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Q1 2017 Taiwan Semiconductor Manufacturing Co Ltd Earnings Call

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## PRESENTATION

**Elizabeth Sun** *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division*

(foreign language) Welcome to TSMC's First Quarter 2017 Earnings Conference and Conference Call. This is Elizabeth Sun, TSMC's Senior Director of Corporate Communication and your host for today. Today's event is webcast live through TSMC's website at [www.tsmc.com](http://www.tsmc.com). (Operator Instructions). As this conference is being viewed by investors around the world, we will conduct the event in English only.

The format for today's event will be as follows. First, TSMC's Senior Vice President and CFO, Ms. Lora Ho, will summarize our operations in the first quarter of 2017, followed by our guidance for the second quarter of 2017. Afterwards, TSMC's 2 Presidents and Co-CEOs, Dr. Mark Liu and Dr. C.C. Wei, and Ms. Ho will jointly provide our key messages. Then we will open the floor for questions and answers.

For those participants on the call, if you do not yet have a copy of the press release, you may download it from TSMC's website at [www.tsmc.com](http://www.tsmc.com). Please also download the summary slide in relation to today's

earnings conference presentation.

As usual, I would like to remind everybody that today's discussions may contain forward-looking statements and are subject to significant risks and uncertainties, which could cause actual results to differ materially from those contained in the forward-looking statements. Please refer to the safe harbor notice that appears on our press release.

And now I would like to turn the podium to TSMC's CFO, Ms. Lora Ho, for the summary of our operations and current quarter guidance.

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**Lora Ho Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP**

Thank you, Elizabeth. Good afternoon, everyone. Welcome to join us today. My presentation, as usual, will start with financial highlights for the first quarter, followed by the guidance of the second quarter.

First quarter revenue decreased 10.8% sequentially but increased 14.9% year-over-year, the sequential decline reflecting mobile product seasonality and about 2% appreciation in NT dollars against the U.S. dollar. When we give our guidance in the first quarter, we were assuming USD 1 to TWD 32. However, the actual average exchange rate was TWD 31.16, which reduced our revenue by about TWD 6 billion. Without the NT dollar's appreciation, our first quarter revenue would have been about TWD 240 billion, exceeding the high end of our guidance.

First quarter gross margin was 51.9%, slightly lower than the fourth quarter 2016, mainly due to lower level capacity utilization and an unfavorable foreign exchange rate, partly balanced by continued cost improvement.

Operating expense ratio rose to 11.1% as R&D as a percentage of revenue increased by 70 basis point, so operating margin decreased 1.1 percentage point sequentially to 40.8% in the first quarter.

Overall, our first quarter EPS was TWD 3.38, and ROE was 24.6%.

Now let's take a look at wafer revenue contribution by application. During the first quarter, Consumer and Computer increased 30% and 1%, respectively; while Communication and Industrial/Standard decreased 18% and 5%, respectively, due to mobile product seasonality.

Now let's take a look at revenue by technology. Combined revenue from 16- and 20-nanometer was 31% of total wafer revenue in the first quarter, while 28-nanometer represented 25% of total wafer revenue. Advanced technologies, which we define as 28-nanometer and below, accounted for 56% of total wafer revenue in the first quarter.

Moving on to the balance sheet. We ended the first quarter with cash and marketable securities of TWD 659 billion, an increase of TWD 27 billion from the fourth quarter. On the liability side, current liabilities slightly increased by TWD 3 billion. On financial ratios, accounts receivable turnover days increased 2

days to 47 days, while days of inventory increased 3 days to 44 days.

Now let me make a few comments on cash flow and the CapEx. During the first quarter, we generated about TWD 161 billion cash from operation and spent \$103 billion in capital expenditure. As a result, we generated free cash flow of TWD 58 billion. We also repaid \$10 billion corporate bonds and net purchase of about \$7 billion fixed income securities. Overall cash balance increased by TWD 23 billion to reach TWD 565 billion at the end of the first quarter.

In the U.S. dollar terms, our first quarter capital expenditure was USD 3.3 billion. Full year capital budget remained at about USD 10 billion.

I have just finished the financial summary for the first quarter. Now let me turn into the second quarter guidance. We expect second quarter demand will be weaker than the first quarter due to supply chain inventory management during the second quarter and mobile product seasonality. Based on our current business outlook and exchange rate assumptions of USD 1 to TWD 30.5, we expect second quarter revenue to be between TWD 213 billion and TWD 216 billion, which represents 8% to 9% sequential decline; gross profit margin to be between 50.5% and 52.5%; and operating margin to be between 39% and 41%. The margin guidance reflects a higher utilization level for work-in-process building to support a strong 10-nanometer shipment in the third quarter.

Also, in the second quarter, we will again need to accrue the 10% tax on the undistributed retained earnings. As a result, our second quarter tax rate will be about 23%. The tax rate will then fall back to 10% to 11% level in the third and fourth quarter, and the full year tax rate will be between 13% and 14%.

This concludes my remark, and I will turn the -- turn it over to Mark for his comments.

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**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

Good afternoon. Let me start from my message on the near-term demand and supply chain inventory.

Since all our shipments are in U.S. dollars, allow me to just use the U.S. dollar to describe our demand. We just concluded our first quarter revenue to be above our January guidance in U.S. dollars. It gives us a minus 9% quarter-to-quarter in U.S. dollars, which is about plus 22% year-to-year growth. This quarter-to-quarter change in 1Q '17 was due to the seasonality of our major smartphone customer and a slower smartphone demand in China.

We now forecast our second quarter revenue to decline about 6% quarter-to-quarter in U.S. dollars. Year-over-year, this is an increase of about 3% year-to-year in U.S. dollars. Together with the 1Q revenue, our first half 2017 revenue would grow about 12% year-over-year in U.S. dollars. This is slightly higher than the 10% increase year-to-year we forecasted in our January investor conference.

We now estimate fabless DOI is still high, high above seasonal exiting first quarter '17. Our second quarter revenue guidance does reflect a quite severe inventory adjustment by our customers,

particularly in smartphone and PC markets. However, the overall end-market smartphone demand appears stable in second quarter '17. We estimate that fabless DOI should approach seasonal level at the end of second quarter of '17, and demand for our products will be poised for a strong growth in the third quarter.

Given the very strong demand in the second half last year, we maintain our second half '17, this year, growth rate estimate of 5% year-over-year. And our full 2017 growth rate target remains to be 5% to 10% in U.S. dollars, as we previously stated.

Now the forecast of overall semiconductor market growth rate compared to 3 months ago, we raised it to 7% from 4% due to a stronger memory market. Semiconductor, excluding memory, market growth rate remains at 7 -- at 4% this year. We also revised foundry revenue growth to 5% from 7% due to this elevated inventory in the supply chain. Our 5% to 10% full year growth forecast shows we will continue to increase our market share this year.

Thank you. I'll hand the mic to C.C. Wei -- oh, I'm sorry, Lora.

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**Lora Ho *Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP***

As the foreign exchange rate is volatile this year, it's almost very difficult to predict, so I will make some comments on foreign exchange rate and impact to our revenue and the profitability. As you may all know, NT dollars is the reporting currency for our -- all our financial statements due to the fact that nearly 100% of TSMC's revenue is denominated in U.S. dollars, and about 75% of our cost of goods sold and about 70% of our operating expenses are based in NT dollars. Therefore, the fluctuation in exchange rate between U.S. dollars and NT dollars will have a sizable impact to our reported revenue and gross margins. The sensitivity of revenue to U.S. dollar/NT dollar exchange rate is nearly 100%. That is, if every 1% appreciation of NT dollars to U.S. dollar will reduce our reported revenue by about 1%. The sensitivity of both our gross margin and operating margin to the same 1% exchange rate change is about 40 basis points. That is, if NT appreciates 1% against U.S. dollars, our gross margin and operating margin will both come down by about 40 basis points.

Compared with the first quarter guidance made in January 12, the NT dollar has appreciated by an average about 2.6% sequentially, which negatively impact our first quarter revenue by about 2.6% and our gross profit margin about 100 basis point, gross margin and operating margin each.

For 2017, the second quarter, we forecast the average NT dollars will further appreciate another 2.1% sequentially, which will negatively impact our second quarter revenue by 2.1% and then reduce our gross margin and operating margin by about 85 basis point.

Should exchange rate have stayed at a fourth quarter '16 level, which was 31.77 in average, our first quarter '17 revenue would have been 1.9% better than the actual number reported here, and our second quarter revenue would have been 4% better than we just guided.

Thank you. I will turn it to C.C. Wei then.

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Thank you, Lora. Good afternoon, ladies and gentlemen. Let me start with 10-nanometer ramp status.

We have passed the reliability qualification on internal technology qualification vehicle and have also passed 500-hour reliability qualification on several customers' product. N10 has been transferred from R&D to operation in both Fab 12 in Hsinchu and Fab 15 in Taichung and is ready for high volume production. Although N10 technology is very challenging, the yield learning progression has been the fastest as compared to the previous node such as the 20- and 16-nanometer. Our current N10 yield progress is slightly ahead of schedule. The ramp of N10 will be very fast in the second half of this year. We expect the 10 nanometers will contribute about 10% of our wafer revenue this year.

Now let's move to N7 and N7+. TSMC N7 will enter risk production in second quarter this year. So far, we have more than 30 customers actively engaged in N7. And we expect about 15 tape-outs in this year with volume production in 2018. In just 1 year after our launch of N7, we plan to introduce N7+ in 2018. N7+ will leverage EUV technology for a few critical layers to save more immersion layers. In addition to process simplification, our N7+ provides better transistor performance by about 10% and reduces the chip size by up to 10% when compared with the N7. High volume production of N7+ is expected in second half 2018 -- I'm sorry, in second half of 2019. Right now, our focus on EUV include power source stability, pellicle for EUV mask and stability of the photoresist. We continue to work with ASML to improve the tool productivity so that it can be ready for mass production on schedule.

Now N5. We have been working with major customers to define 5-nanometer specs and to develop technology to support customers' risk production schedule in second quarter 2019, with volume ramp in 2020. Functional SRAM in our test vehicle has already been established. We plan to use more layers of EUV in N5 as compared to N7+.

In addition to those leading-edge technology, we also continue to improve N16 and 28-nanometer, which are in mass production for many years.

Now let me talk about N12. After we have developed 16-nanometer technologies from 16FF to 16FF+ and then to 16FFC, we further extend this technology to 12-nanometer, which will have about a 10% better performance at the same total power or 25% lower power consumption at the same speed and about 8 to 10% smaller die size compared with our 16FFC. Although 12-nanometer wire have smaller metal pitches as compared to 16FFC, we have worked with IP infrastructure partner to build a complete IP support to make sure our customers' 16-nanometer product can be successfully ported to 12-nanometer with minimal effort.

We anticipate the completion of 12-nanometer development by middle of this year. So far, more than 10 customer has actively engaged with 7 tape-outs being planned in 2017. The major applications were the mid- to low-end smartphones. With 12-nanometer having better cost structure and better performance

than our already competitive 16-nanometer, we expect to maintain a high market segment share in this N16, N12 node.

Now 22ULP. 22ULP is a half node of our 28-nanometer technology. We developed this technology to address the market segment where low operating voltage are required. Applications in IoT, imaging signal processing, GPS, WiFi and 5G millimeter wave are examples that can find good use of this technology. Compared to our 28HPC+, our 22ULP offers 15% performance improvement or 35% power reduction. It also reduces the die size by up to 10%.

In addition, the RF performance, the cut-off frequency or the maximum frequency is also improved to 400 and the 370 gigahertz, which is used for the 5G application. We expect to begin 22ULP volume production in 2018. We've enhanced the features carried by this technology. We expect to maintain a high market share in this 28/22 technology family.

Now let me talk about the specialty technology. Especially this time, I will cover ultra-low power, which is very important for all mobile products. We have offered the foundry's most comprehensive ultra-low power technology portfolio, including 55-nanometer, 40-nanometer, 28-nanometer, 16FFC and now 22ULP and 12ULP. All these technologies are targeting IoT, with low end smartphone, GPS, Bluetooth and other applications. Depending on each application's performance and power requirement, the customer can choose their optimal solution from our portfolio. 55-nanometer and 40-nanometer ULP are in high volume production since early 2016.

So far, there have been more than 35 products running in the line. Meanwhile, 28ULP, 16FFC are also in high volume production. In addition to those technologies, we have also developed near-threshold voltage technology in 40-nanometer. This technology can achieve power consumption below 10 microampere per megahertz active power, which is 5x to 10x lower than industry's best product for today. We are working on the design enablement support for our 40-nanometer near-threshold voltage, which will be completed by third quarter this year.

Now let me update on InFO. First, we expect InFO revenue in 2017 will be about USD 500 million. Now we are engaging with multiple customers to develop next-generation InFO technology for smartphone application for their 2018, 2019 models. We are also developing various InFO technologies to extend the application into high-performance computing area, such as InFO on substrate, and we call it InFOoS; and InFO with memory on substrate, InFO-MS. These technologies will be ready by third quarter this year or first quarter next year.

That's all my update. Thank you for your attention. Mark?

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**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

Okay, let me share with you the last bullets, AI, artificial intelligence, and the ubiquitous computing. This is to share with you the recent development in the semiconductor industry and how TSMC positioned ourselves to ride on this trend. We are in a new era where billions of devices are connected at all times,

and computing takes place at any time and any place. This is what we've referred to as ubiquitous computing. For smartphone, for example, in addition to the smartphone unit growth, more intelligent features, such as voice, image recognition and AI for decision-making, will further increase its computing power and silicon content. Given the vast established subscription base of smartphone today, it is the best launchpad for new consumer hardware and software innovation.

For AI in high-performance computing, let me first define the HPC, high-performance computing, as the semiconductor used in data centers, servers, networking, storage and gaming. Artificial intelligence application and services and 5G infrastructures are the major driving force with leading-edge technology behind this HPC growth. For example, more than half of our customer product tape-outs with our 7-nanometer today we see are HPC products.

Recently, we are also very encouraged by the support of a major AI service provider on ARM-based processor for data center in Open Compute Project Summit this year. Accelerators used in data center are also increasing, adopting the GPUs, FPGAs and ASICs. We expect HPC to become our major growth engine from 2020.

The trend of ubiquitous AI also shows up in many IoT and consumer devices such as robot, drones, surveillance devices, smart TV and set-top box. Ubiquitous AI will also be widely used in a fast-developing autonomous car market. All these require very intensive, localized parallel computing capability which drive up the silicon content.

At TSMC, we work with innovators around the world. TSMC's long-term growth engine ride on this industry trend from mobile computing to ubiquitous computing. The proliferation of AI demands insatiable computing capability from semiconductors. As C.C. just talked about our technology updates, we are developing various technologies and innovation platforms to satisfy this industry trend.

Thank you for your attention.

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**Elizabeth Sun *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division***

This concludes our prepared statements. Before we begin in the Q&A session, I would like to remind everyone to limit your questions to 2 at a time to allow all participants an opportunity to ask questions. Questions will be taken both from the floor and also from the call. Should you wish to raise your questions in Chinese, I will translate that to English before our management answers your question. (Operator Instructions) Questions will be taken in the order in which they were received. (Operator Instructions) Now let's begin the Q&A session.

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## QUESTIONS AND ANSWERS

**Elizabeth Sun *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate***



**Communication Division**

All right, first one -- the first questions will be coming from Credit Suisse, Randy Abrams.

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**Randy Abrams Credit Suisse AG, Research Division - MD and Head of Taiwan Research in the Equity Research Department**

First question, I wanted to ask about 28-nanometer, where you talked about still gaining a bit of market share. There's a couple of rival options. Intel announced 22-nanometer using the FinFET that they have on 22 and then also the Samsung-GLOBALFOUNDRIES have the FD-SOI. And for China, they haven't been a presence but starting to ramp up. So I'm curious how you're viewing these other options in the driver of confidence on the 28-nanometer relative to this.

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Well, Randy, we continue to improve our technologies, so we are very competitive. As I said, we developed 28-nanometer from time up to 28HPC+. Now we have a 22ULP, so we are still confident we can maintain a very high market segment share on this technology node. I don't want to comment on our competitor's progress.

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**Randy Abrams Credit Suisse AG, Research Division - MD and Head of Taiwan Research in the Equity Research Department**

Okay. The second question, I wanted to ask about the margins. You've actually done a great job weathering 2 quarters in a row, where margin is still about 50%, and sales are down high single digit 2 quarters in a row and high margin. If you could take a forward look towards the second half, where we ramp up 10-nanometer and at these exchange rates since you're building WIP in the second quarter, how you expect the margin to trend if there's still some leverage in the model as we go into peak season in the second half?

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**Lora Ho Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP**

Randy, we intend to keep structural profitability and close to 50% margin. As you know, we are ramping 10-nanometer significantly starting from the second half of this year. I remember I said last time, there will be some dilution from 10-nanometer. In terms of the magnitude, our estimation is for the second half, you will have 2 to 3 percentage point dilution to our corporate level gross margin.

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**Randy Abrams Credit Suisse AG, Research Division - MD and Head of Taiwan Research in the Equity Research Department**

And do you expect offsetting that, any incremental leverage from the rest of the business to potentially offset the 10-nanometer dilution?

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**Lora Ho Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP**

Usually, at the very beginning stage of any technology ramp, it's difficult to find offset immediately. But when time goes by, we can offset gradually as the 10-nanometer margin will also continue to improve.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate**

**Communication Division**

All right, next question will be coming from Deutsche Bank, Michael Chou.

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**Michael Chou Deutsche Bank AG, Research Division - Semiconductor Analyst**

C.C., since you mentioned before there will be only one 7-nanometer EUV customer, so are you seeing more customer for 7-nanometer EUV?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Yes, we are. As I've just reported, we are engaged with many customers on 7 and also 7+. So that -- did that answer your question?

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**Michael Chou Deutsche Bank AG, Research Division - Semiconductor Analyst**

I mean, for 7-nanometer plus EUV, right, so management mentioned before, only one customer for EUV in 7-nanometer. So now are you seeing -- how many customers you have?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Many.

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**Michael Chou Deutsche Bank AG, Research Division - Semiconductor Analyst**

Okay, the next question, sir, management mentioned the log scale comparison versus Intel, I think, the 2014, right? So since Intel came out to say that their technology seems to be 3 year ahead of the other competitor, including your company, so do you have any comment on your minimum metal pitch and the gate pitch comparison versus Intel? Or do you have any comment for your 5-nanometer versus Intel 10-nanometer, potential 7-nanometer?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Well, that's a tough question. I think every company, right now, they have their own philosophy developing the next generations of technology. As I reported in the foundry, we work with our customer to define the specs that can fit their product well. So the minimum pitch to define the technology node, we are compatible to the market. But the most important is that we are offering the best solution to our customers' product roadmap. And that's what we care for. So I don't compare that really what is the minimum pitch to define the technology node.

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**Michael Chou Deutsche Bank AG, Research Division - Semiconductor Analyst**

Just a follow-up question, sir. Can we say your power consumption efficiency in your 5-nanometer in 2020 will be ahead all the competitors, including, for instance, IDM? Can we say that?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

We have confidence to do that, yes.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

Next question will be coming from UBS, Bill Lu.

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**Bill Lu *UBS Investment Bank, Research Division - MD and Asia Semiconductors Analyst***

Questions for Dr. Liu. You said that AI, ubiquitous computing will be a driver starting in 2020. I'm wondering if you can talk to us about why that timing because you said that half of your 7-nanometer customers are HPC related. It seems like your customers and your customers' customers are pretty bullish right now as well. So why that timing?

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**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

Well, look, we look at our customer tape-out at 7-nanometer. And look at our development activity in our 5-nanometer, I think that is the time frame that we -- our customer can have a strong advantage to get into that market to grow.

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**Bill Lu *UBS Investment Bank, Research Division - MD and Asia Semiconductors Analyst***

I guess, I'm not so clear because 7-nanometer, that's ramping 2018...

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**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

'19.

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**Bill Lu *UBS Investment Bank, Research Division - MD and Asia Semiconductors Analyst***

To 2019.

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**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

'19. Yes, 2019 is the...

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**Elizabeth Sun *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division***

7+.

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**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

7+. And in order to accumulate huge volume revenue-wise, it takes a couple of years cooking to bring the whole value up.

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**Bill Lu *UBS Investment Bank, Research Division - MD and Asia Semiconductors Analyst***

Okay. So you're saying it becomes a bigger driver by 2020?

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**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

Yes. By driver, I measure by the incremental revenue dollars.

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**Bill Lu *UBS Investment Bank, Research Division - MD and Asia Semiconductors Analyst***

Do you have an estimate for how much as a percentage of revenue, or a total size by 2020?

**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Of HPC? I mentioned last conference, it was currently 15%. And at this point, it slightly increases this year by a couple of percent. But really, it is in the cooking from today to 2020, and we expect -- we do have a number, but currently, it's a model. I really cannot be certain on that number's accuracy. But it's the trend that's picking up, up to that time.

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**Bill Lu UBS Investment Bank, Research Division - MD and Asia Semiconductors Analyst**

My second question is related as well, which is, it seems like every quarter, you're getting more confident on 7-nanometers, both in terms of your execution and your customers' progress. I know the comment previously had been that CapEx stays relatively flat in next several years. Does that change at all with the confidence at 7-nanometers going out between now and 2020?

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Yes, we -- as the program development continues progressing, our confidence gets more, and our customers' confidence also gets more. So in terms of the CapEx, of course, we try to make the 7-nanometer and 10-nanometer relatively compatible; so thus, we try to maximize our CapEx efficiency when we are starting the ramp in 7-nanometer.

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**Bill Lu UBS Investment Bank, Research Division - MD and Asia Semiconductors Analyst**

Can I just ask a quick follow-up? If you look at 28, which I think was the last dominant node for TSMC, that coincided with the smartphone ramp between, I'm throwing a number, it's 2011, 2015, your CapEx went from about \$3 billion to about \$10 billion, right? But that also included a huge revenue ramp. Now as we look at HPC, I mean, to me it's a big opportunity as well, and that's over the next several years. But you're not seeing that CapEx to be triple, right, so what should we expect?

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

You're talking about CapEx after 2020?

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**Lora Ho Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP**

Bill, you think we should add up CapEx, so we'll be more confident on the technology development. Actually, I want to mention one thing is actually, as we have spent tremendous effort trying to improve the capital efficiency. You can see the equipment generation to next generation, the conversion ratio is pretty high. And we're talking about 80% of the time, people feel it's good. And now I can tell you the 10-nanometer transition to 7-nanometer, the migration compatibility is more than 95%. That's the effort we have spent. So we believe the CapEx guidance we are talking about, at a \$10 billion level, has reflected our confidence in all the effort we have put in to include the -- to improve the efficiencies.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

Next question will be coming from Citi's Roland Shu.

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**Roland Shu Citigroup Inc, Research Division - Director and Head of Regional Semiconductor Research**

First question to Mark. Mark, you mentioned on the ARM-based processor for HPC for data centers, HPC actually, the demand increased a lot. So do we see this same trend for this ARM-based process for PC? Yes, because Microsoft, actually, now they are Windows 10 supporting this ARM-based processor.

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

You're referring to Microsoft Windows 10 supporting the ARM-based CPU in the PC and notebook last year, right?

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**Roland Shu Citigroup Inc, Research Division - Director and Head of Regional Semiconductor Research**

Yes.

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

That was very good news to us, but I'd rather not to reveal our customers' booking individually. So I think we still have business to grow, and they get all the support from us and many other OEMs.

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**Roland Shu Citigroup Inc, Research Division - Director and Head of Regional Semiconductor Research**

Yes, so we can assume the very strong second half momentum, definitely, we probably included some momentum for this Windows on ARM player. Can we assume that?

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

I didn't say that, but -- yes, but they will grow. I mean, I cannot reveal to you.

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**Roland Shu Citigroup Inc, Research Division - Director and Head of Regional Semiconductor Research**

Okay. And also, same question for you. 22ULP, you said you are going to mass production from next year. So when can we expect this 22ULP revenue to achieve 10% of total revenue?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Oh, I did not look at that, but I -- all I can say is we start to engage with many customer, and it's very competitive. So I expect some of the 28-nanometers products will move to 22. When we are going to reach 10% of wafer revenue, I do not see the exact schedule yet.

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**Lora Ho Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP**

Actually, we don't separately looking at 22 and 28 because it's an extension of the technology. We look at the combined revenue. We don't do -- we don't look at it separately.

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**Roland Shu Citigroup Inc, Research Division - Director and Head of Regional Semiconductor Research**

Okay, so going forward, that means that we will include 28, 22 as the same node?

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**Lora Ho Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP**

Yes.

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**Roland Shu Citigroup Inc, Research Division - Director and Head of Regional Semiconductor Research**

So how about 16 and 12, they will be also include into the same node?

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**Lora Ho Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP**

Yes.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

Well, question -- next question will be coming from Goldman Sachs' Donald Lu.

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**Donald Lu Goldman Sachs Group Inc., Research Division - Equity Analyst**

(foreign language)

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

I will need to translate that first, Donald, so if I misrepresent you, you have to let me know. Donald's question basically is with respect to the implementation of AI in smartphones, and he's asking whether or not this increment of AI functionality to the smartphones will increase the die size of the smartphone.

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

It should. But every company have their different product strategy. Some target to the low end, some target to the premium, they're all very different. For the low end, still, the cost is still critical, and they want to just get the [inaudible] from the customers. And so they have different strategies, so I cannot really quantify for you. But definitely, a certain piece of silicon will be dedicated to AI. And in the beginning, it could be a separate function, and it could be integrated, too. So remember, our chip size will shrink along the progress of technology. So even maintaining the chip size already is a huge capability build and its contribution from AI already.

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**Donald Lu Goldman Sachs Group Inc., Research Division - Equity Analyst**

So maybe I can follow up a TSMC's smartphone content question. For this year, I think last year, last time, 6 months ago, you just commented it will increase for this year. And is that still the trend? And can you repeat like how much it will increase from last year to this year again?

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Roughly, the -- if you calculate from our share and our average dollar per phone, it's about high single digits.

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**Donald Lu Goldman Sachs Group Inc., Research Division - Equity Analyst**

And this trend you think will continue because of AI and other things for next year?

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

I hope so. I hope it will be more.

**Donald Lu *Goldman Sachs Group Inc., Research Division - Equity Analyst***

Great. My second question is on the guidance for this year. I think in January, you said 5% to 10% in U.S. dollars. And now the whole market, it's slowed down a little bit. That's -- so it will be more like in the low end of that range for this year?

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**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

No.

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**Elizabeth Sun *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division***

Okay, next question will be from JPMorgan's Gokul.

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**Gokul Hariharan *JP Morgan Chase & Co, Research Division - Head of Taiwan Equity Research and Senior Tech Analyst***

My first question, just wanted to refer back to your comments on 10/7-nanometer being a bigger node 16. Could we also compare that to 28, which was at its peak like USD 8.5 billion in terms of revenue? Are we -- how much -- what is the degree of confidence in terms of 7- and 10-nanometer combined at its peak rate being significantly higher than 28? And maybe also could talk about -- you talked about half of the tape-outs being HPC-related. Could we also have some idea about, is the revenue still going to be mostly mobile related or smartphone related? Or is the revenue also going to be more closer to the split that we thought we've seen in the tape-out side in terms of HPC?

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**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

Well, it's -- in dollars right now, to be honest, many of our customers is still working on their products with our 10 and 7. So what do we do is just to try to bring their product to the market, and how successful that still really is still yet to be seen. So it's very difficult for us to calculate what's the business and how many wafers or how many product units their product gets to achieve. But I can tell you that in dollar sign to us, it's a much bigger volume, much bigger nodes than either 16 and 28, okay? And by -- for the same reason, how much is HPC, how much is mobile computing, I think on 10 and 7, it's still too early to say. HPC will still be the bigger portion than you have in norm.

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**Gokul Hariharan *JP Morgan Chase & Co, Research Division - Head of Taiwan Equity Research and Senior Tech Analyst***

Okay. My follow-up is on 7 and 7+. Since that is additional EUV steps, do customers have to redesign the product? Does it drive more customers towards 7+ rather than 7 or you're not seeing any of that happen?

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**C. C. Wei *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

They, too, have to recategorize standard cells, something like that, but the effort will be very minimum because we try all our best and work with IP infrastructure partner to minimize that effect. So it will be, I cannot say transparent, but the effort will be minimized.

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**Gokul Hariharan *JP Morgan Chase & Co, Research Division - Head of Taiwan Equity Research and***

**Senior Tech Analyst**

You don't see any customers delaying their 7 plans because they want to wait for 7+ with EUV? You don't see that?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Well, I think the customers have their own product roadmap, and their new product introduction to the market is probably the most important thing for them to consider. So whether they will delay their product from 7 to 7+, we do not see that yet.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

All right, we will now take our next question from the call. Operator, please proceed with the first caller on the line.

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**Operator**

The first question from the line comes from Brett Simpson from Arete Research.

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**Brett Simpson Arete Research Services LLP - Senior Analyst**

I have 2 questions. First of all, on the HPC segment, if I look at that segment and look at chips like data center chips, server chips, this HPC segment is structurally much higher margin and much more profit in the value chain. Do you think TSMC can make structurally higher gross margins in HPC? And maybe you can discuss that opportunity. And just on the earlier questions of evolving customers to 22-nanometer and 12-nanometer ULP, you mentioned there's minimal upfront NRE for customers to evolve their chips from 28 and 16. Can you talk a bit more about this? Because it seems to be quite a big differentiator versus a customer going to FD-SOI or another fab. Can you maybe talk about how significant a saving this is for customers?

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Okay, let me answer your HPC, how to capture values. Yes, you're right, the HPC products produce much more value in the system build. And our customer will command more value products, and we work with our customer also will trying to get that more value along the supply chain. We -- also remember, this HPC product will not only be wafer business or our advanced packaging technology and associate with our future platform, our system integration, will also come to the service, provide to our customers. So in the futures, the advanced packaging, we also intend to increase our value to our customer, therefore, capture more value along the supply chain.

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Well, let me answer the question on 22ULP and 12ULP, how competitive it is and then -- versus our competitors offering the 22 FD-SOI or others. The first one on the 22ULP, this one we offer low power consumption, higher speed, and with the die size shrink about 10%, as I said. But the beauty is our customers don't have to change anything. They can use their IP portfolio in 28-nanometer. The 10% die shrink is actually the optical direct shrink. So the customer does not have to do anything. They can easily



port their existing product or the new product into 22ULP and take advantage of the higher performance, most important much lower power consumption, and then put their new product to compete in the market. So we think it is very, very competitive. On the 12ULP, we did shrink a little bit on the metal pitch. But as I just mentioned, we also work with the IP infrastructure partner to lower down -- to minimize their effort. So again, this one offers a very effective path -- a cost-effective path from 16-nanometer into 12-nanometer. So we expect for this kind of advantage we offer to our customer, we still can maintain a fairly high market share.

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**Elizabeth Sun *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division***

All right, we will still stay on the line and take the question from the next caller. Operator, please.

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**Operator**

Next question is from Steven Pelayo from HSBC.

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**Steven C. Pelayo *HSBC, Research Division - Head of Technology Research, Asia-Pacific***

A year ago, we talked about your lead customers at 16-nanometer being on 16-nanometer for the second year. Yet, I believe it was C.C. that said, yes, they're increasing functionality there, so the die size doesn't really change too much there. Yet this year, as we go to 10-nanometer, we get a little bit more benefit from a stronger shrink. So I'm curious, what do you think of the impacts? Will a smaller die size thus require less wafers from you in the second half of the year? Or more importantly, is the ASP differential at 10-nanometer significantly more versus, let's say, 16-nanometer FFC that more than offsets any potential die shrink? So could you comment a little bit about die sizes and maybe ASP differentials on 16-nanometer FFC versus 10-nanometer?

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**Elizabeth Sun *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division***

All right, I will repeat Steven's question. He's basically asking that our major customer this year will migrate from 16-nanometer to 10-nanometer, and therefore, he assumes that it will be a smaller die. And since it's a smaller die, whether or not it will be fewer wafers. And if it's fewer wafers, whether or not the ASP increase can more than offset by the fewer wafers.

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**C. C. Wei *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

We don't comment on customer's die size first. And second, I think Mark already pointed out, as we move along the path of the technology, the geometry gets smaller and smaller. However, the content also increased quite a lot. And you can see that from your smartphone you are using today than 2 years or 5 years ago. But again, I don't comment on the customer's die size.

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**Elizabeth Sun *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division***

Steven, do you have second question?

**Steven C. Pelayo HSBC, Research Division - Head of Technology Research, Asia-Pacific**

Well, the second part of that first question was relative to the ASP differentials on 16-nanometer FFC versus 10-nanometer.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

He wants to know how much more we charge at 10-nanometer compared to 16FFC.

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Confidential information.

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**Operator**

Next question is from Patrick Liao of Macquarie.

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**Patrick Liao Macquarie Research - Research Analyst**

I'd like to ask your view of entire year seasonality. Is this changing gradually from recent years, and the first half has become relatively sluggish? This is my first question.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

So Patrick's question is, what has changed in terms of our business seasonality? It looks like our first half is sluggish compared to second half.

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Your observation might be right. This is the second year that we have a slower first half. And that we, at this point, look at the -- has to do with the premium phones seasonality as I have mentioned. And we are going to develop more customer products, hopefully, to smooth out this. But this is the current seasonality we see.

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**Patrick Liao Macquarie Research - Research Analyst**

Okay. My next question would be, TSMC moved 3-nanometers fab plan to U.S. I know this is probably not the right to ask, but very curious, I assume, for many audience.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

So Patrick, you are asking if we will go to U.S. to build a 3-nanometer fab? Is that your question?

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**Patrick Liao Macquarie Research - Research Analyst**

Yes, yes.

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Well, we continue to look for the options on the new fab's location. So far, the fab in the U.S. is not very

optimal due to many considerations, although it's still an open option for us to choose.

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**Elizabeth Sun *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division***

Okay. There seems to be quite a few people still on the line, so we will continue on the line. Operator, please have the next caller. Thank you.

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**Operator**

Next question is from Mehdi Hosseini from SIG.

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**Mehdi Hosseini *Susquehanna Financial Group, LLLP, Research Division - Senior Analyst***

Two follow-ups, one on EUV. Can you please help us understand the extent of EUV adoption, particularly how many layers would you expect the 7-plus nanometer node to adopt EUV? And I have a follow-up.

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**C. C. Wei *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

Well, I say few critical areas, which is we used to do 2 purpose. One is shrink the die and then to do the practice for the EUV. How many critical layers, that I cannot share with you now.

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**Mehdi Hosseini *Susquehanna Financial Group, LLLP, Research Division - Senior Analyst***

Did you say a few critical layers?

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**C. C. Wei *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

A few critical layers.

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**Mehdi Hosseini *Susquehanna Financial Group, LLLP, Research Division - Senior Analyst***

Okay. And then my follow-up question has to do with the capital intensity and how you have been able to increase efficiency of equipment. I wanted to better understand to equipment reuse from 10- to 7-nanometer. I hear Lora talking about a \$10 billion CapEx for a few years. But then, I also heard the equipment that is used for 7, 7+ is going to be pretty much the same set or they're much reusable from 10-nanometer. Can you help me reconcile the CapEx with the equivalent reuse commentary?

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**Lora Ho *Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP***

Okay, you're asking capital intensity and how do we reuse the tools from generation to generation. I have said maybe a couple of times in the few -- coming few years, we expect our capital intensity will be ranging from 30% to 35% still is our view, okay? In terms of how do we do it because capital is very expensive in the company, and that's utmost important decision in the company. So we spend a lot of effort trying to -- as the generation becomes shorter. So that makes the equipment reuse even more critical. So we have invented a lot of ways trying to increase the commonality from node to node. Either fix some idle or orphan tool or trying to utilize those idle/orphan tool, okay? Through either migration or several fabs backup each other. And a lot of innovation coming from operation people trying to reduce the CapEx we have to spend. And also, we are putting more focus on what's the peak capacity building. You cannot follow -- just follow what customers tell you the highest demand they need. You have to look

at the cycle and find out what's the optimal peak capacity you build. And once you build it, you try and utilize the capacity as much as possible, including you have sometimes you have to move product among quarters just for the purpose to utilize capacity. So that are the several ways that we have been doing in the company to improve the capital efficiency.

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**Mehdi Hosseini** *Susquehanna Financial Group, LLLP, Research Division - Senior Analyst*

Can I just have a quick follow-up on that?

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**Elizabeth Sun** *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division*

Okay.

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**Mehdi Hosseini** *Susquehanna Financial Group, LLLP, Research Division - Senior Analyst*

Just very quickly, as you would scale the InFO back-end technology, should we expect the mix of CapEx between front-end and back-end packaging change going forward?

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**Elizabeth Sun** *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division*

So Mehdi's question is now since we have started volume producing with InFO, what will be the mix going forward between the capital spend from the front-end, which is for the wafer, and then the capital spend for the back-end, which is the packaging?

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**Lora Ho** *Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP*

Well, it is indeed our back-end capital has been increasing. For example, we are ramping the InFO technology starting from last year, and I didn't show you the CapEx breakdown. It's pretty high. In the past, I think our back-end is a couple of hundred million. It can go up to \$1 billion, and this year will be the case, okay?

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**Elizabeth Sun** *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division*

Okay, I'll think we will come back to the floor now. Now we are back to the floor for questions. First, let's have Morgan Stanley's Charlie Chan.

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**Charlie Chan** *Morgan Stanley, Research Division - Technology Analyst*

So my first question is on the second quarter guidance. So Mark, you mentioned that there were some supply chain inventory management. So besides the smartphone, what area do you see weakness, for example, gaming, PC, even industrial? And would you also attribute that smartphone chipset weakness to your customers' market share loss, meaning lose to Qualcomm?

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**Mark Liu** *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President*

On the second quarter weakness, smartphone is one. I think -- we think the PC is another one, mostly because of inventory though. And industrial, I don't see the weakness at all. And come to your question

about the -- what's your second question?

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**Charlie Chan *Morgan Stanley, Research Division - Technology Analyst***

Yes, so your customers' market share loss to its competitor.

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**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

Okay. This is not news, right? We anticipate this, and we are working to recover for quite some time. And all these years, recovery work is ongoing, and we already factored those factors in. And still, we expect this year, we -- overall, we should be able to gain market share overall to overcome this. For the long term, of course this customer -- the relationship with this customer gets much better, warmer now, and we are working on them -- with them on the future technologies.

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**Charlie Chan *Morgan Stanley, Research Division - Technology Analyst***

Okay. And also, on your HPC-related comment -- you mentioned that you are excited about ARM-based server get qualified, but does that mean that you already have said starting with -- for your 7-nanometer ARM-based server processor in your 7-nanometer customer already?

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**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

I'm sorry, the question is...

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**Charlie Chan *Morgan Stanley, Research Division - Technology Analyst***

Do you already have ARM-based server processors already?

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**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

Yes, of course, of course.

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**Charlie Chan *Morgan Stanley, Research Division - Technology Analyst***

Okay. And my next question is to Mr. Wei. So regarding your 28-nanometer capacity expansion, I think a couple weeks ago, at your technology symposium, you said -- you mentioned that 28-nanometer capacity will increase 15% year-on-year. But the trend is that -- I don't doubt your competitiveness of 22-nanometer ULP, but the fact is that some of your customer are moving to 16-nanometer. And also, your market share of 28-nanometer is already more than 90%, right? So how confident that you'll maintain growing another 15% in the coming year?

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**C. C. Wei *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

Well, we build our capacity according to customers' demand, and we do it very carefully. So you say that we are going to increase 15% every year. Did we say that?

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**Elizabeth Sun *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division***

This year.

**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

This year, this year, yes. So far, I can share with you that we are still fully loaded and probably a little bit not enough. So we work very hard to increase the capacity to fulfill customer's demand.

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**Charlie Chan Morgan Stanley, Research Division - Technology Analyst**

Even with China's smartphone weakness, you're building your 28-nanometer, it's fully loaded?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Yes, it's continued to be that.

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**Charlie Chan Morgan Stanley, Research Division - Technology Analyst**

Okay. So very quick on just one number. So you mentioned that your 7-nanometer customer already exceeded 30 customers. So what's the customer number for 10-nanometer and 16-nanometer, respectively, currently?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Well, probably comparable to 16-nanometer but 10-nanometer is smaller. So the 7-nanometer and 16 are similar.

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**Charlie Chan Morgan Stanley, Research Division - Technology Analyst**

Similar, okay. Thanks.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

Okay. Next question will be from Daiwa, Rick Hsu.

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**Rick Hsu Daiwa Securities Co. Ltd., Research Division - Head of Regional Technology and Head of Taiwan Research**

Just a quick follow-up to the previous question about your second quarter demand driver. I think Mark mentioned about the weakness mainly from smartphone and PCs due to some more inventory correction. And industrial tend to be stable, do you see any pocket of strength for second quarter?

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

I don't particularly notice, particularly the strengths that are in pockets. Industrial is considered heating up. And we have -- that's the number showing the overall second quarter. Okay, automotive, although small percentage, is still heating up.

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**Rick Hsu Daiwa Securities Co. Ltd., Research Division - Head of Regional Technology and Head of Taiwan Research**

Okay. My second question is, if I remember correctly, I think your 28-nanometer is a very strong node. And even for this year, you still constantly build up more capacity. But for your 20, 16 and 10, I think capacity-wise, for each node is much lower than 28-nanometer. So my question is, do you anticipate that

the next 7 and 7+ will be a strong node with capacity build maybe by 2020, you will be at least as comparable as your 28-nanometer?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

I cannot share with you, but I certainly hope so.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

Okay. Next question will be coming from Credit Lyonnais, Sebastian Hou.

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**Sebastian Hou CL Securities Taiwan Company Limited, Research Division - Research Analyst**

I think my first question is to Dr. Liu on the HPC. Can I follow up on that you mentioned by 2020, HPC will become a bigger driver for the company. Is it bigger or biggest, in terms of incremental revenue, right?

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Well, that depends on how smartphone fare out then. It's a competition. I think in 2020 to '25, that's the time where they really picked up. So I wouldn't say 2020 to compare with the smartphone yet.

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**Sebastian Hou CL Securities Taiwan Company Limited, Research Division - Research Analyst**

Okay. And just a follow-on on that one, is that I think that 6 months ago, that conference, you gave us some idea about the wafer addressable market revenue about HPC is about USD 15 billion by 2020. I remember that time you mentioned that it's hard -- it's very hard for you to quantify artificial intelligence in the numbers. So I wonder the things that you talked about today, is that on top of that \$15 billion or already included?

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

It's part of the story, is still a consistent story. Part of the -- okay, when I talked about AI, I talked about HPC, but I also talked about IoT, automotive and smartphone. So AI is a phenomenon, phenomenon of using more silicon in all kinds of devices. Of course, the AI will require more computation in the data center and more communication in the network and storage. That HPC is part of this AI portion in HPC application.

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**Sebastian Hou CL Securities Taiwan Company Limited, Research Division - Research Analyst**

Good. And one follow -- I think it's one for Dr. Wei is we understand that your 16-nanometer, one of the major customers moving 10, and with your launch of the 12 nanometers, do you expect your 16-nanometer family with 12 next year, the total revenue, the absolute level will recover to the same level as we've seen in 2016?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

We hope so. But let me stress again that 12-nanometer will be used for the mid- to low-end smartphones, and we offer a way for customer to have a cost-effective roadmap for their product. Then, the most advanced premium-grade smartphone will move to the next node as we have expected.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

Okay, follow-up question from Randy Abrams, Credit Suisse.

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**Randy Abrams Credit Suisse AG, Research Division - MD and Head of Taiwan Research in the Equity Research Department**

This one is probably for C.C. On the fan-out, you talked about more mobile products. Could you talk if that's still for the high-end smartphone or you see it moving down into the mass market versus now cost competitive with flip chip. And do you see any cases where customers are splitting the architecture now? So using InFO and maybe migrating a smaller part of the die size, say the 7- and 10-nanometer, and then with InFO keeping somewhat lagging nodes?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Okay. So far today, InFO are still used by most advanced smartphones, okay? We are engaging with the customer, many, to the things you just mentioned to move into more area, including separate the die size into multiple ones to get more efficiency and lower down the cost. That's what we are doing. But more importantly, we are moving the application into the high-performance computing because Mark just mentioned the AI and all those kind of thing will start to develop in the next few years, and we try to catch up with the market.

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**Randy Abrams Credit Suisse AG, Research Division - MD and Head of Taiwan Research in the Equity Research Department**

Great. And the second question I wanted to ask, you maintained, aside from your currency, your growth assumptions for this year, but you lowered the overall foundry industry. Could you maybe talk about factors? Was it a difference in share? Are you feeling like you've taken some share in certain applications or a view on what you expect your competitors versus a few months ago?

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Well, the main reason we revised our foundry growth rate is due to the inventory accumulation we see in end of Q1 and also expected it towards the end of Q2. Regarding -- we have some -- our forecast currently, however, is better than the average foundry growth rate forecast. Therefore, we consider we are gaining market share this year.

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**Randy Abrams Credit Suisse AG, Research Division - MD and Head of Taiwan Research in the Equity Research Department**

Great. And just to clarify, from this inventory correction, you think you've gained enough share to offset, say, for TSMC the impact of this inventory correction?

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Well, inventory correction applies to everyone, okay? So simply that therefore everybody's -- the average foundry market share will drop. So will we, if we are not gaining market share, to be better than



5%.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

Okay. Next question will also be coming from a follow-up and that will be Citi's Roland Shu.

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**Roland Shu Citigroup Inc, Research Division - Director and Head of Regional Semiconductor Research**

I looked at your annual -- actually, on your fourth quarter report and you have the annual result. So last year, your non-wafer revenue actually declined in both absolute number and also as a percentage of the total revenue. And even I looked at the past year from 2013 to 2015, the percentage of the non-wafer revenue actually declined from 6.1% to 4.1% last year. But in this, actually, I think it's -- again, because in the past year, we have a lot of activity to do this 20-nanometer, 20 or 16 or 10-nanometer means a lot of the photomask tape-out of revenue made it. So can you explain what is this disconnection with a lot of the new wafer activity, but we still have this declining non-wafer revenue in the past year?

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**Lora Ho Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP**

All right. I probably cannot link your statement about the declining revenue. But there are also period of time our non-wafer revenue basically the backend and EBO, those are the 2 major non-wafer revenue, it has been around 10% for many years. And with the InFO that joined the company starting from this year, we expect at least we can maintain or even a small increase on the non-wafer revenue as far as I can see.

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**Roland Shu Citigroup Inc, Research Division - Director and Head of Regional Semiconductor Research**

Yes. But the 10%, I think that means there was probably too big a number. Compared to the number you reported, in last year it was only 4.1% of that non-wafer revenue.

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**Lora Ho Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP**

Can I be -- I have to check which pages you are looking at.

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**Roland Shu Citigroup Inc, Research Division - Director and Head of Regional Semiconductor Research**

Page 80-something.

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**Lora Ho Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP**

80-something. I will go back and check.

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**Roland Shu Citigroup Inc, Research Division - Director and Head of Regional Semiconductor Research**

Okay, you have the wafer revenue and the non-wafer revenue there. And also the second question is for the InFO. I think Dr. Wei guided us for InFO revenue last year. For the last year, it was about USD 100 million. But how about your forecast for InFO revenue this year?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

I mentioned this year, it will be for the 2017, about USD 500 million.

**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

All right, follow-up question from UBS, Bill Lu.

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**Bill Lu UBS Investment Bank, Research Division - MD and Asia Semiconductors Analyst**

Two quick follow-ups. One is on Donald's question on smartphone content. In the past, you've given us the content for high end, mid and low end. Can you provide that for this year?

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

I can't -- I don't have that with me. But the similar situation than last year, I think.

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**Bill Lu UBS Investment Bank, Research Division - MD and Asia Semiconductors Analyst**

Okay, great. And then just a clarification with Dr. Wei. You have said that HPC will increasingly use InFO, I have thought that maybe a lot of HPC applications will use CoWoS. Can you talk about the 2?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Oh, yes. Today, most of the HPC -- almost all of the HPC customers are using the CoWoS because that one is a very high performance. And I'm talking about the extent of InFO into the HPC area because that offered a lower cost. And also, it improved the InFO's performance. So it'd still be lower than -- the performance is still lower than the CoWoS, but cost effectively, it's much better. That's why we expect it to be widely used by HPC customer.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

Okay. Follow-up questions from Deutsche Bank, Michael Chou.

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**Michael Chou Deutsche Bank AG, Research Division - Semiconductor Analyst**

You mentioned HPC InFO in the future. So for very high pin count HPC product, would that still use CoWoS or do you think that you will shift to InFO entirely in the future?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

No, I would think it will still use CoWoS. That's still the much better performance for very pin count in the few thousand content on those kind of things.

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**Michael Chou Deutsche Bank AG, Research Division - Semiconductor Analyst**

So can we say maybe 70% to 80% HPC product will be based on InFO, new InFO product in the future? Or do you think that maybe 50% of the HPC will be still based on CoWoS?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Today, I cannot do any prediction, but we are working with the customer because our overall cost structure is very important. That's what we are working on. And we also tried to make a lot of variation to meet the customer's requirement.

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**Michael Chou Deutsche Bank AG, Research Division - Semiconductor Analyst**

As a follow-up for your InFO, do you think the mid- to low-end product will shift to InFO because the things at mid- to low-end product care about cost?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

I would expect that, yes. It's not happening yet.

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**Michael Chou Deutsche Bank AG, Research Division - Semiconductor Analyst**

But in the future, it's possible?

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

It is possible.

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**Michael Chou Deutsche Bank AG, Research Division - Semiconductor Analyst**

Okay. The second question for Mark. You mentioned before you should have a higher market share at 7-nanometer versus 16, 14, right? Yes? So can we say that you can gain more market share in 7-nanometer smartphone market versus 16-, 14-nanometer in 2018 to 2019? I'm not mentioning the customers, I'm just mentioning market share.

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Yes, I think so, I think so. This is -- we really have higher market share in 7 and 7+. And those are for high-end smartphone. The mid- and low-end smartphone will still will go on 22ULP, all those low power technology to capture. We have a multi-prong strategy on this to capture this year.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

Okay. Questions will be coming from JPMorgan's Gokul.

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**Gokul Hariharan JP Morgan Chase & Co, Research Division - Head of Taiwan Equity Research and Senior Tech Analyst**

First question, when I look at HPC currently, unlike smartphone, like you mentioned, premiums will be at 7-nano and 10. All their nodes can also be driven by smartphones because of low cost or mid-end. HPC, if I use the current biggest IDM, which is probably the biggest HPC player right now, most of their capacity is leading edge and they probably have N and N-1, that's pretty much it. And they work on a very accelerated schedule in terms of capacity conversion. So when TSMC -- when HPC becomes the bigger driver for TSMC, how do you think about capacity planning? Are we going to have a lot more conversion from, let's say, 10 or 10/7 to 5? Or are there enough second wave, third wave, even within that ambit of ubiquitous computing that could drive second or third wave for the fresh capacity that you put on?

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

You're talking about sometimes in the future? Let me ponder this with you. TSMC is very different than

this IDM company. We are in every segment in the market. Therefore, we attack the leading edge and we capture the HPC, doesn't mean this technology later on, when the technology move, it doesn't have the usage for all other segments, let alone you talk about HPC's volume. Volume compared with today's high-performance -- no, I'm sorry, premium phones is still smaller. So I don't -- we will consider the technology migration, capacity migration then. But I don't consider that a major change or major problem for us.

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**Gokul Hariharan *JP Morgan Chase & Co, Research Division - Head of Taiwan Equity Research and Senior Tech Analyst***

Great. My follow-up is on more near-term question, especially for second half. If I look at the half-on-half growth, it's almost like 20% going into the second half. I just wanted to understand, are we anticipating that except for the big premium customer ramp-up? Are we also anticipating some the inventory restocking? We expect inventory correction to finish in the first half and we anticipate some general inventory restocking in the second half? Or is this primarily driven by the super cycle that people are expecting?

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**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

Yes, yes, we anticipate -- we try to prepare for the flexibility of the team to cope with the demand with the second half. So you're right, certain activity is already ongoing in the second quarter to make sure that we can deal with the needed demand in the second half.

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**Gokul Hariharan *JP Morgan Chase & Co, Research Division - Head of Taiwan Equity Research and Senior Tech Analyst***

If I could phrase it a little bit differently, do we expect the customers who are really weak in the mid-end smartphone, et cetera, also to have a big rebound in the second half of the year, along with the big seasonality for your main customer?

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**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

The smartphone high, mid- and low end, we consider that we can deal with it. Because at this point, still follow these relatively seasonal patterns and it's more predicable than the premium launch.

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**Elizabeth Sun *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division***

Okay. Follow-up question from Goldman Sachs, Donald Lu.

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**Donald Lu *Goldman Sachs Group Inc., Research Division - Equity Analyst***

May I ask a question on the other gains and losses, still fluctuating in their guidance and where is it coming from, et cetera? It's \$2.62 billion for Q1.

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**Lora Ho *Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP***

Which line you are asking? The gain and loss?

**Donald Lu *Goldman Sachs Group Inc., Research Division - Equity Analyst***

The -- I was looking at Page 3 of the management report. On the second table there, there's other gains and losses, was like \$1.8 billion in last Q1 and \$2.6 billion this Q1. So I just wondering like...

**Lora Ho *Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP***

Oh, you're referring to \$2.62 billion second quarter versus \$1.8 billion last year, right?

**Donald Lu *Goldman Sachs Group Inc., Research Division - Equity Analyst***

Yes.

**Lora Ho *Taiwan Semiconductor Manufacturing Company Limited - CFO and SVP***

I think the big component of this line is interest rate -- interest income. If we have more cash and generate more interest, then that helps on this one.

**Donald Lu *Goldman Sachs Group Inc., Research Division - Equity Analyst***

Okay. Another question is on this year's guidance again. I think you mentioned you lowered the foundry forecast because of inventory correction. But have you considered the news of speculations now that one of your -- the high-end premium phone launch this year might be delayed? For example, could be launched in September, the shipments is in November, December, things like that. If that happens, what will happen to TSMC's guidance?

**C. C. Wei *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

This is totally speculation, right? So I don't make comment.

**Elizabeth Sun *Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division***

Okay. In the interest of time, we'll just allow the final follow-up and that will be from Credit Lyonnais, Sebastian Hou.

**Sebastian Hou *CL Securities Taiwan Company Limited, Research Division - Research Analyst***

So the first follow-up I have is we've seen TSMC blended wafer price on the 12-inch equivalent basis has increased every year since 2010. And my question is that, are you confident in terms of continuing to increase your blended wafer price in the next 5 years?

**Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President***

Well, so far, we're doing okay. So we're still trying hard to continue improve our ASP. That's all I can say, yes.

**Sebastian Hou *CL Securities Taiwan Company Limited, Research Division - Research Analyst***

And my second follow-up is, can you share with us your strategy in how you look at memory. We understand that TSMC has been in open embedded memory and also in the new type of innovative memory like MRAM, RRAM. And can you share with us on your -- how you progress on that and when

we're going to see that embedded memory technology being commercialized on like 16 or even like 7-nanometers? And also, can you share what is your strategy on the discrete memory?

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**Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

Let me talk about discrete memory and C.C. will cover the embedded memory. We consider we are not in commodity business. Therefore, we -- at this point, we do not intend to enter the commodity business currently, which is discrete memory is.

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**C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Co-CEO and President**

So other than the commodity, actually, we work with customer who offer the embedded memory because of today, we are the largest provider of embedded flash. But embedded flash has its own limitation, up to 28-nanometer. So we work with the customer to find a better solution. That means we have to find some memory that can dissipate low power and higher speed. That's why we are working on the RRAM, MRAM and others. So that's our strategy. We certainly work with customer to meet their demand, and we define our embedded memory's roadmap.

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**Elizabeth Sun Taiwan Semiconductor Manufacturing Company Limited - Senior Director of Corporate Communication Division**

All right. With this answer, we conclude today's conference. Please be advised that the replay of the conference will be accessible within 3 hours. Transcript will become available within 24 hours from now. Both of them will be available through our website. Thank you for joining us today. We hope you will join us again next quarter. Goodbye, and have a good day.

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