

Maximizing Maintenance Operations for Profit Optimization: The Journey to Maintenance Excellence

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**Establishing a Strategy for Profit-Centered Maintenance
By
The Maintenance Excellence Institute**

Division of Ralph W. Peters and PEOPLE Inc.

Part V: Validating Results with Your Maintenance Excellence Index

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Introduction: Maximizing maintenance for profit optimization is the goal is not a report with evaluation details from *The Scoreboard for Maintenance Excellence* neatly bound in a report. The goal is successful implementation of prioritized improvement opportunities from the evaluation and to help improve all internal resources do a better job for the tenant/customer. Doing a better job for the internal customer also means support to profit optimization. Part V ties in closely with Part IV to introduce the third benchmarking tool from this series, *The Maintenance Excellence Index*. As a result of applying all benchmarking tools in this proven approach from The Maintenance Excellence Institute, the journey to Maintenance Excellence is well underway with three essential tools to measure results and long term contribution to profit:

1. *The Scoreboard for Maintenance Excellence* for Maximizing Overall Best Practices
2. *The CMMS Benchmarking System* for Optimizing Your IT Investment
3. *Maintenance Excellence Index (MEI)* for Validating Bottom Line Results

This section covers the process of defining and gaining consensus on very specific key performance indicators related to the total maintenance operation. It covers a recommended set of internal benchmarks or metrics for today's facilities leader, the purpose for each, where they traditionally can be found in the CMMS (or financial system), how to calculate each one and how to determine your current baseline. Each element for a developing and calculating your own MEI is covered. Most important this section recommends an attainable performance goal and how your own uniquely developed *Maintenance Excellence Index* will validate results and ROI for Maintenance operations.

Develop Method to Measure and Validate Results: This topic is last but it must be foremost in our minds as we begin the benchmark evaluation of physical asset management and the maintenance process. Each of the 300 evaluation items on *The Scoreboard for Maintenance Excellence* must be viewed in terms of whether or not there are tangible or intangible benefits possible. If we are able to make improvements that generate benefits and can we measure them? Often performance measurement is something new to the in-house maintenance operation, but we highly recommend that a performance measurement system be put in place. Contract maintenance providers understand the value of measurement so that their customers clearly see value added services received. Justification for investments in maintenance best practices for in house maintenance operations must be validated. If you maintenance operation was a third party contract maintenance provider you would expect a profit. So we too must measure and validate results from internal maintenance improvement.

Initiate a Maintenance Excellence Index: Our approach has been to help clients create a Maintenance Excellence Index (MEI) that includes 10 to 15 key performance indicators with agreed upon weighted values. These metrics are then used to provide a one page Excel spreadsheet that brings them all together into a composite Total MEI Performance Value, an index of how all resources are contributing to your part of profit optimization. The metrics selected should be applicable to the specific organization. For example, a pure facilities maintenance operation without critical production or operations equipment to maintain would not use OEE as part its MEI to measure Overall Equipment Effectiveness a world-class metric best suited to a small number of mission essential critical assets within a production operations. The following section provides a review of 21 key metrics that should be considered. These 21 metrics encompass the measurement of all key resources necessary for effective physical asset management;

- People resources and craft labor
- Dollar resources and overall budget dollars from both maintenance and the customer
- MRO material resources
- Planning resources and customer service
- The physical asset as a key resource, its uptime, availability and reliability to perform its function
- Information resources and how data become true information via effective CMMS

Potential Performance Metrics for Using on a Maintenance Excellence Index (MEI)

<u>No.</u>	<u>Performance Metric, Purpose and Data Source</u>	<u>Goal</u>	<u>How to Calculate Metric</u>
1.	% Overall Maintenance Budget Compliance: To evaluate management of \$ assets; <i>Obtained from monthly financials</i>	98%	Traditional Budget Variance =/- % Variance to Actual Planned Budget
2.	Actual Maintenance Cost per Unit of Production: To evaluate/benchmark actual costs against stated goals/baselines or against industry standards; <i>Obtained from asset records and monthly CMMS WO file of completed WOs for the month. Obtained from production results and financial report. Provides ideal support to ABC Costing practices</i>	TBD	Total Maintenance Materials and Labor per reporting period ÷ Total Units produced Note: Production units could also be expressed in equivalent standard hours if traditional standard cost system is being used
3.	% Customer or Capital Funded Jobs Completed as Scheduled and within +/- 5% of Cost Estimate: To measure customer service & \$ assets plus planning effectiveness; <i>Obtained from funded WO types from the CMMS WO files, comparing date promised to date completed and estimated cost to actual cost</i>	98%	Total # of Customer or Capital Funded Jobs Completed as Scheduled within Budget Variance Goal ÷ Total # of Customer or capital Funded Jobs Completed
4.	% Other Planned Work Orders Completed as Scheduled: To measure customer service and planning effectiveness; <i>Obtained from a query of all planned WO types in CMMS WO files and comparing date promised to date completed. Could be expressed in % based on craft hours.</i>	95%	Total # of Planned Jobs Completed as Scheduled within Time Variance Goal ÷ Total # of Planned Jobs completed (Typically higher priority jobs where customer was given a promised completed date, not PM work which is planned)

<u>No.</u>	<u>Performance Metric, Purpose and Data Source (cont)</u>	<u>Goal</u>	<u>How to Calculate Metric</u>
5.	Schedule Compliance: To evaluate how effectiveness scheduling was in regards to executing to meet scheduled dates/time; <i>Obtained from query of CMMS completed WO file where all scheduled jobs coded and their actual completion compared to actual planned completion date/time</i>	95%	Total Scheduled Jobs Completed as Per the Schedule ÷ Total Jobs Scheduled
6.	% Planned Work Orders versus % True Emergency Work Orders: To evaluate positive impact of PM, planning processes and other proactive improvement initiatives (CRI./RCM/etc); <i>Obtained from a query of all true emergency WO types in CMMS WO files and comparing to total WOs completed. Could be expressed in % based on craft hours.</i>	80% to 85% Planned	Total Emergency Type WOs Completed ÷ Total WOs Completed Per Reporting Period (could be expressed as % also using craft hours)
7.	% Craft Time to Work Order for Customer Charge Back: To monitor craft resource Accountability for Internal Revenue Generation (or External); <i>Obtained from a query of all WO types in CMMS WO files that are charged back comparing these craft hours to total craft hours paid</i>	85%	Total Craft Hours for All Work Charged Back to Customer ÷ Total Craft Hours Paid for Reporting Period
8.	% Craft Time to Work Orders: To monitor overall craft resource accountability and to support internal revenue generation ; <i>Obtained from a query of all WO types in CMMS WO files and summation of actual craft hours</i>	100%	Total Craft Hours Charged to All Work Order Types (Including Standing WOs) ÷ Total Craft Hours Paid for Reporting Period
9.	% Craft Utilization (Actual Wrench Time): To maximize craft resources for productive, value-adding work and to evaluate effectiveness of planning process; <i>Obtained from a query of all craft hours reported to non craft work from CMMS time keeping WO files and summation of actual craft hours</i>	60% to 70%	Total Craft Hours of Pure Wrench Time Charged to All Work Order Types minus Total Time to Non Wrench Time Standing WO Types) ÷ Total Craft Hours Paid for Reporting Period
10.	% Craft Performance (Against reliable estimates for PM and planned work): To maximize craft resources, to evaluate planning effectiveness and also to determine training ROI; <i>Obtained from completed WO file in CMMS</i>	95%	Total Actual Craft Hours Charged to Completed WOs With Planned Times ÷ The Total Planned Time from the WOs Having Planned Times
11.	Craft Quality and Service Level: To evaluate quality and service level of repair work as defined by customer; <i>Obtained from WO file in CMMS where all call backs are tracked and monitored via work control and planning processes</i>	95%	100% - Total # Call Backs/Etc ÷ Total Number of WOs Completed Per Reporting Period

<u>No.</u>	<u>Performance Metric, Purpose and Data Source (cont)</u>	<u>Goal</u>	<u>How to Calculate Metric</u>
12.	Overall Craft Effectiveness (OCE): To evaluate cumulative positive impact of overall improvements to Craft Utilization(CU), Craft Performance (CP) and Craft Quality and Service Excellence (CQSE) in combination; <i>Obtained from using results of measuring all three OCE Factors: a) Craft Utilization, b) Craft Performance and c) Craft Quality and Service Excellence</i>	65%	OCE = % CU x % CP x % CQSE Where: CU = 70%....a Realistic Maximum CP = 95%....plus is Achievable CQSE = 95%....plus is Achievable Therefore: OCE = .70 x .95 x .95 = .632 <u>≅ 65%</u>
13.	% Work Orders with Reliable Planned Times: To measure planner's effectiveness at developing reliable planning times; <i>Obtained from completed WO file in CMMS where panning times are being established for as many jobs as possible by planner/supervisor</i>	60 %	# Work Orders with Reliable Planned Times ÷ Total Number of WOs Completed Per Reporting Period
14.	% Overall Preventive Maintenance Compliance (Could be by type asset, production department/location or by supervisory area): To evaluate compliance to actual PM requirements as established for assets under scope of responsibilities; <i>Obtained from completed WO file in CMMS</i>	100%	Total # PM WOs Completed as Scheduled ÷ Total Number of PM WOs Due and Scheduled Per Reporting Period (Note: PMs to be completed within reasonable window of time from date they are generated for scheduling)
15.	Gained \$Value from Craft Utilization/Performance: To determine actual gained \$ value of craft productivity gains as compared to original estimate and/or the initial baseline; <i>Obtained only from using results of measuring two of the OCE Factors: a) Craft Utilization, b) Craft Performance</i>	TBD	[Total Current Craft Hours of Wrench Time minus Baseline Average Wrench Time Hours] x Baseline Cost / Wrench Time Hour (or Actual Cost Per Hour)
16.	% Inventory Accuracy: To evaluate one element of MRO material management and inventory control policies; <i>Obtained from cycle count results and could be based on item count variances or on cost variance</i>	98%	- <u>Item Count Variance:</u> Total Stock Items Cycle Counted as Correct ÷ Total Stock Items Cycle Counted - <u>Cost Variance:</u> Actual Inventory Cost of Total Stock Items Counted as Correct ÷ Total Actual Inventory Cost of Stock Items Counted
17.	% or \$ Value of Actual MRO Inventory Reduction: To evaluate another element of MRO material management against original estimates and the initial baseline MRO inventory value; <i>Obtained from inventory valuation summation at end of each reporting period</i>	10%	Actual \$ Value of Inventory Reduction ÷ Baseline Inventory Value

<u>No.</u>	<u>Performance Metric, Purpose and Data Source (cont)</u>	<u>Goal</u>	<u>How to Calculate Metric</u>
18.	Number of Stock Outs of Inventoried Stock Items: To monitor actual stock item availability per demand plus to monitor any negative impact of MRO inventory reduction goals; <i>Obtained from tracking stock item demand and recording stock outs manually or by coding requisition/purchase orders for the items not available per demand</i>	???	Actual Stock Outs Recorded/Tallied as They Occur
19.	\$ Value of Direct Purchasing Cost Savings: To track direct cost savings from progressive procurement practices as another element of MRO materials management. Could apply to contracted services, valid benefits received from performance contracting, contracted storerooms, vendor managed inventory; <i>Obtained via best method per a standard procedure that defines how direct purchasing savings are to be accounted for</i>	TBD	Tracked via best method per a standard procedure that defines how direct purchasing savings to be accounted for

Possible Metrics for Critical Operational or Production Assets

20	Overall Equipment Effectiveness (OEE): World – class metric to evaluate cumulative positive impact of overall reliability improvements to Asset Availability(A), Asset Performance (P) and Quality (Q) of output all in combination. (Similar to OCE above but for the most critical production assets); <i>Obtained via downtime reporting process, operations performance on critical assets and the resulting quality of output</i>	85%	Where OEE = % Availability x % Performance x % Quality An OEE Factor of 85% is recognized as world-class, which therefore is: OEE = A x P x Q OEE = .95 x .95 x 95 ≅ 85%
21.	% Asset Availability/Uptime: To evaluate trends in downtime due to maintenance and the positive impact of actions to increase uptime; <i>Obtained via downtime reporting process</i>		Total Hours Asset Performs Its Primary Function ÷ Total Hours Asset Scheduled to Perform Its Primary Function

The Maintenance Excellence Index: An Example

On the following page is an actual example that includes 14 metrics on a one page summary spreadsheet that in its Excel spreadsheet format that calculates automatically the Total Maintenance Excellence Index Level, Item I on this spreadsheet as new values for each new Current Month Performance values (Item B) is changed. A copy of this Excel spreadsheet is available by contacting:

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MAINTENANCE EXCELLENCE INDEX Example:14 Categories

A. Performance Metric	1. Direct Purchasing Cost Savings	2. % Overall Budget Compliance	3. % Estmd Jobs Complete as Scheduled (w/in Compliance)	4. % Other Planned WO's Completed as Scheduled	5. OEE	6. % Craft Time to Maintenance WO's	7. % Craft Utilization ("Wrench Time")	8. % Craft Performance (PM and Planned Work)	9. % Work Orders with Planned Time	10. % PM Compliance Overall	11. Gained Value of Capacity Increases	12. % Inventory Accuracy	13. % Value of MRO Inventory Reduction	14. # of Stock Outs	
B. Current Month Performance	200	94	94	91	60	36	56	85	56	74	300	91	2	19	Perf Level
C. Performance Goal	500	98	98	95	85	40	60	95	60	90	1700	98	10	10	10
	450	96	96	93	80	38	58	90	58	88	1500	97	9	11	9
	400	94	94	91	75	36	56	85	56	86	1300	96	8	12	8
	350	92	92	89	70	34	54	80	54	84	1100	95	7	13	7
	300	90	90	87	65	32	52	75	52	82	900	94	6	14	6
	250	88	88	85	60	30	50	70	50	80	700	93	5	15	5
	200	86	86	83	55	28	48	65	48	78	500	92	4	16	4
D. Baseline Performance in BOLD	150	84	84	81	50	26	46	60	46	76	300	91	3	17	3
	100	82	82	79	45	24	44	55	44	74	100	90	2	18	2
	50	80	80	77	40	22	42	50	42	72	50	89	1	19	1
	0	78	78	75	35	20	40	45	40	70	0	88	0	20	0
E. Current Performance Level Scores	4	8	8	8	5	8	8	8	8	2	3	3	2	1	
G. Weighted Value of Performance Metric	11	8	6	8	13	6	10	5	7	2	9	5	5	5	
H. Performance Level Score (F) x Weight (G)	44	64	48	64	65	48	80	40	56	4	27	15	10	5	
J. Total MEI Values Over Time	2/02	3/02	4/02	5/02	6/02	7/02	8/02	9/02	10/02	11/02	12/02	1/03	2/03	4/03	
	565														

F. PERFORMANCE LEVEL SCORES

SCORES X WEIGHT

= 565

I. TOTAL MAINTENANCE EXCELLENCE INDEX VALUE

The Basic Format of the MEI Calculations: The *Total MEI Performance Value* is the composite score of all metrics, considering current performance of each metric as compared to the goal and the weighted value of each individual metric. The total possible score for the *Total MEI Performance Value* is 1000. The key steps in developing and using the MEI are as follows:

<u>Step</u>	<u>Description</u>	<u>Comments</u>
A	Performance Metrics	From 10 to 15 metrics are selected and agreed upon by the organization.
B	Current Month Performance	This is the actual performance level for the metric for the reporting month. This value will also be noted in one of the incremental values blocks below the performance goal. This value will correspond to a value for F, the performance level scores which go from 10 down to 1
C	Performance Goal	This is the pre-established performance goal for each of the MEI metrics. For example, if the Current Month's Performance is at the Performance Goal level, the performance level score for that goal will be a 10, the maximum score.
D	Baseline Performance	The baseline performance level prior to start of MEI performance measurement
E	Current Performance Score	Depending on the current month's performance, a performance level score (F) will be obtained. This value then goes to the Current Performance Score row and serves as the multiplier for the (G) the Weighted Value of the Performance Metric
F	Performance Level Score	Values from 10 down to one, which denotes the level of current performance, compared to the goal. If current performance achieves the predetermined goal, a performance value of 10 is given. Each metric is broken down into incremental value from the baseline to the goal. Each incremental value in the column corresponds to a performance level value. This value becomes the Current Performance Score.
G	Weighted Value of the Performance Metric	The values along this row are the weighted value or relative importance of each of the metrics. These values are obtained via a team process and a consensus on the relative importance of each metric that is selected for the MEI. All of the weighted values sum to 100.

<u>Step</u>	<u>Description</u>	<u>Comments</u>
H	Performance Value Score	The Weighted Values (G) are multiplied by (E) the Current Performance Scores to get the Performance Value Score (H).
I	Total MEI Performance Value	The sum of the Performance Value Scores for each of the metrics and the composite value of monthly maintenance performance on all MEI metrics
J	Total MEI Performance Values Over Time	Location for tracking Total MEI Performance Values over a number of months

Your MEI Validates Your Results: The MEI provides a composite index that integrates a number of key metrics into a composite value; the *Total MEI Performance Value*. Each metric can also be monitored and trended individually comparing their baseline value to an established performance goal. These metrics are then used to provide the one page Excel spreadsheet that brings them all together into a composite Total MEI Performance Value. This is your index as to how all resources are contributing toward maintenance's contribution to profit optimization.

The MEI helps keep in focus the fact that the success of physical asset management and the execution of maintenance processes depend on many factors; therefore, one or two metrics cannot provide the total performance picture. The MEI gives us a broad-based approach to performance measurement. If we have justified the project on craft productivity increases, parts inventory reduction or a decrease in maintenance cost per unit of output, we now can validate the results of our initial projections. Your MEI is developed specifically to validate your results and your projected ROI.

Get Started Now: Take action and get started now with an evaluation of your total Maintenance. Conduct a self-evaluation or get help with this important first step. Take the time to develop a plan of action. Integrate your strategic maintenance plan with your company's business plan. Plan for Maintenance excellence. Commit the necessary internal and external resources to the hard task of implementation. Get the most from your CMMS and measure your results and return on investment. For help on your journey to maintenance excellence both *The Scoreboard for Maintenance Excellence* and *The CMMS Benchmarking System* are available free from The Maintenance Excellence Institute.

Conclusion: The New Millennium view toward maintenance and physical asset management must see maintenance helping to maximize profit optimization. The strategy defined in this five part series has been proven for application to a multitude of different types of maintenance and physical asset management operations within both the public and private sectors. The approach is simple but powerful in terms of achieving results and validating return on investment. Organizations that clearly understand that "Maintenance is Forever" and find the key to balancing all resources toward optimum total operations success will succeed in the 21st Century.

For organizations now evolving into today's profit-optimization trend, profit-centered maintenance can help maximize your profit optimization efforts. A true profit-centered approach must include maximizing one very essential resource; your physical assets, the production assets, the facilities and related businesses processes within an organizations profit optimization process.

You Can Get Maximum Value from Your Maintenance Operation: You can maximize maintenance for profit optimization by applying this proven strategy. To find out the best approach for your organization, for help with planning the pilot evaluation and to receive a complete copy of this five-part series contact.

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Bio of Ralph W. “Pete” Peters

President and founder for **Ralph W. Peters and PEOPLE Inc.** a consulting firm with three divisions for total operations improvement; The Maintenance Excellence Institute (maintenance), The Manufacturing Excellence Institute (manufacturing) and The Institute for Public Service Excellence (governmental). His practical engineering experience and technical leadership in the maintenance, manufacturing and governmental productivity consulting fields has helped hundred of operations achieve manufacturing operations success and maintenance excellence in plant, fleet and facility maintenance operations.

His scope of experience in governmental operations productivity has firmly established his personal capabilities and that of The Institute for Public Service Excellence to support value added government services. Pete is a senior member of the Institute of Industrial Engineers, the Association of Facility Engineers and the Society of Maintenance and Reliability Professionals He has been involved in manufacturing operations management, systems implementation, facilities management, maintenance and governmental productivity consulting for more than 30 years. He is retired from the US Army Corps of Engineers/NC Army National Guard (1995) with 28 years of service and serving in Viet Nam and during Desert Storm.

Pete is author of the upcoming books; *Profit-Centered Maintenance: The New Millennium Strategy for Maintenance Excellence* and *PRIDE in Maintenance*. He is editor/primary author for *The Guide to Computerized Maintenance Management Systems*, Scientific American Newsletters LLC, author of the maintenance chapters in *The Warehouse Management Handbook* and *The Future Capable Company* from Tompkins Press and John Wiley's new *Handbook of Industrial Engineering, 3rd Edition*. A recognized leader in the areas of implementing manufacturing and maintenance best practices, profit-centered maintenance, performance measurement, productivity improvement for government operations and providing value-added total operations consulting, He is also the author of over 200 articles and publications and as a frequent speaker has delivered presentations on manufacturing and maintenance-related topics worldwide. He received his BSIE and MIE from North Carolina State and is a graduate of the US Army Command and General Staff Course and the Engineer Officers Advanced Course.

Clients from the manufacturing and maintenance sectors have included operations in the petrochemical, aerospace, manufacturing, mining, pharmaceutical, hand-tool manufacturing, utilities and automotive industries, in addition to construction fleet management, public transit operations and facilities management for healthcare, educational and governmental facility complexes.