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Q4 2019 Taiwan Semiconductor Manufacturing Co Ltd Earnings Call

EVENT DATE/TIME: JANUARY 16, 2020 / 6:00AM GMT



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PRESENTATION

Jeff Su

(foreign language) Happy New Year to everyone, and welcome to TSMC's Fourth Quarter 2019 Earnings Conference and Conference Call. This is Jeff Su, TSMC's Deputy Director of Investor Relations and your host for today. Today's event is webcast live through TSMC's website at www.tsmc.com. (Operator Instructions) As this conference is being viewed by investors around the world, we will conduct this event in English only.

The format for today's event will be as follows: First, TSMC's Vice President and CFO, Mr. Wendell Huang, will summarize our operations in the fourth quarter of 2019 and the full year of 2019, followed by our guidance for the first quarter of 2020. Afterwards, Mr. Huang and TSMC's CEO, Dr. C.C. Wei, will jointly provide the company's key messages. Then, TSMC's Chairman, Dr. Mark Liu, will host the Q&A session where all 3 executives will entertain your questions.

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. Please also download the summary slides 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 that are subject to significant risks and uncertainties, which could cause actual results to differ materially from those contained in the forward-looking statements. So please refer to the safe harbor notice that appears on our press release.

And now I would like to turn the microphone over to TSMC's CFO, Mr. Wendell Huang, for the summary of operations and the current quarter guidance.

Wendell Huang *Taiwan Semiconductor Manufacturing Company Limited - VP & CFO*

Thank you, Jeff. Happy New Year, everyone. Thank you for joining us today. My presentation will start with financial highlights for the fourth quarter and a recap of full year 2019. After that, I will provide the guidance for the first quarter of 2020.

Fourth quarter revenue increased 8.3% sequentially to TWD 317 billion, driven by high-end smartphones, initial 5G deployment and HPC-related applications using TSMC's industry-leading 7-nanometer technology. Gross margin increased 2.6 percentage points sequentially to 50.2%, thanks to a higher level of capacity utilization and continuous cost improvement, partially offset by an unfavorable foreign exchange rate. Total operating expenses increased by TWD 3.6 billion, reflecting higher development activities for 5-nanometer and 3-nanometer as well as opening expenses in preparation for 5-nanometer ramp. Operating margin increased by 2.4 percentage points sequentially to 39.2%. Overall, our fourth quarter EPS reached TWD 4.47 and ROE was 28.9%.

Now let's take a look at revenue by technology. 7-nanometer process technology continue to ramp strongly and accounted for 35% of wafer revenue in the fourth quarter. 10-nanometer was 1% and 16-nanometer was 20%. Advanced technologies, defined as

16-nanometer and below, accounted for 56% of wafer revenue, up from 51% in the third quarter. On a full year basis, 7-nanometer contribution increased from 9% in 2018 to 27% of wafer revenue in 2019. 10-nanometer was 3% and 16-nanometer was 20%. Advanced technologies accounted for 50% of total wafer revenue, up from 41% in 2018.

Now let's take a look at revenue contribution by platform. Our fourth quarter revenue growth was driven mainly by smartphone and HPC. Smartphone increased 16% quarter-over-quarter to account for 53% of our fourth quarter revenue. HPC increased 6% to account for 29%. IoT decreased 4% to account for 8%. Automotive remained flat and accounted 4%. On a full year basis, smartphone and IoT led the growth with 12% and 33%, respectively, while HPC, automotive and DCE decreased 8%, 7% and 8%, respectively. If we exclude cryptocurrency from both years, HPC would have grown mid-single-digit in 2019. Overall, smartphone accounted for 49% of our 2019 revenue; HPC, 30%; and IoT, 8%.

Moving onto the balance sheet. We ended fourth quarter with cash and marketable securities of TWD 583 billion, flat versus the prior quarter. On the liability side, current liabilities increased by TWD 96 billion as we increased TWD 33 billion in short-term borrowings mainly for hedging purpose, TWD 51 billion in payables to suppliers and TWD 13 billion in dividends payable. On financial ratios, accounts receivable turnover days remained at 41 days. Days of inventory decreased 10 days to 55 days due to higher wafer shipments during the quarter.

Now let me make a few comments on cash flow and CapEx. During the fourth quarter, we generated about TWD 203 billion in cash from operations, spent TWD 170 billion in CapEx and distributed TWD 52 billion for first quarter '19 cash dividend. We also increased 33 -- TWD 36 billion in short-term loans for hedging purpose. Overall, our cash balance slightly increased TWD 3 billion to TWD 455 billion at the end of the quarter. In U.S. dollar terms, our fourth quarter capital expenditures reached USD 5.6 billion and totaled USD 14.9 billion for the full year.

Now let's take a look at the recap of our performance in 2019. 2019 was a challenging year for the global semiconductor industry given rising macroeconomic uncertainties and supply chain inventory correction, to name a few. However, we are able to grow our revenue by 1.3% year-over-year in U.S. dollar terms and 3.7% in NT dollar terms. Gross margin decreased 2.3 percentage points to 46% primarily because of lower capacity utilization in the first half of the year. Operating margin decreased 2.4 percentage points to 34.8%. Overall, full year EPS slightly declined 1.7% to TWD 13.32. On cash flow, we spent TWD 460 billion in Capex, while we generated TWD 615 billion in operating cash flow and TWD 155 billion in free cash flow. We also paid TWD 259 billion in cash dividends, an increase of 25% from the previous year.

I have finished my financial summary. Now let's turn to first quarter guidance. Based on the current business outlook, we expect our first quarter revenue to be between USD 10.2 billion and USD 10.3 billion, which represents a 1.4% sequential decrease at the midpoint. Based on the exchange rate assumption of USD 1 to TWD 29.9, gross margin is expected to be between 48.5% and 50.5%, operating margin between 37.5% and 39.5%.

Now I will look -- I would like to make one more comment on tax rate. In the past, we needed to accrue tax on undistributed earnings, which triggered a much higher tax rate in the second quarter. Now due to the tax regulation changes, we can offset the tax with our capital investments and no longer need to incur the tax expense on undistributed earnings. Meanwhile, we are still subjected to the alternative minimum tax. As a result, we will still have a full year tax rate approximately 12%, and this will be equally applied to all 4 quarters of the year. This concludes my financial presentation.

Let me follow by making a few comments about near-term demand in the inventory and 2020 capital budget. We concluded our fourth quarter with revenue of TWD 317.2 billion or USD 10.4 billion, slightly above our guidance, mainly due to better demand from smartphone-related applications than our forecast 3 months ago. Concluding 2019, the semiconductor industry excluding memory declined 3%, while foundry was flat. TSMC's revenue grew 1.3% year-over-year in U.S. dollar terms, outpacing both the semiconductor ex memory and foundry industry growth.

On the inventory front, our fabless customers' overall inventory continue to be digested throughout the fourth quarter. We now expect it to reduce to the seasonal level exiting 2019, setting up a healthier inventory base entering 2020. Moving into first quarter 2020, despite

mobile product seasonality, our business is expected to be better than the seasonality in recent years, supported by continued ramp of 5G smartphones.

Now I will talk about our capital budget in 2019 and 2020. We expect the ramp of 5G-related and HPC applications to drive strong demand for our advanced technologies in the next several years. In order to meet this increased demand and support of customers' capacity needs, we raised our 2019 CapEx guidance by \$4 billion to \$14 billion to \$15 billion, and we ended up spending \$14.9 billion. Our 2020 capital budget is expected to be between \$15 billion and \$16 billion. Out of the \$15 billion to \$16 billion CapEx for 2020, about 80% of the capital budget will be allocated for advanced process technologies including 3, 5 and 7-nanometers, about 10% will be spent for advanced packaging and mask-making and about 10% for specialty technologies. With this level of capital spending in 2020, we reiterate that TSMC remains committed to sustainable cash dividends on both an annual and quarterly basis.

Now let me turn the microphone to C.C.

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Thank you, Wendell. Good afternoon, ladies and gentlemen. Let me start with our 2020 full year outlook. For the full year of 2020, we forecast the overall semiconductor market growth excluding memory to be 8%, while foundry industry growth is forecast to be about 17%. For TSMC, we are confident we can outperform the foundry revenue growth by several percentage points in U.S. dollar term. Our 2020 business will be supported by strong demand for our industry-leading 7-nanometer and 5-nanometer technologies, where we see strong interests from all 4 growth platform, which are mobile, HPC, IoT and automotive.

Now let me talk about 5G and HPC as the major long-term growth driver for TSMC. We continue to see stronger deployment of 5G networks and smartphones in several major markets around the world. We reiterate mid-teens penetration rate for 5G smartphones of the total smartphone market in 2020. We also forecast a faster penetration of 5G smartphone as compared to 4G over the next several years while silicon content of 5G smartphone will be substantially higher than that of a 4G smartphone.

In addition, the significant performance, bandwidth and latency improvement of 5G network will drive AI application and unlock new usage cases such as real-time response and control across many different types of connected end devices. We believe 5G is a multiyear megatrend that will a world where digital computation is increasingly ubiquitous, which will fuel the course of all 4 of our growth platform in the next several years.

With 5G driving exponential growth in the amount of big data being generated and continuous improvement in algorithms, a smarter and more intelligent world will require massive increase in computation power. Thus, HPC become another major long-term growth driver for TSMC. CPU, networking and AI accelerator will be the main growth area for our HPC platform. By working diligently to provide the foundry industry's most advanced technology and making it available to all the product innovators, TSMC can expand the pool of innovators who fuel the semiconductor industry growth. With the successful ramp-up of N7, N7+ and the upcoming ramp of N6, N5 and N3, we are able to widen our customer product portfolio and expand our addressable market.

We also see growth in networking, thanks to 5G infrastructure deployment over the next few years. With 5G and HPC applications as a major growth driver, we now expect to grow at the high end of our long-term growth projection of 5% to 10% CAGR in U.S. dollar terms.

Now I'll talk about the ramp-up of N7, N7+ and the status of N6. As N7 enters its third year of ramp, we continue to see very strong demand across a wide spectrum of products for mobile, HPC, IoT and automotive applications. Our N7+ is entering its second year of ramp. N7+ is the industry's first high-volume production with EUV photolithography technology while paving the way for N6. Our N6 provides a clear migration path for next wave N7 products as its design rules are fully compatible with N7 while providing 15% to 20% higher density, which improve power consumption when compared to N7. N6 is on track for risk production in first quarter this year and volume production before the end of this year. N6 will have 1 more EUV layer than N7+ and will further extend our N7 family well into the future. We expect our 7-nanometer family to continue to grow in its third year and contribute more than 30% of our wafer revenue in 2020.

Now allow me to talk about our N5 volume production. Our N5 technology is a full node stride from our N7, with 80% logic density gain



and about a 20% speed gain compared with 7-nanometer. N5 will adopt EUV extensively and is well on track for volume production in first half this year and with good yield. We expect a very fast and smooth ramp of N5 in the second half of this year, driven by both mobile and HPC applications. We expect 5-nanometer to contribute about 10% of our wafer revenue in 2020. N5 will be the foundry industry's most advanced solution with the best PPA. We will offer continuous enhancement to further improve the performance, power and density of our 5-nanometer technology solution into the future as well. Thus, we are confident that 5-nanometer will be another large and long-lasting node for TSMC.

Finally, I'll talk about our N3 status. We are working with customers on N3's design, and the technology development progress is going well. We have many technology options in development and we carefully evaluate all the different approaches. Our decision is based on technology, maturity, performance and cost. Our N3 will offer another full node scaling benefit in terms of performance, power and density as compared with our N5 technology. We expect our 3-nanometer technology will be the most advanced foundry technology in both PPA and transistor technology when it is introduced. We will announce more details about our N3 technology at our TSMC North America Technology Symposium on April 29.

Thank you for your attention.

Jeff Su

Okay. Thank you. This concludes our prepared statements. (Operator Instructions)

QUESTIONS AND ANSWERS

Jeff Su

So now let's begin the question-and-answer session. Our first question will come from the floor. *Crédit Suisse*, Randy Abrams.

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

Yes. I guess with the trade war eased a bit, there's still a couple of maybe political issues out there so I wanted to just start with that. The first one, if you could give some color on TSMC's U.S. content and just if -- maybe the calculation, there's talk about content threshold lowered to 10%, and if -- there's some talk that the equipment may be excluded from that calculation. So if you could give a bit more color about that.

And then second, with more of the geopolitical concerns about some of the military technology. You've talked in the past about not needing toward having more scale with the fabs in Taiwan, but if any new considerations on the fab location.

Mark Liu *Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board*

Yes. Happy New Year, everyone. On the possible further tightening up of export control from the U.S. government, I think this is -- they haven't really announced with the specifics about the rules. So everything I say here can only be a speculation. So -- and particularly, I don't want to comment on particular customers. But one thing for sure is our business profile is massive. We are everyone's foundry. And we will deal with each customer fairly and equally. Secondly is we have been and we will follow the law and regulation. So upon the regulation being effective, we will carefully study and evaluate, product by product, our eligibility in the export. And we really have a very sophisticated export control system. As you might know, every product is calculated automatically. Every product is different in terms of their content. So it's really difficult to describe to you generally what is the content percentage is. But I can just tell you that whatever you read on the newspaper is not true, okay? So we are prepared to deal with this new export control regulation.

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

Yes. And thanks for clarifying especially that it's not a node by node, which some of the press was speculating. The second question, I just wanted to ask on the higher Capex, where it came in at the high end of guidance and a higher range of CapEx for 2020. If you could talk maybe the areas where the incremental increase both just from an investment, where that new spend is coming, and maybe what changed on the demand side versus a few months ago to lift the budget. And then the second part, because of this higher base, how you're looking at kind of the base over the, say, the following year because now we have a 2-year higher elevated spend, if, say, some moderation from there.



C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Yes, we did increase substantial amount on the Capex. Let me give you some color why we did it that, okay? We expect -- actually, we expect the mobile phone and HPC, these 2 segments, probably grow above 20% this year; and with another 2 segments, 2 platforms, automotive and IoT, probably in mid-teens. So put all together, we had to increase the capacity. We work with the customer to fulfill their demand and so that's a result of why we increase our capacity.

Now your question about our growth?

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

Yes. The second question was where the spend sits, like 5, 7 versus backend, so where the additional increase...

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Okay. A little bit around 7 that we announced in the last year, and then most of them used in 5 and then prepared for 3. And 10% in the back end, 80% in the leading-edge technology, like the 7, 5, 3 altogether.

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

Okay. And then the 2 -- maybe the follow-up I had was just the moderation of CapEx for -- if you expect that to maybe moderate from the very high level next year. In the backend, 10% would be \$1.5 billion for CapEx. But I'm curious, maybe between backend and mask, if really over a \$1 billion backend CapEx.

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

You're right, I mean, the back end including the mask.

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

Okay. But I guess out of that, do you think the backend CapEx is over \$1 billion investment on that side?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

No.

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

Okay. Okay. And then if -- could you talk about the moderation for...

Jeff Su

I think, Randy, the last part of your question is talking about our CapEx this year and last year is at a higher level. Looking out the next several years, where do we think the CapEx will be.

Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board

That would depend on the growth, right? Yes. If we enjoyed a good growth in these 2 years, I think, and if it's a success introduction of our N3, I mean, the CapEx probably will not drop. Yes.

Jeff Su

Okay. Thank you. Let's go on to the next question. We'll take it from the floor. Citigroup's Roland Shu, over here.

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

First question, I'll just follow up on the Capex. For -- with this \$15 billion to \$16 billion CapEx spending, so what -- how many of the total capacity increase is going to be this year? And how about last year? With this almost \$15 billion CapEx spending, how many percent of the CapEx increased last year?

Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board

Wendell will discuss this question.

Wendell Huang *Taiwan Semiconductor Manufacturing Company Limited - VP & CFO*

You're asking about the capacity increase?

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

Yes.

Wendell Huang *Taiwan Semiconductor Manufacturing Company Limited - VP & CFO*

Right. Okay. Of course, the increase mainly come from advanced technologies, right? So for 2020, we're looking at mid-single-digit capacity increase. Last year, a low single-digit number.

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

Okay. And then how about the total depreciation is going to be this year?

Wendell Huang *Taiwan Semiconductor Manufacturing Company Limited - VP & CFO*

It will increase by high teens in 2020.

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

Okay. And second question is for the gross margin. For your first quarter revenue guidance, U.S. dollar just down slightly. However, apparently in first quarter, we have fewer working days. So it means that your utilization in first quarter definitely is going to be much higher than 4Q. And also for 7-nanometer, last quarter, we said that we -- gross margin has already reached corporate average. And also, I believe, in first quarter, we probably won't have the inventory reevaluation. So all on this, so is your gross margin guidance, 48.5% to 50.5%, a little bit conservative?

Wendell Huang *Taiwan Semiconductor Manufacturing Company Limited - VP & CFO*

The utilization, we expect it to increase a little bit. And of all the factors that you just mentioned, there's also a potential factor, which is foreign exchange rate impact. There are 6 factors affecting our profitability: the development and ramp of our advanced technology, pricing, cost, utilization, technology mix and foreign exchange rate. So when you put all these together, that is how we came up with the guidance.

Jeff Su

Thank you, Roland. All right. Next question will come from Goldman Sachs, Bruce Lu.

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

I'll try to get more granularity, color for the 5G penetration rate. Management just mentioned that it's about mid-teens in 2020. Can we have more color in terms of that, whether it's sell-in or sell-through or what kind of geography distribution, what kind of distribution between high-end and low-end for the 5G?

C. C. Wei *Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO*

Well, I can only say that 5G's penetration is higher than 4G. And you know a few countries, that they are moving faster than the other area, right? And that's all we know. But we are making the judgment, look at the installation of 5G infrastructure, and we look at each country's adoption and we do our own estimate. That's why we come out with mid-teens penetration.

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

So it's more from the top-down perspective instead of like bottom-up from like each product line. Is that right?

C. C. Wei *Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO*

We do both and make a judgment.

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

So in either both, can you give us some color about why distribution, putting high-end and mid-end...

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

That's company confidential.

Jeff Su

Bruce, do you have a follow-up?

Bruce Lu Goldman Sachs Group Inc., Research Division - Research Analyst

Yes, of course. Can I double-check that the assumption of mid-teens penetration is based on like there's no change in terms of de minimis rule?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

That's a good question. Now the change of de minimis rule is still speculative. So our forecast, we assume the business as usual.

Bruce Lu Goldman Sachs Group Inc., Research Division - Research Analyst

I understand it.

Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board

I think the -- yes, the number we currently forecast does not include de minimis rule tightened and change. But for the -- whatever the export control is coming up, we think that 5G's momentum will continue. If any interruption, it will be very short term. After going through the supply chain changes and share exchanges, I think the momentum will -- were just as strong, yes.

Jeff Su

Okay. Your second question?

Bruce Lu Goldman Sachs Group Inc., Research Division - Research Analyst

The second question is regarding to the management. You used to mention that the TSMC becomes more important in terms of geopolitics situations. So does that change your -- cost of your -- does that change your equation in terms of building out the fab, the cost structures? So in the past, we only care about the manufacturing cost as a main cost factor. But given the current situation, do you think that you have to put that into your consideration as well, i.e. you've built -- you know about the saying that building a factory outside of Taiwan is a lot more expensive than doing that in Taiwan. But with all the geographical risk, that building a factory outside of Taiwan becomes right. Do you see the increasing pressure on that? Do you want to -- do we expect any changes on that?

Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board

Yes. The cost in Taiwan is lowest among all regions across the world. We have been studying it continuously. And that decision is made to the best interests of our customers. Yes, the geopolitical is evolving, but we still listen to our customers as the priority. And at this point, our customer, when asked to be manufacturing in a higher-cost region, their answer is, "We cannot be competitive this way." So to increase the -- to maintain the competitiveness of our customer, currently, this is fab layout we're having. In the future, right now it's too early to say. And still our customer prefer we have the lowest cost production sites and doing business with us.

Bruce Lu Goldman Sachs Group Inc., Research Division - Research Analyst

So what if they are willing to pay for a higher price?

Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board

They may be special products, but by and large, it's unlikely.

Jeff Su

Thank you. All right. We have -- let's move to the line. We have quite a few callers on the line. So operator, can we take the next call from the line, please?

Operator

Sure. Your next question comes from the line of Gokul Hariharan from JPMorgan.

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

My first question is on margins. Given that we are looking at very strong demand pickup, could we talk a little bit about any change in the view on longer-term gross margins? We see meaningful improvement in gross margins beyond the 50% range that we have been in the last 4 to 5 years. And also, could you just talk a little bit about the margin dilution impact in second half of 2020 from 5-nanometer? Is it likely to be more modest given there is a very strong 7-nanometer demand also through the course of this year? And I have a follow-up question.

Jeff Su

Okay. Thank you, Gokul. Let me just repeat your question to make sure we got it right. So your first question is asking about sort of with -- given the strong demand pickup, is there any change to TSMC's long-term gross margin target? Why could it not be beyond or above 50%? And then your follow-up or addition to that is looking at this year, could the margin dilution from our 5-nanometer ramp in the second half be more modest given the continued strong demand over 7-nanometer?

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

That's right.

Wendell Huang *Taiwan Semiconductor Manufacturing Company Limited - VP & CFO*

Right. We continue to use 50% gross margin. We think it's still a very good target. Of all the 6 -- I just mentioned the 6 factors that will affect our profitability. One of them actually relates to the ramp of new nodes. So the ramp of every new node, we will see margin dilutions. This relates to your second question. And indeed, we are seeing a margin dilution in the second half of this year from the N5 ramp. Is it going to be better than before? Yes, but only slightly, okay? And the other factors that I just mentioned include the foreign exchange rate, which is really uncertain for anybody to guess. So at this moment, we believe the 50% gross margin is still a good target for us.

Jeff Su

Okay. Gokul, do you have a second question?

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

Yes. Could you talk a little bit about what we are seeing in the N-2, N-3 nodes? Should we anticipate any recovery in the situation in 28-nanometer given overall foundry growth seems to be rebounding? And second part is on 12- and 16-nanometer. Given a lot of the smartphone customers seem to be migrating to 7-nanometer and even 5-nanometer because of the adoption of 5G, will there be any challenge to backfill 12- and 16-nanometer as these customers migrate to more advanced process nodes?

Jeff Su

Okay. So let me just repeat to make sure we understand again. You're asking about our N-2 and N-3. So first part of your question is, do we see any recovery in the demand for 28-nanometer given the overall strong demand that we see this year? And then the second part of your question is that with a lot of products going from 12- and 16-nanometer very quickly to using our 7 and our 5, will we have challenges or difficulty to backfill 12, 16?

C. C. Wei *Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO*

All right. Let me answer 28-nanometer first. With a strong market growth, 28-nanometer, we did see a little bit better than we expected. However, we have reiterated saying that 28-nanometer's capacity has been overbuilt in this industry. So the utilization is still below our average in 28-nanometer. We expect it will be improved in next 1 to 2 years when we develop a new specialty technology for all our customers to utilize. And we start to see the sign because from the new tape-outs, we can be sure that 1 to 2 years later, that the utilization rate will go back to company's average.

Jeff Su

And also 12 and 16.

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

12 and 16, we did not see that. Today, it's still very strong demand. And there continue to be a very high utilization rate. It is all because of we developed it. We continue to improve the technology. And so it's being utilized. The first wave of smartphone, HPC and now it's IoT, automotive.

Jeff Su

Okay. Does that answer your questions, Gokul?

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

Yes.

Operator

The next question comes from the line of Bill Lu from UBS.

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

A question on 5 nanometers. I remember when 7 was ramping, you gave us numbers on the number of tape-outs. I'm wondering if you can help us with 5-nanometer, either also by giving us number of tape-outs. So maybe just comparing it to 7 and whether it's higher or lower.

Jeff Su

Okay. Bill, sorry, you broke up a bit at the end. But I think I understood your question. You want to ask us if we can give you some comparison of the number of tape-outs at 5-nanometer versus our 7-nanometer at a similar stage.

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Well, the 5-nanometer tape-out is little bit less than 7-nanometer compared at the same stage of the time. However, the most important thing is that the high-volume tape-out is almost equal. And so we expect that our 5-nanometer ramp is a very fast and smooth. And it will contribute about 10% to this year's revenue.

Jeff Su

Okay. Do you have...

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

So what's the expectations then? And sorry, just to finish up my first question, so if that's the expectation, then that 5-nanometer will be in terms of wafer capacity as big as 7?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

So we are building the capacity right now and to meet the customers' demand, very high demand. So that's all I can say.

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

Great. Second question is a follow-up on Gokul's question on 28 nanometers. As you develop these specialty technologies, can you talk about what kind of applications are expected to use these new specialty technologies?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Do you want to repeat or...

Jeff Su

Yes, sorry. Okay. Because you're breaking up a little bit, you were asking, Bill, on 28-nanometer, we talk about developing specialty technologies for 28-nanometer. Your question is what type of applications will be used or these specialty technology is targeting?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Well, let me be a bit specific. We are developing the 28-nanometer into 22-nanometer geometry. And ultra-low power is one of the directions we are working on, which can be applied to a lot of IoT devices and also applies to some specialties, such as CMOS image sensor and all others, okay?

Operator

Your next question comes from the line of Brett Simpson from Arete Research.

Brett Simpson Arete Research Services LLP - Senior Analyst

I just had a question on China. China was more than 100% of your Q4 sales growth on a year-on-year basis and sales more than doubled in 2019 from China despite the headwinds from crypto. Can you maybe talk a bit more about the region, what's driving so much growth? And how should we think about China growth specifically in 2020?

Jeff Su

Okay, Brett. Please allow me to repeat your question. Your question is about our China business. You point out that it was 100% of our fourth quarter growth and grew quite strong in 2019 despite the drop-off in cryptocurrency. So you want us to comment on how we should think about China as a percentage of sales and future growth drivers going forward. Is that correct?

Brett Simpson Arete Research Services LLP - Senior Analyst

That's right.

Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board

Well, China is about 20% of our business and has been stable around that number last year this year. So what's changed is I think that last year, we see the China growth particularly strong. And other regions, such as U.S., probably growth is less. So that is a disjunction for this way. But to continue going on, I think the -- we expect to maintain this level.

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Well, let me add some color to it. The same thing, the China major business with TSMC is also still 5G and the AI, the same thing. 2 years ago, probably we have some kind of big increase in the cryptocurrency, but right now it's become normal situation.

Jeff Su

Okay. Brett, do you have a second question?

Brett Simpson Arete Research Services LLP - Senior Analyst

Just to follow up on my question. Looking at 2020, can you maybe just sort of help us with the drivers for growth from China? Do you think it will be mainly 5G smartphone-related? Is there going to be quite a meaningful contribution from other markets like HPC? Any more color would be very helpful.

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

All right. I will be 5G-related, both smartphone that will be increased and also the networking that's in the HPC area. That's 2 major area that China's business that will be increasing in 2020.

Jeff Su

Okay. Brett, do you have a second question?

Brett Simpson Arete Research Services LLP - Senior Analyst

And just the -- second question is really targeted at HPC. Can you maybe talk about how much your 7-nanometer capacity is running HPC at present? I think you were planning to ramp that in the second half of '19. But any more color on the portion of 7-nanometer running HPC would be helpful. And how does this scale as we look at 2020, the use of 7-nanometer for HPC? And I think you mentioned 5-nanometer HPC chips would actually ship in 2020. What would it be used for? Any more help, that would be great.



Jeff Su

Okay. Brett, let me just repeat your question. The first part is how much of our 7-nanometer capacity is for HPC products, how much was this last year, how do we expect this capacity for HPC to scale in 2020 for 7-nanometer. And then the second part is for 5-nanometer, what types of HPC products or applications are being used on 5-nanometer.

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Well, we do not disclose the capacity breakdown for a specific node. In terms of revenue on the HPC in N7, actually all I want to say is it continues to grow, to increase, and we expect that this momentum will continue in the next few years. For the N5, as we said, it's driven by mobile phone and HPC. Still, the 2 big increases this year.

Jeff Su

Okay. Thank you. Let's come back to the floor for -- open the floor for questions. Next question will come from Morgan Stanley's Charlie Chan.

Charlie Chan Morgan Stanley, Research Division - Technology Analyst

So my first question is about your future technology developments, right? So next year, I'm not sure if you are going to introduce so-called 5-nanometer pro -- process. And can you comment on that a little bit? And if you let the extension of the current 5-nanometer, does that mean possibly to your gross margin improvement? So that is the first question.

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

We continue to improve the performance of each node. So next year, you're talking about 5 pro?

Charlie Chan Morgan Stanley, Research Division - Technology Analyst

Yes, 5-nanometer pro or...

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Or whatever. Okay. It will be better than this year's at 5-nanometer, that's for sure, all right? And all the major customers will use it. And so the gross margin improvement, that will be the same as the previous node. It takes about 7 quarter to -- 6 to 8, okay, 6 to 8 quarter to reach the company's average. Okay.

Charlie Chan Morgan Stanley, Research Division - Technology Analyst

Okay. So I would assume that 5-nanometer gross margin will continue to improve into next year.

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

That's for sure.

Charlie Chan Morgan Stanley, Research Division - Technology Analyst

Okay. And next is I'm really interested in your 3-nanometer, right? So currently, what is [basically meaning] the cost per transistor. Do you think you can really reduce the cost per transistor level at 3-nanometer? And I'm also curious, given this assumption, do you think HPC or mobile will be a bigger user for your coming 3-nanometer, focusing both CPU or smartphone AP?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Per transistor cost, I believe, will continue to reduce, okay? That's for sure. Now who is going to use it? That's a major question. Again, still high-end smartphone and HPC will be the users, all right? I cannot be more specific to tell you whom, but that's it.

Charlie Chan Morgan Stanley, Research Division - Technology Analyst

Can I switch back to some near-term follow-up?

Jeff Su

Let's stick with two questions first and then go back in the queue, we can come back. Sorry. Thank you. Next question will come from CLSA, Sebastian Hou over here.



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

So my first question is to follow up on Chairman's comments about that you see the 5G momentum will continue to be strong, even if there's a change on the U.S. exporting rule. Maybe just some near-term disruption because TSMC has evaluated the supply chain change. So can you elaborate more about what the supply chain change you have seen to make you such -- give you such confidence that there will be just a near-term disruption even if there is some change on the exporting rule?

Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board

Well, this is a forward-looking analysis. So I think that some of you also did analysis. Basically, the smartphone, you have to look at this smartphone demand per year. And the -- and then look at the 5G penetration per year, who will be the smartphone supplier - it can change, who will be their shares and where the 5G base station been produced, that will change. So all these things really depends on the -- it boils down to really the forward-looking smartphone demand, would that be interrupted. That's the analysis. I think that if any disruption, it will be a shorter term.

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

Okay. So my follow-up question on that is smartphone, we understand. So if A brand, they lose share, B, C brands will pick up. But what about the infrastructure? If there is a disruption on the infrastructure because one of the key infrastructure supplier may not have the critical processors, so which means the whole 5G infra build-out maybe slowed down, postponed? And what's the point of having those 5G smartphone with the whole supply chain, the whole 5G thesis been postponed?

Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board

I think industry will find I think there's no businesses with just 1 player for too long, okay? The second and third player will sooner or later will come up and it could be pretty soon. And in our business, always a competitive environment. So yes, we have a #1 enter the market, but the #2 and #3 is not too far away.

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

Okay. My second question is on the guidance that the company get this year that the foundry industry is growing 17%. Semis, excluding memory, it's about 8%. And I think if I look at historically, the -- usually, I think the formula for TSMC's growth is usually the global GDP. And semi is about like 2, 3 percent point above that, foundry a little bit above that and TSMC is a little bit above that. So TSMC get a 5% to 10% of the CAGR. So I think that is a very simple formula. But has the formula changed? So I mean that historically, semiconductor is highly correlated with the global GDP growth to some extent. So if TSMC with the foundry industry growing faster, is it like the foundry/TSMC becomes the outlier or it's because also that you're implying that the whole economy is growing faster?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Now at this time, we have a higher growth rate, right, for foundry and for TSMC. It all because it's driven by 5G and AI's application. So whether we can increase our forecast. For example, TSMC always say 5% to 10% CAGR is that our goal. We certainly hope that we can exceed that. But this year, it's still too early to say. But we stay what we said. The foundry industry will be 17% and TSMC will be better than that.

Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board

Sebastian, let me add to this. This year, if the formula does change a bit, we put it in the Korean -- captive Korean player foundry -- captive into the foundry, okay, which is they do that and constantly. So this time, we put the Korean player's captive into the foundry business. So that's why you see the growth quite faster.

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

Okay. So -- but if we also look at -- I think the company also made a comment that you're seeing your 5-year CAGR to be higher, at the high end of the 5% to 10%. So it's not just 1 year, it's just a flash in the pan. So I think if you look at the longer time frame, which means I think there will be more -- I think the correlation with the global GDP, I think that makes more sense, more representative. So does that also mean that like semis and tech innovation is going to drive the global economy grow faster in the next couple of years? Or is it just because global GDP still grow as the growth at 2%, 3% but semis, foundries, TSMC become the outlier, that gap is getting bigger?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Oh, we don't want to say it's outlier. We continue to forecast global GDP still in a normal situation, provided the trade tension between the 2 big countries did not deteriorate. But for semiconductor, I want to say that the content of the semiconductor in our life continue to increase, provide -- see that -- you can see the big example in the smartphone. You can see the big example in the automotive. And you can see that IoT is a big increase also. So now it's changing our world. And that all because of semiconductor content. It's not because of what GDP suddenly become grow faster. And it's not because of semiconductors is an outlier. It will continue to be this way.

Jeff Su

Yes. And remember, last year, as Wendell said, the -- it's the semi industry ex memory was a year of decline. So obviously, there's a base effect in play as well for 2020.

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

Yes, sure. I'm talking about 5 years.

Jeff Su

Sure. Yes. Okay. Thank you. Let's move back to the line, please, and we'll take the next question from the line, please, operator?

Operator

Your question comes from the line of Mehdi Hosseini from SIG.

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

I have one clarification. When you were referring to 5-nanometer, does that include 6? And if it doesn't, what is your view of availability of 6-nanometer by year-end '20?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Do I have to repeat the question? You say that 5-nanometer is including 6 or not. Now 6 is 7 nanometer's family. So we look at the 7, 7+, 6 as a 1 family. 5 is another big node.

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

Okay. And you're still on schedule to have 6 available by end of this year, correct?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Volume production at the end of this year. Right now, it's ready for our customers' tape-out.

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

Sure. Okay. And then in terms of just the we're talking about the growth, more than 20%. At the same time, one of the leading microprocessor manufacturer based in North America has talked about increased outsourcing. And I just want to get your view. When you look into the longer term, would there be a structural change in semiconductor manufacturing, where TSMC would actually be able to grab a higher market share because they will be more outsourcing specifically from a key company based in North America?

Jeff Su

All right. Let me repeat your question, Mehdi. I think you're asking us to comment on the potential for an increased outsourcing from a major microprocessor or CPU vendor. Long term, could this be a structural change and the potential for longer term outsourcing?

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

Yes.

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

We certainly welcome that outsourcing continue to grow. And for TSMC, all I can say is that we develop the technology to meet our customers' requirement. And we are confident that we are the best technology leader and we have excellent manufacturing. And of course, as a result, we expect that we gain some market share out of it. But that is for the future for TSMC's growth. And I cannot be more specific than that.

Jeff Su

Okay. Thank you. Let's move on. We have a follow-up question from the line from JPMorgan's Gokul Hariharan.

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

So a quick question on the high end of the 5% to 10% growth. Could you talk a little bit about why only high end of 5% to 10% when the CapEx to be seems to be 40% to 50% from the last kind of \$10 billion to \$12 billion -- \$10 billion to \$11 billion CapEx change over the last 5 years? Any reasons why we are a bit more cautious? Do we feel that the 5G cycle after a couple of years could start to kind of decelerate? Especially given this year, we are already starting off with a very strong 20% kind of growth. So just wanted to think about the puts and takes in terms of the high end of 5% to 10%, then why not stronger than that growth, given the big jump in CapEx and indication that CapEx could stay around these levels even going into the 3-nanometer era.

Jeff Su

Okay. Gokul, let me try to summarize your question. Basically, Gokul was asking why our long-term growth target is only at the high end of 5% to 10% when our CapEx has increased 40% to 50% versus the \$10 billion to \$12 billion in the past. He is asking or wondering, is this because we think -- take a more cautious view that 5G cycle may be strong this year and next year but may slow down after that? And so why do we still say at the high end of 5% to 10%?

Wendell Huang Taiwan Semiconductor Manufacturing Company Limited - VP & CFO

Last year, before we increased the CapEx, we were looking at somewhere in the middle of that 5% to 10%. But afterwards, when we see the ramp in 5G deployment, we increased the CapEx. And now we're looking at high end of the 5% to 10% range. So that is the difference. And also let me explain this from a capital intensity point of view. Last year, while we increased the CapEx, the capital intensity was over 40%. This year, we think it will be lower than 40%. And from next year on, although it's still pretty early, we think it will be somewhere between 30% or 35%, which is dissimilar to the old norm that we used to say before.

Jeff Su

Gokul, do you have a second question?

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

Yes. Just one more broader question for Dr. Liu. At a Board level, Dr. Liu, could you talk a little bit about how the Board thinks about TSMC's positioning as a foundry for everyone, everybody's foundry, given the broader geopolitical changes that are happening? I don't want to go into each episode in terms of like the change in the de minimis rule, et cetera. But thinking 4 to 5 years out, how does -- or what are the steps that the Board is considering to kind of -- to ensure that TSMC can remain everybody's foundry even in a more challenging kind of geopolitical environment and a lot more policy kind of blips compared to, say, the last 5 to 7 years?

Jeff Su

Okay. Let me try to summarize your question. Again, I think he's asking -- Gokul's asking for Mark to please share your thoughts on, from a Board level, TSMC's positioning as everyone's foundry. Of course, we're facing a lot of different geopolitical changes and challenges. Gokul doesn't need us to comment on each one. But generally, how are we thinking about 5 to 7 years out, how TSMC can position ourselves and how we can remain to be everyone's foundry?

Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board

Yes. The -- first of all, currently, we discussed the strategy with the Board. And the Board fully agree with our current strategy, okay? And of course, this strategy contains several necessary component. First of all, we develop our technology ourselves. All the technology, IP and know-how and technology all developed in Taiwan here. Secondly is, another necessary element is our technology has to be leaders.



When you're technology leaders, people will have to come to you. And that's how we maintain to be everyone's foundry. There are exceptions, of course, because of their domestic trade policy that I cannot overcome. But basically, that so far, this strategy should be able to play on.

Jeff Su

Okay. Does that answer your question, Gokul?

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

Yes.

Jeff Su

All right. Thank you. Let's come back to the floor and see if there's any follow-up questions from anyone? Morgan Stanley, Charlie?

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

So first of all, for first quarter, you mentioned that utilization rates are higher. But in terms of U.S. dollars revenue go down slightly. So what is the ASP or product mix change here?

Jeff Su

So Charlie is asking that we said first quarter, the utilization rate will slightly increase. But our U.S. -- our guidance shows a slight decrease in the U.S. -- the revenue in terms of U.S. dollars. So why is that? Does that imply an ASP change?

Wendell Huang *Taiwan Semiconductor Manufacturing Company Limited - VP & CFO*

Last year, fourth quarter or even third quarter last year, part of the wafer revenue come from wafers prepared in the first quarter -- first half of 2019, when the utilization was pretty low. And we're pretty much digesting all of those already.

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

Okay. So it looks like the year is open, right? But do you see any kind of any next data points, for example, any segment or any customers cutting forecast or orders recently? Can you comment on that?

C. C. Wei *Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO*

No, we did not see that.

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

And lastly, it's a little bit subtle, right? CapEx, I think 3 months ago -- I think the guidance for this year, CapEx is USD 14 billion to USD 15 billion. But now it's like slight USD 1 billion higher. So what is that additional CapEx for? Is that mainly for 7-nanometer or 5-nanometer?

Wendell Huang *Taiwan Semiconductor Manufacturing Company Limited - VP & CFO*

Well, other than the advanced technology, we also mentioned earlier, we also increased the CapEx this year for specialty technology as well as advanced packaging. So those are the areas that we are focusing on.

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

And lastly, if I may, I guess a market share question. We appreciate that the company provide your assumption for industry growth, right? So I guess, first of all, we want to clarify when you add Korea captive foundry in the comparison, is that an apple-to-apple comparison, meaning do you include that into last year's revenue base?

C. C. Wei *Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO*

I think we did, right? Yes, we did.

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

Okay. So include then, apple-to-apple comparison is up 17%.

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Up 17%.

Charlie Chan Morgan Stanley, Research Division - Technology Analyst

Okay. And then (inaudible) to China competitors' market share, I think that's a...

Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board

I think that probably needs to correct it. I don't think we include the foundry growth in last year, the Samsung captive supply. So the growth is 17% is particularly high.

Charlie Chan Morgan Stanley, Research Division - Technology Analyst

Okay. So what is kind of apple-to-apple comparison then?

Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board

I think 6 points. So it will be [17%] (corrected by company after the call) if you apple-to-apple comparison.

Charlie Chan Morgan Stanley, Research Division - Technology Analyst

Okay. So based on that kind of [17%] (corrected by company after the call) industry growth, right, I think lots of investors are asking whether you're sort of losing market share in China because China want to push the localization, right? Some chatters are talking about SMIC taking more orders from you guys at 14-nanometer. Can you also comment a little bit on this front?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Usually, we don't specifically answer this kind of very sensitive questions specifically on one competitor. But let me tell you that what the newspaper say is not true.

Jeff Su

All right. thank you. Charlie, also let me just clarify, last time, we did not say that \$14 billion to \$15 billion for 2020 CapEx. We said it will probably stay at a similar level as 2019. But we do not specifically say that dollar range, all right? Just to clarify. All right. Let's go back to the line. Sorry, we have a follow-up from SIG, Mehdi.

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

Wanted to go back to your commentary about the 5G phone. And how should I think about opportunities if I were to think about the sub-6 versus millimeter wave? And specifically, do you think that this year, opportunities with mobile, you talked about a 20% -- more than 20% growth. Is that all going to be sub-6? Or is it going to be a mix of the 2 technologies?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Okay. The question is clear enough. If the 5G grows, is that because of sub-6 or the millimeter wave? And my answer is both, okay? That's the 5G's phone and the base station is for sub-6 and the millimeter wave.

Jeff Su

Do you have a second question, Mehdi?

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

Yes. Actually, if I were to have a follow-up, do you think you will actually be building a millimeter wave phone or for millimeter wave, it's just going to be limited to base station?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Okay. Actually, the phone is much easier to build with millimeter wave plus sub-6. The base station probably will have a much higher number in sub-6 rather than millimeter wave.



Jeff Su

All right. Let's come back to the floor. We have a follow-up from Crédit Suisse, Randy Abrams.

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

You talked about the good investment in the backend. Last year, I think you said \$2.5 billion was the revenue run rate in 2018. If you can maybe give a view the size of the business now and maybe what type of growth you're expecting for this year.

Wendell Huang Taiwan Semiconductor Manufacturing Company Limited - VP & CFO

Yes. The revenue size of backend was \$2.8 billion in 2019. We're expecting double-digit growth for this year, mid-teens.

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

Mid-teens, right. Okay. And if I could ask on the 2 other areas that don't get as much attention, automotive and IoT. So automotive was depressed last year. But I think you're talking about a pretty big pickup to grow teens. Could you talk to the areas, like if it's just cyclical rebound or if there are certain types of products or components coming back for the automotive, where you're gaining content share? And for the automotive -- sorry, for the IOT, it was very strong growth. It's a big category. So if you could maybe center on if there's a few particular pieces within IoT driving the momentum for that category.

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Well, actually the growth of this year, most come from the content increase rather than the unit increase. Because we -- I just mentioned that it will be mid-teens, right, mid-teens increase. Certainly, it's not mid-teens unit. You don't expect so many car being sold. And so it's a content -- the semiconductor content increase is more important than the unit.

Jeff Su

And then Randy is also asking about for IoT, are there specific areas or segments that's driving the growth in IoT?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Wearable is very popular now everywhere. And according to our Chairman, content also increased.

Jeff Su

Next, we have a follow-up from Citigroup, Roland Shu.

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

Yes. Last time, CEO guide this, you expected the 7-nanometer revenue will continue to grow in 2020. So do you still hold to the view?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Yes.

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

So how much growth it will be this year? So last year, we have 27%. Is this able to above the highest level of 20-nanometer, around 34%?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

Close.

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

Okay. And also for 7-nanometer, do you see any competitor with the technology breakthrough and likely to impact or taking your market share in the near term?

Jeff Su

Can you repeat the question?

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

Yes. Do you see any competitors with 7-nanometer technology breakthrough and will likely to threaten you or take your market share going forward.

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

We will continue to hold a very high market share. That's all we can say. And I don't comment on my competitor.

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

Okay. Yes. My second question is you said that you continue expanding your customer and the product portfolio. And so you have new customers and the products from cryptocurrency in 2018. And the last year, you have this new CPU foundry outsourcing as your new customer in technology. So how about this year? Do you see any new customers or new applications to contribute to your growth?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

If this year's growth, counting on my customer is what we engaged last year already. So as I said, we continue to expand our product portfolio, and we continue to increase the number of our customers.

Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board

So I think the content increase along with 5G penetration is the major phenomenon, including the leading-edge as well as the mature nodes. And it's just a wide spread of customers or existing customers.

Jeff Su

Okay. We have a follow-up here from CLSA, Sebastian Hou.

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

My first follow-up is we heard that the 7-nanometer demand is very strong at TSMC. And most of the customers are on allocation mode right now. So with the step-up of CapEx for this year, I believe some of that also devote into 7-nanometer for this year. Do you still expect this similar tightness that your customer may experience on 7-nanometer by the end of this year?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

We do have very high demand from 7-nanometer. And we work very hard to meet customers' demand. Last year, we announced we put \$1.5 billion more to increase the 7 nanometers capacity. We work hard to increase the capacity.

Mark Liu Taiwan Semiconductor Manufacturing Company Limited - Chairman of the Board

Yes. With 5-nanometer ramp up in the second half of this year, the tightness of 7-nanometer we hopefully can be soothed a bit for the customers.

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

Okay. And is there -- are there any process nodes that TSMC is seeing not growing this year?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

28-nanometer.

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

But 28 is already pretty low last year. But you're still seeing that not growing?

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

You say not growing, right, not growing.

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

All right. So even for 16, 12, this platform, TSMC also expects that to go up. Okay. So that's why you say that the newspaper is wrong.

C. C. Wei Taiwan Semiconductor Manufacturing Company Limited - Vice Chairman & CEO

I don't want to be so specific.

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

Okay. Well, that's pretty clear.

Jeff Su

All right. In the interest of time, we'll see if there's any last questions from anybody. If not, then this concludes our Q&A session. Before we conclude today's conference, please be advised that the replay of the conference will be accessible within 4 hours from now. The transcript will be available within 24 hours from now, both of which will be available through TSMC's website at www.tsmc.com. Thank you for joining us today. We hope you will join us again next quarter. Goodbye, Happy New Year, and have a great day.

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