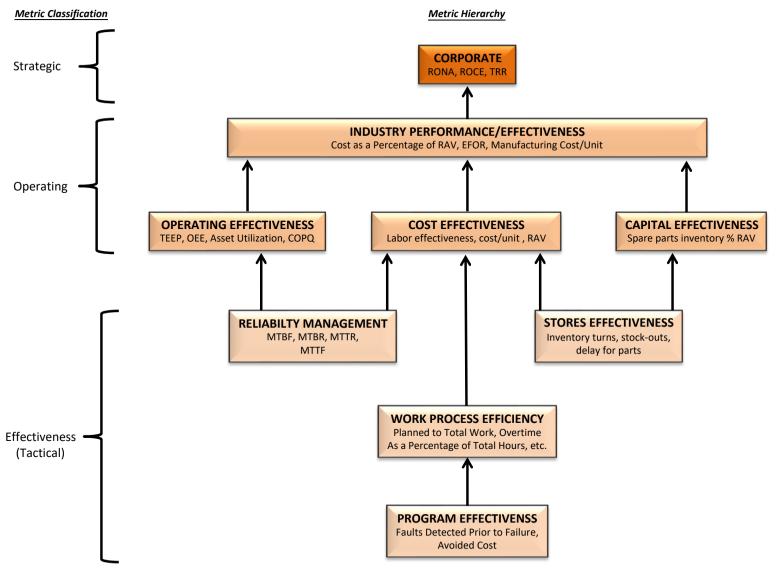
METRIC HIERARCHY DISCUSSION

BY: RICKY SMITH, CMRP, CMRT, CRL & PAUL DUFRESNE









Ref. The Physical Asset Management Handbook 4thEdition John S. Mitchell







SMRP Metrics

Pillar 1 -Business and Management

- 1.1 -Ratio of Replacement Asset Value (RAV) to Craft-Wage Head Count
- 1.2 -Maintenance Unit Cost
- 1.3 -Stocked Maintenance, Repair, and Operating (MRO) Inventory Value as a Percent of Replacement Value
- 1.4 -Total Maintenance Cost as a Percent of Replacement Asset Value (RAV)

Pillar 2 - Manufacturing Process Reliability

- 2.1.1 -Overall Equipment Effectiveness (OEE)
- 2.1.2 -Total Effective Equipment Performance (TEEP)
- 2.2 -Availability
- 2.3 -Uptime
- 2.4 -Idle Time
- 2.5 -Utilization Time

Pillar 3 -Equipment Reliability

- 3.1 -Systems Covered by Criticality Analysis
- 3.2 -Total Downtime
- 3.3 -Schedule Downtime
- 3.4 -Unscheduled Downtime
- 3.5.1 -Systems Covered by Criticality Analysis
- 3.5.2 -Mean Time Between Failures (MTBF)
- 3.5.3 -Mean Time to Repair or Replace (MTTR)
- 3.5.4 -Mean Downtime (MDT)
- 3.5.5 Mean Time to Failure (MTTF)

Pillar 4 -Organization and Leadership

- 4.1 -Rework
- 4.2.1 Maintenance Training Cost
- 4.2.2 Maintenance Training Hours
- 4.2.3 Maintenance Training Return of Investment (ROI)

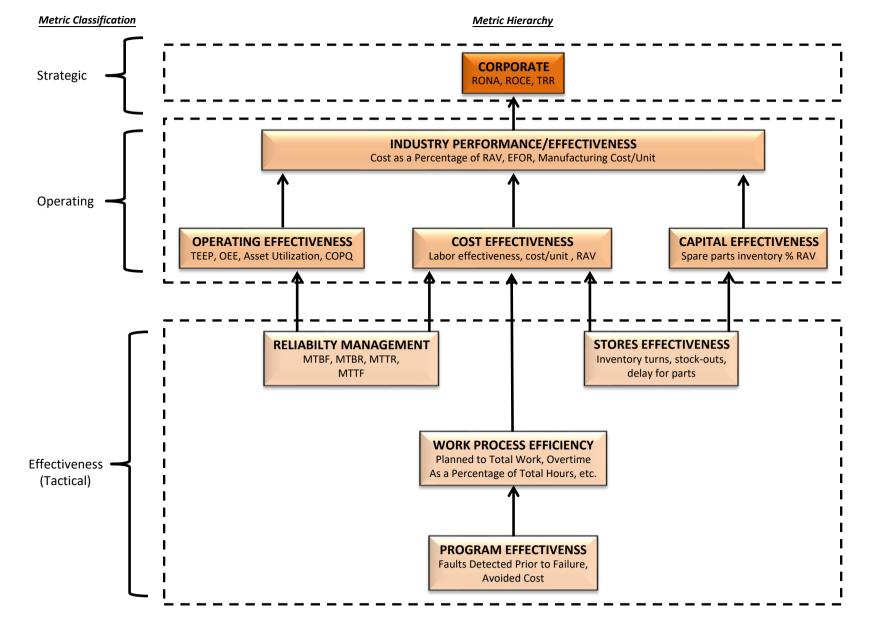
Pillar 5 -Work Management

- 5.1.1 -Corrective Maintenance Cost
- 5.1.2 -Corrective Maintenance Hours
- 5.1.3 -Preventive Maintenance Cost
- 5.1.4 -Preventive Maintenance Hours
- 5.1.5 -Conditioned Based Maintenance Cost
- 5.1.6 -Condition Based Maintenance Hours
- 5.1.9 Maintenance Shutdown Costs
- 5.3.1 -Planned Work
- 5.3.2 -Unplanned Work
- 5.3.3 -Actual Cost to Planning Estimate
- 5.3.4 -Actual Hours to Planning Estimate
- 5.3.5 -Planning Variance Index
- 5.3.6 -Planner Productivity
- 5 4 1 -Reactive Work
- 5.4.2 -Proactive Work
- 5.4.3 -Schedule Compliance Hours
- 5.4.4 -Schedule Compliance Work Orders
- 5.4.5 -Standing Work Orders
- 5.4.6 -Work Order Aging
- 5.4.7 -Work Order Cycle Time
- 5.4.8 -Planned Backlog
- 5.4.9 -Ready Backlog
- 5.4.11 Preventive Maintenance (PM) & Predictive Maintenance (PdM) Work Orders Overdue
- 5.4.12 -PM & PdM Yield
- 5.4.14 -PM & PdM Compliance
- 5.5.1 -Craft Worker to Supervisor Ratio
- 5.5.2 -Craft Worker to Planner Ratio
- 5.5.3 -Direct to Indirect Maintenance Personnel Ratio
- 5.5.4 -Indirect Maintenance Personnel Cost
- 5.5.5 -Infernal Maintenance Personnel Cost
- 5.5.6 -Craft Workers on Shift Ratio
- 5.5.7 -Overtime Maintenance Cost
- 5.5.8 -Overtime Maintenance Hours
- 5.5.31 -Store Inventory Turns
- 5.5.32 -Vendor Managed Inventory
- 5.5.33 -Stock Outs
- 5.5.34 -Inactive Stocks
- 5.5.35 -Storeroom Transactions
- 5.5.36 -Storeroom Records
- 5.5.38 Maintenance Material Cost
- 5.5.71 -Contractor Cost
- 5.5.72 -Contractor Hours
- 5.6.1 -Wrench Time
- 5.7.1 -Continuous Improvement Hours









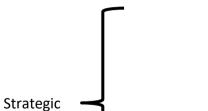






Metric Classification

Metric Hierarchy





Strategic Corporate Metrics:

- •Return on Net Assets (RONA)
- •Return on Capital Expended (ROCE)
- •Return on Assets (ROA)
- •Return on Active Capital Employed (ROACE)
- •Return on Average Assets (ROAA)
- •Return on Invested Capital (ROIC)
- •True Reject Rate (TRR)







Metric Hierarchy

INDUSTRY PERFORMANCE/EFFECTIVENESS

Cost as a Percentage of RAV, EFOR, Manufacturing Cost/Unit

Industry Performance/Effectiveness Metrics:

- 1.1 Ratio of Replacement Asset Value (RAV) to Craft-Wage Head Count
- 1.2 Maintenance Unit Cost
- 1.4 Total Maintenance Cost as a Percent of Replacement Asset Value (RAV)



OPERATING EFFECTIVENESS

TEEP, OEE, Asset Utilization, COPQ

Operating

Effectiveness

Operating Metrics:

•2.1.1 Overall

Equipment Effectiveness (OEE)

- •2.1.2 Total Effective Equipment Performance (TEEP)
- •2.2 Availability
- •2.3 Uptime
- •2.4 Idle Time
- •2.5 Utilization Time

COST EFFECTIVENESS

Labor effectiveness, cost/unit, RAV

Cost Effectiveness Metrics:

- •1.2 Maintenance Unit Cost
- •1.4 Total Maintenance Cost as a Percent of Replacement Asset Value (RAV)
- •5.1.1 Corrective Maintenance Cost
- •5.1.2 Corrective Maintenance Hours
- •5.1.3 Preventive Maintenance Cost
- •5.1.4 Preventive Maintenance Hours
- •5.1.5 Condition Based Maintenance

Cost

- •5.1.6 Condition Based Maintenance Hours
- •5.1.9 Maintenance Shutdown Cost
- •5.5.4 Indirect Maintenance

Personnel Cost

- •5.5.5 Internal Maintenance
- Personnel Cost
- •5.5.7 Overtime Maintenance Cost



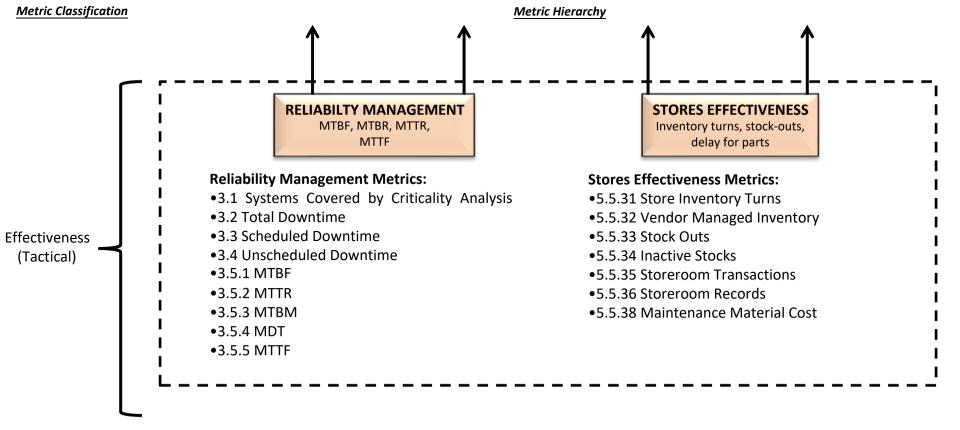
Capital Effectiveness Metrics:

 1.3 Stocked Maintenance, Repair, and Operating (MRO) Inventory as a Percent of Replacement Value















Effectiveness .

(Tactical)

Continued

WORK PROCESS EFFICIENCY

Planned to Total Work, Overtime As a Percentage of Total Hours, etc.

Work Process Efficiency Metrics: Work Process Efficiency Metrics:

- •5.3.1 Planned Work •5.4.8 Planned Backlog
- •5.3.2 Unplanned Work •5.4.9 Ready Backlog
- •5.3.3 Actual Cost to Planning Estimate •5.4.11 PM & PdM Work Orders Overdue •5.3.4 Actual Hours to Planning Estimate •5.4.12 PM & PdM Yield
- •5.3.5 Standing Work Orders •5.4.14 PM & PdM Compliance
- •5.3.6 Planner Productivity•5.5.1 Craft Worker to Supervisor Ratio •5.4.1 Reactive Work•5.5.2 Craft Worker to Planner Ratio
- •5.4.2 Proactive Work•

5.5.3 Direct to Indirect Maint Personnel Ratio

- •5.4.3 Schedule Compliance Hours•5.5.4 Indirect Maintenance Personnel Cost •5.4.4 Schedule Compliance Work Orders•5.5.5 Internal Maintenance Personnel Cost •5.4.5 Standing Work Orders•5.5.6 Craft Workers on Shift Ratio
- •5.4.6 Work Order Aging •5.5.7 Overtime Maintenance Cost
- •5.4.7 Work Order Cycle Time •5.5.8 Overtime Maintenance Hours

PROGRAM EFFECTIVENSS

Faults Detected Prior to Failure, Avoided Cost

Program Effectiveness Metrics:

- •4.1 Rework
- •4.2.1 Maintenance Training Cost
- •4.2.2 Maintenance Training Hours
- •4.2.3 Maintenance Training Return on Investment ROI)

Program Effectiveness Metrics:

- •5.6.1 Wrench Time
- •5.7.1 Continuous Improvement Hours









#1 Software for Maintenance

& Reliability Teams

UpKeep is a service-first company that builds software designed to make maintenance easier for technicians and managers everywhere. Reduce downtime up to 18% by switching over to a preventative maintenance solution!

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Our Products



Mobile-first maintenance management and collaboration across all location, assets, and teams

"With nearly 340 different machines in our work environment, it's an impossible task to manually assign and track PM's. With UpKeep we can schedule regular maintenance without overlapping tasks with other critical jobs."

★ ★ ★ ★ Paul D, Health and Safety Coordinator



An end-to-end solution for remote condition-based monitoring

Connected and secure IoT sensors for real-time remote condition asset monitoring





Integrated & Centralized Data Ecosystem for World Class Asset Operations

The only purpose built Asset Data Platform. Asset Focused ELT Solution for advanced analytics and integrated, real-time asset data.



The Maintenance Community Coalition was founded on the belief that working together will benefit everyone within our community

www.upkeep.com

Committed to helping each other thrive in our individual professional journeys by sharing resources and expertise, granting scholarships, hosting events, and unlocking knowledge – always at no cost.

♠ UpKi	nep V	Work Orders						
Wyrk Orders		□ 00 🖰 Q Search 4 Work Orders						
Preventive Mains Analytics	enance	$\boxed{\boxplus} \boxed{\textcircled{\otimes} \ Everyone} \boxed{\textcircled{\otimes} \ Anywhere} \boxed{\textcircled{\otimes} \ Any Day} \boxed{\textcircled{\otimes} \ Any Status} \boxed{\textcircled{\otimes} \ Any Priority} \boxed{\textcircled{\square}} \ Bookmarked$						
		Due v	Status	Work Order Title	Priority	Assignment)	Location	Asset(s)
(i) Locations (ii) Assets	0	41420	O Open	Broken light	High	*	8449 N. Green Court Pasadena	Light bulb
Parts & Inventory Purchase Orders	c	4/13/20	O Open	Fix the HVAC unit in quad	Med	45	6 Vernon Ave. Woodhaven	HVAC #5
② Meters № People & Teams ③ Vendors & Custor		4/12/20	• in Progress	Change forklift oil	Low	6	8051 Lexington St. Manchester	Forklift - Back Roos
∰ Categories ☐ Files		4/11/20	in Progress	Grease oil bearings	Low		425 Proctor Lane Tuscaloosa	AC Motor
€ Back	Monthly Pres	0	Open	Broken gate	High	466	9655 North Taylor St. Latrobe	Front Gate
Main	Medium priority 28, 2022 at 10.18 AM	remove	Dn Hold	Clean the lobby windows	Low	•	4 SW. Boston Drive Fort Myers	
O 0		0	Complete	Clean the lobby windows	Low	•	8051 Lexington St. Manchester	
(F. Monthly	escription HVAC preventative m By for AC function	uirtenance,	Complete	Clean the lobby windows	Low	•	8051 Lexington St. Manchester	
Extension Suite 8			Open	Broken gate	High	456	9655 North Taylor St. Latrobe	Front Gate
Asset TRANE Brooks	HVAC Suite B 17621414569							
	Start Wor	king						