KPMG

Using AIoT to Boost SMB Performance

Performance-driven KPMG helps small and medium businesses migrate to the cloud with AI and IoT applications

KPMG

Industry: Audit, tax, and advisory services

Global Headquarters: Amstelveen, Netherlands

Number of employees worldwide: 200,000

KPMG, a distinguished global firm providing audit, tax, and advisory services, leverages AIoT (the artificial intelligence of things) technologies by combining developments in the Internet of Things (IoT) and artificial intelligence (AI) to help small and medium businesses improve equipment utilization rate, increase yield, build predictive maintenance, and migrate to the cloud, with the intent to enhance return on investment (ROI).

Chi-Zhan Kao, associate director, advisory service department, KPMG thinks it is more practical for small and medium businesses to incorporate IoT applications based on ROI considerations.
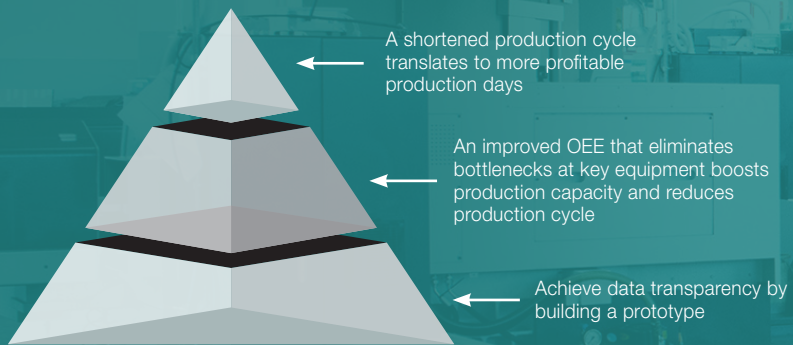
"Our clients attach great importance to ROI. When we pitch our IoT, machine learning, and AI services, the first question that they ask is about the use of collecting data for the manufacturing execution system (MES)," says Chi-Zhan Kao, associate director, advisory service department, KPMG, drawing on his experience to help a Japanese-Taiwanese joint venture firm that manufactures engine parts.

Although Industry 4.0 technologies such as the IoT and machine learning are the major trends in the global manufacturing industry, most efforts are made toward the improvement of functionality and intelligence. Financial benefits such as ROI, which are the most practical and meaningful to business owners, are rarely talked about.

"Clients generally want to raise their capacity utilization (UT). From MES data, we found their UT is low, mostly around 70%. If a large-scale manufacturer has such a low UT, it makes almost no profit. It is also particularly painful for business owners when they have to pay employees overtime."

When Kao began working on this project two years ago, he found the client's UT was too low, resulting in a long production cycle, a low order fill rate, and high overtime costs. He decided to help the client resolve its operational bottleneck from the perspective of overall equipment effectiveness (OEE), which is closely related to UT. The first step was to make use of the IoT to enhance visualization of data management.

Benefits of IoT Technologies

A shortened production cycle translates to more profitable production days

An improved OEE that eliminates bottlenecks at key equipment boosts production capacity and reduces production cycle

Achieve data transparency by building a prototype

*Capacity utilization (UT) is critical to the profitability of small and medium manufacturers*

First Stage: Use IoT to Improve OEE

"For the client, we wrote a software program to monitor information collected from IoT devices. We discovered a couple of problems. First, MES data and IoT data of equipment uptime were inconsistent. Second, data gathered by IoT devices indicated that equipment utilization was indeed low, especially during night shifts."

After looking further into the client's operations, Kao found, from the client's MES data, they were still relying on a manual clocking system. OEE during night shifts was low because employees were slacking off. Now through the newly gathered data, production managers can have a clearer picture of uptime, tunning, idle, and downtime hours within the day, and can thereby improve the night shift OEE in real time. Upper management can also use the data to regularly keep track of the weekly and monthly progress.

OEE Trend Chart
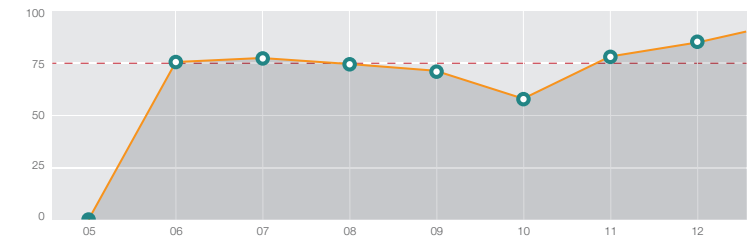
OEE Monthly Report

		Production	Total Working Hours	Running Hours	Idle Hours	Downtime Hours	Labor Hours	OEE
2017	08	0.00	26718	19739	4575	16152.00	73.8%	●
	09	172140.00	21105	14886	1809	16942.00	70.53%	●
	10	380921.00	26649	15368	1098	27956.000	57.67%	●
	11	710179.00	28609	22083	960	21046.00	77.19%	●
	12	306167.00	18041	14979	1082	12150.00	80.03%	●

From the gathered data, the problem of a low OEE was identified and resolved.

The IoT combined with precise management improved equipment OEE from 70% to 82%-85 % and shortened the production cycle.

After 18 months of implementation and testing, the engine part manufacturer boosted its OEE from 70% to 82%-85%, which was a significant improvement. Not only was the production cycle shortened, but overtime costs were also reduced considerably.

"If we translate the savings in overtime costs into the ROI for the IoT implementation, it is actually a good deal for the client."

Kao showed the client the real value that IoT data can create, so the client asked him to initiate the next stage of the improvement plan.
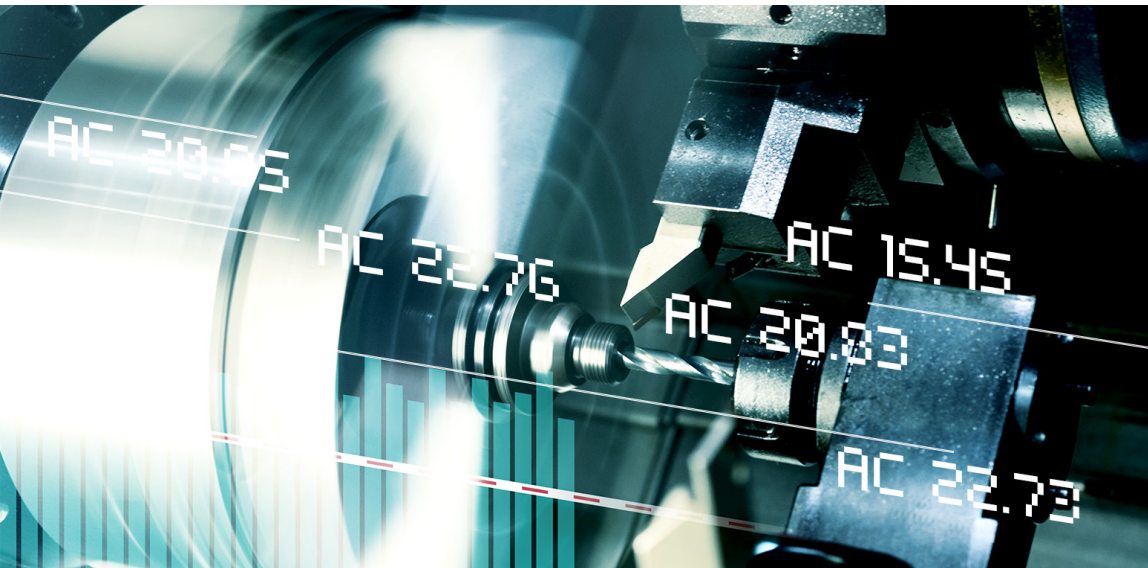
Second Stage: Using AI to Increase Yield and Improve Processes

"An increase by one percentage point in yield translates to an increase by one percentage point in profit margin. If the rework process on the rejects encounters more problems, there will be additional waste of material and labor." notes Kao.

Since the beginning of 2017, the client has been dealing with the issue of poor yield, causing the entire production pattern to deviate from the norm. The root cause has not been identified yet.

To avoid an abnormality from occurring, Kao thinks it is crucial to effectively control production variation. By adding more sensors to existing IoT devices to collect additional data on vibration, temperature, rotating speed, and electric current, and sending them to a back-end AI platform for analysis, variation control standards can be established and predictive maintenance can be conducted before variation becomes a big problem in order to avoid the production of defective products.
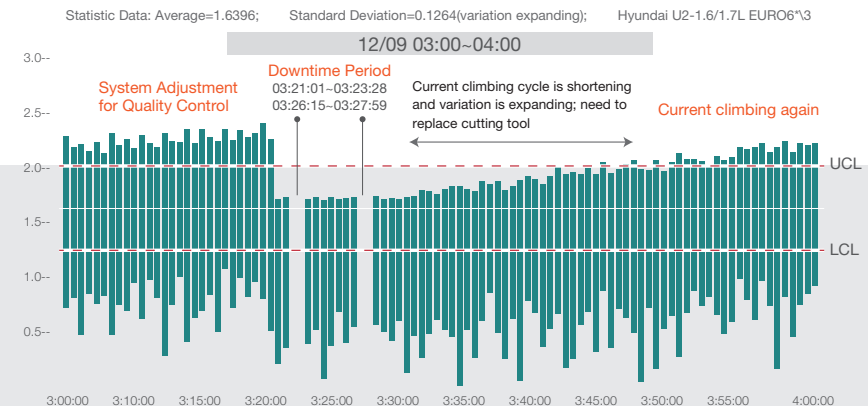
> **"An increase by one percentage point in yield translates to an increase by one percentage point in profit margin. If the rework process on the rejects encounters more problems, there will be additional waste of material and labor."**
>
> **Chi-Zhan Kao**
> Associate Director, Advisory Service Department

Statistic Data: Average=1.6396; Standard Deviation=0.1264(variation expanding); Hyundai U2-1.6/1.7L EURO6*\3

12/09 03:00~04:00

System Adjustment for Quality Control

Downtime Period
03:21:01~03:23:28
03:26:15~03:27:59

Current climbing cycle is shortening and variation is expanding; need to replace cutting tool

Current climbing again

When process variation becomes larger and larger, early replacement of parts is necessary to avoid the production of defective products

For example, when a machine's cutting tool shows an overly high current frequency, there may be tooling damage. An early replacement of potentially damaged tooling can prevent unexpected downtime or accidents, thereby improving production yield and process stability while reducing equipment maintenance and repair costs.

Data collection is the first step to predictive maintenance

Leverage Cost-effective Cloud

Industry 4.0 presents a tremendous opportunity for the manufacturing industry to transform itself. Kao thinks cloud-based applications, AI, and big data analytics are the focus of market attention. However, to small and medium businesses, the ROI on IT hardware investment may be less than optimal, especially during early-stage implementation when the benefits have yet to manifest themselves. As such, a cloud-based platform may be a more secure, reliable, and cost-effective choice.

"Our IoT services can help clients build a cloud-based big data analytics model, wherein data is directly forwarded to public or private cloud platforms for analysis." Kao also notes that at the initial stage, it is not easy to reliably collect data and uncover useful and accurate information, so working with a good IoT partner is essential.

"We surveyed a number of IoT partners and discussed with clients. Upon evaluation of their credentials, we selected Moxa. Our practical experiences working with Moxa indicate that Moxa provides reliable IoT software and hardware products and services, which indeed play a critical role in helping our clients bring Industry 4.0 implementations to reality."

> **"Moxa's reliable IIoT software and hardware products and services indeed play a critical role in helping our clients bring Industry 4.0 implementations to reality."**
>
> **Chi-Zhan Kao**
> Associate Director, Advisory Service Department

Cloud platform is a secure, reliable, and cost-effective choice for small and medium businesses

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