Plant Services

APM 4.0: Aligning Industry 4.0 with asset management

How new tools can and should meet companies where they are on their digital transformation journey.

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Contrary to popular opinion, a digital transformation journey to improve maintenance and asset performance need not be an ordered, strict, logical set of steps that symbolize the typical maintenance maturity pyramid. It also should not take the form of a rip-and-replace and complete re-engineering approach.

Technologies such as condition-based monitoring and product inspections are a critical part of asset performance management (APM) and can be augmented and improved, not entirely replaced, with new technologies. Also, digital transformation is rarely achieved with a decision to implement a large data lake, gather all kinds of indiscriminate data, and then figure out what to do with the data. A more assertive approach isolates a specific and important problem and then organizes to solve it.

Today, an advanced detection and mitigation strategy for improving performance is not based on fixed hierarchical steps. Rather, it is about starting with the right APM issues to solve, and doing so with applications that are important to the business at an individual site.

APM 4.0: aligning Industry 4.0 with asset management

APM 4.0 can be defined as more than mechanical equipment maintenance and the avoidance of unplanned downtime. It is an approach that aligns Industry 4.0 technologies with maintenance best practices in order to extend asset life and improve asset reliability. APM 4.0 must ensure the highest equipment availability along with peak equipment performance that is fully aligned with the business goals for any manufacturer. That means preventing reductions in asset performance that affect losses in quality, yield, and off-spec product.

Also, it must ensure that asset strategy and decisions made on equipment, fully account for the cost and risk for each asset and the full system delivering to bottom-line profit and sustainability. For example, a manufacturer may have issues with process operations affecting the full performance of assets and resulting in declining yields, accelerated catalyst decay, excessive waste products, or off-spec product. Again, these are critical items in achieving superior APM 4.0 performance – the equipment must be available and perform well.

As always with APM 4.0, the place a company must start is not determined by its maintenance maturity. It begins with an assessment of the critical issues that a company faces. Generally, but not always, the critical element is availability. For example, total energy use and yield of most valuable products does not matter if the equipment does not keep producing. But such is not always the first and most critical issue. Some manufacturers have more pressing needs for quality, yield improvements, and reductions in waste product.

Other manufacturing operators feel that current tools give them insufficient comfort in the strategic and tactical decisions they need to make on equipment operation, spare parts inventory, criticality assessment, and asset interactions that affect overall asset performance. It's important to note that assets are combinations of process and mechanical equipment – after all, one cannot separate the machine from the process, or the process from the machine. One machine can behave very differently in a different location and with a different task, and this dynamic may contradict widely held internal opinions about how to manage that asset. When assessing criticality, the combination of machines and manufacturing process must be considered together for ultimate performance.

PdM: value regardless of maintenance maturity. Digital transformation, especially advanced predictive maintenance (PdM), can and should start where a company is today. PdM can bolt on and bring benefits with little effort, regardless of a company's maintenance maturity. The only requirement to start is the PdM application and a maintenance planner who can receive the alerts and determine the best mitigation options.

Modern PdM technology can deliver true, measured, pattern matching using artificial intelligence and machine learning (AI/ML), and will always deliver earlier warnings about emerging degradation and failure patterns. Modern PdM saves time, and ultimately money. The earlier the warning, the smaller the risk, since a company can plan to mitigate the issues in a coordinated, controlled, and safe manner.

Rather than an unplanned shutdown, an orderly transmission likely means avoiding such mishaps as when leaks and emissions occur. For example, in a petrochemical plant on an unplanned shutdown, one accidental lifting of the flare valves can issue more carbon into the atmosphere than the entire rest of the year. Equally, the extra lead time before a failure may offer the opportunity for different feedstock sourcing to minimize disturbances and losses.

PrM: taking digital transformation to the next level. For those ready for more digital maturity, the availability of current advanced PdM applications called prescriptive maintenance (PrM) take the functionality to a higher level. They can offer advice on the precise failure mode, the likely cause, and the mitigation options of process adjustments, minor repairs, or service/repair details. These, too, are simple extensions to PdM with very clever internal capabilities.

The superior solutions are not limited, but allow users to select such advice in three configurable ways. They include advice from an asset management system, input from manually-entered instructions, and/or assertions from a Failure Modes and Effects Analysis (FMEA) data store. The predominant issue is that some changes indicate clear degradation and failure issues, but others merely signify anomalies in equipment performance. Such anomalies always need human intervention to understand the causation, which can be due to equipment degradation or due to changes in process behavior that can damage equipment.

PdM and PrM: team alignment on what to fix first

PdM/PrM technology applications offer detailed, thorough, and more frequent inspections every few minutes, as opposed to operation rounds and maintenance inspections happening once per shift or once a week. These applications offer a faster, cheaper way to inspect and, excepting any mandated physical inspections, can reduce the burden and cost of employing users for such rote tasks.

Furthermore, many approaches to identify risk and criticality often are misunderstood and misapplied when determining equipment inspections and service. These tools can be very complex, time consuming, and a financial burden, to provide only limited results. Some elements, such as risk priority number (RPN), are completely specious, based on pure opinion, and give widely different rankings based on minor changes in one parameter.

More modern and comprehensive approaches offer faster and cheaper results, and a more inclusive feel for the true risk and criticality. They execute based on data, rather than opinion. After all, the loudest voice in the morning meeting isn't always the right one. Instead, a tool with hundreds of simulations can point out the combinations and relationships between

machines, the effects of weather, logistics of supply and delivery, all with indicators of what is really affecting the bottom line. It'll be clear what to fix first.

Modern analytical applications can meet a company on its digital transformation journey today, without disruption. Constant process monitoring and state of the art AI analysis can give warnings before things go awry. They offer immediate advice on what to adjust and in what order, to achieve the appropriate cost, risk and performance in terms of availability, quality, and yield from the assets.

This leads back to one important question: where should you start? It's up to you. Digital transformation tools that improve total productivity at a company's plant can be applied now. Significant, early results are possible. You just have to start.

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