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A Silver Bullet for Asset Performance Management 2.0

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In 2017, McKinsey conducted a study on productivity gains driven by technology transformations, such as the steam engine, early robotic technology, and advances in information technology. Currently, the new drivers of automation put manufacturing in the hot seat. Surpassing earlier gains, McKinsey projects the decades ahead will deliver unprecedented annual productivity growth of between 0.8-1.4 per cent.

Advances in robotics, artificial intelligence, and machine learning will match or outperform human capabilities in a range of work activities, involving fast, precise, repetitive action, and cognitive proficiency. Deploying such new capabilities is now the industrial imperative for manufacturers striving to drive automation and efficiency improvements in increasingly competitive global markets. Currently, eliminating production losses caused by unplanned downtime is the highest priority in addressing a USD 20 billion a year problem – for the process industries alone.

The problem remains

For the past 50 years, maintenance practices have evolved to address equipment reliability and availability. The progression of approaches includes: run-to-failure, calendar-based, usage-based, condition-based, and reliability centred maintenance (RCM). Yet, equipment continues to fail. Why is this happening? First, the progression of maintenance practices is more complicated to calculate, compared to service and inspection intervals. However, Industry analysts, such as ARC, point out that more than 80 per cent of all equipment failures are caused by operating equipment outside of design and safety limits; and current practices cannot detect such seemingly “random” equipment failures. The solution to address up to 100 per cent of failures arrives at the confluence of both maintenance and operations activities.

Asset Performance Management (APM) 2.0

ARC asserts that for managing assets, APM 2.0 incorporates new analytics with traditional plant historian data sources and new data sources (including maintenance, laboratory, vibration and event tracking systems). Such diverse data assures new opportunities to optimize mechanical and operational availability and performance. Both

maintenance and operations need data-driven mechanisms to assess degradation, fine tune activities, and provide early intervention (that changes process operations) to avoid damage.

Superior predictive diagnostics and prescriptive guidance permit operators to respond faster, earlier and more effectively. Key technologies providing breakthroughs are centred upon fundamental analytics and data science strategy; especially machine learning.

A silver bullet for APM 2.0

Advanced machine learning software is highly successful in the early identification of minuscule behavioural changes in equipment, which can be harbingers of degradation and failure. Cutting-edge software learns behavioural patterns from streams of digital data, produced by sensors, which reside on and around machines and processes, in combination with other data events. Only leading solutions in the field that are autonomous by nature have little need for human intervention.

Such application methodology constantly learns and adapts to new signal patterns when operating conditions change. Failure signatures learned on one machine inoculate it, ensuring that the same condition does not recur. Learned signatures readily transfer to similar machines, preventing the same degradation conditions from affecting them.

For example, a North American energy company was losing up to a million dollars in repairs and lost revenue from repeated breakdowns of electric submersible pumps. The advance machine learning software application learned the operational behaviour of 18 pumps from archived historical values and maintenance events. During the learning period, on one pump, it detected the explicit pattern leading to a casing leak that caused an environmental incident. By applying this failure signature to all 18 pumps, the software provided an early warning on another pump, which was about to suffer the same failure. Early action to pull and repair the pump avoided a repeat incident and major losses.

A new frontier of performance

McKinsey sees entirely new and more affordable manufacturing analytics methods and solutions



Michael Brooks

emerging with Industry 4.0, an industry trend that is closely related to the Industrial Internet of Things (IIoT). This new phase includes cyber physical systems monitoring physical processes to make decentralized decisions. Both the asset and process analytics are jointly responsible for creating a multi-faceted asset view to enable fact-based decision-making that considers a broader set of tradeoffs. The sheer number of asset types to cover presents a key challenge.

Industry 4.0 also brings new mechanisms based on big data and machine learning. In fact, machine learning can crunch data lakes to discern patterns and predict future outcomes with great certainty. Yet, it cannot solve everything. A combination of models and machine learning can detect and avoid risky process operating conditions. It can explain explicit conditions anytime, calibrate, and tune the model automatically via machine learning to achieve timely, accurate process status with simpler calibration.

Bringing it all together

Only companies with a keen sense of urgency and commitment should embark on this journey. To successfully use analytics to improve safety and reliability, several elements need to be present. Many of which, are based on human (company) behaviour and culture. End customers must focus on specific business problems before finding appropriate solutions (not technology) that align with business goals. In choosing the right team of problem solvers, companies need to be prepared to ask tough questions about the solution's accuracy, timeliness, ease of deployment, scalability, and effectiveness. 