Introducing
The Reliable Maintenance Excellence Index

The key to profit-and customer-centered maintenance is measuring results and return on investment. If you were a maintenance contractor, your results would generate profit and customer -centered service. The Reliable Maintenance Excellence Index (RMEI) is another benchmarking tool that takes benchmarking down to actual results at the shop level as shown in Figure 1.

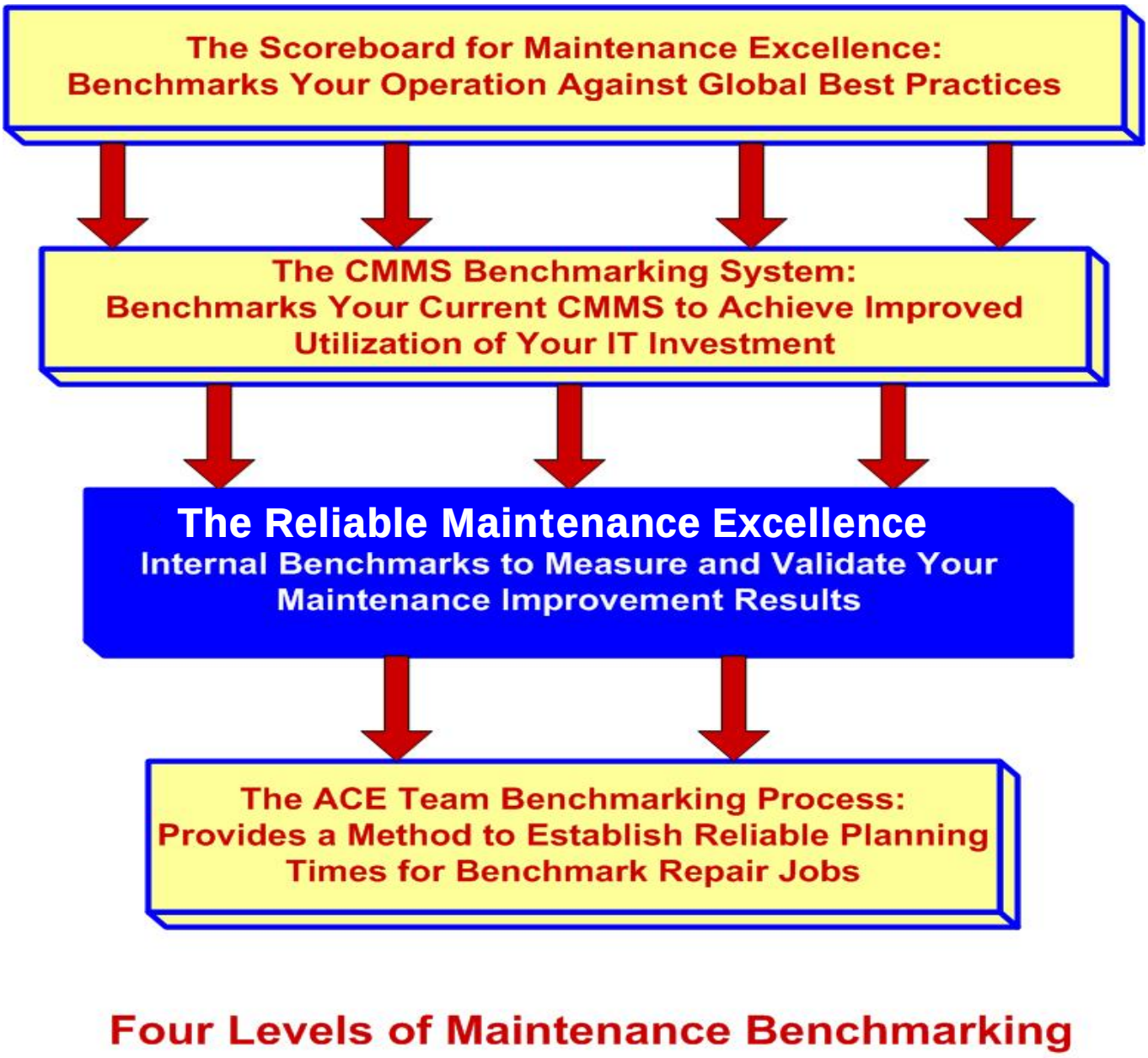

Figure 1: The Reliable Maintenance Excellence Index Measures Shop Level Results

Profit-Centered Maintenance: Many Maintenance Leaders question the philosophy of Profit-Centered maintenance for in-house maintenance. You can be sure today's growing numbers of contract maintenance providers clearly understand Profit-Centered maintenance. Let's hope you are not too late in getting your plans of action in action and implemented.

The Reliable Maintenance Excellence Index (Figure3) is for validating benefits and for showing bottom line results and justification the implementation best practices. And this material will support determining your unique ROI options. The total costs of many improvement projects with a new CMMS. Top Leaders must view maintenance process improvements as a true return on investment and not merely another cost associated with maintenance and physical asset management. This information can be your guideline for determining the ROI for almost any maintenance excellence initiative.

It is a good investment to provide Maintenance Leaders with timely and accurate information to manage and measure maintenance as a business. In turn, the Maintenance Leader must treat maintenance as a profitable business by providing information to company leaders that clearly shows a return on investment. Craft utilization and performance, preventive maintenance compliance, work backlogs, downtime levels, the effectiveness of planning and scheduling, etc., should be evaluated as part of a broad-based maintenance performance measurement system. What is your answer to the question in Figure 2?

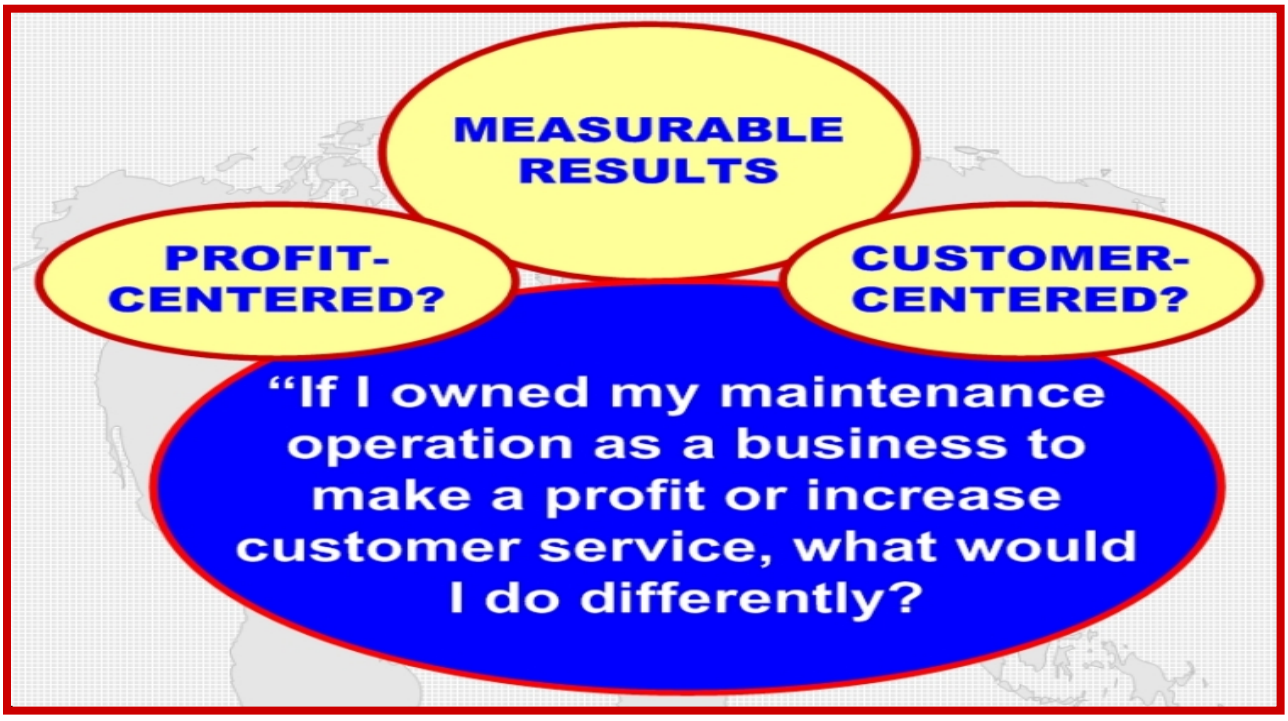

Figure 2: What If You Owned Your Maintenance Operation?

Figure 3 on the next page provides an example of a The Reliable Maintenance Excellence Index that uses multiple performance metrics as an overall performance measurement indicator.

The Reliable Maintenance Excellence Index

A-Performance Measures	1. Actual Maintenance Cost Per Unit of Production	2. % Major Work Completed within 5% of Cost Estimate	3. % Overall Maintenance Budget Compliance	4. % Overall Schedule Compliance	5. % Overall PM Compliance	6. % Planned Work	7. % Craft Time for Customer Charge Back	8. % Work Orders With Reliable Planned Time	9. % Critical Asset Availability	10. % Wrench Time (Craft Utilization)	11. % Craft Performance	12. % Inventory Accuracy	13. Number of Stock Outs of Inventoried Stock Items	F-Performance Level Scores
B-Current Month Perf	$1.30	90	94	90	94	68	75	50	90	34	90	90	15	Perf Level
C-Performance Goals	$1.00	95	98	95	100	80	85	60	95	50	95	98	10	10
D-Baseline Performance Levels If Available ⇧⇩	1.05	94	96	94	98	78	83	58	94	48	94	97	11	9
	1.10	93	94	93	96	76	81	56	93	46	93	96	12	8
	1.15	92	92	92	94	74	78	54	92	44	92	95	13	7
	1.20	91	90	91	92	72	75	52	91	42	91	94	14	6
	1.25	90	88	90	90	70	72	50	90	40	90	93	15	5
	$1.30	89	86	89	88	68	69	48	89	38	89	92	16	4
	1.35	88	84	88	86	66	66	46	88	36	88	91	17	3
	1.40	87	82	87	84	64	63	44	87	34	87	90	18	2
	1.45	86	80	86	82	62	60	42	86	32	86	88	19	1
	1.50	85	78	85	80	60	57	40	85	30	85	87	20	0
E-Performance Level Score	4	5	8	5	7	4	6	5	5	2	5	2	5	E-Perf. Level x G-Weighted Value
G-Weighted Value Metric	10	6	6	7	11	7	6	7	13	8	8	6	5	
H-Performance Level Score (E) x Weight (G)	40	30	48	35	77	28	36	35	45	16	40	12	25	467
J-Total RMEI Value	Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Dec	Jan	Maximum RMEI Value = 1000
		409	435	467										

I. Total RMEI Value ⇦

Figure 3: The Reliable Maintenance Excellence Index

The Maintenance Excellence Institute
6809 Foxfire Place, Raleigh, NC 27615 and 2625 East Beach Drive, Oak Island, NC 28465
Office: 919-270-1173 **Direct Cell:** 919-280-1253 **SKYPE:** PRIDEnWork **Web:** PRIDE-in-Maintenance.com

Developing Key Performance Indicators: The process for developing your Reliable Maintenance Excellence Index includes defining and gaining consensus on very specific key performance indicators related to the total maintenance operation. Also you should consider metrics that affect the success of the total operation. The expanded version of this introduction covers a recommended set of internal benchmarks or metrics for Maintenance Leaders to consider, the purpose for each metric, where they traditionally can be found in the CMMS (or financial system) database, how to calculate each one and how to determine your current baseline..

Key performance indicators to measure the overall effectiveness of a maintenance operation can include.

- **Percent Craft Utilization (CU):** Evaluates actual wrench time (hands-on time) for craft labor. Provides one of the two key elements for measuring the Overall Craft Effectiveness (OCE). Measures the overall increase in craft labor wrench time due to a proactive, planned maintenance strategy with effective planning and scheduling, positive impact from the PM/PdM program, effective MRO materials management service and improved CMMS.

- **Percent Craft Performance (CP):** Evaluates actual craft performance against a reasonable/reliable planned time for a planned repair job or task such as PM inspections. Where craft labor utilization measures "effectiveness", this measure addresses the "efficiency" factor for overall craft effectiveness (OCE). This measure is improved by having effective craft skills to do the job along with the motivation to work efficiently. It is directly impacted by shop working areas, having the right personal and special tools available and safe working conditions.

- **Overall Equipment Effectiveness (OEE):** A world –class metric that originated from the total productive maintenance (TPM) movement that evaluates critical equipment in terms of equipment availability, equipment performance and the quality of output. Improving OEE focuses on eliminating the six major losses plus we feel should be seven and include operator issues as highlighted below in Figure 4.

	Breakdowns
Availability Issues ⇒	**Set-up and Adjustments**
	Idling and Minor Stoppages
Performance Issues ⇒	**Reduced Speed**
	Operator Issues
	Process Defects
Quality Issues ⇒	**Reduced Yield**

Figure 4: Six Major Losses Plus Operator Issues

The average OEE Factor is in the 40% to 50% range before an improvement process starts. A world class OEE Factor is around 85%, which means that all three elements must be around 95% i.e. .95 (Availability) x .95 (Performance) x .95 (Quality) = .857 x 100 = 85.7% OEE Factor.

The OEE Factor = Availability % x Performance % x Quality %

- **The Overall Craft Effectiveness (OCE) Factor:** The OCE Factor relates to craft labor assets as compared to the metric for OEE that measures the combination of equipment asset availability, performance and quality output, basically Asset Productivity. The OCE Factor focuses upon measuring and improving the value-added contribution that people assets make to total physical asset management. The OCE Factor is an important and often overlooked segment for measurement. OCE includes Craft Utilization (CU), Craft Performance (CP) and Craft Service Quality (CSQ) as shown below in Figure 5.

OCE =	CU%	x	CP%	x	CSQ
	Craft Utilization	x	Craft Performance	x	Craft Service Quality

Figure 5: Overall Craft Effectiveness

- **Craft Service Quality (CSQ):** Measures the number of callbacks or percentage of craft rework) and the quality of maintenance repair work. It provides one key indicator for maintenance customer service and helps focus on “doing the repair right the first time”.

- **Schedule Compliance:** Percent Jobs Completed as Scheduled: Evaluates the overall effectiveness of executing the planned work on the agreed upon schedule by the craft work force

- **Percent Planned Work:** Measured by either by the percentage Work Orders Planned or percentage Actual Craft Hours on Planned Work. This metric evaluates the overall effectiveness of the planning process as well as the impact of all maintenance best practices to promote a proactive maintenance repair strategy, i.e. PM, PdM, reliability improvement actions, effective MRO support, etc

- **Percent Work Orders with Reliable Planning Times:** Provides a key measure for the maintenance planner position. Evaluates the ability and effectiveness of the maintenance planner/coordinator position to establish reliable planning times using maintenance standard data or other available data for determining planning times. The objective for the planning process is to have as many jobs scoped and planned as possible to the level that reliable estimates are established.

- **Percent Planned Work Orders Generated From PM/PdM Program:** Provides valuable feedback that the PM/PdM effort is helping avoid catastrophic failure and is truly providing benefits. Measures how well PM/PdM program is detecting deficiencies before catastrophic failure or downtime occurs. The reliability improvement goal however is not to continue to fix before failure but to eliminate root causes of failure and in turn the failure rate. However, this is an important metric as a client’s PM/PdM program is reinforced or renewed and in turn begins to provide measurable results.

- **Percent PM/PdM Compliance:** Measures the execution and compliance to completing scheduled PM's, PdM data collection, lube services, scheduled structural/process inspections, calibrations, etc. Typical completion of scheduled PM/PdM actions required within a week's window of time is used as criteria for compliance. This metric can also apply to instrumentation calibration and to any regulatory inspections such as crane inspections, fire protection testing/PM Etc. We have seen large operations even print out daily operator-based inspections for material handling equipment a very real requirement from OSHA.

- **Percentage Storeroom Service Level or Number of Stock Outs:** Evaluates the MRO inventory/materials management process capability to have availability of stock items that are normally stocked in the maintenance storeroom. A 95% plus service level should be the goal. Provides an excellent counter measure to ensure planned inventory reduction goal is not detrimental to storeroom customer service. Does not measure non-stock items that require requisitioning/purchasing as direct purchases or availability of project related items

- **Percent Inventory Accuracy**: Maintains accurate fiscal accountability of stocked items to ensure total confidence in current inventory levels and dollar value of MRO inventories. Measures the effectiveness of the cycle-counting process and storeroom control

- **Dollar Value of MRO Inventory Reductions:** Helps to ensure that proactive MRO inventory management practices and that well planned MRO inventory reductions are given proper credit and recognition within the organization. This reduction may also serve to offset additions to inventory of items that are more useful and critical spares. Again, wherever we recommend this one we always recommend that our client also measure stock outs, because we can shoot our self in the foot with indiscriminate, on site inventory reductions demanded by financial Top Leaders

- **Percent Asset Utilization/Availability:** A good metric that evaluates how well the overall capacity of an asset is being used in the operation. This metric can often be used alone for critical assets. In addition, it can easily be expanded into the complete measurement of Overall Equipment Effectiveness (OEE). Smart operations will have this info flow via the shop floor reporting system. In this case, maintenance must ensure that the downtime call by operations is correct. Manufacturing managers can easily manipulate this call when their production goals are threatened and they need an easy excuse for not making their production target. Therefore, maintenance and operations must both work with a cooperative spirit on this one because everyone loses when production misses promised shipment of sold products.

- **Maintenance Cost Per Unit of Output**: Measures bottom line maintenance cost per unit of output and evaluates net improvements related to maintenance improvements on total operation costs. Excellent metric for process type industries and/or for discrete manufacturers with major single product output and a strong standard cost and production reporting system. BigLots headquartered in Columbus, Ohio has a measured day work plan for distribution center employees. As a result, they have a very close count on cartons shipped each day.

Therefore, we were able to use Maintenance Cost per Carton very easily by using operations counts of output; equivalent cartons being shipped to BigLots stores. In addition, each of their four major distributions centers had significantly different average maintenance cost per carton. This provided a very good internal benchmarking tool.

- **Maintenance Cost as Percent of Total Operations Cost**: Provides an overall comparison of how maintenance cost impacts the total operations cost. For very similar operations, this metric may be useful. It can be harmful in the hands of financial people that do not realize that is extremely difficult to get true comparisons between different organizations, even those operations like universities. Comparing, centuries old Cambridge University facilities cost to a newer modern facilities complex requires clear definition of total maintenance requirements etc, etc.

Measure and Validate Results: 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. Therefore, we too must measure and validate results from internal maintenance improvement.

Initiate a Reliable Maintenance Excellence Index: Our approach has been to help clients focus on results and creating an important deliverable; The Reliable Maintenance Excellence Index (RMEI) 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 all client metrics together into a composite Total MEI Performance Value as shown in previously is Figure 3. The RMEI process gives a composite internal benchmark as to how all resources are contributing to profit optimization and customer service. The metrics selected should be applicable to the specific type of maintenance organization. For example, a pure facilities maintenance operation without critical production or operations equipment to maintain would not use OEE as part its RMEI to measure Overall Equipment Effectiveness, a metric best suited to a small number of mission essential critical assets within a production operation.

Again, it is important to have metrics that 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 primary function
- Information resources and how data become true information via effective CMMS

Conclusion: The New Millennium view toward maintenance and physical asset management must see maintenance helping to maximize profit optimization. The strategy defined in our books and articles have been proven during implementation within a multitude of different types of maintenance and physical asset management operations. This has included 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.

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