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Ask an Expert: Advanced analytics and asset productivity

By joining the power of advanced analytics with an end-to-end approach to maintaining assets, companies are unearthing savings they couldn't begin to anticipate

by Carl March and Alan Osan

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This ask an expert column addresses questions clients frequently ask on how and why to marry a comprehensive asset productivity program with powerful data analysis techniques. There are many benefits, we learn, and it's not as difficult as you may think.

Q. *Why do you now talk about "asset productivity" instead of the well-established "maintenance and reliability"?*

A. Getting the best return on an asset through its entire life is difficult. Whether you are dealing with a truck or a multimillion-dollar manufacturing plant, operators must make a series of complex trade-offs between capital and operating costs, throughput, and service life. As a result of this complexity, companies tend to pursue narrow objectives at the expense of overall performance. For example, they might make savings on initial CAPEX, but end up paying for them in increased maintenance costs or lost production opportunity. Or they might choose to run assets hard to improve short term output, only to have them fail earlier as a result.

Increasingly, many companies we speak to are trying to get away from this paradigm and take a through-life, total cost of ownership (TCO) view. That's what asset productivity is about. Companies that master the challenge undergo a profound mindset shift. Rather than treat the maintenance and operation of their assets as a cost to be minimized, they see asset productivity improvement as a highly profitable investment opportunity.

Q. *Where do advanced analytics fit into the asset productivity question?*

A. Advanced analytics means using today's computing power, advanced algorithms and rich data sources to help solve difficult problems.

Advanced analytics are important in asset productivity for two reasons. First, because optimizing the performance of an asset across its entire lifespan is an inherently difficult problem involving complex tradeoffs across a multitude of variables subject to high degree of uncertainty. Solving these types of problems requires sophisticated methods.

Second, today's industrial assets generate an extraordinary amount of data on their own operation and performance, which allows us to gain insights at a level of granularity that wasn't available before. A single

wind turbine will generate 100 megabytes of data every minute, for example. That's 2.4 gigabytes a day, or almost a terabyte a year. An oil refinery generates something in the order of five terabytes a year. The challenge today is how best to use this data to answer questions that couldn't easily be answered in the past.

Q. *So how are companies using that data right now?*

A. Leading players are already using advanced analytics to transform the way they run their operations. One global aerospace company, for example, has built a ground-based maintenance system that interacts with the on-board fault detection systems on passenger aircraft. If an issue arises in flight, the system automatically prepares a trouble-shooting and diagnostic scheme and can even order appropriate spare parts, so its technicians can be ready to respond as soon as the aircraft lands, even before the airline reports the fault.

Other companies have found ways to mine their historical data on equipment performance to challenge long-held assumptions about the way they should maintain and operate their assets. One heavy equipment operator analyzed several years of data on major component failures, and used that data to simulate the likelihood of future failures in a range of different operation and maintenance scenarios. It found that its current approach—involving comprehensive overhauls every eight to ten years—was a waste of effort, since the majority of failures happened much earlier due to manufacturing or assembly issues. The company scrapped the overhaul program and invested some of the millions of dollars it saved every year into a new program that used live condition monitoring to detect potential failures before they occurred, and targeted component replacement to prevent them.

Similar insights apply in manufacturing process optimization. In one chemical process, for example, the accepted wisdom has always been that the condition of the catalysts used in a key step is critical in determining overall yield and energy efficiency. During their lifetime, catalysts gradually become contaminated, reducing their efficiency. Engineers running such processes spend considerable time and effort adjusting them to minimize such contamination. However, when one company analyzed all the different sources of loss in its process with a view of how to maximize its hourly profitability, it found that the effects of catalyst contamination, although real, were far smaller than a number of other issues, like by-product removal from the main flow.

Q. *Is there potential to go even further?*

A. While the direction of future progress is clear, the limits of that progress thankfully are not. We see three big trends that are already underway.

First, advanced analytics resources, capabilities and systems are no longer the preserve of advanced industries like the aerospace, semiconductor and automotive sectors. They are now making their way into a whole range of other industries, where they are showing a lot of promise.

Second, the use of data to identify relationships between past events, and thereby understand the underlying drivers of asset performance,

will allow companies to dramatically improve their predictive modeling capabilities and will support real-time decision making.

Third, the insights generated by data analysis and modeling will create numerous new mutually beneficial collaboration opportunities across traditional functional and organizational divides. Rich data on the performance of purchased components will fundamentally change the relationship between engineering, manufacturing and purchasing, for example. And equipment manufacturers and owners of commercial assets will be better able to pursue their common desire for continuous improvement.

Some equipment makers are already retrieving, managing and analyzing the feedback from sensors installed on their products. By using that data to trigger specific interventions on a real time basis, owners will be able to decrease unplanned stoppages and cut operating costs. At the same time, all the rich data they will gain on the in-service performance of its products will allow the manufacturers to improve their designs and reduce waste in their supply chains.

Q. *What advice do you have for companies that aren't yet using advanced analytics to improve asset productivity?*

A. There are a few important steps any company should take.

The very first step is to make sure you have the basics in place—like a strong operations function with a culture of performance management and continuous improvement, and a good maintenance organization. Advanced analytics can extend and enhance conventional asset productivity measures. It can't replace them.

The next step is to ensure you are capturing all the available data and storing it in a way that is conducive to analysis. Many companies "leak" valuable data in different ways. Some fail to collect relevant data by not installing or commissioning appropriate sensors on critical assets, or by failing to enforce reporting standards for in-service failures or maintenance interventions. Others lose the big picture by leaving islands of data isolated in the systems of individual assets instead of streaming it to a central repository. And some companies that do invest in data collection find that they can't use that data because poor organization or management of the database makes effective access impossible. Once they've plugged these leaks, companies also need to ensure appropriate personnel have access rights for the data generated by their assets so they can use it productively.

Getting data management right doesn't necessarily require a big up-front IT investment. Most companies find they can make a great start with the tools they already own, such as spreadsheets and maintenance management systems. If they want to build more sophisticated capabilities later on, this can often be funded directly from savings they've already achieved.

The third step is to develop the capabilities to make use of that data. While the tools and computing power needed to conduct sophisticated analysis are becoming cheaper and more readily available all the time, smart people with the skills to conduct analysis, build models, make predictions and communicate their findings are in short supply. Leading

companies have become systematic in acquiring those skills, combining the use of external resources with the development of in-house capabilities through hiring, coaching and formal training programs.

Finally, you need action in response to the insights of your analysis. That means modifying your management processes and decision-making approaches to turn what you find into asset-productivity improvement initiatives. It means testing and verifying new approaches and then rolling them out systematically to all the relevant assets in your organization.

Ultimately, the best organizations are starting to adopt a data-driven approach across all parts of their asset lifecycle, from design and configuration decisions, through operation and maintenance, to life-extension or decommissioning.

Q. *What kind of payback can companies expect for this effort?*

A. Perhaps the most exciting thing about the advanced analytics approach is its ability to deliver significant performance benefits—typically double-digit percentages—with little or no capital investment. In the heavy equipment maintenance example we described earlier, the use of analytics allowed the company to simply stop doing a lot of costly maintenance activities, with no reduction in overall reliability. Or take the case of a major metals producer that was struggling to boost throughput at its plant. When it used advanced simulation technology to optimize its complex and variable production sequences, it was able to push 30 percent more materials through its existing equipment.

Advanced analytics helps to get the best return out of targeted investments in equipment and technology too. One wind-farm operator was able to reduce the cost of unscheduled downtime by 50 percent and maintenance costs by 45 percent by deploying sensors on a critical turbine subsystem, and analyzing the output of those sensors to detect impending failures in real time.

Advanced analytics can even deliver surprisingly significant results in areas where optimization opportunities are considered limited at best. At another chemical company, 50 years of continuous process improvement had resulted in world-class levels of process yield, and plant managers were struggling to find single figure percentage point improvements in performance. When it started to look at the performance of its process in terms of profit per hour, however, and applied advanced analytical tools to identify the ideal operating parameters for different production rates, the company was able to secure a 20 percent reduction in wasted input material■

About the authors: Carl March is a manufacturing specialist in McKinsey's Atlanta office, and Alan Osan is a master expert in the Pittsburgh office.