Operational Highlights

5.1 Business Activities

5.1.1 Business Scope

As the founder and leader of the dedicated semiconductor foundry segment, TSMC provides a full range of integrated semiconductor foundry services, including the most advanced process technologies, leading specialty technologies, the most comprehensive design ecosystem support, excellent manufacturing productivity and quality, advanced mask and packaging services, and so on, to meet a growing variety of customer needs. The Company strives to provide the best overall value to its customers and views customer success as TSMC success. As a result, TSMC has won customer trust from around the world and has experienced strong growth and success.

5.1.2 Customer Applications

TSMC manufactured 10,436 different products for 481 customers in 2018. These chips were used across a broad spectrum of electronic applications, including computers and peripherals, information appliances, wired and wireless communication systems, servers and data center, automotive and industrial equipment, consumer electronics such as digital TVs, game consoles, digital cameras, IoT and wearables, and many other devices and applications.

The rapid ongoing evolution of end products prompts customers to pursue differentiation using TSMC’s innovative technologies and services and, at the same time, spurs TSMC’s own development of technology. As always, success depends on leading rather than following industry trends.

5.1.3 Consolidated Shipments and Net Revenue in 2018 and 2017

<table>
<thead>
<tr>
<th></th>
<th>2018</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shipments</td>
<td>Net Revenue (Note 3)</td>
</tr>
<tr>
<td>Wafer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic (Note 1)</td>
<td>1,575</td>
<td>81,718,513</td>
</tr>
<tr>
<td>Export</td>
<td>8,177</td>
<td>829,577,851</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others (Note 2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic (Note 1)</td>
<td>NA</td>
<td>8,282,048</td>
</tr>
<tr>
<td>Export</td>
<td>NA</td>
<td>94,085,417</td>
</tr>
<tr>
<td>Total</td>
<td>1,575</td>
<td>91,116,561</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Domestic (Note 1)</td>
<td>80,716,267</td>
</tr>
<tr>
<td></td>
<td>Export</td>
<td>941,356,950</td>
</tr>
<tr>
<td></td>
<td></td>
<td>972,073,217</td>
</tr>
</tbody>
</table>

Note 1: Domestic means sales to Taiwan.
Note 2: Others mainly include revenue associated with packaging and testing services, mask making, design services, and royalties.
Note 3: Commencing in 2018, the Company began to break down the net revenue by product based on a new method which associates most estimated sales returns and allowances with individual sales transactions, as opposed to the previous method which allocated sales returns and allowances based on the aforementioned gross revenue. The Company believes the new method provides a more relevant breakdown than the previous one. On a comparable basis, the classification of 2017 has been revised accordingly.

5.1.4 Production in 2018 and 2017

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity (12-inch equivalent wafers)</th>
<th>Output (12-inch equivalent wafers)</th>
<th>Amount (NT$ millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>12 - 13</td>
<td>10 - 11</td>
<td>679,356</td>
</tr>
<tr>
<td>2017</td>
<td>11 - 12</td>
<td>10 - 11</td>
<td>615,600</td>
</tr>
</tbody>
</table>
5.2 Technology Leadership

5.2.1 R&D Organization and Investment

In 2018 TSMC continued to invest in research and development, with total R&D expenditures amounting to 8% of revenue, a level that equals or exceeds the R&D investment of many other leading high-tech companies. Despite the increasingly complex and difficult challenges to continue extending Moore’s Law, which calls for the doubling of semiconductor computing power every two years, TSMC has focused its R&D efforts on enabling the Company to continually offer its customers first-to-market, leading-edge technologies and design solutions that contribute to their product success. In 2018, following the volume ramp-up of the industry leading 7nm technology, the R&D organization completed the transfer to manufacturing of the 7nm+ technology, an enhanced version of 7nm. At the same time, the R&D organization continues to fuel the pipeline of technological innovation needed to maintain industry leadership. TSMC’s 5nm technology, the fifth generation of technology platform to make use of 3D FinFET transistors, is on track for risk production in 2019. TSMC’s 3nm technology has entered full development stage and the definition and intensive early development efforts have been progressing for nodes beyond 3nm.

In addition to CMOS logic, TSMC conducts R&D on a wide range of other semiconductor technologies that provide the functionality required by customers for mobile SoC and other applications. Highlights in 2018 include: high-volume production of Gen-3 Integrated Fan-Out Package on Package (InFO-PoP) for mobile application processor packaging; successful qualification of Gen-4 Info-PoP advanced packaging technology for mobile applications and Integrated Fan-Out on Substrate (InFO-os) for HPC applications; development of industry’s unique 90nm BCD (Bipolar CMOS-DMOS) technology offering leading-edge 5-16V power devices and dense logic integration with competitive cost, as the next generation mobile Power Management IC (PMIC) solution; stable yield and reliability demonstration of 28nm node eFlash for high performance mobile computing and high performance low-k/low-kappa platforms with expected technical qualification for automobile electronics and micro controller units (MCUs) in 2019; mass production launch of new generation CMOS image sensors of sub-micron pixel size for three dimensional range detection and imaging; and success in 2018, R&D successfully implemented EUV mask technology into 7nm+ and 5nm nodes. Solid progress was made on the production yield and the reduction of blank native defects to meet high-volume manufacturing requirements.

5.2.2 R&D Accomplishments in 2018

Highlights

* **5nm Technology**

Even though the semiconductor industry is approaching the physical limits of silicon, 5nm technology still follows Moore’s Law and delivers substantial density improvement with better performance at same power or lower power consumption at comparable performance. In 2018, TSMC continued full development of 5nm focusing on manufacturing baseline process setup, yield, learning, transistor and interconnect RC performance improvement and reliability evaluation. The SRAM and logic yield results met the required expectations and TSMC is thus now committed to the goal of risk production in 2019.

* **3nm Technology**

Development of the 3nm FinFET (Fin field-effect transistor) technology, targeting both mobile applications and high performance computing devices, made good progress in 2018. 3nm FinFET technology is expected to offer excellent improvement in speed, power, density and cost over 5nm FinFET technology.

* **Lithography Technology**

The main focus for R&D/ lithography in 2018 was 7nm+ technology transfer, 7nm technology development and preparation for development of 3nm technology and beyond. For 7nm+ development, the technology was smoothly transferred and R&D is working with the fab to clean up any remaining patterning issues. As for 5nm development, EUV (extreme ultraviolet) lithography showed promising imaging capability with expected good wafer yield. R&D is working on EUV cost reduction, mask defect reduction in scanner, and mask-making capability improvement. In 2019, TSMC will focus intensively on improving EUV quality and adopting more EUV layers in 3nm technology and beyond.

In 2018, TSMC offered world-class partnerships with world-class research institutions, including SRC in the U.S. and IMEC in Belgium. TSMC also continued to expand research collaboration with leading universities throughout the world for two grand purposes: the advancement of semiconductor technologies and the inculcation of talents for the future.

![R&D Expenditures](chart)

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount (NIS thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>13,078,088</td>
</tr>
<tr>
<td>2018</td>
<td>13,477,519</td>
</tr>
<tr>
<td>07/2018</td>
<td>14,390,692</td>
</tr>
<tr>
<td>02/2019</td>
<td>15,572,058</td>
</tr>
</tbody>
</table>

**Advanced Fan-Out and InFO (Integrated Fan-Out)**

In 2018, TSMC continued to lead in high-volume manufacturing of Info-PoP Gen-3 packaging for mobile application processors and Integrated Fan-Out on Substrate (InFO-os) applications. Info-PoP Gen-4 was also successfully qualified for mobile applications and started developing multi-die integration with fine-pitch die-to-die interconnection and InFO-LHD (ultra-high density) for both mobile and HPC applications. Based on Info-PoP Gen-4 qualification, it could have smaller package size with finer RDL (redistribution layer) line, BGA (ball grid array) pitch. Gen-4 also enhances thermal performance. The newly developed InFO-PoP could be stacked with various commercial DRAM devices with competitive performance. This InFO-PoP with backside RDL will boost penetration into mobile applications and processor applications with wide coverage from premium to mid-end market and was High-Volume Manufacturing (HVM) ready in 2019. New generation IRP (integrated passive device) technology, which provides high density capacitors and low ESL (effective series inductance) for electrical performance boost, passed qualification on Info-PoP. Enhanced InFO-PoP will benefit AI and 5G mobile applications. New RD HVM is scheduled to begin in 2019. To meet the demands of 5G mobile communications, TSMC has developed an advanced InFO antenna in package (InFO-AIP) technology, in which the RF chip and millimeter wave antenna are integrated into an Info-PoP package. InFO-AIP technology provides high speed, small-size, low-cost solutions for millimeter wave system applications such as 5G mobile, video streaming and virtual reality (VR) wireless communications. This technology can also support the fast-evolving automotive applications in car radar, auto-driving and driving safety.

**Advanced Interconnect**

TSMC has made significant progress in chip performance by interconnect time delay reduction. The novel Via processes have demonstrated a 30% reduction in Via resistance with comparable chip reliability and performance. In addition, the novel materials and optimized integration approach have been verified with lower capacitance loading and enhanced device reliability. TSMC customers could enhance their competitiveness by using these prominent advances in interconnect RC (resistance-capacitance) delay.
Advanced Technology Research

Innovation in transistor architectures and materials continues to enable higher performance and reduced power consumption in advanced logic technologies. TSMC is at the forefront of transistor research. At the 2018 International Electron Device Meeting (IEDM), TSMC published the first high performance CMOS Ge gate stack, a record low n-type contact resistance, and Ge-channel vertically stacked lateral gate-all-around nanowire transistors. TSMC continues to look for hardware accelerators for AI and HP computing. Also presented at 2018 IEDM: Phase change memory was integrated in 40nm CMOS technology and demonstrated as a key technology candidate for AI applications. TSMC research is well positioned to pave the way for continued density scaling, performance enhancement and power reduction to deliver advanced logic technologies for mobile and high performance computation applications.

Specialty Technologies

TSMC offers a broad mix of technologies to address a wide range of applications:

- **Mixed Signal/Radio Frequency (MS/RF) Technology**
  
  In 2018, in order to facilitate transistor circuit design for the increasing demand of 5G cutting-edge wireless technologies, TSMC successfully delivered various options in 16nm, 22nm and 28nm devices with a Si-based millimeter wave (mmWave) model to fulfill customers’ requirement in cross-functional integrated applications. To achieve better performance in insertion loss and isolation in special process for cellular/Wi-Fi RF switch applications, TSMC reduced the key parameter R_LC to 78 fs (femto-seconds) by providing 40nm process as a lower cost alternative.

- **Power IC/Bipolar-CMOS-DMOS (BCD) Technology**
  
  TSMC developed unique 90nm BCD technology, offering leading-edge 5V, 3.3V, 1.8V and IO 1.3V in dense and dense logic integration at a competitive cost, as a next generation mobile Power Management IC (PMIC) solution. TSMC continually enriches this platform to cover more PMIC applications with 40nm ultra-low-power compatible 20-24V HV devices with integrated RRAM for 3D time-of-flight applications.

- **Panel Drivers Technology**
  
  In 2018, TSMC deployed 40nm UHD 4K display driver ICs in Display Driver IC (DDIC) and Touch with Display Driver Integration (TTDI). In addition, the Company also penetrated the markets for OLED (organic light emitting diode), AM/O and medium panel driver ICs. Dozens of customers and products entered mass production and the yield has been excellent. For next generation products, TSMC has introduced dual platforms in advanced high-voltage technologies, wafer stacking, and panel verification, and plans to begin risk production in the first half of 2019.

- **Micro-electromechanical Systems (MEMS) Technology**
  
  In 2018, TSMC’s modular MEMS technology was qualified for mass production of accelerometers and a pilot run of high-resolution pressure sensors. Future plans include the development of next-generation high-sensitivity thin-microphone, MEMS Si-pillar TSV (through silicon via) technology and BioMEMS applications.

- **GaN Technology**
  
  The first generation of 650V/100V enhancement high electron mobility transistor (E-HEMT) went into risk production in 2018. The second generation of 650V/110V E-HEMT and RF 100V D-HEMT GaN devices were developed and passed engineering qualification, also in 2018.

- **Complementary Metal-Oxide-Semiconductor (CMOS) Image Sensor Technology**
  
  In 2018, TSMC had several achievements in CMOS image sensor technology including: (1) mass production of new-generation sensors of sub-micron pixel for mobile application; (2) successful development of Ge-on-Si sensor for 3D range sensing applications with performance superior to Si sensor; (3) successful application of wafer stack technology to prototype Single Photon Avalanche Diode (SPAD) sensor array technology for 3D time-of-flight applications.

- **Embedded Flash/Emerging Memory Technology**
  
  TSMC reached and announced its first on-chip flash memory (NVM) technologies in 2018. At the 40nm node, NOR-based cell technology with Split-Gate cell was successfully mass-produced to support consumer electronics applications such as IoT, smartcards and MCU and was also qualified for automotive electronics applications. At 28nm node, embedded flash development for HP mobile computing and HP low-leakage platforms have demonstrated stable yield and reliability, and technical qualification is expected in 2019 for automobile electronics and micro controller units (MCU). Customers also announced industry’s first on-chip flash memory MCU using TSMC’s 28nm embedded flash technology for next generation autonomous cars. In 2018 TSMC offered 40nm RRAM technology to be embedded in NVM technologies as a low-cost solution for the price-sensitive IoT market. Development in 28nm and 22nm embedded resistive memory technology is on track and expected to enter production in 2020. TSMC is also developing 28nm and 22nm embedded MRAM technology as the solution for embedded flash technology replacement beyond the 40nm Split-Gate cell node. 2019 production of embedded MRAM is expected to serve many emerging applications.

5.2.3 Technology Platform

TSMC provides customers with advanced technology platforms that include the comprehensive design infrastructure required to optimize design productivity and cycle time. These include: design flows for electronic design automation (EDA); silicon-proven libraries and IP building blocks; and simulation and verification design kits, i.e., process design kits (PDKs) and technology files.

For TSMC’s latest advanced technologies of 5nm, 7nm, 7nm+12nm, 22nm, and 3D IC design enablement platform, EDA tools, features and IP solutions are readily available for customers to adopt to meet their product requirements at various design stages. TSMC also extends its IP quality program (TSMC 9000) to allow IP audits to be performed either at TSMC or at TSMC-certified laboratories. To help customers plan new product tape-outs incorporating library/IP from TSMC’s Open Innovation Platform™ (OIP) ecosystem, the OIP ecosystem features a portal to connect customers to an ecosystem of 39 IP solution providers. Overall, TSMC and its IP partners have accumulated a portfolio of more than 20,000 IP titles, from 0.35um to 5nm with major IP types to meet customer design needs. TSMC and its EDA partners have created numerous deliverables from 0.13um to 5nm that have successfully supported customer tape-outs.

5.2.4 Design Enablement

TSMC’s technology platforms provide a solid foundation to facilitate the design process. Customers can design directly using the Company’s internally developed IP and tools or use tools available from TSMC’s OIP partners. TSMC provides a broad range of PDKs for digital logic, mixed-signal, radio frequency (RF), high voltage driver, CMOS image sensor (CIS) and embedded flash technologies across a range of technology nodes from 0.5um to 5nm. In addition, the Company provides technology files for design rule checking (DRC), layout verification of schematic (LVS), resistance-capacitance (RC) extraction, automatic place and route, and a layout editor to ensure process technology information is accurately represented in electronic design automation (EDA) tools. By 2018, TSMC had provided more than 9,000 technology files and more than 300 PDKs via TSMC-Online™. There are more than 100,000 customer downloads of these files every year.

Library and IP

Silicon intellectual property (IP) is the basic building block of integrated circuit designs. Various IP types are available to support different customer design applications including foundation IP, analog IP, embedded memory IP, interface IP and soft IP. TSMC and its alliance partners offer customers a rich portfolio of reusable IPs, which are essential building blocks for many circuit designs. In 2018, the Company expanded its library and silicon IP portfolio to contain more than 20,000 items, a 25% increase over 2017.

Design Methodology and Flow

Reference flows are built on top of certified EDA (electronic design automation) tools to provide additional design flow methodology innovations that can help boost productivity. In 2018, TSMC addressed critical design challenges associated with the new 5nm and 3D IC technology for digital and SoC applications by announcing the readiness of reference flows through OIP collaboration that feature FinFET-specific design solutions and methodologies for performance, power and area optimization.

5.2.5 Intellectual Property

A strong portfolio of intellectual property rights strengthens TSMC’s technology leadership and protects our advanced and leading-edge technologies. As of end of 2018, TSMC has accumulated near 50,000 patent applications, and over 34,000 patent grants worldwide. In 2018, TSMC has obtained near 2,500 U.S. patents to rank #6 among U.S. patent assignees, making the ranking of top 10 U.S. patent assignees for the third consecutive year. Additionally, TSMC actively develops worldwide patent strategy, ranking #1 among patent applicants in Taiwan, and obtaining over 1,000 patents in Taiwan and China. In terms of patent quality, the average allowance rate of TSMC’s U.S. applications is 98% and ranks #1 among top 10 U.S. patent
TSMC has established a process to generate company value from intellectual property by aligning intellectual property strategy with R&D, business operation objectives, marketing, and corporate development strategies. Intellectual property rights protect the company’s freedom to operate, enhance competitive position, and provide leverage to participate in many profit-generating activities.

TSMC has worked continuously to improve the quality of intellectual property portfolio and to reduce the maintenance costs. TSMC will continue to invest in intellectual property portfolio and intellectual property management system to ensure the company’s technology leadership and receive maximum business value from intellectual property rights.

5.2.7 Future R&D Plans

To maintain and strengthen TSMC’s technology leadership, the Company plans to continue investing heavily in R&D. For advanced CMOS logic, the Company’s 5nm and 3nm CMOS nodes continue progressing in the pipeline. In addition, the Company’s reinforced exploratory R&D work is focused on beyond-3nm node; in areas such as 3D transistors, new memory, and low-R interconnect, on track to establish a solid foundation to feed into technology platforms. For 3D IC advanced packaging, innovations for energy-efficient sub-system integration and scaling provide further augmentation to CMOS logic applications. For specialty technologies, the Company has intensified its focus on new specialty technologies such as RF and 3D intelligent sensors targeting 5G and smart IoT applications. The Corporate Research function established in 2017 continues to focus on novel materials, process, devices, circuits, RF designs and micro-electromechanical system designs. Participants include major university research groups worldwide. TSMC and the University Shuttle Program participants achieve “win-win” collaboration through the program, which allows graduate students to implement exciting designs and achieve silicon proof points for innovations in various end-applications.

5.3 Manufacturing Excellence

5.3.1 GIGAFAB® Facilities

Maintaining dependable capacity is a key part of TSMC’s manufacturing strategy. The Company currently operates three 12-inch GIGAFAB® facilities – fabs 12, 14 and 15. The combined capacity of the three facilities exceeded 8 million 12-inch wafers in 2018. Production within these three facilities supports 0.13µm, 90nm, 65nm, 40nm, 28nm, 20nm, 16nm, 10nm, and 7nm process technologies, including each technology’s 14nm FinFET CMOS technology and 5nm logic technology platform and applications.

5.3.2 Agile and Intelligent Operations

The Company’s sophisticated, agile operation system continues to drive manufacturing excellence by integrating demand and capacity modeling, lean Work in Process (WIP) line management, lot dispatching and scheduling, and equipment quality performance to provide fast ramp-up, short cycle time, stable manufacturing, on-time delivery, and total quality satisfaction. The system also provides great flexibility to quickly support customers’ urgent pull-in requests when needed.

TSMC has also introduced new applications such as IoT, intelligent mobile devices and mobile robots to consolidate data collection, yield traceability, workflow efficiency, and material transportation to continuously enhance fab operation efficiency. Committed to manufacturing excellence, TSMC has integrated expert systems, advanced algorithms, artificial intelligence and machine learning technology to build up an advanced manufacturing environment. Advanced manufacturing technologies are widely applied in scheduling and dispatching, people productivity, equipment productivity, process and equipment control, quality defense, and robotic control in order to optimize quality, productivity, efficiency, and flexibility while maximizing cost effectiveness and accelerating overall innovation.

<table>
<thead>
<tr>
<th>Summary of TSMC’s Major Future R&amp;D Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Name</strong></td>
</tr>
<tr>
<td>5nm logic technology platform and applications</td>
</tr>
<tr>
<td>Beyond-3nm logic technology platform and applications</td>
</tr>
<tr>
<td>3D IC</td>
</tr>
<tr>
<td>Non-generation lithography</td>
</tr>
<tr>
<td>Long-term research</td>
</tr>
</tbody>
</table>

The projects above account for roughly 70% of the total R&D budget for 2019, estimated to be around 9% of 2019 revenue.
5.3.4 Raw Materials and Supply Chain Management

In 2018, TSMC continued to review and resolve supply issues, quality issues and potential supply chain risks through the collaboration of teams formed by operations, quality control and business organizations. TSMC also worked with suppliers to further advance material and process innovation, improve quality and create recycling savings with benefits from win-win solutions.

### Raw Materials Supply

<table>
<thead>
<tr>
<th>Material</th>
<th>Major Suppliers</th>
<th>Market Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Wafers</td>
<td>CPT, GlobalWafers, LSI, ULSI, Others</td>
<td>N/A</td>
</tr>
<tr>
<td>Chemicals</td>
<td>Air Liquide, Henkel-Baden, Linde LienHwa, Hoechst, Dow Chemical, Central Glass</td>
<td>N/A</td>
</tr>
<tr>
<td>Lithographic Materials</td>
<td>ASML, KLA-Tencor, Lam Research, Fujifilm Electronic Materials, Fujibo, Dow Chemical, Asahi Kasei, Versum, Merck, BASF, SUMCO, SEH, GlobalWafers, PCT</td>
<td>N/A</td>
</tr>
<tr>
<td>Glass</td>
<td>Nippon Electric Products, Corning, Foton, LandGlass, M Materials Technology, Sangliang Nano Science and Technology</td>
<td>N/A</td>
</tr>
<tr>
<td>Surface Prep, Substrats</td>
<td>ATI, AIG, Eastman Chemical, Sumitomo Chemical</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Procurement Strategy:**

- TSMC’s suppliers’ silicon wafers are required to pass stringent qualification certification procedures.
- TSMC assists suppliers from multiple sources to ensure adequate supplies for volume manufacturing and to appropriately manage supply risks.
- Raw wafer quality enhancement programs are in place to support TSMC’s technology development.
- TSMC regularly reviews the quality, delivery, cost, sustainability and service performance of its wafer suppliers. The results of these reviews are incorporated into subsequent purchasing decisions.
- TSMC ensures that its wafer quality assurance system ensures that TSMC can maintain the highest quality in its products and services.
- TSMC takes various approaches with supplierson to better manage the cost and quality.

**Major Materials and Suppliers:**

- These 5 suppliers together provide over 90% of the world’s raw wafer supply.
- Each supplier has multiple manufacturing sites in order to meet customer demand, including points in North America, Asia, and Europe.
- These 10 companies are the major worldwide suppliers of chemicals.
- These 10 companies are the major worldwide suppliers of lithographic materials.
- These 10 companies are the major worldwide suppliers of glass materials.
- These 8 companies are the major worldwide suppliers of CMP Chemical Mechanical polishing) materials.

### Suppliers Accounting for at Least 10% of Annual Consolidated Net Procurement

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Procurement Amount 2018</th>
<th>As % of 2018 Total Net Procurement</th>
<th>Relation to TSMC</th>
<th>Procurement Amount 2017</th>
<th>As % of 2017 Total Net Procurement</th>
<th>Relation to TSMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>11,047,599</td>
<td>None</td>
<td>0%</td>
<td>8,889,055</td>
<td>17%</td>
<td>None</td>
</tr>
<tr>
<td>Company B</td>
<td>18,213,643</td>
<td>10%</td>
<td>None</td>
<td>6,219,455</td>
<td>15%</td>
<td>None</td>
</tr>
<tr>
<td>Company C</td>
<td>8,003,885</td>
<td>None</td>
<td>10%</td>
<td>5,173,288</td>
<td>None</td>
<td>18%</td>
</tr>
<tr>
<td>VIS</td>
<td>5,142,486</td>
<td>8%</td>
<td>None</td>
<td>5,175,327</td>
<td>None</td>
<td>17%</td>
</tr>
<tr>
<td>Company D</td>
<td>5,158,177</td>
<td>None</td>
<td>5%</td>
<td>5,156,154</td>
<td>None</td>
<td>18%</td>
</tr>
<tr>
<td>Others</td>
<td>53,084,662</td>
<td>47%</td>
<td>None</td>
<td>70,864,126</td>
<td>37%</td>
<td>None</td>
</tr>
<tr>
<td><strong>Total net procurement</strong></td>
<td>62,402,554</td>
<td>100%</td>
<td>None</td>
<td>53,193,653</td>
<td>100%</td>
<td>None</td>
</tr>
</tbody>
</table>

### Reason for Increase or Decrease:

- Due to market or customer product demand changes, etc.

5.3.5 Quality and Reliability

TSMC’s strong industry reputation stems from its commitment to provide customers with the highest-quality wafers and best service for their products. Quality and Reliability (Q&R) services aim to achieve “quality on demand” to fulfill customers’ requirements for time-to-market delivery, product reliability, and competitiveness over a broad range of product market segments. An automotive quality improvement program has been implemented to meet customer requirements for low Defect Parts Per Million (DPPM).

Q&R technical services assist customers in the technology development stages and product design stages to design-in superior product reliability. In 2018, Q&R worked with R&D in advanced logic technology, specialty technology and advanced packaging technology development and qualification. Q&R has successfully qualified the leading-edge 7nm + technology (the third FinFET generation), which includes Extreme Ultraviolet (EUV) process and characterized process window with Fab for mass production in 2019. TSMC has led the industry in 7nm technology qualification. The Company developed a complete model to simulate thermal dissipation effect during FinFET operation, to provide more accurate electromigration (EM) design guideline for customers, to develop statistical electromigration budgeting (SEB) model to calculate effective metal electromigration failure rate on whole chip and implement it into electronic design automation (EDA) tool. Through the 7nm+ development process, TSMC enhanced profound reliability learning with new process steps and new reliability methodologies, which, in turn, provided an important foundation for 5nm technology development and prepared for 5nm risk production to start in 2019.

For specialty technologies, Q&R completed the second generation diffractive optical element (DOE) product qualification and ramped up DOE unit production to support a key customer’s new product launch with 3D sensing and facial recognition applications. In high-voltage technologies, 0.3µm Bipolar-CMOS-DMOS (BCD) and 0.18µm, third generation BCD process passed automotive grade qualification. For CoWoS® packaging technologies, Q&R integrated high bandwidth memory (HBM) with advanced silicon technology and completed component level, board level and customer product system level qualifications. It has been in production and over one million units have been shipped to key customers without quality or reliability issues. The technology enables the applications of HPC and AI. In addition, Integrated Fan-Out (InFO) assembly technology for mobile applications moved into the third generation of manufacturing. Over 70 million InFO devices have been shipped without any InFO related quality or reliability issues.

To enhance employee problem-solving capabilities and develop related quality systems and methodologies, Q&R continued to hold several company-wide symposiums and training programs such as Total Quality Excellence (TQE), Design of Experiment (DOE), Statistical Process Control (SPC) and metrology in 2018. This included the promotion and training of deep machine learning, which was successfully applied to automatic classification of wafer defects and advanced spectral analysis to detect differences among processes and equipment so that correctable actions could be triggered. In 2019, Q&R will continue the development of employee capabilities by promoting and using new methodologies to enhance TSMC competitiveness. To improve raw material quality, in 2017 Q&R began...
encouraging raw materials suppliers to participate in the National Quality Control Circle Competition, which has achieved good results. In 2018, Q&R-backed raw materials suppliers won one gold, four silver and six bronze medals. In 2019 and beyond, Q&R will continue to urge raw materials suppliers to join this quality competition to help them improve quality and further enhance TSMC competitiveness.

In developing leading-edge technologies, one of the most challenging tasks is to establish effective metrology methods to minimize process variations. In 2018, Q&R joined forces with R&D metrology experts to address nanometer and atomic-scale characterization needs with a “hybrid metrology” approach, where multiple techniques, both chemical analysis and physical measurement, are used to provide a full characterization of ever more complex 3D nanometer structures. This hybrid metrology approach is being used to support 5nm technology development and will be extended to assist in 3nm and specialty technology development.

The health and safety of employees have always been a priority at TSMC. Since the end of 2015, Q&R has collaborated with the Environmental Safety and Health (ESH) organization to build capability to detect and analyze carcinogenic, mutagenic and reprotoxic (CMR) substances. Beginning in 2017, raw materials suppliers were required to replace PFOA (Perfluorooctanoic Acid) raw materials with non-PFOA alternatives to comply with green procurement policy.

Q&R is also responsible for leading the Company toward the ultimate goal of zero-defect production through the use of continuous improvement programs. Periodic customer feedback indicates that products shipped from TSMC have consistently met or exceeded their field quality and reliability requirements. In 2018, a third-party audit verified the effectiveness of TSMC quality management systems in compliance with IATF 16949:2016 and BRC QC (Batch Record Control) 2017 certificates requirements. In addition, since 2017 Q&R and Fab have jointly worked on new enhancements for automotive product quality improvement, including design rule implementation and migration to Automotive-Quality System 2.0. This covers Fab in-line and Wafer Acceptance Testing using Gk (process capability index) tightening and wafer lots handling. Q&R also provides dedicated resources for fieldline return analysis and timely physical failure analysis (PFA) for process improvement to meet automotive customers’ low DPM requirement.

5.4 Customer Trust

5.4.1 Customers

TSMC’s customers worldwide have a variety of successful product specializes and excellent performance records in various segments of the semiconductor industry. Customers include fabless semiconductor companies, systems companies, and integrated device manufacturers such as Advanced Micro Devices, Inc., Broadcom Limited, Heliicon Technologies Co. Ltd., Intel Corporation, Marvell Technology Group Ltd., MediaTek Inc., NVIDIA Corporation, NXP Semiconductors N.V., Qualcomm Inc., Sony Corporation, Texas Instruments Inc., and many more.

Customer Service

TSMC believes that providing superior service is critical to enhancing customer satisfaction and relationship, which, in turn, is very important to retaining existing customers, strengthening customer relationships and attracting new customers. With a dedicated customer service team as the main contact for coordination and facilitation, TSMC strives to provide world-class design support, mask making, wafer manufacturing, and backend services to provide customers an optimum experience and, in return, gain customer trust and sustain Company revenues and profitability.

To facilitate customer interaction and information access on a real-time basis, TSMC-Online™ offers a suite of web-based applications that play an active role in design, engineering and logistics collaborations. Customers have 24/7 access to critical information and customized reports. Design collaboration focuses on content availability and accessibility, with close attention paid to complete, accurate and up-to-date information at each stage of the design life cycle. Engineering collaboration includes online access to engineering tools, wafer yields, wafer acceptance test (WAT) analysis, and quality and reliability data. Logistics collaboration provides access to data on any given order status in wafer fabrication, backend process and shipping.

Customer Satisfaction

To measure customer satisfaction and to ensure that customer needs are fully understood, TSMC conducts an annual customer satisfaction survey (ACSS) with most active customers, either by web or interview through an independent consultancy.

Complementary to the survey, quarterly business reviews (QBRs) are also conducted by the customer service team so that customers can give feedback to TSMC on a regular basis. Through surveys, feedback reviews and intensive interaction with customers, TSMC is able to stay in close touch and provide better service and collaboration.

Customer feedback is routinely reviewed, analyzed and then used to develop appropriate improvement plans; all in all becoming an integral part of the customer satisfaction process with a complete closed loop. TSMC uses data derived from the survey as a base to identify future focus areas. TSMC acts on the belief that customer satisfaction leads to healthy relationships, and healthy relationships lead to higher levels of retention and expansion.

Customers that Accounted for at Least 10% of Annual Consolidated Net Revenue

<table>
<thead>
<tr>
<th>Customer</th>
<th>2018 Net Revenue (NT$)</th>
<th>% of 2018 Total Net Revenue</th>
<th>Relation to TSMC</th>
<th>2017 Net Revenue (NT$)</th>
<th>% of 2017 Total Net Revenue</th>
<th>Relation to TSMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer A</td>
<td>224,889,695</td>
<td>22%</td>
<td>None</td>
<td>220,463,127</td>
<td>23%</td>
<td>None</td>
</tr>
<tr>
<td>Others</td>
<td>856,782,682</td>
<td>78%</td>
<td>None</td>
<td>796,804,114</td>
<td>77%</td>
<td>None</td>
</tr>
<tr>
<td>Total net revenue</td>
<td>1,681,672,377</td>
<td>100%</td>
<td>None</td>
<td>971,267,241</td>
<td>100%</td>
<td>None</td>
</tr>
</tbody>
</table>

Note: Customers that Accounted for at Least 10% of Annual Consolidated Net Revenue

5.4.2 Open Innovation Platform® (OIP) Initiative

Innovation has always been an exciting and challenging proposition. Competition among semiconductor companies continues to grow more intense in the face of increasing industry consolidation and the commoditization of technology at more mature, conventional levels. Companies must find ways to keep innovating in order to survive and prosper. One way to accelerate innovation is through active collaboration with external partners. At TSMC this is known as “Open Innovation” - it is an “outside-in” approach to complement traditional “inside-out” methods. TSMC has adopted this path to innovate via its Open Innovation Platform® (OIP) Initiative, which is a key part of the TSMC Grand Alliance.

TSMC announced the fifth OIP Alliance, the OIP Cloud Alliance, at the 2018 Open Innovation Platform® Ecosystem Forum. Inaugural members Amazon Web Services (AWS), Cadence, Microsoft Azure, and Synopsys worked jointly with TSMC to implement Open Innovation Platform Virtual Design Environment (OIP VDE), which enables semiconductor customers to design securely in the cloud. In TSMC’s enablement of OIP VDE, both digital RTL-to-GDSII and custom schematic-capture-to-GDSII design flows have been validated along with OIP collateral, including process technology files, PDK, foundation IP and reference flows. To ensure low barriers to entry and high technical support levels, Cadence and Synopsys act as focal points helping customers to set up VDE and providing first-line support.

The OIP initiative is a comprehensive design technology infrastructure that encompasses all critical IC implementation areas to reduce design barriers and improve first-time silicon success. OIP promotes the speedy implementation of innovation amongst the semiconductor design community and its ecosystem partners using TSMC’s IP, design implementation, design for manufacturability (DFM) capabilities, process technology and backend services.

Crucial to OIP are ecosystem interfaces and collaborative components initiated and supported by TSMC that more efficiently empower innovation throughout the supply chain and, in turn, drive the creation and sharing of new revenue and profits. TSMC’s active accuracy assurance (AAA) initiative is key to OIP providing the accuracy and quality required by the ecosystem interfaces and collaborative components.

Reason for Increase or Decrease:

No significant change.

80
TSMC’s Open Innovation® model brings together the creative thinking of customers and partners under the common goal of shortening each of the following: design time, time-to-volume, time-to-market and, ultimately, time-to-revenue. The model features:

- the foundry segment’s earliest and most comprehensive electronic design automation (EDA) certification program, delivering timely design tool enhancement required by new process technologies
- the foundry segment’s largest, most comprehensive and most robust silicon-proven IP (intellectual properties) and library portfolio, and
- comprehensive design ecosystem alliance programs covering market-leading EDA, library, IP, and design service partners.

TSMC’s OIP alliance consists of 23 EDA partners, four cloud partners, 39 IP partners, 20 design center alliance (DCA) partners, and seven value chain aggregator (VCA) partners. TSMC and its partners work together proactively and engage much earlier and deeper than ever before in order to address mounting design challenges at advanced technology nodes. Through this early and intensive collaboration effort, TSMC’s OIP is able to deliver the needed design infrastructure with timely enhancement of EDA tools, early availability of critical IPs and quality design services when customers need them. Taking full advantage of the process technologies once they reach production-ready maturity is critical to customers’ success.

TSMC’s OIP partner management portal facilitates communication with its ecosystem partners for efficient business productivity. Designed with a highly intuitive interface, this portal can be accessed via a direct link from TSMC-Online®.

In October TSMC held its 2018 Open Innovation Platform® (OIP) Ecosystem Summit in Santa Clara, California and in Nanjing. This annual event demonstrates how TSMC and its ecosystem partners jointly develop design solutions on top of TSMC’s advanced technologies through OIP collaboration. At the forum, TSMC delivered key messages of the new OIP Cloud Alliance and collaborated solution of OIP Virtual Design Environment (OIP VDE) with the goal of further enhancing customer design productivity by leveraging the flexibility and computing power of the Cloud, and presented on EDA and IP readiness of 5nm, 7nm, 7nm+ and their respective power, performance and area (PPA) benefits. TSMC also showed the progress in 22nm technology, in automotive design enablement platforms in 16FFC and 7nm, and in the availability of various 3D IC reference flows covering a wide range of applications. The readiness of design ecosystem solutions will help customers design applications to capture the market opportunities in mobile, high-performance computing, the Internet of Things and automotive. Followed with invited keynote from Microsoft, highlighting the new collaboration with TSMC in Cloud computing to facilitate customers’ adoption of Cloud resources and apply them securely in their semiconductor designs.

5.5 Human Capital

Human capital is TSMC’s most treasured asset. In this regard, the Company’s main role is to provide jobs with challenging, meaningful work in a safe environment with excellent compensation and benefits. TSMC goes beyond this, however, by actively encouraging employees to nurture and enjoy a healthy family life, to develop outside interests, to expand social participation, and, in general, live a happy life.

TSMC participates in the Responsible Business Alliance (RBA) as a full member and abides by local laws. The Company refrains from forcing employees to do unwilling labor service, listens to the employees, keeps communication channels open, respects the right of all workers to form and join trade unions of their own choosing as well as to refrain from such activities as they choose.

5.5.1 TSMC Human Rights Policy

TSMC abides local laws and regulations in all countries and regions where we operate, and upholds the human rights of workers, including regular, contract and temporary employees, and interns. We treat all workers with dignity and respect as understood by the international human rights standards such as The International Bill of Human Rights, The International Labour Organization’s Declaration on Fundamental Principles and Rights at Work, and Ten Principles of the United Nations Global Compact. We also align our actions with the Responsible Business Alliance Code of Conduct. And TSMC’s Supplier Code of Conduct requires our suppliers to follow the same standards.

5.5.2 Workforce Structure

At the end of 2018, TSMC had 48,752 employees worldwide, including 5,294 managers, 22,285 professionals, 4,109 assistants, and 17,064 technicians. The following table summarizes TSMC’s workforce as of the end of February, 2019:

<table>
<thead>
<tr>
<th>Job</th>
<th>12/31/2017</th>
<th>12/31/2018</th>
<th>02/28/2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers</td>
<td>5,101</td>
<td>5,248</td>
<td>5,244</td>
</tr>
<tr>
<td>Professionals</td>
<td>21,895</td>
<td>22,285</td>
<td>22,459</td>
</tr>
<tr>
<td>Assistant</td>
<td>4,082</td>
<td>4,189</td>
<td>4,119</td>
</tr>
<tr>
<td>Engineer/Design</td>
<td>9,103</td>
<td>9,103</td>
<td>9,113</td>
</tr>
<tr>
<td>Total</td>
<td>48,683</td>
<td>49,062</td>
<td>49,091</td>
</tr>
</tbody>
</table>

Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Male (%)</th>
<th>Female (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>61.5%</td>
<td>38.5%</td>
</tr>
</tbody>
</table>

Education

<table>
<thead>
<tr>
<th>Education</th>
<th>Male (%)</th>
<th>Female (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ph.D.</td>
<td>6.6%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Masters</td>
<td>41.5%</td>
<td>58.5%</td>
</tr>
<tr>
<td>Bachelor</td>
<td>34.1%</td>
<td>35.9%</td>
</tr>
<tr>
<td>Other Higher</td>
<td>11.4%</td>
<td>11.0%</td>
</tr>
<tr>
<td>High School</td>
<td>16.0%</td>
<td>13.9%</td>
</tr>
</tbody>
</table>

Average Years of Age

36.1

Average Years of Service

8.6

8.7

9.2

5.5.4 People Development

Employee development, an integral and critical factor for the growth of any company, should be goal oriented, disciplined and planned. TSMC is committed to expanding and fulfilling employee potential by providing meaningful work in a global workplace. TSMC is also committed to cultivating a consistent and diverse learning environment. To this end, the Company has initiated the “TSMC Employee Training and Education Procedure” to ensure the Company’s and the individuals’ development objectives can be achieved through the integration of internal and external training resources with internal rotation opportunities.

To help employees reach their potential, TSMC dedicates to do the on-the-job training and systematic job rotation; more than that, TSMC provides various learning resources and channels to encourage employees to do self-learning to further uplift their performance and potential. TSMC integrates internal and external resources and designs diversified development programs based on business objectives, the nature of the individual’s job, work performance and career development path. The Company provides employees a diverse network of learning resources, including on-the-job training, classroom training, e-learning, coaching, mentoring and job rotation; it also creates an educational atmosphere through learning activities in response to organization development requirements and employee capability enhancement goals.

The Company provides employees with a wide range of onsite general, professional and managerial training programs. In addition to engaging external experts as trainers, hundreds of TSMC employees are trained to be qualified instructors to deliver their valuable knowhow in internal training courses.

TSMC’s training programs include:

- New employee – for basic training and job orientation. In addition, the newcomers’ managers and the Company’s well-established buddy system are in place to support new hires in their assimilation process regarding both corporate culture and work requirements.
- General – refers to training required by government regulations and/or Company policies, as well as training on general subjects for all employees or employees in various job functions. Topics include industry-specific safety, workplace health and safety, quality, fab emergency response and personal effectiveness management.
TSMC’s compensation program includes a monthly salary, the actual total compensation received by employees has been based on the philosophy of sharing wealth with employees in competitive externally, fair internally, and adapted locally. TSMC’s compensation and benefits program above the industry average.

Employment at TSMC entitles employees to a comprehensive training program, including a variety of courses and programs designed to improve employees’ skills and knowledge. The training program is available in-house and online, and includes technical, professional, and soft skills courses. TSMC also offers training for various levels of managers and employees, including management, technical, and functional training.

In 2018, TSMC conducted 989 internal training sessions and provided nearly 530,000 hours of training and a total of more than 540,000 attendees participated. On average, each employee attended over 11 hours of training and TSMC spent over NT$82 million on the training and development for employees.

5.5.5 Compensation

5.5.6 Employee Engagement

The Company encourages employees to maintain a healthy and well-balanced life while pursuing their goals effectively. TSMC continuously facilitates employee communication and provides employee caring, benefit, rewards and recognition programs.

Employee Communication

TSMC values two-way communication and is committed to keeping communication channels open and transparent for management, subordinates, and peers. The Ombudsman System is dedicated to ensuring that employees are able to openly communicate and share ideas and concerns with management regarding working conditions and management practices without fear of discrimination, reprisal, intimidation or harassment.

TSMC makes continuous efforts to listen to the voice of employees and to facilitate mutual and timely employee communication, based on multiple channels and platforms, which in turn fosters harmonious labor relations and creates a win-win situation for the Company and employees.

A host of two-way communication channels, including:

- Communication meetings for various levels of managers and employees, for example, Chairman’S CEO’S communication meeting, and communication meetings in individual functions/ divisions.

- Employee Voice Channels
- Ombudsman System
- Employee Opinion Box
- Internal Audit Committee
- Fab Caring Circle
- Sexual Harassment Investigation Committee

- The Company holds quarterly labor-management meetings to provide business updates, and invite employees to discuss labor conditions, and employee welfare activities.

- Unperiodical employee satisfaction surveys to selected employees, with follow-up actions based on the survey findings.

- Core value surveys, held biennially, to understand the Company’s implementation of core values and employees’ commitment and engagement.

- The employee portal, myTSMC, an internal website featuring the Founder’s, Chairman’s, and CEO’S talks, corporate messages, executive interviews, and other activities of interest to employees.

- eSilicon Garden, a website hosting TSMC’s internal electronic publications providing real-time updates on major activities of the Company, as well as inspirational content featuring outstanding teams and individuals.

- Two reporting channels for complaints regarding management, financial, auditing, ethics and business conduct issues:
  - The whistleblower reporting system administered by the audit committee
  - The ombudsman system administered by senior manager appointed by the CEO

- The employee opinion box, which provides an opportunity for employees to submit suggestions or opinions regarding their work and the overall work environment.

- The Fab Caring Circle in each fab addresses the issues related to employees’ work and personal life; the system is dedicated mainly to the Company’s direct labor workers.

- Sexual harassment investigation committee: This channel is dedicated to ensuring a work environment free from the threat of sexual harassment; the committee consists of three directors, one from human resources, one from legal affairs, and the third from other organizations.
TSMC has many internal communication channels, a major reason why the relationship between management and employees has been quite harmonious. The Company respects the right of all workers to form and join trade unions of their own choosing as well as the right to refrain from such activities. No employees have pursued this avenue or issued a request to form a union so far.

In 2018 and in 2019 as of the date of this annual report, there have been no losses resulting from labor disputes.

**Employee Benefit Programs**
- Convenient onsite services and amenities: cafeterias, laundry services, convenience stores, bakery, juice bar, coffee shop, travel, banking, and commuting assistance are accessible for employees in the fabs.
- Comprehensive health management services, including programs for weight control, in-fab clinic and dentist services, smoking cessation, massage service, cancer screening, and blood donation, as well as mental and health seminars to raise personal health awareness. Other health management programs include post health-exam follow-up activities, prevention of cerebrovascular disease, ergonomic hazards management, and maternal care and protection. Employee assistance programs include five free annual counseling hours for mental health and financial/legal issues, with extensions available depending on the individual’s needs.
- Diverse employee welfare programs: including 80 hobby clubs, 70 presentations covering various topics, 14 art events, sports day, and family day. In addition, holiday bonuses, marriage bonuses, confidence allowances and emergency subsidies are also available to address employees’ needs.
- Premium sports centers: a variety of workout facilities available to address employees’ needs.
- Diverse employee welfare programs: including 80 hobby clubs, 70 presentations covering various topics, 14 art events, sports day, and family day. In addition, holiday bonuses, marriage bonuses, confidence allowances and emergency subsidies are also available to address employees’ needs.
- Flexible preschool service: childcare service, operated to meet employees’ work schedules, is available in four fabs in Hsinchu, Taichung, and Tainan.

**Employee Recognition**
TSMC sponsors various internal award programs to recognize outstanding achievements by employees, both individual and at a team level. With these award programs, TSMC aims to encourage continued employee development, which, in turn, adds to the Company’s competitive advantage.

The award programs include:
- TSMC Medal of Honor: recognizes those who contribute significantly to the Company’s business performance.
- TSMC Academy: recognizes outstanding scientists and engineers whose individual technical capabilities make significant contributions to the Company.
- TSMC Excellent Labor Award: recognizes technicians and group leaders whose outstanding performances make significant contributions to the Company.
- Total Quality Excellence for each fab: recognizes employees’ continuous efforts in creating value for the Company.
- Service Award: TSMC’s recognition and appreciation of senior employees and their long-term commitment and dedication to the Company.
- Excellent Instructor Award: praises the outstanding performance and contribution of the Company’s internal instructors in training courses for employees.
- Function-wide awards dedicated to innovation, such as the Idea Forum and TQE awards, which recognize employees’ initiative and continuous implementation of innovative practices.

Apart from corporate-wide awards, TSMC encourages employees to participate in external talent activities and competitions. In 2018, distinguished TSMC employees continued to be recognized through a host of national awards, including the National Model Labor Award, the Outstanding Young Engineer Award, and the National Manager Excellence Award.

**5.5.8 Retirement Policy**
TSMC’s retirement policy is set according to the labor standard laws and labor pension practices of various respective regions. With the Company’s sound financial system, TSMC ensures employees solid pension contributions and payments, which encourages employees to set long-term career plans and further deepens their commitment to TSMC.

**5.6 Material Contracts**

Research and Development Funding Agreement (Expired)
**Term of Agreement:**
10/31/2012 - 12/31/2017
**Contracting Party:**
ASML Holding N.V. (ASML)
**Summary:**
TSMC shall provide EUR276 million to ASML’s research and development programs from 2013 to 2017.

Note: TSMC is not currently party to any other material contract, other than contracts entered into in the ordinary course of our business. The Company’s “Significant Contingent Liabilities and Unrecognized Commitments” are disclosed in Annual Report section (II), Financial Statements, page 82.