

SMART MAINTENANCE

TIGER'S FUTURE-READY FRAMEWORK
FOR THE IIOT ERA



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Introduction



The Industrial Internet of Things (IIoT) enables realization of a fully integrated and collaborative manufacturing ecosystem including smart maintenance by leveraging AI-powered automation, machine-to-machine (M2M) communication, and real-time data analytics.

The maintenance and operations department can become smart by seamlessly detecting anomalies, predicting failures, forecasting reliability, or digitally assisting technicians all in real-time for instant problem resolutions instead of reacting to failures. Smart maintenance

can be realized with increased adoption of smart devices, sensors, actuators, AI, Advanced Analytics, Cloud, Edge computing, AR/VR, IT/OT integration, etc.

The idea of Smart maintenance goes beyond just ensuring the performance and efficiency of the equipment or assets but also have a positive impact on product quality and service excellence which in turn ensure customer satisfaction. To sustain and grow, it is imperative that manufacturers understand this evolution of smart maintenance and how it could extend value beyond the boundaries of operations and maintenance department



Evolution of the Smart Maintenance Mindset

Today, the COVID-19 pandemic has exposed many vulnerabilities across the manufacturing value chain and has increased competitive pressure to operate efficiently, become more customer-centric and resilient. Such demands have called for a shift in how smart maintenance can be potentially perceived, strategized, and implemented.

From a product standpoint, the advent of IoT-enabled smart devices has enabled product engineering teams to derive useful insights around product interventions and improvements. This is complemented by maintenance as a service which utilizes analytics to provide value-added services to customers that aim to optimize energy consumption, proactively determine asset wear and tear, and provide visibility to various service metrics, such as warranty period/price, etc. leading to service excellence.

Smart maintenance can enable future-ready manufacturers to embrace new business models in this post-COVID world. However, they need to take a holistic approach towards maintenance so that they can derive and extend value beyond just equipment/asset maintenance.

By leveraging Tiger Analytics' experience across remote condition monitoring, field services, product excellence as well as service excellence we have developed this Smart Maintenance Framework that would enable manufacturers to transform their operations and maintenance, after-sales service functions, get insights on product improvements, and ultimately aim for customer excellence.

The Tiger Framework for Maximizing Value from Smart Maintenance



Remote condition monitoring and field services are the two components of our Smart maintenance framework adopted by the operations & maintenance departments of many companies. The primary objective of these two components is to automate and improve the efficiency of the assets. However, our framework also looks at maintenance from a lens of how maintenance can add value

to product excellence, service excellence and finally realize the end goal of customer excellence. This framework would not only help the maintenance and operations department of a manufacturer responsible for the upkeep of various assets/equipment but also the manufacturer who supply the equipment/asset.

Remote Condition Monitoring

Maintenance Cost, Equipment Efficiency and Uptime: Through remote condition monitoring, you can monitor asset's abnormalities using sensor technologies. It could be an on-premise or cloud-based data delivery platform to gather and share insights about asset anomalies, predict system failures based on patterns, and make more accurate forecasts about the need for repairs and the associated spare parts. This helps in reducing maintenance costs while increasing asset uptime and performance. Remotely monitoring assets across multiple locations reduces the labor involved.

Predictive maintenance has gained importance since the dawn of the IIoT era. Additionally, edge computing through embedded data analytics has enabled faster operational decision-making as well as removed the need for greater network bandwidth.

One of the top 20 steel manufacturers wanted to optimize their existing maintenance process which was very operator-driven and manual. As part of a Digital Twin program, the client deployed sensors and developed analytics models which were extremely analyst-dependent. This was not scalable as significant effort was required to develop and maintain the model for one equipment and the effort multiplied with the onboarding of every new equipment. Besides, few models were tried, and with no standardized framework the

dependency on their analysts increased. Hence, they engaged Tiger to develop an anomaly detection as well as asset reliability forecasting solution which is scalable and analyst independent. Tiger utilized sensor-based near real-time information (vibration, pressure, RPM, current, temperature, etc.) from the equipment to build a robust framework for automatic model selection for anomaly detection and forecasted asset reliability that resulted in an immediate saving of ~USD 1.7 MM in terms of cost of maintenance [Learn more](#)

Whether mechanical or electrical issues, smart maintenance ensures they are tracked in real-time to avoid wear and tear problems that could lead to asset failures or workplace safety. Additionally, it ensures scheduled routine inspections to track specified criteria and recommend the replacement of assets that show wear and tear regularly. Hence, with smart maintenance, you can also avoid unplanned asset downtime and wastage.

Tiger Analytics deployed an advanced analytics solution on Edge to identify the optimal number of sensors along with the best position to detect rotor wear and tear for a Fortune 500 global manufacturer leading to a 66% reduction in data and cost of sensors due to optimal position identification as well as reduced wastage of polymer.



Field Services

Inventory management: Manufacturers are under constant pressure to manage their spare parts. Smart maintenance can ensure optimal spare parts inventory to reduce inventory holding costs as well as avoid revenue loss due to less inventory. Smart maintenance can empower manufacturers to review critical spare parts and uncover insights to eliminate obsolete or malfunctioning parts leveraging remote condition monitoring and predicting failures.

We delivered **\$ 3MM** of cost savings recurring annually through a wheel failure forecasting model to maintain an optimal level of wheel inventory for the maintenance department of a railroad industry player. [Learn more](#)

Productivity and Turn Around Time: Digital assistants are increasingly seen as value creators, given their ability to increase responsiveness in real-time. They allow field technicians to work efficiently and ask for information. These digital assistants are driven by NLP to understand and learn industry or organization-specific terminologies. AI-driven man-machine conversations can also provide ML-based predictions for the root cause of failure while recommending the next best actions to the field technicians.

In this post-COVID world, remote work need are making Augmented Reality (AR) less of a future strategy and more a current reality for maintenance teams. While innovations like digitized user manuals have been empowering field technicians for years but today's technology is capable of so much more. Now, technicians can remotely evaluate maintenance processes, cross-check manuals, and conduct inspections by using smart glasses or through handheld devices in real-time without having to visit the site/asset thereby significantly reducing the turnaround time.

A fortune 500 global manufacturer wanted to replace the manuals used by technicians for maintenance and troubleshooting with an NLP-based chatbot. Tiger Analytics developed a troubleshooting assistant app that enables on-field technicians to ask questions (through text or voice) to a bot and get relevant solutions. This intuitive method of chatbot-based resolution resulted in a quicker turnaround and improved the technician's productivity significantly.

Product Excellence

Product Quality: Smart maintenance can provide insights into product quality. Even a single poorly functioning component can affect the overall quality of the end-product. Through remote monitoring of equipment in real-time, combined with root cause analysis, you can get insights on the performance of the overall equipment as well as its associated components/parts and ensure it is functioning or performing at the desired level. You can also adopt a preventive approach to identify potential issues and fix them proactively ensuring the output from the asset/equipment is of optimal quality.

For instance, Tiger Analytics helped a global manufacturer detect worn-out rotor blades impacting the quality of the cut polymers leveraging data analytics and predictive models. The models deployed on Edge achieved accuracy of ~100% in clearly classifying dull blades, enabling the manufacturer to proactively monitor and replace them. This solution helped to ensure polymers are cut to the desired configuration or quality.

[Learn more](#)

Product feature: The development of new product features is another aspect that can be enabled by smart maintenance. Smart maintenance can help to check whether the product or a particular component is working as intended. Gathering data on usage of products in various real-life conditions and across different customers can give insights to product efficiency, assist in identifying performance issues and other safety-related interventions. This helps the product engineering team to come up with new features and improve their product.

Tiger Analytics reviewed ~23K boating accidents over a period of 7 years, analyzed 200+ data points related to accidents for a boat manufacturer, and delivered a text analytics solution to help the product engineering and product integrity team identify design and safety related interventions. [Learn more](#)



Service Excellence

Energy optimization: In today's IIoT-enabled production facilities, smart maintenance and energy management go hand in glove. By leveraging analytics, the energy consumption of assets can be optimized. Smart maintenance can not only monitor the energy consumption but use advanced analytics to forecast energy consumption and help to negotiate better rates with their utility service provider. Additionally, operating the equipment at times where the utility rates are lower can reduce energy costs.

Tiger Analytics delivered an analytical model to predict the overall energy consumption of a production facility and identify areas where energy efficiency could be gained by modifying the production schedule for a leading manufacturer. [Learn more](#)

Recommendation on warranty: Using smart maintenance, companies can now focus on collecting and analyzing equipment/product data in the production/client environment on a continuous basis. This in turn enables them to build customer profiles based on equipment/product usage as well as by incorporating other external factors such as weather and operational conditions. Building an analytics layer on top of this can equip manufacturers with intelligent recommendations about best-fit warranty plans that would be specific for each of their products and customer clusters.

Tiger Analytics built a platform to automate the existing manual process, enabling reliability engineers to perform root cause analysis at a part level and generate machine learning-based personalized maintenance plans for existing customers. The solution was able to generate additional revenue of \$1 MM per annum for the after-sales service unit of a leading manufacturer. [Learn more](#)

Visibility to services metrics: Smart maintenance can help better understand Key Performance Indicators (KPI) associated with maintenance services such as service costs, asset health, warranty, risks, etc.

Tiger Analytics developed a Service Excellence portal for a leading industrial manufacturer to help them monitor the health of these assets, identify assets at risk through a survival model, and provide visibility into various service metrics in real-time.

Customer Excellence

Improved Revenue and Customer Experience: Smart maintenance can help improve bottom-line revenue by better understanding customers. It assesses their usage of field operations, end-of-life services, or spare parts and provides data analytics to determine customers propensity to purchase and likely immediate demands. Analysis of customer usage data can also give insights on upselling/cross-selling of other services like upgrades and extended warranties – leading to additional revenue.

Furthermore, smart maintenance can positively impact customer experience by monitoring different aspects of customer health such as the last maintenance date, the time between maintenance, renewal dates, end-of-life details, etc. This in turn helps manufacturers proactively come up with customized maintenance plans, service offerings, and recommendations specific to their customers that are likely to add more value and ensure customer satisfaction and retention.

For a fortune 500 industrial manufacturer, Tiger built a customer excellence portal to help them monitor different aspects of customer health in real-time and enabled them to better understand and profile customers based on RFM (Recency Frequency Monetary) analysis.



The Path Ahead



The road to successfully implementing smart maintenance has various challenges starting with resistance to change in the mindset, operating model, and collaboration among different stakeholders among others. Given how smart maintenance is evolving beyond operations, the involvement of the product team, customer-facing team, and other stakeholders across the value chain is essential to help implement this framework. The readiness and the maturity of the manufacturer in terms of process, people and technology are other dimensions to consider before embarking on this journey.

The industry is gradually moving in this direction and now is a good time for manufacturers to start ideating this with various stakeholders and bringing them on board. Tiger Analytics with our experience and expertise in this area can partner with manufacturers to implement the framework to deliver business value leveraging our expertise in data engineering to lay the data foundation coupled with data science, BI, and UX design to deliver easy to consume and valuable insights. For further perspective on how to harness the power of data science in the maintenance of process systems please click on the [link](#)

About the Authors



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(Sr. Director - Business Development) leads a vertical group focusing on manufacturing, transportation & logistics, energy, utilities, real estate, engineering, and construction industry. He comes with 20+ years of business consulting experience in the manufacturing and supply chain domain. He has diverse experience in the IoT domain - proposed price modeling for a leading Industrial manufacturer's new remote condition monitoring services, IIoT based solutions for asset reliability growth, proposed Industry 4.0 based solutions for heavy equipment manufacturer, etc.



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Business Development Manager with a focus on manufacturing, real estate, engineering, and construction industry. He has 10+ years of experience in the consulting space with a demonstrated history of working in the analytics, information technology and service industry. He has worked extensively with manufacturing and automotive clients focused on industrial automation and IIoT based solutions and was instrumental in kick starting a smart factory initiative for a leading industrial manufacturer.

About Tiger Analytics

Tiger Analytics, based in the Bay Area, is pioneering what AI (Data Science, Data Engineering and Application Engineering) can do to solve some of the toughest problems faced by global organizations and at scale. Our 2000+ skilled data scientists, data engineers and business consultants develop bespoke, OpenIP solutions powered by data and technology for 50+ Fortune 1000 companies. We have offices in multiple cities across the US, Canada, UK, India, and Singapore, and a substantial remote global workforce.

