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**PRODUCTIVITY MATTERS: ELECTRONICS** 

## High performance, high value

TEH SHI NING finds out how wafer foundry SSMC moves from 'plain vanilla icecream' to 'specialty ice-cream'



**Mr Jagadish:** Photographed through the cassette of an RFID Wafer Pod, the CEO says that with RFID, information is automatically transmitted to display screens, enabling operators to locate each pod more quickly and know where the pod is headed for next - PHOTO: ARTHUR LEE

THE global semiconductor industry's outlook may be overcast, but 2012 is set to be wafer foundry Systems on Silicon Manufacturing Co's best year yet. Chief executive Jagadish CV expects SSMC to deliver "best in class performance, best in class productivity, delivery, record shipments and record profits" this year, the result of relentless process development and improvement, he says.

When manufacturing first began at the US\$1.5 billion Pasir Ris foundry in 2000, SSMC was making "plain vanilla ice-cream". Its staple was the CMOS (complementary metal-oxide-semiconductor) logic chip.

But by 2007, the firm had developed in-house variations of the production process and started producing what Mr Jagadish likes to describe as "specialty ice-cream" - high-performance mixed-signal processes.

"This specialty ice-cream, with extra flavours, nuts, other toppings, it's more complex, so the number of layers in the wafer starts going up. That raises the value, it cannot be easily done by others," he says.

Its wafer foundry, which sits on a 78,000 square-metre site in Pasir Ris, now runs round the clock 365 days a year to churn out 53,000 wafers every month.

These wafers have niche applications and SSMC claims world leadership in supplying chips for ePassports and near-field communication (with which people can pay for purchases with their mobile phones), among other uses.

Much of the progress in recent years has to do with the culture of innovation SSMC is encouraging, says Mr Jagadish, who is most eager to speak about the idea circuits forming among employees from floor operators to senior management.

### **Cornered into innovation**

When SSMC was first founded by Philips, Taiwan Semiconductor Manufacturing Company (TSMC) and the Economic Development Board's equity investment arm EDB Investments, it had more than 100 expatriate managers. Today, there are fewer than 10. "We have localised the job content," says Mr Jagadish.

This took about five to six years, as foreign experts came to train local talent to take over job responsibilities. Close to 80 per cent of its indirect labour among current total headcount of 1692 are Singaporeans or permanent residents.

Mr Jagadish considers this a strength. "I've seen enough in this industry to know that if you do not do things in a local way, you can never be competitive," he says.

"I can't bring in the ideas of Taiwan and operate like TSMC. We need to do it in a local way, and get the maximum benefits."

EDB Investments has since sold its stake and SSMC is now a 60-40 joint venture between Dutch semiconductors company NXP, formerly a division of Philips, and TSMC.

One trademark of "the Singapore way" is disciplined execution. Singaporeans are good at following standard operating procedures and instructions, says Mr Jagadish. "We don't have managers in the night time. There is a system in place, safety, emergency responses - there is no need to supervise people artificially."

That same dutiful adherence to instructions can be a disadvantage when it comes to breeding innovative ideas, he adds. But SSMC has seen successful innovation become the culture of the company. Some innovation was born of necessity, the proverbial mother of invention. "You corner them into a situation, tell them 'Guys, we have no choice, you've got to find a way', and they do," says Mr Jagadish.

A few years ago, SSMC was wrapping up manufacturing for a product used in embedded flash technology when the Japan supplier of a specialty gas used in making the wafer said it could not supply gas at the purity and quantity demanded. On top of that, the cost of gas per wafer had risen to \$37.

Mr Jagadish put his team to work finding a solution. They came up with three: reduce usage of the gas, find an alternative nearer source and maintain quality at slightly lower level of purity. This allowed them to finish production, with a far lower cost of gas per wafer - \$7.

"They were cornered, the innovation comes when you're cornered and in a situation where you have to do something or you'd lose the business," he says.

### **Rewards for ideas**

But pressure isn't the only way to encourage innovation, incentives work too.

SSMC's "Transform Platform" tracks the few hundred innovation projects employees are working on at any one time. These range from simple ideas to improve day-to-day workflow or "\$10K ideas" which save SSMC \$10,000, to million dollar ones, patentable processes or trade secrets.

Monetary rewards are given out for projects which are expected to yield results within 12 months. Each person on a Lean Six Sigma team to cut waste gets \$50, while submitting a patent can net an employee a \$3,000 reward.

One team, comprising managers, engineers, operators and suppliers, launched a project they called "Liquid Gold", which ended up saving SSMC an Olympic-sized swimming pool of water each day.

The fab uses NEWater in its scrubbers, to filter out gases, chemicals and residue in exhaust before releasing, but water was getting pricier. "From \$1.20 to \$1.30, to \$1.40 per cubic metre, we had to do something about it," Mr Jagadish says.

SSMC also managed to tap on PUB's Water Efficiency Fund to help defray the \$1 million cost of building the in-house water recycling system they created to collect used water from the scrubbers, filter it with reverse

osmosis membranes and send cleaned water back to the scrubbers.

#### Adopting new technology

Productivity improvements also come from learning from more advanced fabs, says Mr Jagadish. The foundry is in the middle of rolling out RFID (radio frequency identification) tags to track the thousands of wafers on its production floor at any one time.

SSMC first observed this being used in 12-inch fabs and decided that it could be brought into its own 200mm fab. Currently, pods which carry the wafers around in a cleanroom environment, are already labelled with a smart tag that provides information on its stage of production.

But operators still need to manually press a button to read the tag. With RFID, information is automatically transmitted to display screens, enabling operators to locate each pod more quickly and know where the pod is headed for next.

"This is very essential when we're trying to speed up the manufacturing process," says Mr Jagadish, such as in the rush to meet priority orders.

SSMC is spending close to \$1.3 million on this project, which will be completed by the end of this year, and expects to save on the need for 29 workers. But no one is about to be laid off, as cycle time is improved instead.

"In fact, we need every one of them. We want them to do be able to do the next level job of a technician. I don't think the fear of redundancy is in any one of our workers," he says.

SSMC itself is a leading producer of RFID chips. "We're passionate about the silicon that we make... so the semiconductor chips we manufacture are in turn being used by ourselves as we automate," says Mr Jagadish.

#### Future planning

But all these projects to automate and innovate could prove futile without a clear strategic plan for the future. "We went from plain vanilla to specialty ice-cream. In the next few years, maybe we will create customised icecreams. So we need to look at developing skills for the future," he says.

SSMC is looking at what it might take to grow the automotive industry, which accounts for 5 per cent of business today, into a larger revenue contributor. Mr Jagadish sees value in the sector's longer gestation period and its being less likely to move to a different market.

Preparing for the future also means meeting challenges head-on. Rising business costs is one that SSMC is tackling with projects to cut electricity and water costs and raise operational efficiency. But a shortage of technically skilled talent, as the finance industry continues to draw bright young engineers, remains a challenge, Mr Jagadish says.

For now, Singapore's reliable electricity and water supply critical to sensitive manufacturing systems like SSMC's, its respect for intellectual property and security systems which allow for production of items like passports, keeps it attractive.

However, despite "making good progress", Singapore's electronics ecosystem is still not as good as Taiwan's, he says.

SMEs here tend to lack the ability to do business with a longer-term view. "A lot of the time, they start with all the enthusiasm and you do the handholding, get them started, but after a while they say 'No, I don't want to do this.' They can't compete with the SMEs of Taiwan, Korea or Malaysia."

Mr Jagadish also thinks the current levels of funding support from government agencies for productivity and automation is "not good enough" and suggests support in the range of 50 to 70 per cent of investments instead.

"For Singapore's context, we're going to be short of manpower on an ongoing basis. In order to bring in the productivity standards of the Western world, while we encourage R&D in universities we also need to encourage investments into productivity," he says.

A stronger initial push is crucial to help companies, driven by returns on investment, justify sinking in the money and "prove the concept", after which government help can be gradually withdrawn.

