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The Human Factors' Influence on Maintenance Reliability Management

by Krishnan Shrikanth

P People **P** Process **P** Productivity

Human factors play a vital role in influencing maintenance reliability management in an organization. This article presents some specifics on the influence of culture and leadership in the process and chemical industries.

In a world where globalization is dynamic and workforces represent cross-cultural borders, it becomes imperative to take into consideration the key pillars to organizational effectiveness. The first P, PEOPLE, focuses on the interrelationship of people and groups within any organization and takes these factors into account when designing and administering the organization. People have an impact on profitability since leadership and workforce behaviors play a role in process assets and operational excellence.

Human Cultural Factors in Management

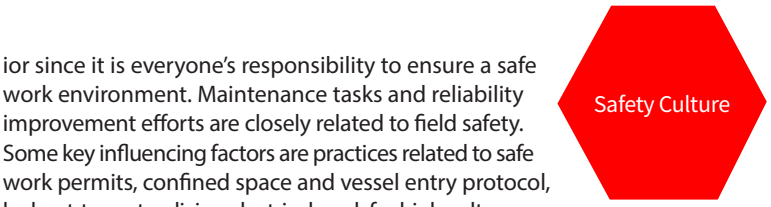
Culture refers to an organization's values, beliefs and behaviors. The key enablers in creating the culture are enhanced by how the strategic leadership framework is developed. This framework consists of creating a vision and mission, ensuring availability of resources and empowering people to achieve organizational excellence. It has been well established that social and psychological factors are important to worker satisfaction and productivity. Considerable advancements in the motivation model by Maslow, Herzberg, McClelland and McGregor apply in understanding worker motivation. More recently is the introduction of participative management and self-empowered shop floor teams, reflecting the Japanese concept of the autonomous operator maintenance team. As the industrial climate changes the style of human factors, management also changes.

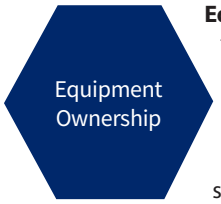
Maintenance Reliability Management Behavioral Characteristics

So, what is the maintenance reliability excellence culture? It's a culture where every human cultural factor has an influence on the organization's efforts toward achieving its maintenance reliability objectives.

Human behavioral factors that could influence maintenance reliability are broadly classified under six categories. Details for each influential factor from a cultural perspective are presented.

Safety Culture Behaviors: In many organizations, a safety manager or plant manager is responsible for safety. This is absolutely not accepted behavior since it is everyone's responsibility to ensure a safe work environment. Maintenance tasks and reliability improvement efforts are closely related to field safety. Some key influencing factors are practices related to safe work permits, confined space and vessel entry protocol, lockout-tagout policies, electrical work for high voltage panels permits, excavation work permits, regulatory inspections and environmental permits from an equipment maintenance standpoint. The degree of influence and drive from management to maintenance reliability teams to take over this challenge is one of the most important cultural factors. Management's commitment and leadership drive for safety should be part of the organizational culture.





Equipment Ownership: This factor involves the degree to which the maintenance workforce or operators feel a sense of personal ownership for the equipment or area of the plant. Where ownership exists, the equipment tends to be operated and maintained correctly. One key step is to move toward small, self-empowered, plant-oriented, operator maintenance teams comprised of five to seven members. Each team is responsible for operating a designated plant area and focusing on efforts, such as lubrication, minor adjustments and servicing. This means operators need to be trained in superficial maintenance and they have to own it.

This is well characterized by concepts like total productive maintenance (TPM) or operator-based maintenance (OBM).

Figure 1: Elements of maintenance reliability influenced by human behaviors

Functional Organizational Structure: To build and manage effective, collaborative global teams, you must focus on the people/organizational factor. Balancing a traditional hierarchy maintenance reliability national structure versus the global/matrix structure, which is becoming more popular with globalization and working across cross-country borders, needs continued management support to transition the same.

Organizational Structure

Figure 2: Elements of a functional organizational structure impacting the maintenance reliability culture

We versus them polarization: The production/maintenance conflict is well known and goes something like this: "Production ran and damaged it and we mend it." In other words, "They operate it incorrectly and never let us have the equipment for proper maintenance." The production view is: "We make the money and maintenance does not understand our objectives – we give them the plant for a shift and they keep it for a day." The "we" versus "them" syndrome indicates an amount of polarization in the organization.

Outsourcing maintenance alliances on human factors: The sense of ownership becomes more challenging with this type of organizational structure. However, there are ways to make this alliance a success factor. One consideration is to deliver a level of service tied to key performance indicators (KPIs). In this way, the contractor alliance brings in the right skilled workforce with expertise in functions like job planning, stores management, etc. This impacts the motivation of all production maintenance teams, as well as job security and morale of maintenance employees.

Centralized versus decentralized maintenance structure: This is another example of a cultural impact to the production unit. The key to cultural effectiveness is how well management strategies are aligned to cater to the maintenance structure.

Repair versus capacity assurance function: The mind-set change requires maintenance reliability functions to support capacity utilization at the minimum designed levels. This allows the organization to get more from current or existing facilities with proper balance to safety, quality and cost factors.

Reliability Characteristics

Structured maintenance and reliability programs: Programs, like reliability-centered maintenance (RCM), risk-based inspection (RBI), predictive maintenance (PdM), condition-based maintenance (CBM), turnaround management and critical safety/regulatory inspection regimes, contribute to eliminating premature failure of the asset. The impact is felt with improved production capability and reduction in overall facility costs.

Data Mining / CMMS System

Data Mining and Analytics: With recent trends to utilize lean, Six Sigma approaches to improve reliability performance and minimize variability in production processes by using principles of statistical process control, trend analysis and threshold set point reviews, the quest for data gathering and analytics is gaining increased importance. Data varies from operational performance data, like pressure, temperature, flow rates, etc., to vibration analysis, oil analysis, infrared thermography results, ultrasonic testing, electrical motor current analysis, partial discharge/corona detection, computerized maintenance management system (CMMS) data capture, quality and integrity, and many more. How to consolidate all the data in a common platform and make a meaningful analysis poses a challenge to the reliability function.

Best Practices in Maintenance and Operational Areas: Based on benchmarking studies from various industry sectors with several statistical data mining, there are certain prescribed practices worth considering to enable higher plant capacity utilization and lower total costs. Maintenance practices should focus on process and behavioral safety aspects, plan-

Best Practices / Defect Elimination

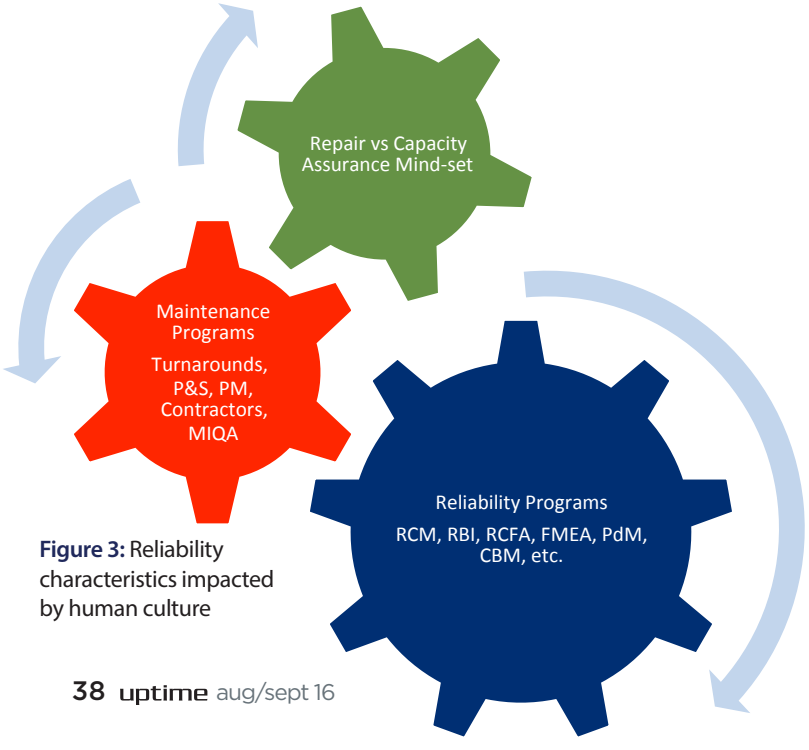


Figure 3: Reliability characteristics impacted by human culture

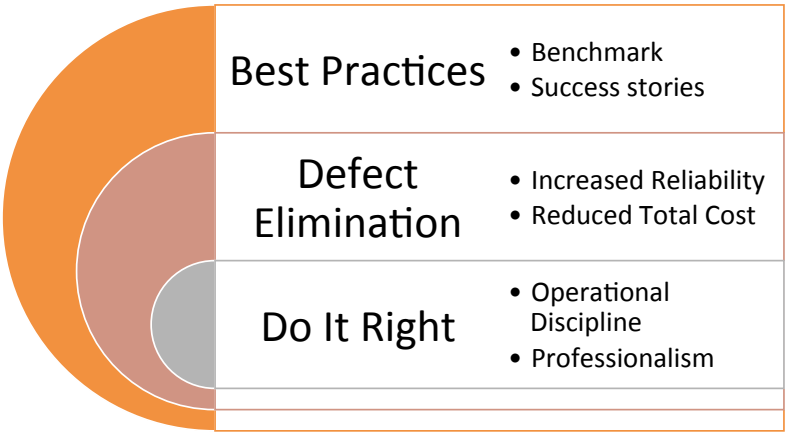


Figure 4: Best practices / sustainability characteristics impacted by human culture

ning and scheduling, skills development and training, operator maintainer relationship and involvement, and analysis tools and techniques. Operational practices should provide the ability to detect abnormalities accurately and quickly, set optimal asset conditions and promote TPM and OBM concepts. The impact can be felt on the number of run to failure cases versus planned maintenance strategy execution, leading to higher team motivation and morale.

Defect Elimination/Do It Right Maintenance Quality: Quality of work is defined as "do it right the first time, always." But human errors made during preventive maintenance (PM) or CBM tasks may eventually lead to additonal failures. This may be due to incorrectly installing a replacement part, using the wrong material of construction, or using defective parts not identified with proper tagging. Also contributing to poor quality are the skills of maintenance or contractor personnel on the task. So, how is a "do it right" culture achieved? Some proven ways to overcome defects are: provide training and procedures for critical and complex assembly systems, use a proper checklist, use the right calibrated tools and perform quality root cause failure analysis (RCFA) and failure modes and effect analysis (FMEA). Equally important is how management appreciates and rewards quality work among the team, such as recognition for reduced rework, improved uptime and reduced total costs, as a result of effective maintenance quality practices.

Conclusion

Clearly, human dynamics in maintenance reliability is a challenging management function to keep the dynamics of unit reliability, safety, cost in balance with market demand and customer expectations. These factors are gained more from experiencing and managing a maintenance reliability function, with the type of asset, manufacturing industry, culture of the country you work in and your personal cultural fit playing key roles in shaping the characteristics of a good maintenance reliability organization.

Many KPIs reflect the impact of your cultural factors. The most important KPIs are the safety performance of the plant and the balance of reliability (availability) to total cost of the unit. Some contributing KPIs are lowest downtime, highest uptime, zero breakdowns, zero accidents, highest overall equipment effectiveness (OEE), best scheduling compliance, lowest maintenance cost to estimated replacement value (ERV)/replacement asset value (RAV) ratio, increased maintenance effectiveness, etc.

All of these require some cultural change or paradigm shift of the maintenance reliability approach. **Is your organization ready?**

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