

The Liang Mong-song Story: Hunting Down a Turncoat
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TSMC admitted at an investor conference on Jan. 15 that it has been overtaken in 16nm technology by Samsung. A big reason is Liang Mong-song, who sold out to the Korean company. Here's the story of what went down.

On Jan. 8, two foreign brokerages downgraded their recommendations for Taiwan Semiconductor Manufacturing Co. (TSMC). For one of them, Credit Suisse, it was the first time it had voiced pessimism over TSMC's prospects after having had looked favorably on the world's largest contract chip maker for more than five years. The main reason cited was more intense competition from Samsung Electronics and Globalfoundries this year.

Five years ago, TSMC Chairman Morris Chang called Samsung a blip on the radar, but the Korean giant has come on quickly and is now poised to deal TSMC a major blow.

Chang began developing energy-saving FinFET technology more than 10 years ago, and TSMC was expected to mass produce chips using the 16nm FinFET process in the second half of 2015. But Samsung beat TSMC to the punch by at least six months, launching mass production of wafers using similar technology in early December 2014.

The big question at TSMC's investor conference on Jan. 15 was whether the chip maker had lost the majority of Apple's orders for Apple's new-generation A9 processor to Samsung. Answering analysts' questions, Chang admitted that in the technology arena, "we have fallen a little behind."

But he defended the company's fundamentals over the past six months and stressed that TSMC would catch up next year and "gain a bigger market share in a bigger market."

TSMC is now lagging an Asian competitor in logic process technology for the first time in more than a decade and may lose A9 processor orders because of it.

A key force behind Samsung's edge is a middle-aged Taiwanese with bushy eyebrows who has been Samsung's System LSI division's chief technology officer for three and a half years and works at Samsung's R&D headquarters in Seoul. His name is Liang Mong-song, a former senior director of R&D at TSMC's Advanced Modules Technology Division.

To him, and the five former TSMC colleagues he took with him to Samsung, this constitutes a momentous victory.

"If TSMC didn't allow him (Liang) to leave at the time, it wouldn't be in such bad shape today," laments one semiconductor professor close to TSMC's executives. This one individual, whose changing of jobs so profoundly affected the fates of two countries' major chip makers, has come to be known as Taiwan's No. 1 turncoat.

Losing 80% of Apple's Orders

TSMC sued Liang in late 2011 to prevent him from leaking TSMC's trade secrets to Samsung in Taiwan's Intellectual Property Court and won first and second trials against its former employee, the latter verdict coming in May 2014. A copy of the written verdict in the second trial obtained by Commonwealth Magazine reveals that Liang's contribution to Samsung and harm to TSMC goes far beyond what had previously been suspected.

The TSMC suit alleged that after Liang left the company in 2009, he not only joined Samsung subsidiary Sungkyunkwan University as a professor in August that year, "but was already leaking TSMC trade secrets to Samsung."

As evidence, TSMC presented a report by outside experts offering a structural analysis of key manufacturing processes of TSMC, Samsung and IBM products. The process involved analyzing transistors 1/10,000th the size of a hair with the most advanced electron microscopes to compare the main structural characteristics and constituent materials of the three companies' last four generations of chips.

Because Samsung's technology originally came from IBM, the wafers produced beginning in 2009 using the 65nm process had characteristics similar to IBM's products but completely different from TSMC's products, a predictable result.

But what shocked TSMC was that in the following years, the characteristics of Samsung's 45nm, 32nm and 28nm generations increasingly mirrored those of TSMC's chips. The report listed seven key process areas that were nearly identical for the two companies.

Also, the silicon germanium alloy used in Samsung's 28nm P-type electrodes had a diamond-shaped structure similar to TSMC's but completely different from IBM's "U-shaped" structure.

The similarity of these technical characteristics, as unique as fingerprints and nearly impossible to copy, led TSMC to believe that "Liang Mong-song has already leaked TSMC's trade secrets to Samsung."

Also, the 16nm and 14nm FinFet products that both companies will mass produce this year were even more alike. "It could be hard to tell (if the product) came from Samsung or TSMC if only structural analysis is used," the report said.

This assessment shocked semiconductor industry insiders because it suggested that the competitive advantage TSMC had spent more than 20 years and hundreds of billions of Taiwan dollars in R&D investment to build had suddenly vanished.

CommonWealth Magazine gave the written verdict to an executive at one of the world's three biggest IC design companies to analyze, and he had no doubt as to what happened. "TSMC really should sue Liang Mong-song!" he insists after reading the report.

"Samsung has made up ground on TSMC just too quickly these past few years. If know-how wasn't passed on to them, that couldn't have happened," the industry insider says.

An electrical engineering professor at a local university, recognized as an expert in semiconductor production processes, agreed with the above-mentioned report's doubts. "Its suspicions are reasonable," the professor said.

In a research note issued by CLSA on Jan. 12, the brokerage said TSMC received all of Apple's processor orders last year, but because of the lag in its FinFET technology, it would likely miss out on 80 percent of Apple's newly added orders, costing the chip maker more than US\$1 billion (or about NT\$31.5 billion) in lost business.

Stopping the Bleeding: A Court Victory

The Intellectual Property Court ruling in May 2014 in TSMC's civil action against Liang may offer a glimmer of hope for TSMC.

In their verdict, the judges agreed to all of TSMC's requests, including barring Liang from working for or serving Samsung in any capacity from the time of the ruling to Dec. 31, 2015, "because of fears that TSMC's trade secrets were infringed." The court had not agreed to TSMC's request to keep Liang away from Samsung in the first trial.

From the perspectives of both the legal community and the high-tech sector, the ruling was groundbreaking. Taiwanese courts had never before blocked senior executives of a company from working at a competitor after the non-compete period had expired.

CommonWealth Magazine obtained copies of the confidential written verdicts of both the first and second trials and also interviewed the chief judge and several of the people directly involved in the case to bring the context of these critical rulings into the public eye. Several new details shed light on the mysterious Liang, now seen as the No. 1 traitor of Taiwan's high-tech sector, and his thinking in defecting to a hated rival.

The Main Character: Who Is Liang Mong-song?

The 62-year-old Liang got his Ph.D. in electrical engineering from the University of California, Berkeley. After graduating, he worked for a few years at American processor vendor Advanced Micro Devices (AMD), and then returned to Taiwan at the age of 40 in 1992 to work for TSMC.

His Korean wife was once a semiconductor engineer and a colleague of Liang's at AMD, and she also worked as a flight attendant.

During his 17-year career at TSMC, he was a top performer.

In 2003, TSMC's home-grown technology overtook IBM's, and the company drew worldwide attention for its 0.13 micron copper damascene process. The Executive Yuan (Taiwan's administrative branch of government) praised TSMC's R&D team, and the contribution of Liang,

who was responsible for the Advanced Modules Division, was ranked second behind only that of Chiang Shang-yi, the company's former executive vice president who headed TSMC's R&D team at the time.

The FinFET technology at the heart of today's fierce battle between TSMC and Samsung was also one of Liang's strengths. In its claim against Liang, TSMC stressed: "Liang Mong-song was deeply involved in TSMC's FinFET process research, and he was the inventor behind related patents."

The degree to which TSMC valued Liang was reflected in his compensation. During the trial process, TSMC revealed that during the 17 years he worked for TSMC, Liang earned NT\$626.9 million in salary and stock and cash bonuses. That averages to more than NT\$36 million a year, far exceeding the income of the vast majority of corporate CEOs in Taiwan.

So why would Liang even think of leaving in the first place? Apparently because he felt unappreciated after losing out on a promotion.

When Chiang Shang-yi retired in 2006, TSMC decided to have two R&D vice presidents assume Chiang's position because of the company's growing R&D organization. Former Intel executive Wei-jen Lo was named to one of the positions, while Liang lost out to Jack Sun, TSMC's current chief technology officer, for the other.

"I think he had high expectations that when I left he would be one of the two (R&D vice presidents)," recalls Chiang, who is now an advisor to Morris Chang.

TSMC chose Sun for the position because his broader expertise better fit a position that required integrating several different technologies. It assigned Liang to head its "more than Moore" program, designed to bring added value to mature semiconductor technologies.

Liang saw it as assigning a top-class talent to a second-rate project. In his only appearance at either of the two trials, Liang testified in the first trial that he felt he had been "frozen out" and "demoted" and was ultimately "forced" out.

"Having someone with my background work in a unit where I could not fully exploit (my talents) ... left me feeling cheated, insulted and completely unappreciated by my superiors," he said.

The argument that TSMC had deprived Liang's right to work was a factor in the court's refusal after the first trial to prohibit Liang from working for Samsung.

In retrospect, Liang's ego may have gotten in his way of a good opportunity because the emergence of the Internet of Things has given new importance to "more than Moore," and it was because of the good results generated by the project's leader, C.C. Wei, that Wei later emerged as one of two successors to Morris Chang.

TSMC had taken measures to prevent Liang from working for a competitor. As with many senior

executives at Taiwanese tech companies, Liang signed a "golden handcuff" clause stipulating that half of the stock he received as a bonus would be kept with an overseas unit of TSMC, and he would be seen as forfeiting the stock should he work for a competitor within two years of leaving TSMC. When Liang resigned, he re-signed the contract to confirm his understanding of the agreement.

When Liang quit, he told the company he wanted to spend time with his parents and would teach at National Tsing Hua University in Hsinchu. But six months later, he suddenly turned up as a visiting professor at Sungkyunkwan University.

Because the university is part of the Samsung Group, Taiwanese media reported that Liang had started working for Samsung, and netizens discovered that his e-mail address was "msliang@samsung.com". But TSMC waited nearly two years, until the non-compete contract nearly expired and Liang was in fact working at Samsung, before taking legal action.

Many people were puzzled why the normally decisive TSMC had suddenly gone soft. In fact, in May 2010, the vice president of TSMC's human resources division at the time, Tu Long-chin, sent an e-mail to Liang saying he had seen reports that Liang was already employed by Samsung. That, Tu warned, would constitute a violation of the non-compete clause and lead to the forfeiture of his shares, which would be handed over to the TSMC Education and Culture Foundation.

Liang immediately replied, writing: "I have never, am not now and will never in the future do anything to let down the company."

The Break-up: Breach of Trust

A month later Tu and Richard Thurston, then general counsel and vice president of TSMC's legal division, held a meeting with Liang at which he promised that he "will not join Samsung now or in the future." The next day, he even sent a letter to Thurston, with whom he had been close, saying that he was thinking of resigning his position at Sungkyunkwan University.

During that time, Liang even wrote a letter to Morris Chang, insisting on his innocence and saying that he had TSMC blood in his system.

Ultimately, TSMC executives decided to believe their old comrade who had fought alongside them for more than a decade and pay him the more than NT\$100 million his 738,000 withheld shares were worth in three installments.

But on July 13, 2011, just two months after collecting the final installment of the stock payout, Liang formally became the chief technology officer of Samsung Electronics' System LSI division. When the news spread, it came as a slap in the face to those who trusted him.

And it prompted TSMC to ask a court to bar Liang from working at Samsung on preventive grounds, fearing that he might leak TSMC trade secrets to the Korean electronics behemoth.

"Liang Mong-song ... obviously lacks integrity....It is hard to expect that he will comply with his confidentiality obligations to TSMC," the company wrote in its complaint.

CommonWealth Magazine sent an e-mail to Liang for comment, but has yet to receive a response.

Betrayal: Covering Up the Big Lie

The judge who ruled in favor of TSMC in the second trial, Sung-mei Hsiung, actually seemed to favor Liang early in the trial, rejecting TSMC's request for a provisional injunction.

"At the time, everybody sympathized with him," Hsiung says. Because Liang's wife was Korean, Hsiung felt that it made perfect sense for Liang to go teach in South Korea and that TSMC's allegations that he was really working for Samsung were not necessarily true.

But in the trial's later stages, she was surprised to discover that Liang's wife in fact lived in Taiwan while Liang worked as a visiting teacher. That sowed doubts in Hsiung's mind about why the defendant was spending so much time in South Korea.

According to Liang's exit and entry records obtained by the court, during the period of time he taught at Sungkyunkwan University, spanning 630 days from August 2009 to March 2011, he was in South Korea for 340 days, even though he taught only one course of three hours a week.

TSMC argued that because the time Liang spent in South Korea was far beyond his teaching requirements, "it's evident that Liang Mong-song was really providing services to Samsung during that time."

To prove its point, TSMC submitted new and more definitive proof in the second trial, evidence that proved to be one of the keys that turned the tide during the court proceedings.

TSMC commissioned a Korean law firm to find out if Liang's employment at the university was simply a guise for something more nefarious. What it discovered is that he was actually teaching at Samsung's own corporate university – the Samsung Institute of Technology – located in the company's factory complex.

Liang's 10 Korean "students" were in fact veteran Samsung employees.

TSMC was fortunate that Hsiung was not your average judge. Armed with a Ph.D. in law from UC Berkeley, she is one of Taiwan's leading scholars on intellectual property and has taught at National Taiwan University. Within the legal community, she is known for her forward thinking and international perspective.

Also, Hsiung's husband happens to be Korean, and she had been to Sungkyunkwan University many times, making her fully aware of its close relationship with Samsung. She understood even more clearly the nature of the unspoken functions these corporate universities in South Korea fulfill.

She once talked about a Japanese case at a seminar that gave her pause. Nippon Steel and Sumitomo Metal sued a former engineer for leaking secrets to Korean conglomerate Pohang Iron and Steel Company. A key part of the plot was that after the Nippon Steel engineer quit and took with him a highly confidential steel formula, he first worked at Pohang University of Science and Technology during his non-compete clause period.

That case made Hsiung think of the "similar role" Sungkyunkwan University plays for Samsung.

"This is an old (Korean) trick. We can't always be played by them like this," Hsiung says.

The judge, who often attends meetings in the United States and Japan, is deeply aware that these "corporate turncoats" have become a serious headache for advanced countries such as the United States and Japan, and they have taken extreme measures to protect the commercial secrets of their big corporations.

"How many big corporations can one country have? If we don't protect them, who are we supposed to protect," Hsiung stressed.

TSMC's Dilemma: Why Not Sue Samsung?

Ten years ago, TSMC used reverse engineering to analyze the products of rival Semiconductor Manufacturing International Corporation (SMIC) and discovered that they were nearly identical to TSMC's.

The company's former legal counsel, Richard Thurston, was highly suspicious that a former executive was delivering trade secrets to SMIC and decided to sue SMIC in the United States for patent infringement and theft of trade secrets, resulting in a major victory years later. SMIC has not been a threat to TSMC since.

So what are the chances that TSMC will use the tactic again and sue Samsung to keep it at bay?

Sylvia Fang, who took over from Thurston as TSMC vice president and general counsel, says her company is not contemplating legal action at present. Samsung is much bigger than SMIC was a decade ago and its product line far more sophisticated, meaning that rushing to sue could have unpredictable or even unintended consequences.

"Though we are always prepared, we will not take action rashly," she says cautiously.

The defection of a top TSMC R&D executive to the enemy has led to seismic shift in the global wafer contracting industry.

Similar incidents have occurred repeatedly in Taiwan's high-tech sector in recent years. The flat panel and IC design sectors have had their own "Liang Mong-songs," all of them "turncoats" capable of shaking up the country.

As China uses whatever means possible to catch up with and overtake Taiwan's powerful high-tech sector, the issue has grown increasingly serious, almost to the point of costing the country its future.

This is truly a national security crisis. Liang Mong-song's story has sounded the alarm to corporate leaders, executives and individuals.

Translated from the Chinese by Luke Sabatier