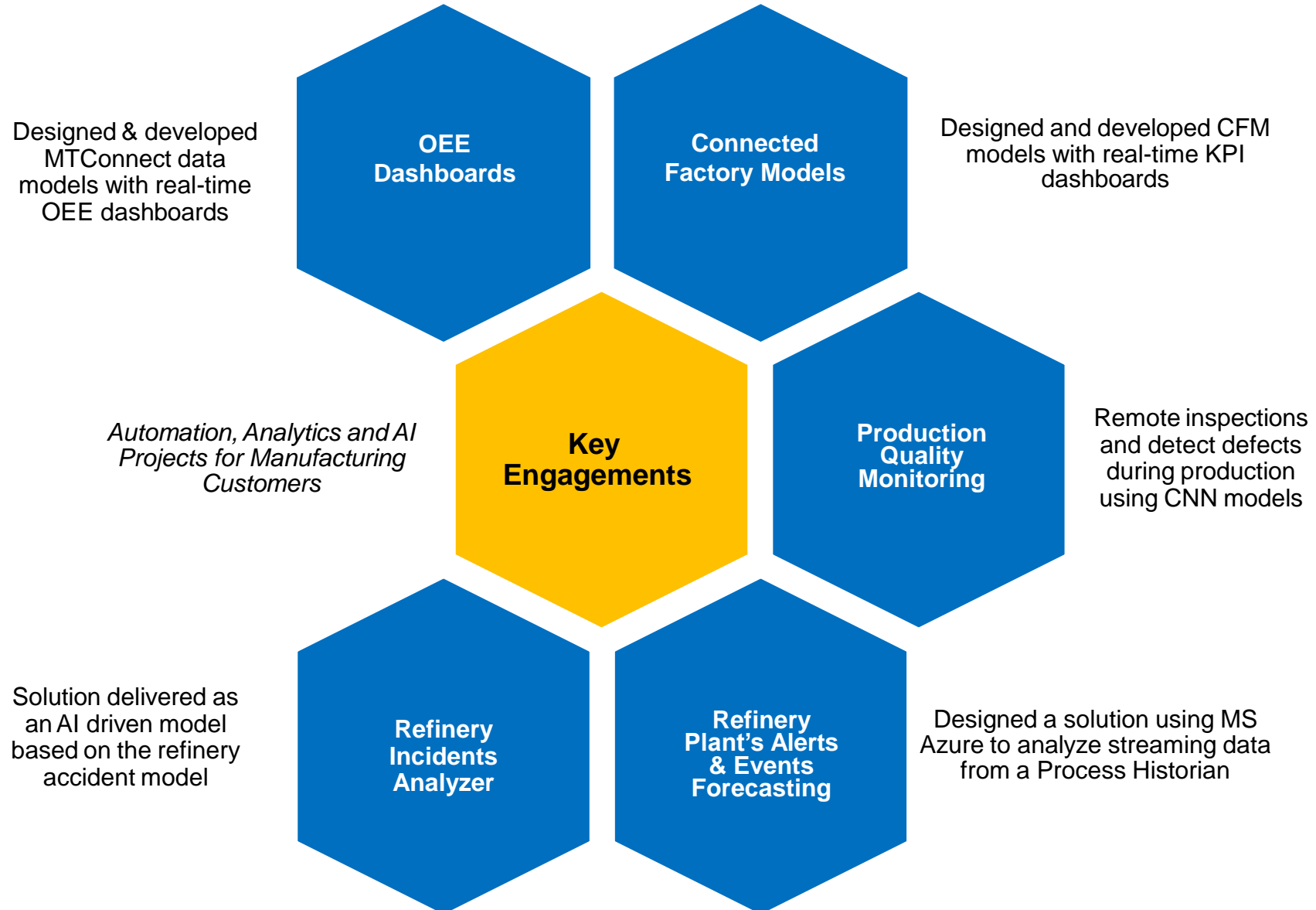
FOCUS AREAS



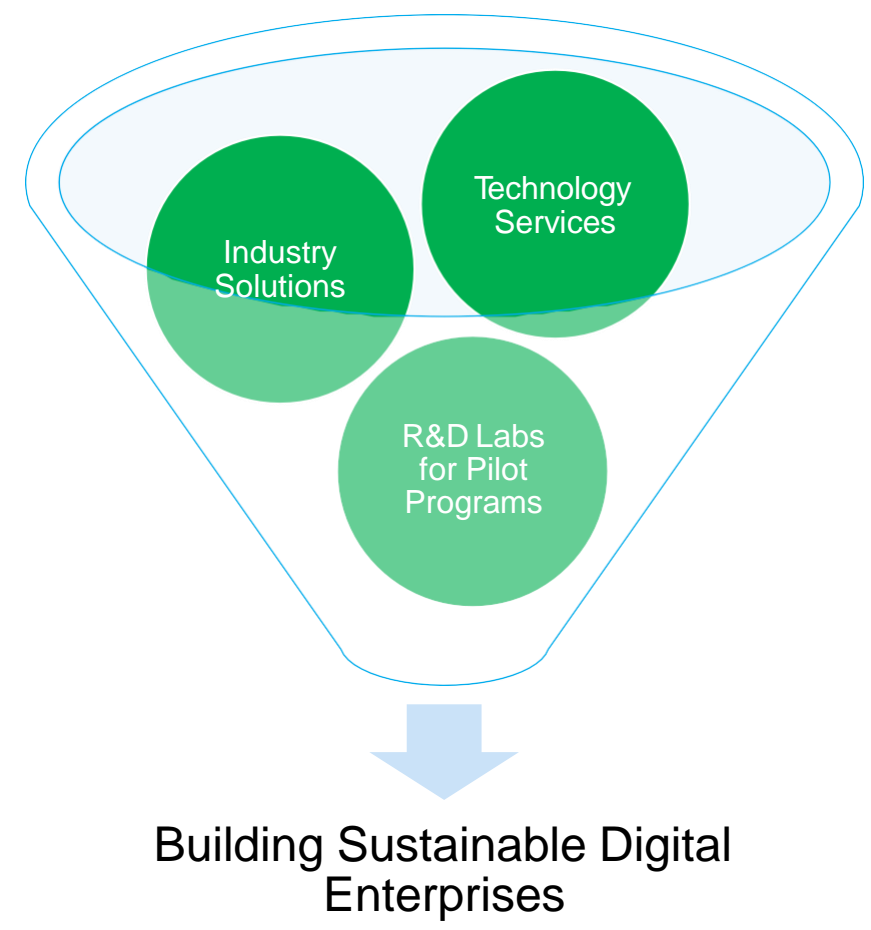
DISCOVERY PROJECTS

<p>Data & Analytics</p> <p>Sample Use Cases</p> <ul style="list-style-type: none"> ▪ Internal & External supplier data used for process ▪ Predictive Maintenance ▪ Data used between processes ▪ Machine & process data used for statistics & quality analysis 	<p>Process Automation</p> <p>Sample Use Cases</p> <ul style="list-style-type: none"> ▪ Automatic downtime response ▪ Automatic changeover ▪ Automated assembly ▪ Auto-adjust based on data ▪ Automated inspections 	<p>Material Flow</p> <p>Sample Use Cases</p> <ul style="list-style-type: none"> ▪ Automatic machine loading ▪ Automated component feeding ▪ Automated finished good conveyance ▪ Digital Material Replenishment ▪ Automated palletizing 	<p>Physical to Digital</p> <p>Sample Use Cases</p> <ul style="list-style-type: none"> ▪ AR Operator training support ▪ Electronic Work Instructions ▪ Electronic Performance Dashboard ▪ Mobile checklist ▪ Product and Process tracking
<p>Benefits</p> <ul style="list-style-type: none"> ▪ Improved Quality ▪ Improved OEE ▪ Material Usage & Reduced Scrap ▪ Traceability 	<p>Benefits</p> <ul style="list-style-type: none"> ▪ Labor Efficiency ▪ Reduce Scrap & Downtime ▪ Improved Quality 	<p>Benefits</p> <ul style="list-style-type: none"> ▪ Labor Efficiency ▪ Material Utilization 	<p>Benefits</p> <ul style="list-style-type: none"> ▪ Reduce Manual Reporting Time ▪ Improve Quality & Traceability ▪ Reduced Time For Training

IT-OT ENGAGEMENTS

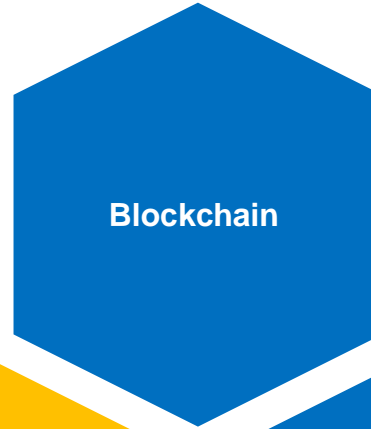
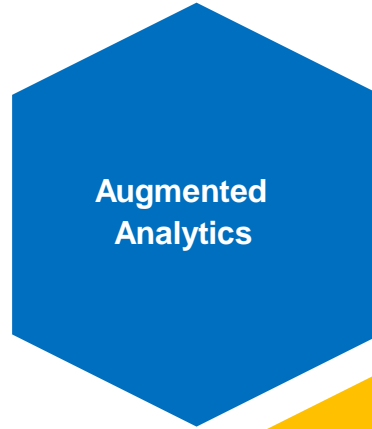


MANAGING OPERATIONS



INDUSTRY 4.0 PROJECTS

- E&P Analytics Workbench
- Upstream Data Analyzer (UDA) for NPT Reduction
- AI enabled EOR (Enhanced Oil Recovery) & Production Decline



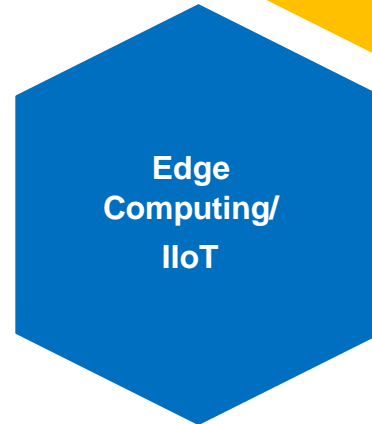
- Gas Management for Pipeline Firms
- LSTK (Lump Sum Turn Key)/EPC Projects Management

Industry 4.0 Projects which can be leveraged by Manufacturing Enterprises



- Predicting Pipeline Integrity from Cybersecurity Incidents
- Identity and Access Management

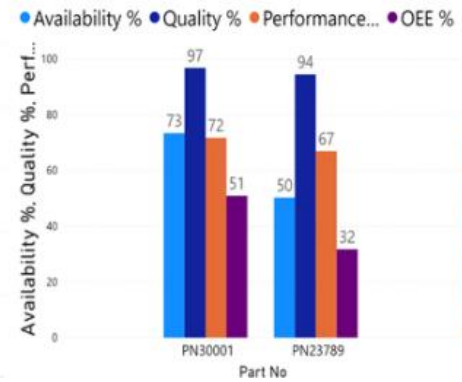
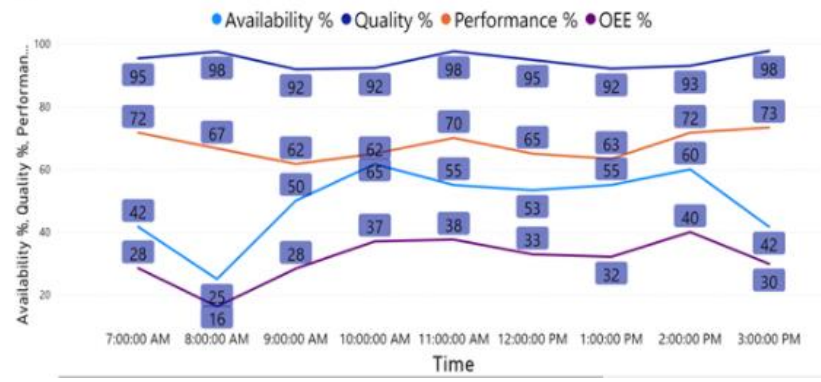
- Refinery Plant's Alerts Events Forecasting
- Process Historian Analytics



- External and Internal Corrosion Analysis for Pipeline
- Prediction of Defects from variance analysis on produced items vs design specs

OPERATIONAL MANAGEMENT - OEE

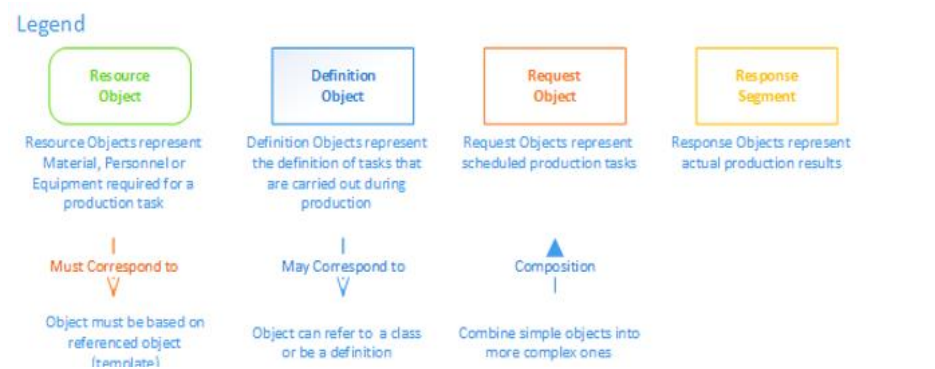
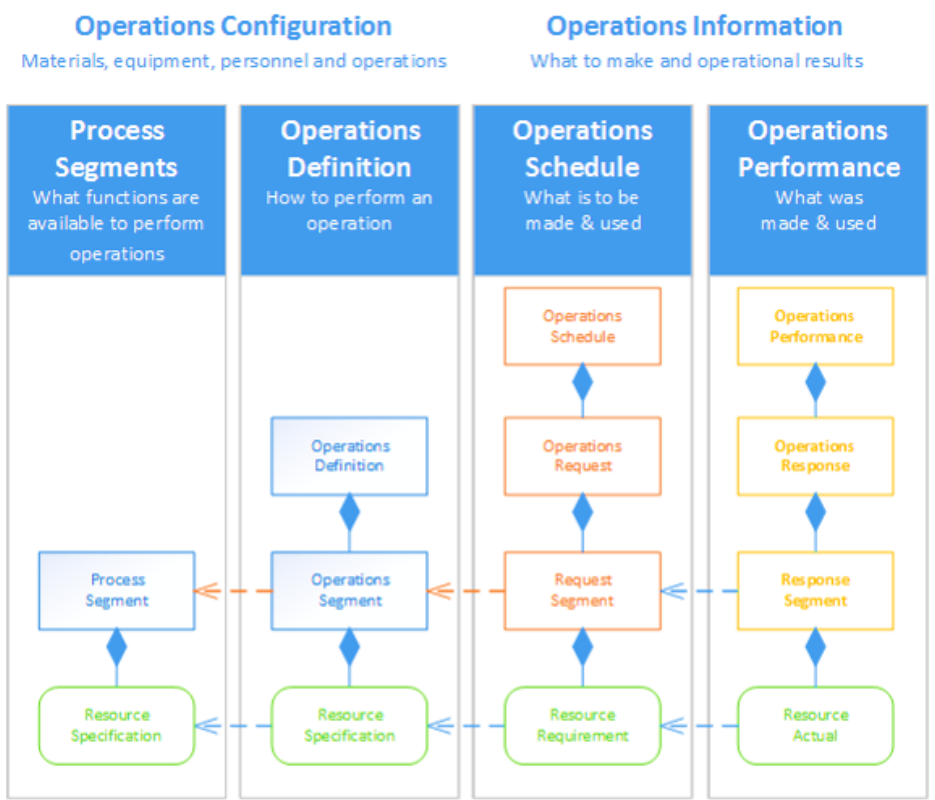
Operator Name				M/C No		Part No		TIME								
All				All		All		All								
Operator Name	Year	Month	Time	M/c No	Part No	Total Downtime	Setup Time	Total Break	Possible Production time	Actual Production Time	Production Qty	Rejected Qty	Availability %	Quality %	Performance %	OEE %
Raguram	2020	September	7:00:00 AM	MC1001	PN23789	20	15	35	60	25	43	2	41.67	95.35	71.67	28.72
Raguram	2020	September	8:00:00 AM	MC1001	PN23789	25	20	45	60	15	40	1	25.00	97.50	66.67	14.29
Raguram	2020	September	9:00:00 AM	MC1001	PN23789	30	0	30	60	30	37	3	50.00	91.89	61.67	26.32
Raguram	2020	September	10:00:00 AM	MC1001	PN23789	23	0	23	60	37	39	3	61.67	92.31	65.00	31.25
Raguram	2020	September	11:00:00 AM	MC1001	PN23789	27	0	27	60	33	42	1	55.00	97.62	70.00	37.50
Raguram	2020	September	12:00:00 PM	MC1001	PN23789	28	0	28	60	32	39	2	53.33	94.87	65.00	31.25
Raguram	2020	September	1:00:00 PM	MC1001	PN23789	27	0	27	60	33	38	3	55.00	92.11	63.33	31.25
Raguram	2020	September	2:00:00 PM	MC1001	PN23789	24	0	24	60	36	43	3	60.00	93.02	71.67	40.00
Raguram	2020	September	3:00:00 PM	MC2001	PN30001	20	15	35	60	25	44	1	41.67	97.73	73.33	29.17
Raguram	2020	September	4:00:00 PM	MC2001	PN30001	10	15	25	60	35	39	2	58.33	94.87	65.00	31.25
Raguram	2020	September	5:00:00 PM	MC2001	PN30001	5	0	5	60	55	45	1	91.67	97.78	75.00	62.50
Total						254		319	780	461			59.10	95.34	68.72	38.72



Idle-Reason	PN23789	PN30001	Total
M/cDown	28	10	38
No Material	47	30	77
NoAir	25	5	30
NoOil	23	0	23
NoPower	24	0	24
Waiting	57	5	62
Total	204	50	254

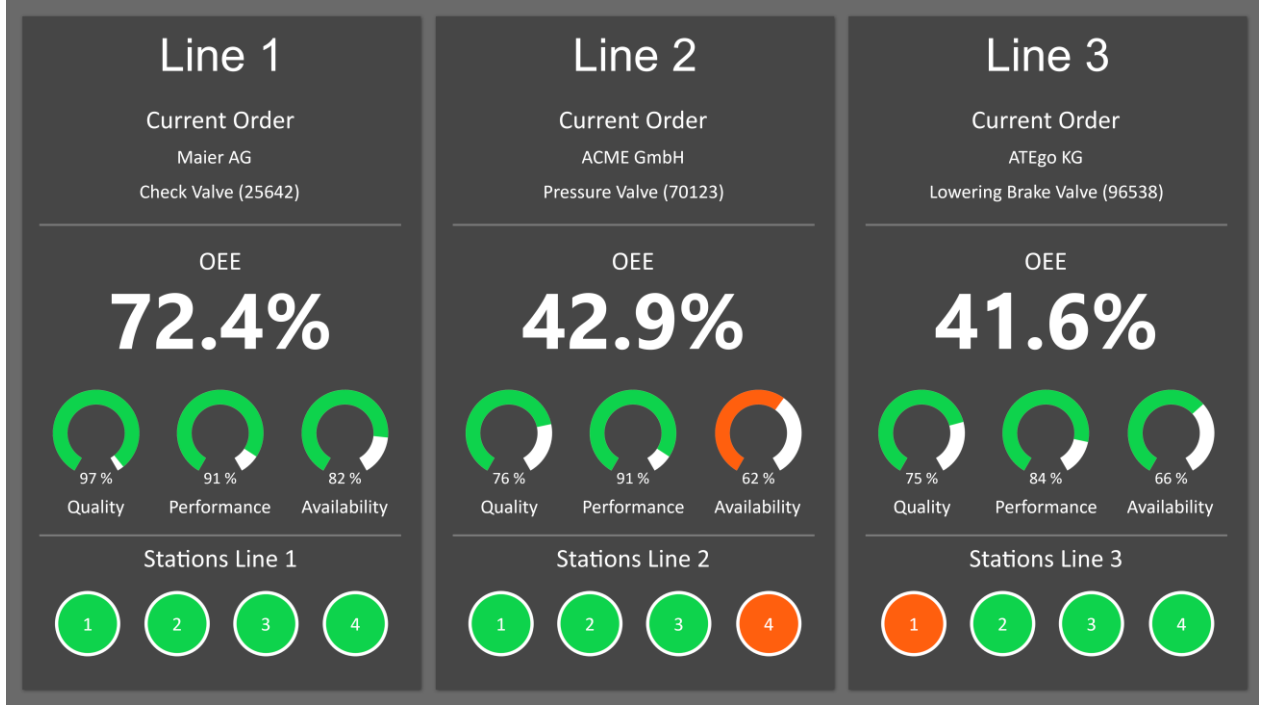
- ✓ Real-time dashboard shows availability, quality, and productivity by Machine, Product, Order, Shift, & Operator
- ✓ Supports OEE analytics for trends/outliers, forecasts by Machine, Product, Order, Shift, and Operator between any production period
- ✓ Supports MT Connect apps using MT agents to analyze machine /component health status

COMPLIANCE TO ISA 95 - OEE



OEE Factor	Six Big Losses
Availability	<ul style="list-style-type: none"> • Breakdowns (e.g. equipment failure, tooling failure, unplanned maintenance) • Setup and Adjustments (e.g. changeover, material shortage, warm-up time)
Performance	<ul style="list-style-type: none"> • Reduced Speed (e.g. rough running, equipment wear, operator inefficiency, incorrect settings) • Small Stops (e.g. obstructed flow, jam, misfeed, sensor blocked, cleaning, checking)
Quality	<ul style="list-style-type: none"> • Startup Rejects (scrap, rework, in process damage, incorrect assembly) • Production Rejects (same as above; but during steady-state production)

OEE MONITORING & COUNTERMEASURES

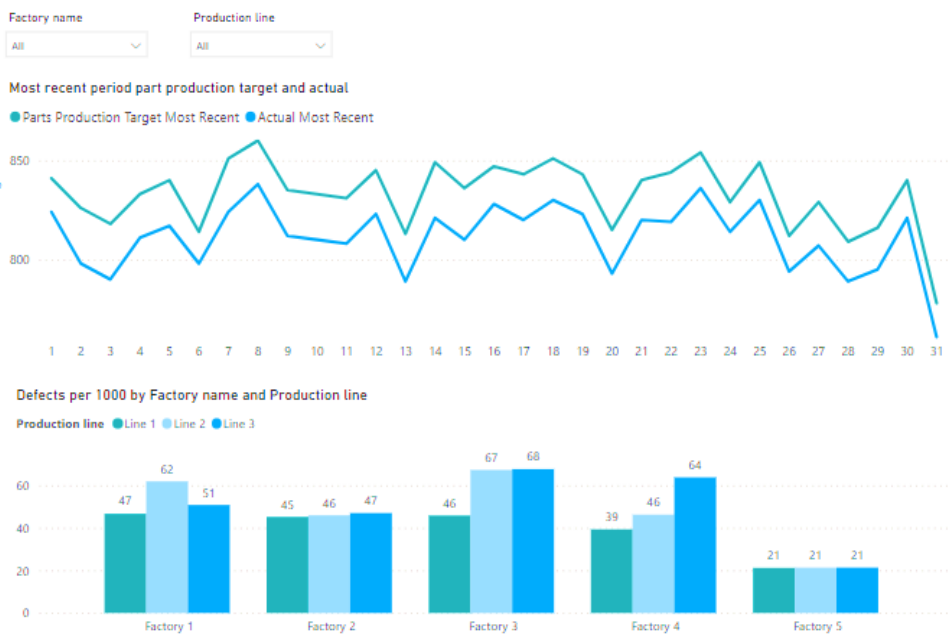
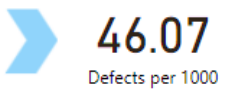
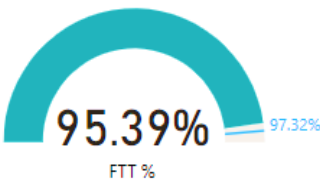


AVAILABILITY	PERFORMANCE	QUALITY
<p>PLANNED DOWNTIME / EXT. UNPLANNED</p> <p>Reason for Loss</p> <ul style="list-style-type: none"> • Changeovers • Planned maintenance • Material shortages • Labour shortages <p>Countermeasures</p> <ul style="list-style-type: none"> • Planned Downtime Management • 5S Workplace Organisation • ABC Planning 	<p>MINOR STOP LOSS</p> <p>Reason for Loss</p> <ul style="list-style-type: none"> • Fallen product • Obstruction • Blockages • Misalignment <p>Countermeasures</p> <ul style="list-style-type: none"> • IFA Opportunity Analysis • 5S Workplace Organisation • Management Routines (SIC) • Line Minor stop audits 	<p>REJECTS ON STARTUP</p> <p>Reason for Loss</p> <ul style="list-style-type: none"> • Product out of specification at start of run • Scrap created before nominal running after changeover • Damaged product after planned maintenance activity <p>Countermeasures</p> <ul style="list-style-type: none"> • Planned Downtime Management • 5S Workplace Organisation • Standard Operating Procedures • Precision settings
<p>BREAKDOWN LOSS</p> <p>Reason for Loss</p> <ul style="list-style-type: none"> • Equipment failure • Major component failure • Unplanned maintenance <p>Countermeasures</p> <ul style="list-style-type: none"> • Kaizen Blitz • ProACT • Root cause analysis • Asset Care 	<p>SPEED LOSS</p> <p>Reason for Loss</p> <ul style="list-style-type: none"> • Running lower than rated speed • Untrained operator not able to run at nominal speed • Misalignment <p>Countermeasures</p> <ul style="list-style-type: none"> • IFA Opportunity Analysis • Line Balance Optimisation • Management Routines (SIC) 	<p>PRODUCTION REJECTS</p> <p>Reason for Loss</p> <ul style="list-style-type: none"> • Product out of specification • Damaged product • Scrap <p>Countermeasures</p> <ul style="list-style-type: none"> • IFA Opportunity Analysis • Six Sigma • Error proofing

OEE ANALYTICS



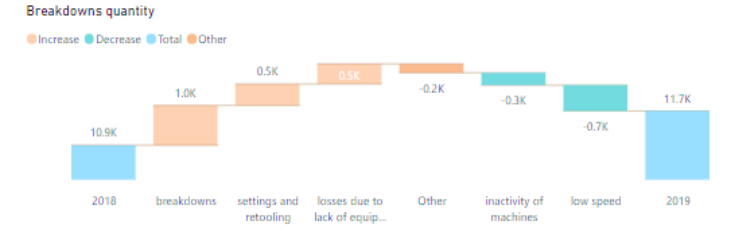
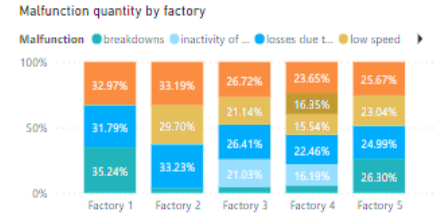
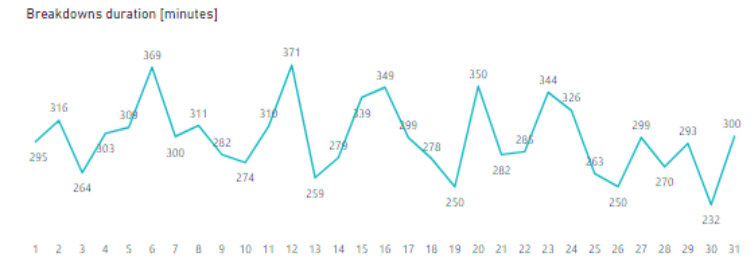
Productivity analysis



Malfunction analysis

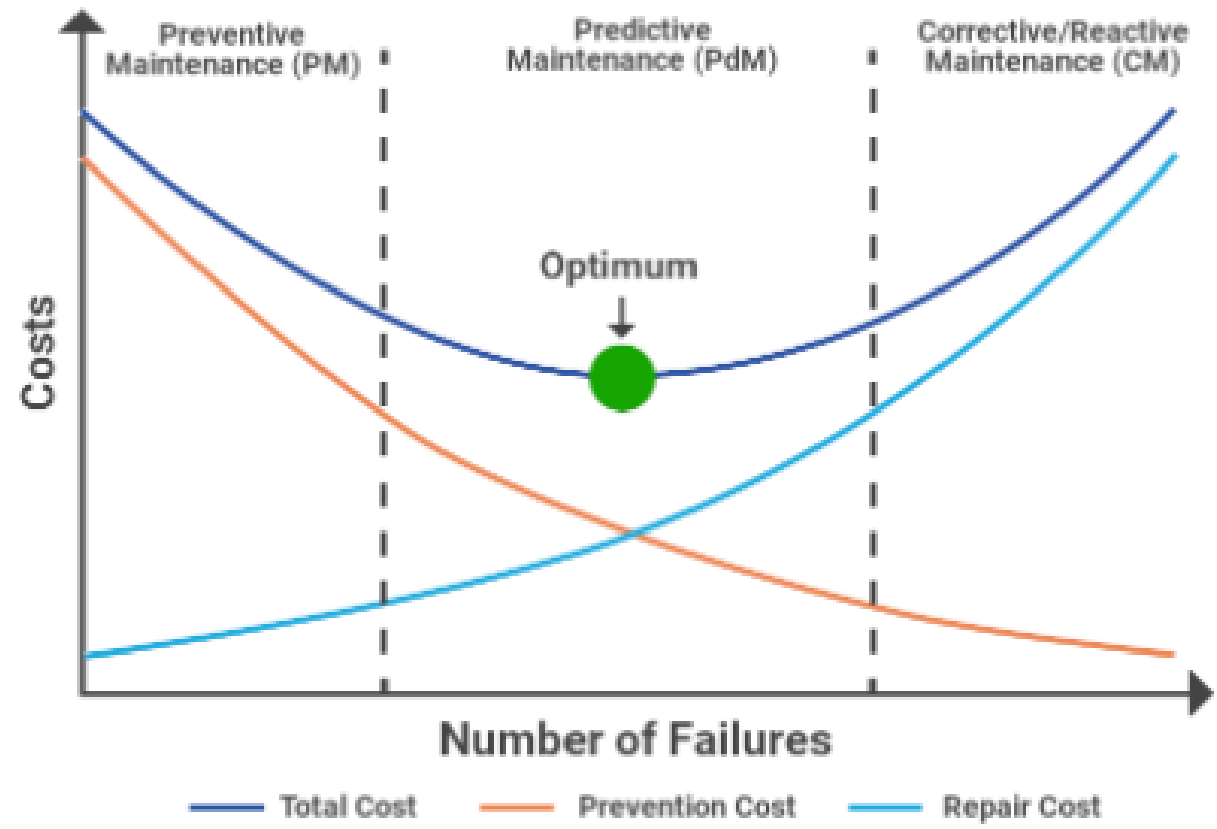
Defects: 42158 units

Duration of breakdowns: 234 Days, 4 Hours and 26 Minutes

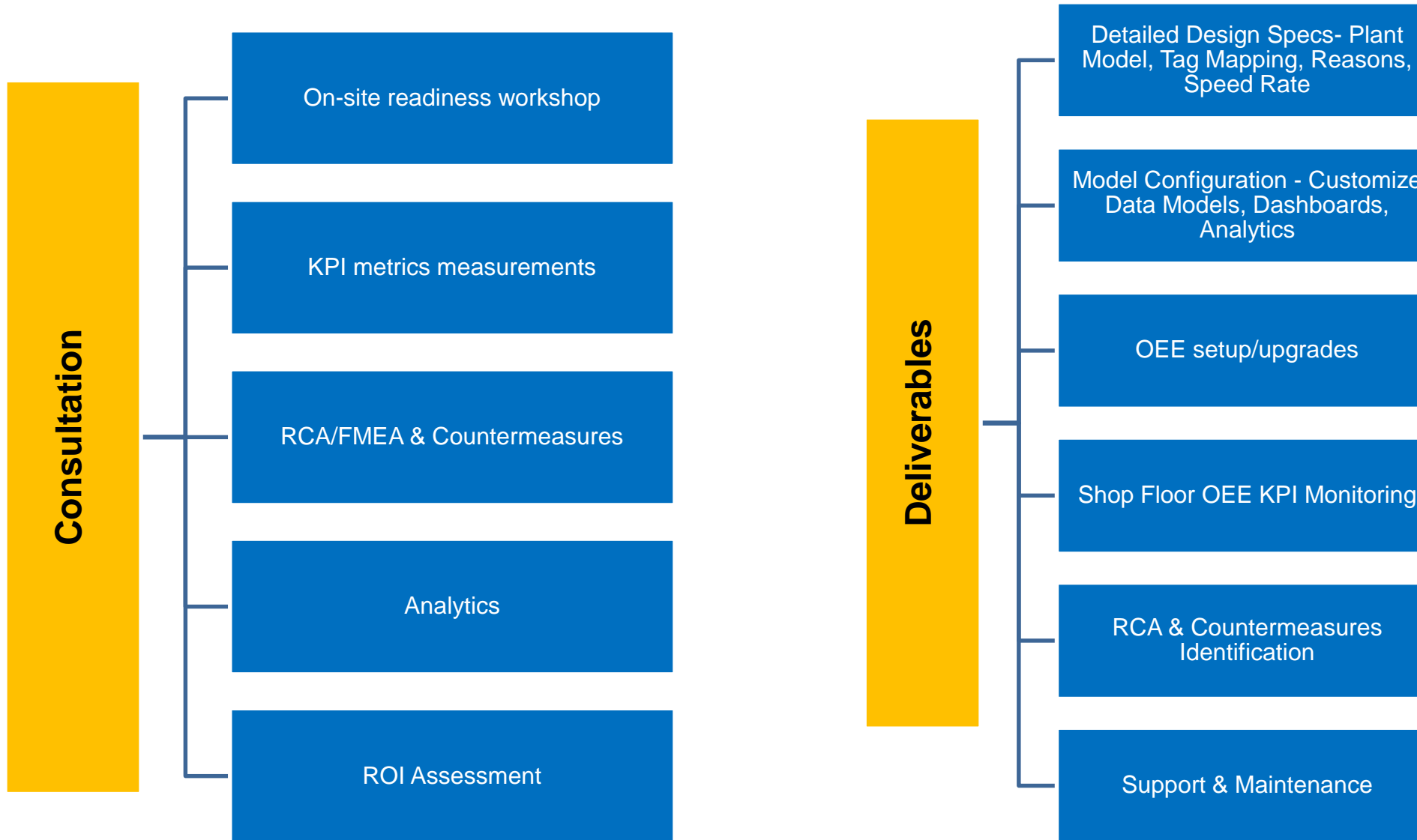


OEE VALUE ADDS

Machine Maintenance Optimization



OEE ENGAGEMENT DELIVERABLES



Thank You

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