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# ACCELERATING THE RELIABILITY JOURNEY IN THE BOTTLING INDUSTRY

BUILDING A CULTURE OF TOTAL ASSET MANAGEMENT  
AND CONTINUOUS IMPROVEMENT

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# INTRODUCTION

Today's advancements in technology (e.g. IoT, edge devices, sensors, etc.) have enabled various industries within the manufacturing sector to have more access to data and effectively use it to provide insights as to how equipment is performing. Being able to spot impending failures before they happen helps mitigate high maintenance costs, unplanned downtime, loss of production or safety and environmental implications. However, to take advantage of this technology, it is imperative that a complete and accurate equipment maintenance strategy be in place to implement the right technologies for the right equipment failure modes, and that it be executed at the right frequency to gain improvements.

This eBook focuses on the current trends and challenges in the bottling industry, and how these companies are transitioning to new methodologies for monitoring the performance of their assets. Further, it demonstrates the critical components of reliability as a whole and the importance of assessing the maturity of a reliability program before adopting new technologies to ensure that the right people and processes are in place to drive the success of the initiative.

Once these items are in place, we will discuss why it is imperative to implement a methodology and process for continuous improvement and sustainability to support the new program. In the face of new operational challenges due to material and labor shortages, environmental and health standards, and a higher demand for products, companies in the bottling industry must look at their entire asset performance management (APM) lifecycle and identify the barriers and gaps in their processes that are preventing them from reaching their strategic business goals.

# THE BOTTLING INDUSTRY

The bottling industry is one of the largest segments of food & beverage, playing a critical role in the protection and preservation of products. According to Mordor Intelligence, the United States Beverage Contract Bottling and Filling Market is expected to register a compound annual growth rate of 9.12% in the next five years. Therefore, consumption of bottled drinks continues to increase, fueling the diversification and expansion of product offerings from producers.

Bottling companies are required to continue increasing their capacity to support the market growth and the diversification of products. Along with the need to increase capacity, bottlers are faced with the challenge of [finding](#) and [retaining](#) skilled workers due to labor shortages. A successful execution of any asset risk strategy must address all these issues and more in the very near future.

Although the bottling industry has been around for decades, there has been an increase in operational challenges to meet consumer demands, all while managing risk due to material and labor supply shortages. Companies in this competitive environment have had to initiate a change in culture and begin to look for solutions that can simplify their antiquated and difficult processes and optimize them with automation.

Bottling organizations would benefit from looking at their organization from a total asset performance management perspective. This includes careful consideration within each of the major entities in executing the entire lifecycle of the asset as depicted in the asset performance management lifecycle diagram in Figure 1.

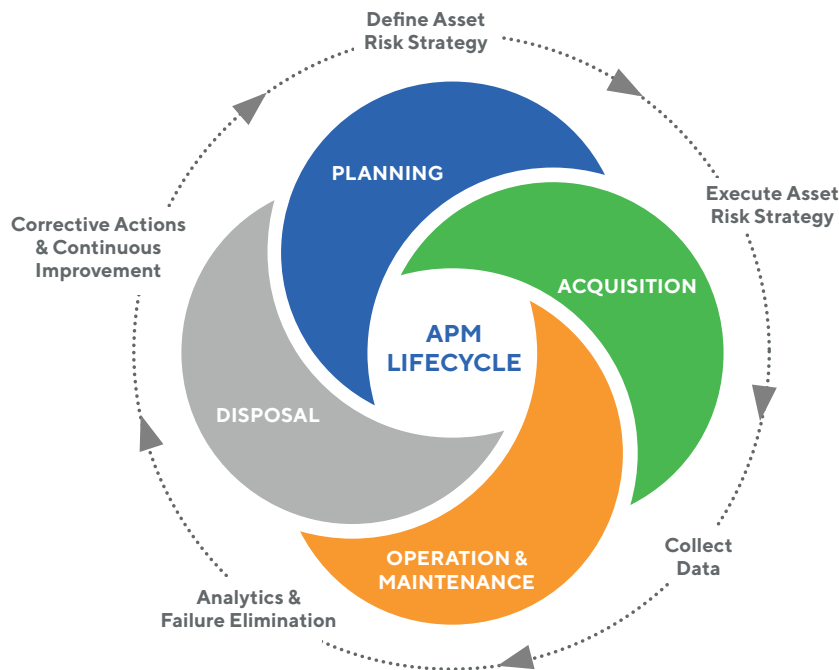


Figure 1: Asset Performance Management Lifecycle Diagram

## ASSET PERFORMANCE MANAGEMENT LIFECYCLE DIAGRAM

Determining the maturity level of any company is the first step in understanding where there may be restraining factors to improving reliability. This is accomplished by experienced people having worked in the industry for many years that have eliminated similar obstacles in this environment and implemented tools, processes, and methodologies to overcome these deficiencies. They identify specific gaps and propose recommendations to close these gaps in a complete asset strategy that aligns to the specific bottling company strategy.

In the bottling industry, there has been a shift of focus towards a total productive maintenance (TPM) mindset, which is the process of using machines, equipment, employees and supporting processes to improve the integrity of production and the quality of systems. Understanding what areas an organization is doing well and what areas need improvement is critical to reaching total productive maintenance. This approach is supported and enhanced by using the complete asset performance management lifecycle.

TPM involves an emphasis on proactive and [preventive maintenance](#) techniques, and strives for:

- NO breakdowns
- NO unplanned downtime
- NO defects
- NO accidents

While these are also major goals of the APM lifecycle, it utilizes additional workstreams to ensure improvements are made and are sustainable. On a company's journey towards a TPM mindset and best practices, there must be established roles, [governance](#), and change management efforts to really drive the increase in productivity and ensure that it will be sustainable in the future to support continuous improvement efforts.

Many times, this important workstream is missed when only using a TPM approach. Therefore, having the right **people** and processes is so vital to an organization. Clearly defined roles and responsibilities, skilled employees, and standardized processes will enable an organization to be more efficient in its operations and continually improve.

## COMMON INDUSTRY OBJECTIVES

Given the state of the bottling industry, and the need for evolution to improve, we first need to understand what are the major goals and objectives of the industry and specific bottling facilities that cannot be met using today's approach to producing product. The major goals and objectives of the bottling industry include:

1. **Adhere** to the industry's environmental and safety standards from the sourcing of materials to packaging. To move towards more sustainable business operations, companies within this industry must look at the potential areas where they can reduce plastic waste, energy, and water consumption in order to minimize the negative environmental impacts.

This transition involves an understanding of the [intersection of Asset Management strategies and ESG](#) through proper alignment of its corporate environmental initiatives with the everyday operations and maintenance strategies they deploy. When daily activities and processes begin to mirror the sustainability goals and expectations of the industry, companies can minimize risk.

2. **Standardize** business processes, equipment maintenance strategies, and [KPIs](#) across all operating bottling facilities. To manage and improve, one must have common processes as a baseline to compare variance and compliance. This also means having common equipment maintenance strategies that provide the proper foundation of how to care for and identify equipment problems well in advance of failure which directly impact production and profitability.
3. **Develop** a team of [skilled](#) and [trained](#) employees to operate and maintain equipment, effectively and efficiently plan and schedule the required corrective and preventive work and manage the MRO supply chain needed to provide the materials to perform the work. Finally, a team of skilled professionals is also needed to understand and use the data produced by the equipment and processes to proactively identify problems before a full functional failure is realized impacting production.
4. **Become Data Driven** through insights and improvement actions by using technology (e.g., IoT, edge devices, sensors, etc.) to gather and analyze data for operations, maintenance, and reliability. By utilizing the latest technology to become less dependent on labor, companies can directly impact the results of labor shortages and widely varying availability of employee (e.g., due to attendance). Tremendous amounts of data (line speeds, quality, fill metrics, vibration, temperature, etc.) are produced each minute by assets and processes, but being able to analyze the data and provide meaningful insights and actions in a timely manner is the key to using the data to the utmost potential.
5. **Manage** continuous improvement and operational risk to remain competitive as the market becomes more saturated and product offerings become more diverse. As production lines and people interact with one another, opportunities for improvement should be continually identified, stored, reviewed, prioritized, and implemented to impact business. These methods, processes, and KPIs are not visible to executive management and must be in order for them to manage and maintain a low-cost structure via capital and operational risk activities (risks impacting safety, operations, maintenance, environment, reliability, and more).

## INDUSTRY METRICS FOR SUCCESS

Given the common industry objectives bottling industry companies are striving to achieve, there must remain a focus on key metrics for improvement. Below are several key metrics for success used in the bottling industry.

<b>Line utilization</b>	<b>Improved material yield</b>	<b>Product quality</b>
<b>Bottles per minute</b>	<b>Mechanical efficiency</b>	<b>Employee safety</b>
<b>Sustainability and recyclability of materials used</b>	<b>Cost per bottle</b>	

To impact a metric, we must first understand what key areas impact that metric. For example, for line utilization and mechanical efficiency one of the major contributors is processing time or downtime. If the equipment supporting the line fails in any way, it immediately impacts these metrics, therefore, operations and maintenance of this equipment is paramount for increasing these metrics.

Cost per bottle includes ALL costs realized in the company (e.g., overhead, maintenance, materials, utilities and more). Therefore, becoming less dependent on the direct labor force and utilizing technology will directly impact this metric.

Finally, employee safety is measured by the number of incidents or near misses. Any effort that can reduce the direct engagement of personnel with operating equipment will directly reduce the number of incidents and near misses.

Thus, utilizing the proper equipment maintenance strategy can alter the quantity and duration of interaction with equipment by using technology to gather and analyze data when possible and economically feasible. While these KPIs are visible to executive management, many times, the underlying activities that drive them must be understood by all personnel to continually impact them in a positive direction.

## **BUSINESS CHALLENGES IN THE BOTTLING INDUSTRY**

Like all businesses, the bottling industry is faced with the challenge of reducing carbon emissions and minimizing waste while meeting capacity and demand and remaining competitive in the market. However, there are several key challenges we have identified that require new approaches and thinking to overcome and continue improvement for the bottling industry.

### **Five key challenges to consider:**

#### **1. SUSTAINABILITY**

To enable sustainment, one needs consistency and availability in the future with resources (people, materials, capital dollars spent to manage business health and risk), processes, technology.

##### **Resources:**

For people: [continued education and training](#) (key component is maintenance and reliability).

For materials: using least amount by having a process that is highly tuned to operate within tighter operating characteristics, reducing the need for resources (e.g., electricity, water, chemicals).

For capital dollars: properly identifying the processes and equipment that are the highest risk for failure, which directly impacts safety, machine line utilization and other key metrics discussed earlier.

##### **Processes:**

The processes within a company should always be evolving and improving. This does not happen without specific effort to continually measure, audit, and identify opportunities for improvement. A key component for those companies consistently identified a top performer in their industry is that they have a focused effort and organization to continually evaluate everything they do to eliminate waste and efforts that add no value to producing their products.

### **Technology:**

Technology in many cases is outpacing the labor market and its ability to understand and apply the technologies in manufacturing and the bottling industry. The industrial internet of things (IIoT), edge devices, sensors, and smarter equipment all play a key role in helping bottling companies reduce costs. However, supporting, maintaining, and properly using this technology is all too often cut due to the lack of understanding held by many in the organization. Bottling companies must look at the long-term use of this technology, the software, maintenance, and people resources needed to train and interpret the use of data produced to improve production and lowering costs.

## **2. NEW REGULATIONS IN QUALITY AND INCREASING SAFETY STANDARDS ASSURANCE OF FINISHED GOODS**

As innovations and improvement happen in virtually every sector, food and beverage production is no exception. Increased demand for the higher quality of manufactured food and beverage products has led directly to new instances of quality control. Many new federally mandated regulations, such as the [U.S. Food Safety and Modernization Act](#), have been put in place to police this new emphasis on quality control, so ensuring one's company is confident in the complete manufacturing process of goods is essential.

Problems in quality assurance can happen in multiple areas of the production process, including but not limited to:

- Ingredient and materials storage
- Mixing procedures of ingredients
- Production processes of unfinished goods
- Packaging and distribution of finished goods

Lapses in the reliability of different production systems within these processes can result in unknown errors in quality control which leads to a loss in both monetary capital and physical inventory.

- Major demand fluctuations in a growing population
- Increased competition within the industry

## **3. ELEVATED MANDATES FOR TECHNOLOGICAL INNOVATION AND AUTOMATION**

Digital acceleration is happening and the use of technologies like equipment sensors that support [Condition-based maintenance \(CBM\)](#), Artificial Intelligence (AI), Machine Learning (ML), automation, and advanced analytics, is enabling food and beverage companies to reduce human error, cut down on product wastage, lower storage and transportation costs, reduce lead time, optimize service time and quality, and create happier customers. However, many bottling companies are not sure where to begin using this technology.

Without understanding the data needs and people skills to evaluate much of the data, bottling companies have spent millions of dollars on technology with limited benefits. In most cases, the bottling company needs a [solid road map for implementing the technology](#) with new processes and people skills that all support the improvement effort. By taking this approach, they can

innovate with the essential to addressing many key challenges within the food and beverage industry including the following:

- Lower operational costs
- Better safety ratings
- More reliability
- Increased reliability
- Increased process control over production processes
- Higher production output

#### 4. WASTE REDUCTION

While reducing and eliminating waste has always been a challenge, it has become a leading challenge in the bottling industry due to the shortage of electricity, water, and proliferation of plastic waste on a global level. By improving the process downtime and control capabilities of the bottling lines, drastic reductions in waste can be achieved. Through downtime reductions, maintenance labor can be reduced by decreasing the need for equipment repairs and material resources needed to make the corrective repairs.

- Resources (labor, material, utilities, dollars, time).

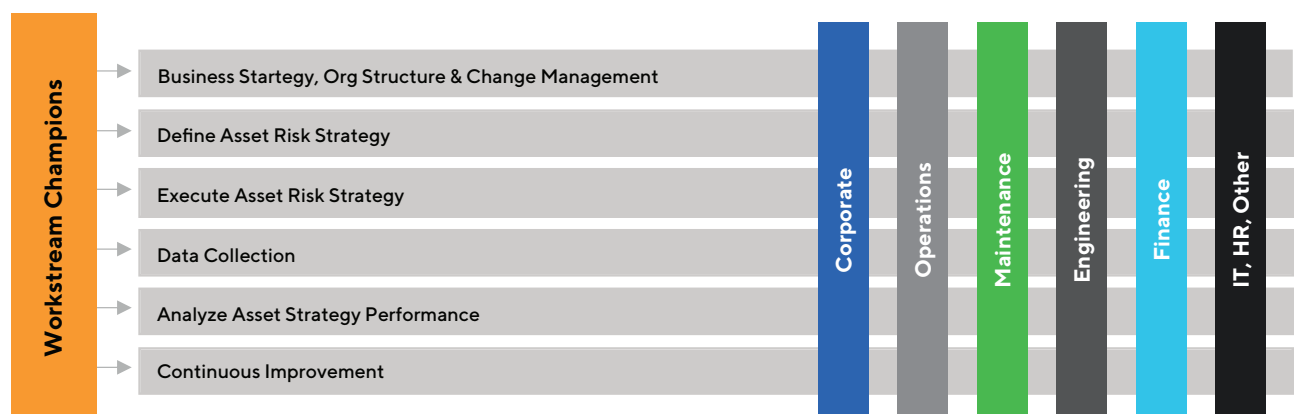
#### 5. SUPPLY CHAIN ISSUES

Parts are not available, lead times are too long, replacement parts are not available, etc.

Many would suggest to simply increase inventory as a direct answer to solving this problem; however, this requires additional capital that may be needed elsewhere in the business to solve higher priority issues. Supply chain challenges can be addressed through improved [planning and scheduling](#) of maintenance work.

### ADDRESSING INDUSTRY BUSINESS CHALLENGES WITH ASSET PERFORMANCE MANAGEMENT

Applying the six main workstreams of asset performance management will address the leading challenges within the bottling industry.





## I. Business Strategy, Organizational Structure and Change Management

The following discussion is based on a bottling company's business strategy to maximize production rates as the current market is in a sold-out position. The maturity of the asset management practices within the process of line fillers and packaging presents an opportunity to identify where equipment failures, downtime, and material defects can be addressed.

### Line Fillers and Packaging Equipment

The common two sources of constraints on beverage operating lines are line fillers and packaging. Bottlenecks can occur in any area of the process, but line fillers tend to experience the most constraints, and happen to be the most expensive machines on the line due to the low throughput in comparison to other equipment.

When assessing OEE (Overall Equipment Effectiveness) in the bottling industry, it is important to consider the differences in the rates at which a filler can run vs. the capacity of the packaging process. Since a filler has the lowest throughput, it often can only supply a portion of bottles per minute (bpm) that a packer can handle forcing the uptime of this equipment to be critical to meet the key metrics of line utilization, bottles per minute, and cost per bottle.

## II. Define Asset Risk Strategy

The equipment on the line filler and packaging equipment have been used to illustrate the holistic equipment maintenance plan that is developed based on failure modes to properly operate and maintain equipment.

## III. Executing the Asset Strategy

To leverage technology, [a sensor-based vibration program](#) should be used to systematically gather data without the need for human intervention. The sensors should be placed on the equipment properly to gather the vibration data based on the failure modes in step two above.

## IV. Data Collection

Using standard sensors and data communications technology available in the market today, the data is gathered daily and uploaded into an appropriate tool to detail vibration analysis.

## V. Monitor and Analyze Strategy

Standard and acceptable upper and lower bands of vibration limits can be established for each equipment in the software platform. Data is then uploaded and compared to the established limits, and actions are automatically created if required. A skilled analyst then reviews the alerts and creates a maintenance recommendation to address the issue.

- Using work order history to develop and monitor KPIs on executing the strategy/ work. For example, [Preventive Maintenance \(PM\)](#) compliance, [CBM](#) compliance, proactive vs reactive % of work, cost, etc.
- Be able to validate if your asset strategy is working
  - Having a lot of corrective work orders on certain equipment, be able to understand why it is failing (do we have the right mitigation tasks for the certain failure mode)

- Can use it to determine if the business is following the process
  - Are we planning and scheduling
  - Recording failure modes
  - Recording time and materials being utilized
    - Understand how you are using critical spares and inventory
  - Completing work orders
  - Monitor how well we are executing the process
  - Use the data for continuous improvement efforts
    - Bad actor analysis

## VI. Continuous Improvement

Through analysis of the data, any additional failure modes that are not being covered, or strategies that are not working effectively ([PMs](#), [Operator Care](#), [Lubrication](#), [CBM](#), etc.) can then be modified based on root cause analysis to correct and update the equipment maintenance strategy, thus, closing the APM lifecycle using the workstreams identified.

The P-F Curve below, which is used in conjunction with [condition monitoring](#), represents an asset's behavior or condition in its progression towards a failed state. It helps us to visualize the interval between a potential failure and the functional failure of a physical asset. Condition monitoring gives companies the real-time awareness of how their assets are operating and enables the team to execute on corrective actions before reaching a complete failure and resulting in high maintenance costs. Although many companies in the bottling industry have been utilizing preventive maintenance strategies to lengthen the P-F interval, condition-based maintenance is the most effective in showing indications of irregularities of asset performance.

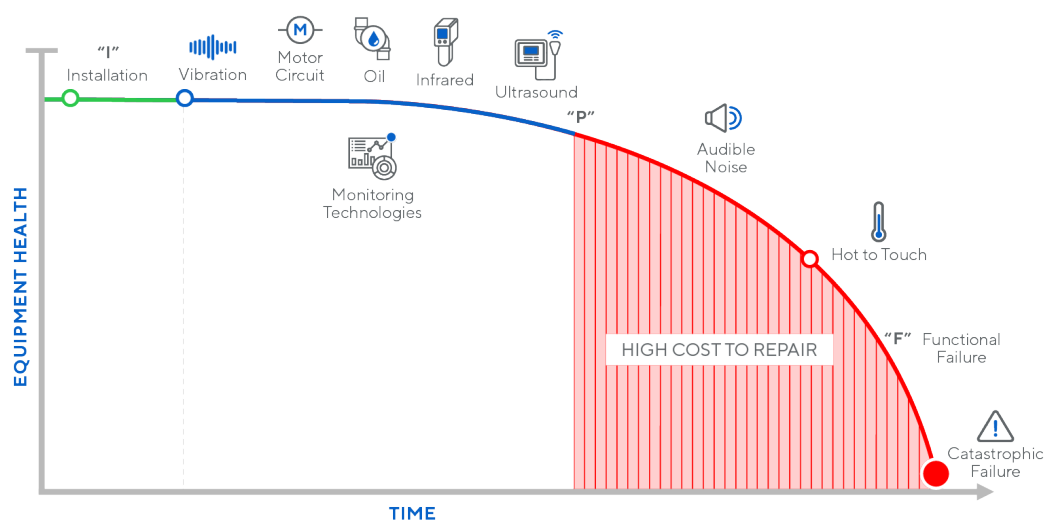


Figure 2: P-F Curve

The frequency of when the failures are detected, as well as the methodologies used, both play a role in determining the length of the P-F interval. The use of condition-based maintenance enables companies to slow down the progression of an asset from a potential failure to a functioning failure by incorporating more sensitive methods of inspection (i.e., oil analysis, ultrasound, vibration, thermography, motor circuit testing) and setting correct parameters to determine the frequency of corrective actions. This results in lower maintenance costs due to an earlier detection of the failures. A proper execution of an asset management strategy will result in quality data captured from [condition monitoring](#), proper identification of work, and optimized [planning and scheduling](#).

## IMPACT OF A RELIABILITY JOURNEY ON BUSINESS CHALLENGES AND STRATEGIES

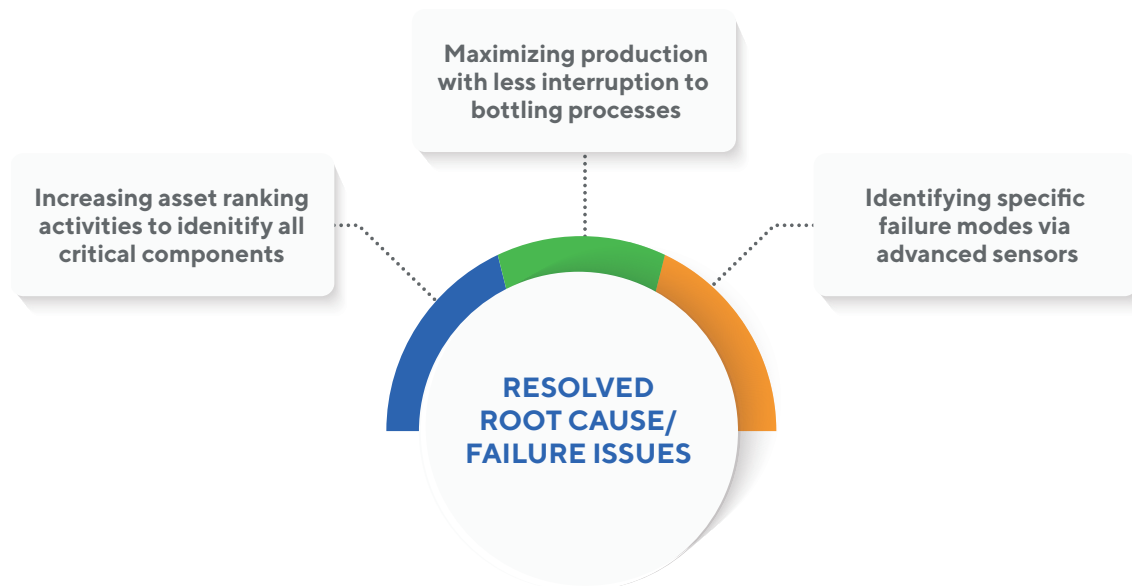


Figure 3: Business Impact After Implementation of a Reliability Journey

## FACILITATING THE IMPLEMENTATION OF DIGITAL TRANSFORMATION

Citing the above APM lifecycle and example journey, it can be seen how this approach is critical to highlighting the commonly overlooked [barriers of adopting new technologies](#) and the importance of [looking at the foundational elements of reliability best practices before implementing predictive technologies](#). This approach continually supports the digital transformation of the bottling company and aids in directly overcoming the industry challenges.

One key among the barriers of adoption that companies are faced with is a culture change to the outdated processes and practices. To ensure the success of any initiative intended to support the maintenance and reliability program, it is critical to first establish a strategy for organizational alignment and change management which includes up front team [training](#). Once this component has been implemented, the next areas of focus include defining the asset risk strategy, executing the asset strategy, data collection, monitoring and analyzing the strategy effectiveness, and continuous improvement.

When these components are executed against best practices, companies can ensure that they are executing on the right work on the right pieces of equipment while validating their efforts with proper data representation. The value of incorporating these elements into any reliability program is to be able to manage and drive business through dependable data derived from [condition-based maintenance](#) technologies, [work management execution](#), production losses, and real-time operations data.

[Condition monitoring](#) is just one aspect of the entire reliability journey. The implementation of strategic asset management strategies allows companies to be more data-driven when monitoring production loss, maintenance KPIs, and process compliance. Aligning on these components before adopting new technologies for process optimization will enable companies to get the most out of their condition monitoring program and ensure continuous success and improvement. Otherwise, it can be difficult to justify the cost and culture change of integrating new technologies to any organization.

## SUMMARY AND CONCLUSIONS

There are many challenges facing the bottling industry today, including sustainability, new regulations in quality and increasing safety standards, elevated mandates for technological innovation, waste reduction, and supply chain issues. However, using the described asset performance management approach can provide a methodology, with tools and processes to directly address these challenges and support the digital transformation of bottling companies all while positively impacting the key metrics desired. These metrics include:

- Line utilization
- Cost per bottle
- Employee safety
- Sustainability

With additional benefits in the following areas:

- Reduced maintenance costs
- Increased asset availability
- Minimized unplanned downtime
- Minimized unnecessary maintenance
- Minimized waste of materials and time

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Allied Reliability's production and asset management experts are committed to optimizing equipment, processes, and people. Our experts work with you for best outcomes.

Understanding how critical asset failures impact the environment, production, financials, and safety enables us to deliver the right monitoring, analytics, decision making and maintenance plans.

We bring unique asset management content along with best practices, advanced tools, and proven methodologies to help customers move forward in their Digital Transformation journey to deliver enhanced performance.

Contact us for more information about our offerings in:

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- Criticality Analysis
- PM Evaluation
- Asset Health Matrix
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