



THE 20TH INTERNATIONAL OPERATIONS & MAINTENANCE
CONFERENCE IN THE ARAB COUNTRIES

Maintenance Metrics

An account of hindrances in maintenance performance and developmental requirements in favor of improving Maintenance Metrics

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- IOR -Institute of Refrigeration UK (18499)
- SCE-Saudi Council of Engineers (278515)
- SMRP – Society of Maintenance & Reliability Professionals (859130)
- ISHRAE -The Indian Society of Heating, Refrigerating and Air Conditioning Engineers (50986)

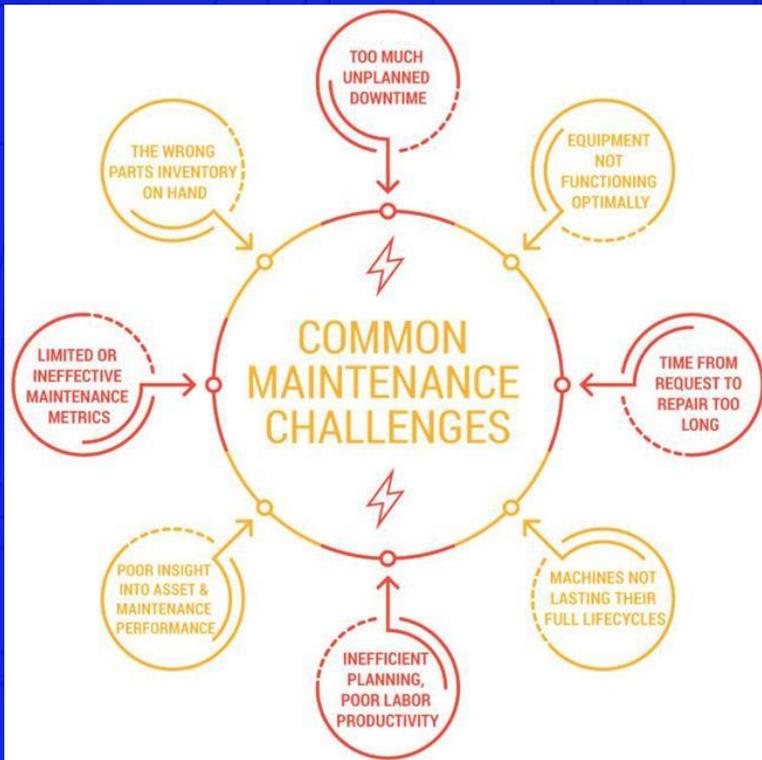


Paper Presentation Content



- **Abstract**
- **Introduction**
- **Maintenance Metrics: Introduction**
- **Common Hindrances in Maintenance Performance**
- **Developmental requirements for improving the Maintenance Metrics**
- **Conclusion**

Target Audience



- Professionals and specialists in the fields of operations and maintenance, facilities management, and asset management
- Decision Makers
- Design Consultants



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Abstract

Purpose

The purpose of this paper is to review the on-field practices in maintenance management and highlight the possible hindrances and developments required for improving the Maintenance Metrics from the point of view of practitioners

Design/methodology/approach

The paper systematically categorizes the existing issues faced in Maintenance and then analyzes and reviews it methodically

Findings

The paper finds that critical issues in maintenance management range from various Management models, maintenance techniques, scheduling, and information systems etc. Within each category, gaps have been identified. And within each system developmental requirements have been highlighted for Improving the Maintenance Metrics



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Abstract..... Continued

Practical implications

Practices on improving maintenance Metrics in maintenance management has so far been very limitedly documented and highlighted. This paper views on considerable number of field experiences suggests a classification into hindrances in Improving Maintenance Metrics. Subsequently, various Developmental requirements are highlighted and identified in the field of maintenance management for practitioners and decisionmakers to overcome the hindrances and improve the Maintenance Metrics

Originality/value

The paper contains a comprehensive field experiences of Maintenance management in question and their hindrances and support for Maintenance management. The paper will be useful to on field practitioners, maintenance professionals and others concerned with maintenance-to-maintenance Metrics in maintenance management

Key Words

Maintenance Management, Maintenance Metrics, Maintenance Performance, CMMS



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Introduction

The rise in the infrastructure projects and widespread automation in building maintenance and production/Manufacturing facilities has resulted in increase in fraction of personal working in maintenance as well as increase in maintenance cost

Maintenance costs are often largest part of the operation budget.

Yet, performance from maintenance management in terms of quality, effectiveness and efficiency is questioned.

Also, questions are faced by maintenance managers whether the output is produced more effectively and efficiently in terms of contributes to the company profits

In the area of maintenance performance, various measurement metrics and approaches have been discussed in detail.

Contribution of Various maintenance performance measurements have been mentioned in achieving business goal.

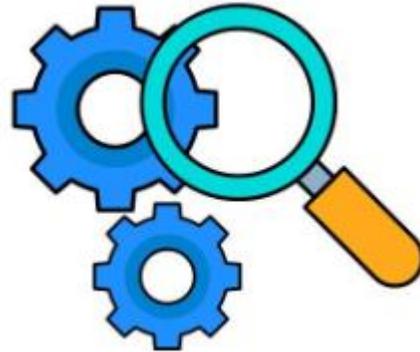
Various issues in field maintenance which effects the Improvement of Maintenance indicators have been identified and critical observations have been highlighted.

Based on the experience certain developmental requirements are suggested and discussed for improving Maintenance Metrics

The specific objectives of this paper



To highlight a classification of existing issues in the field of maintenance management.



To identify critical observations on each classification



Based on identified classification of issues above, to suggest developmental requirements for future in the field of Maintenance

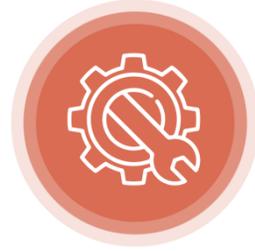
The organization of this paper



1. After a brief introduction of Maintenance, maintenance matrices and their importance have been briefed in the next section.



2. Detailed highlight is done for existing issues in maintenance and have been classified into several categories.



3. Detailed discussion on these categories/subcategories along with critical observations on each is undertaken in the next section.



4. In the final section, Developmental requirements are suggested and modern trends in maintenance management are highlighted.



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Maintenance Metrics

Maintenance metrics are measurements that give insight into how everything and everyone is operating at your facility.

They quantify the daily activity of maintenance, and in doing so, paint a picture of how people and assets are working

These numbers also allow you to compare the impact of these actions on the ultimate goals of your department

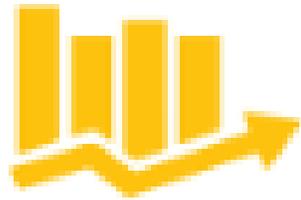
Metrics tell you a lot about how everyday tasks influence the bigger picture, which gives you control over your maintenance operation and practical ways to improve work

Well monitored maintenance Metrics form the basis of maintenance KPIs which help maintenance teams to reach business goals

Maintenance Metrics: Importance



Strategic Maintenance
Actions



Well-Monitored
Maintenance metrics



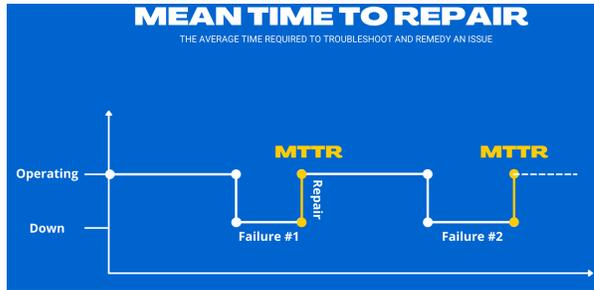
Maintenance KPIs



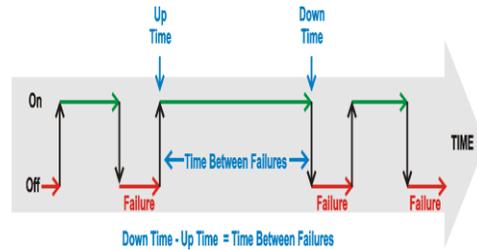
Business Goals

- Well monitored maintenance Metrics form the basis of maintenance KPIs which help maintenance teams to reach business goals.

Various Maintenance Metrics



1. Mean Time to Repair (MTTR)



2. Mean time between failures (MTBF)

$$\text{AVAILABILITY} \times \text{PERFORMANCE} \times \text{QUALITY} = \text{OEE}$$

3. Overall Equipment Effectiveness(OEE)

$$\text{PM Compliance} = \left(\frac{\text{number of completed PMs}}{\text{number of scheduled PMs}} \right) \times 100$$

4. Preventive maintenance compliance (PMC) .

$$\text{PMP} = \frac{\text{\# of Planned Maintenance Hours}}{\text{\# of Total Maintenance Hours}} \times 100$$

5. Planned Maintenance Percentage.

Common Hindrances in Maintenance Performance

1. System Design

- **Access Issues:** the Systems are designed such that, its usually hard or impossible for maintenance workers to reach to the system or equipment for any maintenance work



No maintenance access to FCU.



No maintenance access to FCU.



No maintenance access to FCU.

Common Hindrances in Maintenance Performance

-Confined Spaces: Equipment's are installed in such a space that always involves risk of workforce for doing any maintenance activity



Limited Space to access FCU.
MV Cables running below FCU



Raised floor Chilled water Piping
for CRAH Units. No space to
access Valves



EVAPCO Condenser Installed 9
Meters above ground on platform
with no sideways access

Common Hindrances in Maintenance Performance

2. Facility Layout: usually found in the manufacturing or Production facilities
These also include Confined Spaces and equipment accessibility



Equipment installed in
confined space, at height 9 M



Air cooler installed just above
door



No Access/Space to inspect
/Replace Motors

Common Hindrances in Maintenance Performance

3.Operation Schedule: Love-Hate Relationship between Production and Maintenance. This is predominant in Production & Manufacturing Business.



Maintenance personal Wait for
Production to finish



Usually, production schedules over run the Maintenance
schedules intentionally or unintentionally



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Common Hindrances in Maintenance Performance

4. Management: Management is the Critical component of overall Maintenance philosophy.

5. Technology: Maintenance is a continues process and is evolving day by day with the advancement of technology.

Lack of diagnostic tools and online monitoring system in predictive maintenance keeps the maintenance old fashioned and hinders the Maintenance performance in many ways.

6. Workforce: Manpower is one of the majors M`s of Maintenance (Men, Machine, Method & Material). Companies accounting less for the Manpower skills, their Trainings and awareness, result in lesser Maintenance performance

7. Work Ethics: Work ethics play a very important role in the overall business development. In Maintenance management this plays a pivotal role specially in Service based business



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Development requirements for improving in Maintenance Performance

1. Development of Technical/ Engineering Support

- Ensure proper design, review, control, implementation, and documentation of equipment design changes in a timely manner.
- Ensure effective implementation of Corrective Measures/actions.
- Perform monitoring activities that optimize equipment reliability and efficiency.
- Ensure that engineer support procedures and documents provide appropriate direction and that they support the efficiency and safe operations of the equipment.
- Ensure implementation of the Maintenance Management software's for data driven analytics and instant decision making



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Development requirements..... Continued

2. Development of Administration

- Establish and ensure effective implementation of policies and the planning and control of equipment activities.
- Formulate and utilize formal management objectives to improve equipment performance.
- Monitor and assess station activities to improve all aspects of equipment performance.
- Ensure that positions are filled with highly qualified individuals.
- Achieve a high degree of personnel and public safety.



Development requirements..... Continued

3. Development of Maintenance Management

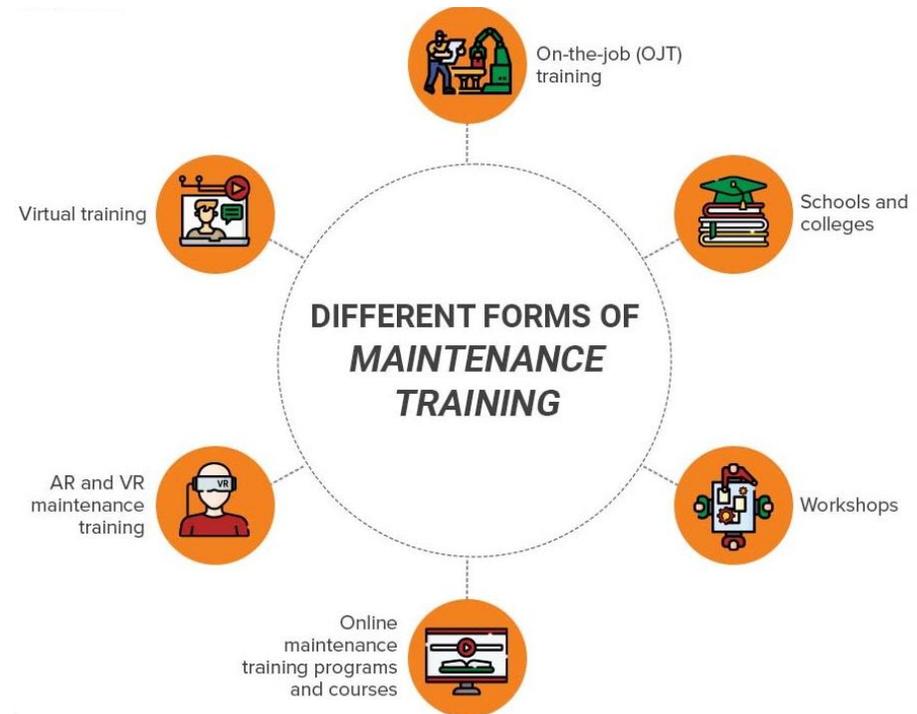
- Ensure effective implementation and control of maintenance activities.
- Implementation of Best Corrective Actions
- Conduct maintenance in a safe and efficient manner.
- Contribute to optimum performance and reliability of plant systems and equipment.
- Control the performance of maintenance in an efficient and safe manner such that economical, safe, and reliable plant operation is optimized.
- Provide directions, when appropriate, for the performance of work and to ensure that maintenance is performed safely and efficiently.
- Ensure technological applications and advancements for control and optimization



Development requirements..... Continued

4. Development of Training programs/Training Department

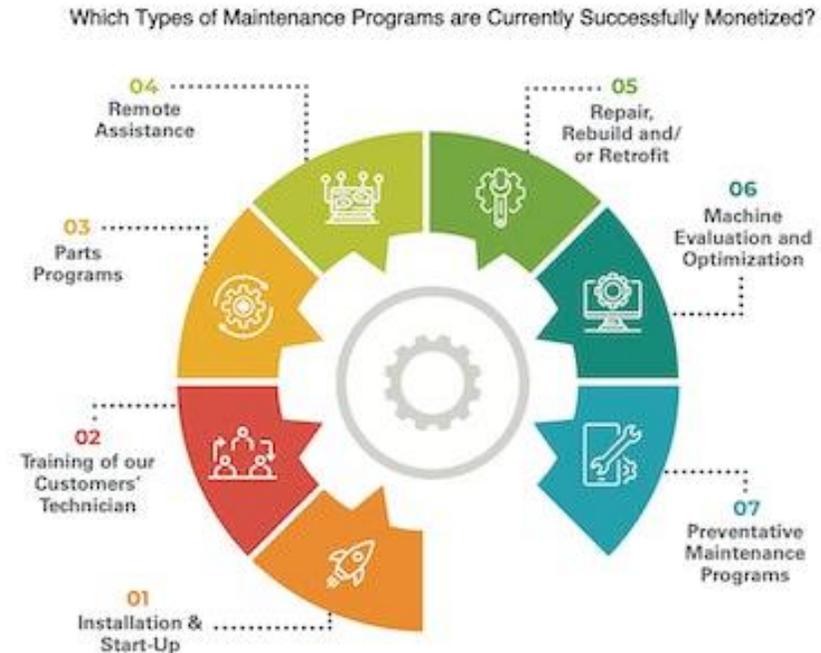
- Ensure effective implementation and control of training activities.
- Ensure the training facilities, equipment, and materials effectively support training activities.
- Develop and improve the knowledge and skills necessary to perform assigned job functions.
- To train Manpower on use of technology and technological tools in performing Maintenance operations.



Development requirements..... Continued

5. Technological Developments

- Implementation of CMMS
- Implementation of Modern technological/ Diagnostic tools for Predictive Maintenance.
- Implementation and Integration of IoT systems/ online monitoring systems
- Implementation of Handheld gadgets for Maintenance staff. Using handheld Gadgets in Maintenance Activities is not only revolutionary in the field of Maintenance but is impact full as well.



Source: PMMI Business Intelligence, Packaging and Predictive Maintenance



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Conclusion

- Involvement of FM Professionals and Maintenance Managers in Design process
- Establishing FM and Maintenance Management Consulting Firms
- Documenting the issues and highlighting them for getting solutions
- Implementation of Modern technological and Diagnostic tools in predictive maintenance
- Measures to have better Online monitoring and controlling techniques.
- Development of Manpower through training and awareness of modern tools and techniques
- Implementation of CMMS for better control and data access



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