

## JEP PRECISION ENGINEERING

# Switch to smart factory helps JEP do more with less

Precision engineering company's data-and-automation drive mirrors changes in sector as it tools up for high-tech age.

**A**LMOST three decades ago, JEP Precision Engineering started out with a modest 10,000 sq ft production floor, where it produced small parts for the aerospace industry.

The precision engineering sector, then reliant on manual processes, would soon come to be seen as old-fashioned and labour-intensive.

But both JEP and the sector have since moved with the times.

Over the years, precision engineering has gone beyond manual machining and tooling, with more processes being automated and digitalised.

Reflecting this push for innovation, the industry body, previously known as the Singapore Precision

Deputy chief executive officer Adelene Lau says the high-tech approach is also more appealing to bright young minds. JEP works with the Institute of Technical Education and polytechnics to raise awareness of the industry, participating in career fairs and giving talks.

BT PHOTO: YEN MENG JIIN

Engineering & Tooling Association, changed its name in 2015, with the "T" now standing for "Technology".

JEP was no laggard in adapting for the future, either, as it grew and moved multiple times over the years.

In 2006, founder Joe Lau received the Entrepreneur of the Year Innovation Award from the Association of Small and Medium Enterprises and the Rotary Club of Singapore, for his efforts in innovation and knowledge management.

Nor has the firm rested on its laurels. Ahead of its 2017 move to a new facility in Seletar Aerospace Park – boasting a manufacturing floor space of 200,000 sq ft – JEP took the chance to transform in other ways as well.

"Before moving to this new facility, we identified what could be improved," said deputy chief executive officer Adelene Lau.

Having pinpointed areas for change, the firm then embarked upon what it dubbed its Smart Factory Initiative, comprising five projects. But the slick name belies the bumpy road towards innovation.

## GETTING EVERYONE ON BOARD

"To go digital, there's a lot of investment involved. Cost is one of the deterrents," says Ms Lau. But more than that, one of the hardest things for a firm to change is the mindset of its people.

This is particularly the case for those who have been in the industry for a long time, and may be used to traditional ways of doing things.

Quite a few JEP staff have been with the firm since the beginning, rising over the years to management level or higher.

Their familiarity with old processes meant that they did not quite see the need for new methods, says Ms Lau: "They feel, 'Oh, it's been working for the past 20 years.'"

"We do have to convince our employees that it works. That's why we ran a pilot run."

In 2016, JEP worked with the Singapore Institute of Manufacturing Technology (SIMTech) for a pilot run of a system that tracks their machines.

SIMTech, a research institute under A\*Star, helped to tailor an Overall Equipment Effectiveness (OEE) Monitoring and Analysis System to JEP's specific needs.

Starting with what was "initially a very simple, basic" OEE system, JEP told SIMTech what other variables needed to be monitored and what sort of reports to generate.

The pilot began with four machines, yielding insights into where and how JEP could make changes for greater efficiency.

Thanks to the pilot run, the staff – including the production general manager – were convinced of the new system's value.

"They now know the real factors (behind produc-

tion issues). Before that it was really all based on gut feel," recalls Ms Lau.

The system has since been rolled out to 90 of JEP's 130 machines.

## KEEPING A SHARPER EYE ON THINGS

What was it about the automated OEE system that won over JEP's staff?

Before the system was in place, the capacity and availability of the factory's machines were determined through estimations made manually using Excel.

This could mean inaccurate calculations, resulting in a misleading picture of current production and ineffective decision-making about further capital investment.

Furthermore, when JEP wanted to verify the actual time taken to make a specific part – as compared to the ideal manufacturing time – an engineer had to be present for the entire manufacturing process of that part.

On a day-to-day basis, the previous system was also less efficient.

JEP used to rely on a manual system for tracking the status of machines and the order flow in the production line. All this information was displayed on a board that had to be updated manually each day.

Enter the OEE Monitoring and Analysis System. In physical terms, this consists of a real-time dashboard display, and a data collection box which consolidates information sent from each machine.

The dashboard shows the live status of all the relevant machines, removing the need for manual updating and giving a more accurate overview.

It also shows workflow-related data such as work-order status and scheduled jobs. This clear real-time presentation of data makes day-to-day operations more efficient.

But the deeper value of the system is in the information itself.

With the aid of sensors, the system automatically captures machine stoppages, as well as production, quality and maintenance data.

By gathering and tracking this over time, the system also allows JEP to drill down to individual machines or work centres for details on how efficient the production process is.

For instance, engineers can find out the overall machine utilisation, unscheduled downtime, effective cycle time and occurrence of non-conforming parts for each machine.

Information is power. Based on insights gained from the data, JEP could work out where to make changes, says Ms Lau: "From there, we saw how we could improve, so we thought it made sense for us to implement it."

The system helped JEP improve efficiency.

Machine breakdowns have fallen by between 15





to 40 per cent, and idle time has been cut by 20 per cent. Tooling downtime has also been reduced by 30 to 60 per cent.

With the ability to spot problems fast and pinpoint issues, defects and the need for rework have fallen by 15 to 40 per cent.

And throughput has improved by 10 to 15 per cent.

### AUTOMATE TO FREE UP HANDS

Another major part of JEP's smart factory push is the introduction of the Mazak flexible manufacturing system (FMS) for two production lines.

Each line comprises a pallet system and five connected machines.

Previously, a machinist would have to load and unload each machine in the line, and configure the machine for the right production setup.

As the lines are used for high-mix, low-volume components, each has several different setups depending on what it is producing.

All this time taken for loading, unloading and set-up eats into the machines' utilisation rates.

With the Mazak system, the machine tools are connected by a central control system and an automated transport system.

Each line just has one loading and unloading station. After one production worker loads the first machine at the start of the shift, the automated transport system moves the parts along the line, from one machine to the next.

Set-up time is reduced to almost zero. Machine downtime is also cut, meaning an increase in production capacity and flexibility.

With the Mazak system, productivity has risen 25 per cent, as measured by the cumulative cycle time per part across all qualifying equipment types.

There is an even larger gain, says Ms Lau: "The key benefit of FMS is the allocation of manpower."

Previously, five machines would tie up at least three

machinists throughout the day. Now, just two machinists are needed at the start of the day to load the line.

This frees up manpower for other purposes, says Ms Lau: "We started to allocate them to different groups of machines or more value-added jobs."

The benefits of the FMS are not so much the pure productivity numbers, but the ability to tackle problems such as costs and manpower limitations, she adds.

### THE RIGHT PEOPLE

Even as the precision engineering sector evolves to become increasingly about automation and technology, people remain at the heart of this journey in many ways.

Asked for the driving forces behind JEP's successful transformation push, Ms Lau says: "I think the biggest factor is management."

Though she is the daughter of JEP founder Mr Lau, the company is certainly not keeping it all in the family.

In 2011, Soh Chee Siong joined the firm as chief executive officer, with more than three decades of aerospace component manufacturing experience under his belt.

Mr Soh was a major proponent of JEP's Smart Factory Initiative, says Ms Lau.

There is also another, very different way in which people are a motivating force: the difficulty of recruiting sufficient manpower.

Says Ms Lau: "We had to find ways to be more cost-efficient and more lean. It was very difficult for us to attract talent, especially young people."

"Going digital is actually one of the ways that can help us tackle manpower and costs."

The high-tech approach is also more appealing to bright young minds. JEP works with the Institute of Technical Education and polytechnics to raise awareness of the industry, participating in career fairs and giving talks.

The idea is to convey to tomorrow's workers what a job in precision engineering truly involves.

"The difference now is, it's no longer just standing at the machines and pressing buttons," says Ms Lau. "It's not just machining stuff. You need to be able to read data."

The firm also has an internship programme for polytechnic students, and hosts visits every other month.

Each time, 30 to 40 students visit the factory floor and see for themselves how the industry is striding into the future.

As JEP transforms itself, it also transforms perceptions. Before the visit, many students have misconceptions about what the industry is like, says Ms Lau. "Slowly, we start changing the concept for them."

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– JEP deputy CEO Adelene Lau



## 'If you don't analyse the data, it's just data.'

IN 2016, Bryan Mok ran machines on JEP Precision Engineering's factory floor. Two years later, the 25-year-old engineer now has a bird's-eye view of production operations.

When he started his journey with the company, it was as a machinist: first manning the vertical turning lathe, then milling machines.

A year after joining, when the company began rolling out its Overall Equipment Effectiveness (OEE) Monitoring and Analysis system, he found himself at the forefront of the transformation – and had to pick up entirely new skills.

The OEE system collects a wealth of data about machine performance and the production process.

But information is useful only if you make sense of it and take appropriate action, he notes: "If you don't analyse the data, it's just data."

For Mr Mok, who has a diploma in precision engineering, data analysis was an entirely foreign field: "That's something that I've never learnt in school before. I never thought it existed."

He took about three months to pick up the required skills, all on the job and without specific training. "It's very concept-based," he recalls. "You have to read up and understand what these variables mean. Every small change will make a big impact."

Previously, the firm tracked production performance simply by the amount of products manufactured, notes Mr Mok. In contrast, the data collected by the OEE system is fine-grained.

Now, the data analysis team can see specific points where time is lost, or analyse the effectiveness of individual machines. Different reasons for losses are uncovered across different departments.

All this in turn makes it possible to figure out how to improve.

Mr Mok helped to expand the OEE system from the milling department where it was introduced, to half-a-dozen more departments across the firm.

Every week, he meets other members of the data analysis team to discuss the numbers for that week, as well as to look at the trend over the last few months.

"As a person that analyses OEE, I'm also analysing: How can I improve this entire process?"

In essence, he looks at how to "help the company earn more money," he quips.

But when he started out in his precision engineering career, did he ever expect to be doing this today?

"Honestly, no," he replies.

"It's been interesting. I've never been involved in this kind of top-down job before."

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