Driving Positive Change

The world is changing. Challenges await us while opportunities emerge.

Since its founding by Dr. Morris Chang in 1987, we at TSMC have applied technology and innovation to uplift society and overcome the challenges faced by humankind for over 31 years.

Beyond succeeding in its core businesses, TSMC also diligently strives to carry out the responsibilities of a good corporate citizen. We insist on ethical management, act upon innovation, develop responsible supply chains, put green power into action, aim to be the most attractive employer, and aspire to bring about changes to our society.

"Corporate Social Responsibility" is a principle internalized by every TSMC employee. We not only pursue our own business growth, but also endeavor to create value for our stakeholders and serve as a positive impact on society.

Build a more convenient, greener, and sustainable world.

Let’s drive positive change together.

TSMC 2017 Corporate Social Responsibility Report
TSMC’s market share has grown for eight consecutive years to reach 56% in 2017, and is the only semiconductor company to be included in the Dow Jones Sustainability Indices for 17 consecutive years, as well as the first company to be named Industry Group Leader for three consecutive years.

These achievements were not accomplished overnight, but are the results of long-term commitment from many like-minded colleagues. They are also the motivation that sustains us in continuing to cultivate corporate social responsibility.

Although we have been challenged along the way, we persist in working hard to make positive change. In the past few years, we have continued to expand research and development, leading the industry in launching new generations of process technology, making progress through innovation, and improving life and social welfare. At the same time, we have begun to link the company’s operations with the United Nations’ Sustainable Development Goals and adopt impact valuations to gain a better knowledge of the impact of our operations on the value chain and evaluate the connections between management decisions and sustainable value creation.

Change never stops. In 2017, TSMC focused on Ethical Management, Innovation and Service, Responsible Supply Chain, Green Manufacturing, Inclusive Workplace, and Common Good. We managed these six focuses, as well as 17 related material issues, through clear strategy, measurable and time-based goals, and quantifiable results. These six focuses are the realization of TSMC’s CSR Policy of Integrity, Strengthening Environmental Protection, and Caring for the Disadvantaged. They provide the foundation for TSMC’s 2020/2025 Goals, respond to the UN SDGs in the economic, environmental, and social dimensions, and support global sustainability through concrete action.

We enable sustainability to take root in our corporate culture, pursue profitable and steady growth, and do our utmost to ensure that every TSMC stakeholder can benefit.

Lora Ho
Senior Vice President and Corporate Social Responsibility Committee Chairperson
In the face of issues such as extreme weather, natural disasters, and an aging society, we concentrate on our core business, strengthen foundations for sustainability, and proudly fulfill our responsibilities as a corporate citizen to seek any possible solution to society’s problems. In 2017, we worked with our partners to propose a Responsible Supply Chain Action Plan. With our two-pronged strategy of “efficient management” and “resilient capability”, we lead our suppliers towards sustainability and spread positive change. To fulfill our environmental responsibilities, we have purchased 400 GWh of green energy in the past three years, mitigating the impact of greenhouse gases on society. Internally, we demonstrated our “green power” by completing 719 environmental projects in 2017, generating economic value of NT$2.37 billion. It is also worth noting that our shareholders approved the revision of the Company’s Articles of Incorporation to add four items to our business scope, enabling the recycled waste recovered from our manufacturing process to become products to be re-used internally or sold externally, taking action to implement circular economy.

We have also become closer and closer to the community over the past year. In addition to the TSMC Education and Culture Foundation’s ongoing cultivation of arts, culture, and diverse education, we further integrated the Company’s resources with employee initiatives in volunteer work to establish the TSMC Charity Foundation. This foundation gathers the strength of our employees to promote filial piety and promote an elder-friendly society, and helps the disadvantaged to gain resources for education, living and pursuing happiness. In 2017, volunteers served 24,612 times for 106,176 service hours, generating 330,677 cumulative beneficiaries.

In addition to taking action on sustainability, we also seek to understand the impact and change these investments make on society. We have adopted the Social Return on Investment (SROI) framework to calculate social value of projects in energy conservation and quality education, tangibly demonstrating the results of TSMC’s investments in social participation and advancing with our stakeholders towards hope and mutual benefit.

Looking to the future, the challenges of industry competition, political and economic volatility, and the operational impact of climate change can not be avoided, and will only grow more difficult. From business model innovation, to unceasing technology breakthroughs, to serving as an enabler for sustainability, TSMC aspires to do the right thing, and invites everyone to stand with us. Working together, we can move mountains. Let us join hands, and make positive change continue to happen.
Sustainability Performance

**Economy**
- 343.11bn (NT$)
  - Reached record high net income in 2017
- 23.6%
  - 2017 ROE
- 1
  - The world’s largest semiconductor foundry
- 19%
  - Continued to invest in research and development in 2017, with total R&D expenditures of US$ 2,651 million, up about 19% from the previous year
- 7nm
  - Led the industry in manufacturing of 7nm technology in 2017

**Environmental**
- 13%
  - 2017 unit product GHG emission reduced 13% below 2010 level
- 55%
  - 2017 unit product Perfluorinated Compounds (PFC) emission reduced 55% below 2010 level
- 10.4%
  - 2017 unit product power consumption reduced 10.4% below 2010 level
- 24.7%
  - 2017 unit product water consumption reduced 24.7% below 2010 level
- 4
  - In 2017, the Company amended its Articles of Incorporation to add four more categories to its scope of business for the realization of circular economy

**Social**
- 218,951 (US$)
  - In 2017, profit per employee reached US$218,951 for TSMC employees in Taiwan; the only Asian company in Expert Market survey’s Top 10 list
- 32
  - In 2017, annual compensation of a newly-graduated engineer in Taiwan with a Master’s degree was equal to 32 months’ salary, outperforming our industry peers
- 24,612
  - 2017 volunteer person-time
- 106,176
  - 2017 volunteer service hours
- $747,726,172 (NT$)
  - Total input for social participation in 2017

**TSMC 2017 Corporate Social Responsibility Report**
Awards and Recognitions

**Climate Change Scoring Level:** Leadership

- Selected as one of The World’s Most Admired Companies
- Selected as one of the Top Regarded Companies
- Listed in the Global Top 50 ranking

**Corporate Knights**

- Selected as one of the 100 Most Sustainable Corporations
- Rated “Prime” by oekom Corporate Rating

**RobecoSAM Sustainability Award - Gold Class**

- Selected as component of MSCI ESG Leaders Indexes
- Selected as component of MSCI SRI Indexes

**Fortune Global 2000**

- Selected as one of the Top Regarded Companies

**Clarivate Analytics**

- Top 10 Global Innovators in Semiconductor Industry

**Nikkei Asia 300 Indexes**

- Best CEO (Technology/Semiconductor) – 1st Place – All Asia
- Best CFO (Technology/Semiconductor) – 1st Place – All Asia
- Best Investor Relations Program (Technology/Semiconductor) – 1st Place – All Asia
- Best Investor Relations Professional (Technology/Semiconductor) – 1st Place – All Asia
- Best Analyst Days (Technology/Semiconductor) – 1st Place – All Asia

**Taiwan Stock Exchange**

- Ranked in top 5% in Corporate Governance Evaluation of Listed Companies

**Taiwan Institute of Sustainable Energy**

- Taiwan Corporate Sustainability Awards - No.1 for Domestic Corporates

**Cheers Magazine**

- Most Admired Company in Technology/Manufacturing Group for the New Generation

**TSMC 2017 Corporate Social Responsibility Report**

For more details of 2017 CSR awards and recognitions, please refer to TSMC’s 2017 Annual Report.
Our Business

Focus One
Ethical Management

Focus Two
Innovation and Service

Focus Three
Responsible Supply Chain

Focus Four
Green Manufacturing

Focus Five
Inclusive Workplace

Focus Six
Common Good

Appendix
Our Business

Focus One  Ethical Management
Focus Two  Innovation and Service
Focus Three  Responsible Supply Chain
Focus Four  Green Manufacturing
Focus Five  Inclusive Workplace
Focus Six  Common Good
Appendix

About TSMC

Founded in Taiwan 31 years ago, TSMC is the world’s first and largest semiconductor foundry. By choosing not to develop any semiconductor products under its own name, TSMC ensures that it never competes directly with its customers. Based on its differentiated strengths, TSMC is solely focused on manufacturing customers’ products. Amid dramatic changes in the global political and economic environment in 2017, our commitment to stakeholders remains firm. Our consolidated revenue reached a historic high of NT$977.45 billion, and we maintained the leading position with an estimated market segment share of 56%. We continue to excel in the economic, environmental and social dimensions to create sustainable value to the Company and society.

977.45 bn (NT$)
Consolidated revenue reached historic high in 2017

58%
58% of TSMC’s wafer revenue came from manufacturing processes with geometries of 28nm and below, up from 54 percent in 2016

1
The world’s largest semiconductor foundry

465 customers
Manufactured 9,920 different products using 258 distinct technologies for 465 different customers

48,602 employees
Employed about 48,000 people worldwide at the end of 2017, and recruited 3,663 new employees

Net Revenue by Geography

North America
64%
Europe, the Middle East and Africa
7%
China
11%
Japan
7%
Asia Pacific Region (Excluding China and Japan)
11%

Net Revenue by End-Product Application

Communications
59%
Industrial and Standard Products
23%
Computer Sector
10%
Consumer Products
8%

Headquarters
Hsinchu Science Park, Taiwan

Founded
1987

Net Income
2017
NT$ 343.11 bn

Market Share
56%
The foundry segment of the global semiconductor industry in 2017

Annual capacity of the manufacturing facilities managed by TSMC and its subsidiaries reached above 11 million 12-inch equivalent wafers in 2017

The world’s largest wafer capacity provider for logic ICs

The world’s third largest semiconductor company

TSMC 2017 Corporate Social Responsibility Report
TSMC adopts four strategies to increase long-term investment value: “Continue to invest in process technologies and capacity”, “Maintain trusting relationships with customers”, “Pursue growth in revenue and in market segment share”, and “Maintain or improve profitability and investment returns”.

Financial performance is mainly determined by revenue growth and consistent improvement in profitability, and good financial performance is the key to corporate sustainability. Committed to deliver good financial performance, TSMC has set clear strategic financial objectives to help investors better understand TSMC’s long-term investment value, while its financial track record gives investors high confidence in TSMC’s capability to achieve profitable growth and good shareholder returns. Through its good financial performance, TSMC creates greater economic value for its stakeholders, including shareholders, employees, customers, suppliers, government, community, and others. Among these stakeholders, financial performance is particularly important to shareholders, as it often plays a decisive role in the Company’s investment value.
TSMC's solid financial performance enables the Company to distribute profits to shareholders in the form of dividends. From 2004 to 2017, TSMC has paid out nearly NT$1.2 trillion, or US$38 billion, in cash dividends. For the distribution of 2017 earnings, TSMC's Board of Directors proposed a cash dividend of NT$8 per share, to be paid in 2018.

Supported by solid operating performance and future growth potential, TSMC's stock performance including cash dividends increased 30.7% during 2017, marking 9 consecutive years of annual growth. Since the Company went public in 1994, TSMC has been profitable every year and TSMC's market capitalization has grown steadily. As of December 31, 2017, TSMC’s market capitalization reached NT$6.0 trillion or US$201 billion.
Our Commitments

• Act at all times in accordance with all applicable laws and regulations.
• Inter-company transactions are based on the arm’s length principle, in compliance with internationally accepted transfer pricing guidance published by the OECD.
• Be transparent in financial reporting. Disclosures are made in accordance with applicable regulations and reporting requirements.
• Do not undertake transactions whose sole purpose is for tax avoidance.
• Develop strong, mutually respectful relationships with tax authorities based on transparency and trust.
• Always consider tax as part of major business decisions.
• Analyze the operating environment and assess tax risk through corporate management mechanism.

Tax Risk

• While we are subject to tax laws and regulations in various jurisdictions in which we operate or conduct business, our principal operations are conducted in the R.O.C. and we are exposed primarily to taxes levied by the government of the R.O.C. We have established processes and systems to closely monitor and assess the potential tax risk from amendments to existing tax regulations or the implementation of new tax laws.
• Our effective tax rate for 2017 was 13.4%, lower than the R.O.C. statutory corporate income tax rate of 17%, due primarily to a five-year tax exemption for capital investments made in previous years, and tax credit for research and development expenditures.

TSMC supports tax policies and incentives that encourage innovation and foster economic growth. We aim for our tax approach to be transparent and sustainable in the long term.

2017 Taxes Paid Breakdown

<table>
<thead>
<tr>
<th>Country</th>
<th>Tax Paid (NT$)</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taiwan</td>
<td>69.6 bn</td>
<td>95.1%</td>
</tr>
<tr>
<td>Asia (Exclude R.O.C.)</td>
<td>2.4%</td>
<td>0.1%</td>
</tr>
<tr>
<td>North America</td>
<td>2.4%</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>7.5%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Corporate Income Tax</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor and Health Insurance, Social Security</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In 2017, TSMC's total tax payments on cash basis worldwide were NT$69.6 billion.

In 2017, over 90% of TSMC's revenue and operating profit were generated from our business operations in Taiwan. Meanwhile, over 90% of our tax payments were also made to the Taiwan R.O.C. government.

Based on data provided by "Bloomberg Professional", TSMC was the largest corporate income taxpayer among all publicly listed companies in Taiwan in 2017.

TSMC's 2017 income tax payment in Taiwan represented 12.2% of total corporate income taxes collected by the R.O.C. government.
Sustainable Governance

Our Business

Focus One
Ethical Management

Focus Two
Innovation and Service

Focus Three
Responsible Supply Chain

Focus Four
Green Manufacturing

Focus Five
Inclusive Workplace

Focus Six
Common Good

Appendix
Since its establishment, TSMC has not only strived for the highest achievements in its core business of dedicated IC foundry services but has also actively developed positive relationships with all stakeholders including employees, shareholders, customers, suppliers, and society to fulfill its responsibility as a corporate citizen and pursue a sustainable future.

Corporate Social Responsibility Policy

TSMC believes in acting ethically, following the law, and balancing the interests of all stakeholders. The Company endeavors to use the experience of developing a sustainable business to drive the industry and supply chain into a positive cycle and to act together with them as an uplifting force in society.

Guiding Principles

- Acting with Integrity
- Strengthening Environmental Protection
- Caring for the Disadvantaged

Mission

Vision

To Uplift Society

Morris Chang
Chairman

TSMC 2017 Corporate Social Responsibility Report
“TSMC Corporate Social Responsibility Policy” is the top guiding principle for our sustainable development. The “CSR Matrix” set by Chairman Dr. Morris Chang clearly defines the scope of TSMC’s corporate social responsibility. The horizontal axis shows the seven areas where TSMC aims to set an example: morality, business ethics, economy, rule of law, sustainability, work/life balance and happiness, and philanthropy. On the vertical axis are actions that TSMC has taken to fulfill its responsibilities.
TSMC advocates and acts upon the principles of operational transparency and respect for shareholder rights. We believe that the basis for successful corporate governance is a sound and effective Board of Directors. In line with this principle, the TSMC Board delegates various responsibilities and authority to two Board Committees, Audit Committee and Compensation Committee. Each Committee’s chairperson regularly reports to the Board on the activities and actions of the relevant committee. The Board of Directors plays the role to oversee and provide guidance to the Company’s comprehensive sustainable management strategies. The chairperson of the CSR committee reports annually to the Board of Directors on implementation results for the year and the future work plan.

Corporate Governance

In order to build an effective compliance system of ethical standards and regulatory compliance initiatives, TSMC established not only the Ethics Code, but also the internal policies and procedures in major areas of law. We also track and identify any relevant regulatory changes to ensure that TSMC’s internal policies and procedures are effective and up to date. For more details of Ethics and Regulatory Compliance at TSMC, please also refer to TSMC’s 2017 Annual Report “Code of Ethics and Business Conduct” and “Regulatory Compliance”.

TSMC established an enterprise risk management (ERM) program to integrate and manage strategic, operational, financial and hazardous risks together with potential consequences to operations and financial results. For more details of Risk Management, please refer to TSMC’s 2017 Annual Report “Risk Management”.

In October 2017, Dr. Morris Chang, as TSMC Chairman for the last thirty years, announced his plan to retire from the Company immediately after the Annual Shareholders’ Meeting in early June, 2018. All present directors of the board, except himself, have unanimously agreed to be nominated, and if elected, will serve as directors of the board during the next term. They all have agreed to have TSMC under the dual leadership of Dr. Mark Liu and Dr. C.C. Wei, who are TSMC’s presidents and Co-CEOs currently. Dr. Liu will be the Chairman of the Board, and Dr. Wei will be the Chief Executive Officer.

For details of the Company’s corporate governance, please refer to the “Corporate Governance” section of TSMC’s 2017 annual report. Starting from 2016 Annual Report, TSMC voluntarily discloses the compensation of its Directors, President & Co-CEOs and Chief Financial Officer on an individualized basis. For details, please refer to “Board Members” and “Management Team” of TSMC’s 2017 Annual Report. In addition, in 2017, the median total compensation of all TSMC global employees is about NT$1,570,000, and the ratio between the total annual compensation of President & Co-CEO and the median employee compensation is about 134:1.
TSMC is committed to its stakeholders and diligently carries out the responsibilities of a good corporate citizen. Through explicit direction from executive leaders and a strong management system, TSMC establishes continuous improvement plans to enhance its sustainability performance on economic, environmental and social dimensions.

The highest-level corporate social responsibility organization within TSMC

<table>
<thead>
<tr>
<th>Chairperson</th>
<th>The CFO was appointed by the Chairman to be the committee chairperson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members</td>
<td>Representatives from each functional unit related to economic, environmental, social and corporate governance</td>
</tr>
<tr>
<td>Major Projects</td>
<td>Quarterly: The committee meets each quarter to discuss issues of interest to stakeholders, and conducts cross-departmental communication, coordination, and resource integration. It also monitors the execution of budgets and performance by each department. Annually: The Chairperson of the Corporate Social Responsibility Committee reports annually to the Board of Directors on implementation results for the year and the work plan for the following year.</td>
</tr>
</tbody>
</table>

Lora Ho
Corporate Social Responsibility Committee Chairperson

Main Points of 2017 Chairperson’s Report to the Board of Directors

Implementation Results for the Year
- The strategies and performance of green manufacturing
- Fulfilled RBA Code of Conduct requirements with respect to supply chain management
- Set targets to drive local procurement
- The achievements and highlights of TSMC Education and Culture Foundation, as well as TSMC Charity Foundation

Work Plan for the Following Year
- Continue to align its sustainability targets with the United Nations Sustainability Development Goals (SDGs)
- Expand its coverage of CSR management for TSMC’s overseas fabs and major affiliates
- Execute social impact valuation projects

Corporate Social Responsibility Committee
Achievements in 2017

- Responded actively to global sustainability trends through social impact valuation that examined the added value created by TSMC’s sustainability actions
- Led each functional unit to study the United Nations Sustainable Development Goals, develop strategies and programs, and implement them in our daily operations
- Formally established the TSMC Charity Foundation, focused on taking care of elders, promoting filial piety, caring for the disadvantaged, and protecting the environment
- Followed RBA Code of Conduct requirements to increase quality and quantity of supplier audit and training so as to enhance supplier management capability
- Comprehensively strengthened green management through purchasing green power and improving energy efficiency
- Established a more extensive communication system for sustainability issues
  - Revised TSMC’s Corporate Social Responsibility Report; set strategies, vision, and targets for the material issues; responded to the United Nations Sustainable Development Goals
  - Established online survey platform for internal and external stakeholders
  - Launched a new Corporate Social Responsibility Report website
Shared value is the core spirit of enterprise sustainability advocated by TSMC. TSMC expects to positively impact society and environment with its operations to create sustainable value for stakeholders throughout the Company’s continued growth.

### Six Main Capitals

**Finance**
- Generate economic value and return by effectively managing financial resources

**Manufacturing**
- Provide products that meet the needs of each client by carefully maintaining equipment and infrastructure, manufacturing resources

**Intelligence**
- Strengthen the power of knowledge capital through constant dedication to innovative developments and patents

**Human Resource**
- Create key assets for the Company by looking for outstanding, like-minded colleagues and strengthening talent development

**Environment**
- Reduce natural resource consumption and maintain optimal usage efficiency by managing sources

**Society**
- Give back to society and obtain its trust through community participation

### Process and Methods

**Senior Management Support**
- Chairman of the Board’s definition of CSR and expression of TSMC’s role in facing social and environmental challenges shall become the Company’s highest moral guideline of pursuit of sustainability

**Committee of Corporate Social Responsibility**
- CSR committee is to generate sustainable momentum within the organization by holding quarterly meetings on cross-functional communication/facilitation and resource integration and auditing projects’ execution progress and performance

**Organization Culture**
- Cultivate an organizational culture of keeping and fully committing to promises. Constantly promise to fully commit on important issues, set long term goals respective to those issues, improve diligently, and review results regularly

### Value Creation Framework

### Notes

1. The output value driven by the supply chain is evaluated by the Industrial Output Table (including imports) published by the Directorate-General of Budget, Accounting and Statistics of Executive Yuan.

2. GHG value = Greenhouse Gas Emissions (tCO2e) × Excess Emissions Fee per Unit (NT$/tCO2e)

3. Work Injury Value = Work Injury Cost + Medical Cost + Willingness to pay of Occupational Injury


5. Talent and Community Development covers TSMC University Collaboration Programs in Taiwan, environmental initiatives, and education sponsorships. For relevant value assessment, please refer to “TSMC 2016-2017 Social Impact Valuation Report”.

6. These impacts are not fully captured in this report.

### Financial Summary

<table>
<thead>
<tr>
<th>Category</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Dividend</td>
<td>181,513</td>
<td>243,147</td>
<td></td>
</tr>
<tr>
<td>Net Income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Revenue</td>
<td>977,447</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Value Driven by the Supply Chain (Excess Emissions Fee)</td>
<td></td>
<td></td>
<td>1,275,200</td>
</tr>
<tr>
<td>Depreciation and Amortization</td>
<td>260,143</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GHG Value</td>
<td>12,195</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Emissions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Discharge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Injury</td>
<td>65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employees Development and Training</td>
<td>832</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taxes</td>
<td>69,574</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee Compensation</td>
<td>104,130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talent and Community Development</td>
<td>831</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shareholders/Investors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplier/Contractor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Unit: NT$ million
In 2017, TSMC continued to deepen its understanding and practice of the Sustainable Development Goals Compass (SDG Compass) through implementing the prescribed five steps of “Understanding the SDGs,” “Defining Priorities,” “Setting Goals,” “Integrating,” and “Reporting and Communicating.” Accordingly, TSMC has incorporated SDGs into our core strategy of operations, thereby establishing long-term sustainable development goals and enabling the pursuit of a vision of sustainable development. As one of the global industrial leaders in the semiconductor industry, TSMC bears the responsibility of tackling the challenges faced by all of humanity. This responsibility drives our collaborative efforts with our stakeholders, including employees, customers, suppliers/contractors, and society, to chart a path toward sustainability for the mutual benefit of all involved.

1. Understanding SDGs and Defining Priorities

Based on business-driven and philanthropy-driven, we comprehensively examined the relationship between SDGs and TSMC’s value chain from the perspective of major issues in CSR. A formal declaration was then made through TSMC’s CSR Committee which stated, “SDGs are part of TSMC’s sustainability DNA, and sustainable development vision is a long-term goal that we need to achieve.” Understanding the purpose and spirit of the SDGs, we identified SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 8 (Decent Work and Economic Growth), SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action) as our high-priority goals. These are business-driven focuses, as they are integral to the nature of TSMC’s operations. SDG 1 (No poverty), SDG 3 (Good Health and Well-being), SDG 4 (Quality Education) and SDG 16 (Peace, Justice and Strong Institutions) are philanthropy-driven, as they are related to TSMC’s role as a corporate citizen.

2. Goal Setting and Integration

“Businesses need to understand the compelling case for the SDGs, determine methods to incorporate them in their activities, and ultimately find ways to make them part of their organizational culture, reporting systems and operations,” said SDG Fund Director Paloma Durán. After prioritizing the SDGs that TSMC wants to achieve, we worked with our stakeholders, including employees, customers, suppliers/contractors, and society, to set TSMC’s own sustainable development goals and incorporate them into procurement, operations, and customer usage — the three different stages of TSMC’s value chain. By working with our stakeholders to implement the SDGs, TSMC echoed the SDGs and put them into practice.

3. Reporting and Communicating

TSMC is committed to abiding to the SDG Compass reporting and communication principles for identifying priority SDGs in terms of TSMC material issues. In the future, TSMC will follow Stage 1 to continually review and revise the SDG priorities and deliver concrete contributions. In addition, TSMC shall clearly state yearly sustainability performance and SDG goal achievement status and further facilitate improvement measures of sustainability management for reporting and engaging with stakeholders.
### TSMC Focuses

<table>
<thead>
<tr>
<th></th>
<th>Value Chain</th>
<th>SDGs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Procurement</td>
<td>TSMC Operations</td>
</tr>
</tbody>
</table>

#### Ethical Management
- Implement the core value of "integrity," fully aware that corruption and bribery will fundamentally undermine the foundation of corporate sustainability. Our open reporting system allows the code of conduct to be deeply rooted in the daily work of employees and suppliers.

#### Innovation and Service
- Respond to rapid technological changes and global sustainability trends. TSMC introduces new technological applications through innovation, as well as resolves climate change issues faced by humankind through product and process innovation.

#### Responsible Supply Chain
- Leverage local purchasing volume. As an industrial leader in the semiconductor industry, we should increase our utilization of local service providers as well as incorporate a corporate sustainability mindset and requirements into our supply chain management in order to drive the responsible behavior across the entire supply chain.

#### Green Manufacturing
- Building cleaner production plants is a basic requirement of corporate sustainability. Our spirit of responsibility drives us to construct green manufacturing plants that emphasize dematerialization, decarbonization and detoxification across all aspects of our products, processes, and supply chain.

#### Inclusive Workplace
- Embrace our original vision of seeking out people who subscribe to our values. We are committed to establishing a safe and inclusive workplace, ensuring every employee enjoys basic human rights and can develop their skills in a safe work environment, and making our workplace an asset worth protecting.

#### Common Good
- Society and Company are interdependent. Through its two major charitable foundations, TSMC has been deeply involved in issues such as education, helping the less privileged, assisting the elderly who live alone, and other cultural assets. We aim to support and encourage the power of love and positive social influence.

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**TSMC’s Material Issues to UN SDGs**

**TSMC 2017 Corporate Social Responsibility Report**
### Linking SDGs to TSMC 2020/2025 Goals

<table>
<thead>
<tr>
<th>TSMC Approaches</th>
<th>TSMC 2020/2025 Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replace PFOA-related substances</td>
<td>100% compliance for product, hazardous substance free legal and customer requirements</td>
</tr>
<tr>
<td>Improve efficient water and ammonia nitrogen treatment</td>
<td>Reduce ammonia nitrogen concentration in wastewater discharge to &lt;25mg/L</td>
</tr>
<tr>
<td>Increase urban reclaimed water usage</td>
<td>Replace tap water with reclaimed water for up to 38,000 tons/day</td>
</tr>
<tr>
<td>Research, develop and manufacture more energy-efficient products</td>
<td>Reduce power consumption per unit wafer (W/A) with water equivalent - mask layer, by 10% relative to that in 2016</td>
</tr>
<tr>
<td>Cooperate with suppliers to develop energy-efficient equipment</td>
<td>Accomplished 2,800 kWh of electricity savings for new measures of energy saving</td>
</tr>
<tr>
<td>Use renewable energy</td>
<td>Continue to purchase renewable energy</td>
</tr>
<tr>
<td>Ban child labor</td>
<td>More than 240 suppliers completed the audit by FY2017</td>
</tr>
<tr>
<td>Promote a safe work environment</td>
<td>Frequency of disability &lt;0.17, severity of disability &lt;4.55</td>
</tr>
<tr>
<td>Support local suppliers</td>
<td>Cooperated with local suppliers for process and yield rate</td>
</tr>
<tr>
<td>Enhance suppliers’ quality culture</td>
<td>90% of local suppliers participated in the National United Circle Competition</td>
</tr>
<tr>
<td>Promote reduction of industrial waste output</td>
<td>Reduce waste volume of major local waste-reducing equipment by 34% relative to that in 2014</td>
</tr>
<tr>
<td>Promote fab site economy</td>
<td>Reduce contaminated waste treatment per unit wafer to 33 kg, 8-inch wafer equivalent - mask layer</td>
</tr>
<tr>
<td>Promote adaptation strategies for climate risk</td>
<td>Reduce CO2 emission per unit product by 18% relative to that in 2010</td>
</tr>
<tr>
<td>Strengthen resilience of supply chain climate risk</td>
<td>Organized suppliers emergency response,elenagement for 160 suppliers</td>
</tr>
</tbody>
</table>

#### Business-Driven
- **Clean Water and Sanitation**
- **Affordable and Clean Energy**
- **Decent Work and Economic Growth**
- **Responsible Consumption and Production**
- **Climate Action**

#### Philanthropy-Driven
- **No Poverty**
- **Good Health and Well-being**
- **Quality Education**
- **Peace, Justice and Strong Institutions**

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Note: TSMC will directly purchase renewable energy and set its long-term target when regulations on renewable energy and market supply conductions in Taiwan are ready.

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**TSMC 2017 Corporate Social Responsibility Report**
Social Impact Valuation – Energy Conservation and Quality Education

To fulfill the 17 Sustainable Development Goals (SDGs) set forth in its new sustainable development agenda, the United Nations established the United Nations Social Impact Fund, which would employ the Social Return on Investment (SROI) framework to measure the economic, environmental, and social sustainable values created by the investments it selected, clearly indicating a trend towards monetizing social impact.

TSMC, true to its ultimate goal of "uplifting society", began conducting a comprehensive study of the relationship between its operations and the SDGs in 2016, actively searching for its primary and applicable area of contribution. In 2017, we selected SDG 13 (Climate Action) and SDG 4 (Quality Education) as our first two topics for SROI implementation, identifying relevant and ongoing areas of sustainability efforts. Through interviews and surveys, we identified the changes and impacts to the stakeholders arising from these efforts and converted them into monetary values from their perspectives.

In the process of communicating with our stakeholders, we received much positive feedback and realized that through our energy conservation activities, we not only lowered our energy consumption, strengthened awareness and skills in energy conservation, increased employees’ organizational commitment, but also created business opportunities with a green focus in the industry. As with our efforts in quality education, they enhanced human capital, reduced the economic burden of academics and students, improved the quality of education, cultivated semiconductor talents, and advanced the industry’s competitiveness. These actions in sustainability explicitly demonstrate TSMC’s investments and organizational commitment, but also created business opportunities with a green focus in the industry.

Steps to Calculating SROI

Establishing Scope and Identifying Stakeholders
- Selected two areas of focus, Energy Conservation and Quality Education
- Identify key stakeholders

Evidencing and Valuing Outcomes
- Understand what changes and describe outcomes by engaging stakeholders
- Identify financial proxies to value outcomes

Calculating Social Impact
- Perform sensitivity analysis and confirm outcomes with stakeholders
- Calculate the social impact of our efforts

For details regarding our calculations, assumptions, and constraints, please refer to TSMC 2016-2017 Social Impact Valuation Report.
TSMC’s Roles

In these changing times, TSMC aims to be a trustworthy company, continuing to pursue innovation, maintain its technology leadership, purchase responsibly, and drive supply chain development. At the same time, we support sustainability through green manufacturing, and strive to be the most attractive employer centered around our talent. This is how we drive change in society.
Ethical Management

A Trusted Company

Integrity is the most important core value of TSMC’s culture. Internally, we continue to instill a high standard of ethical culture by providing training and promotional campaigns. TSMC’s employees set the “tone from the top” by acting in compliance with governing legislation and regulations. Externally, we assist our customers and suppliers to understand and act in accordance with TSMC’s ethical standards. We aim to become a trusted partner for our stakeholders.

29,000 employees completed “2017 TSMC Ethics and Compliance Training”

888 facility and spare parts suppliers attended the face-to-face training sessions on TSMC’s ethical standards in person

96.2% of TSMC’s suppliers believe our employees’ ethics is extremely high or high
The management of TSMC takes ethics and regulatory compliance seriously. It is reflected not only internally in the formulation of compliance policies and procedures, providing training and promotion activities, and periodic assessment and declaration, but also externally through the participation of third parties. Furthermore, the culture of ethics and regulatory compliance is cultivated through adequate reporting channels and whistleblower protection.

- Conduct ethics and regulatory compliance training to employees on annual basis. The completion rate reaches 95% every year. (2020)
- No material regulatory violation (where the fine exceeds NT$1 million). (2020)
Completion rate: 95%
- Refine the target: Instead of calculating the completion rate on the basis of TSMC as a whole, the aim is for each fab/division to reach a completion rate of 95%, to ensure that every fab/division participates actively in the training.
- Expand to production staff: All 13,000 staff on our production lines will be required to receive relevant training, and the completion rate is set at 95%.

Develop a suppliers ethics guidelines manual
- Develop an ethics guidelines manual to facilitate suppliers' internal promotion activities.

No material regulatory violation (where the fine exceeds NT$1 million)
- No material regulatory violation (where the fine exceeds NT$1 million)

Target groups for this initiative in 2017 are facility and spare parts suppliers.
Integrity is the core value upon which TSMC was built, and compliance with both our ethical standards and applicable laws and regulations embodies that core value. We extend this core value to our suppliers to ensure that operating with integrity is a shared priority throughout our supply chain.

Sylvia Fang
Vice President, Legal and General Counsel

TSMC ensures compliance with TSMC’s Code of Ethics and Business Conduct (the “Ethics Code”) and relevant laws and regulations in a systematically way by implementing the following methodologies in six dimensions.

**Tone from the Top**

TSMC’s management acts in accordance with the Ethics Code and fosters a robust ethics and regulatory compliance culture at TSMC. In view of the importance of compliance with the Ethics Code and our anti-corruption policies, the members of the Board of Directors and the Audit Committee evaluate and supervise the requirements and implementation of relevant internal rules through periodical and ad-hoc reports. In addition, TSMC formed an Ethics Committee in 2016 chaired by our vice president overseeing the Ombudsman System, and comprised of the vice presidents of Legal and Human Resource functions and other executives. The Committee supervises investigations of potential ethics violation cases and determines the appropriate disciplinary action to be imposed. The Committee also has the authority to oversee the promotion of the Ethics Code and our core value of “Integrity”.

In 2017, the Ethics Committee held 10 meetings, and determined to discipline 9 employees (3 of which were dismissed) for 4 major violations. In addition, considering the importance of the Ethics Code and regulatory compliance, various functions, such as Operations, Human Resources, Accounting and Internal Audit, proactively invited the Legal department to conduct 13 face-to-face training sessions for about 1,700 employees. Through the training, which included case studies, the employees gained deeper understanding of TSMC’s zero-tolerance policy for Ethics Code and anti-corruption principles. Lastly, there were no material regulatory violations, where “materiality” means the fine exceeds NT$1 million.

**Ethics Committee**

Chair
Ombudsman Chair

Member
Legal Org. VP

Member
HR Org. VP

Member
Operations Org. VP

Member
Legal Division Head responsible for fraud investigations

Observer(s)
Internal Audit Head
Corporate & Compliance Legal Division Head
Compliance Policies and Procedures

In order to build an effective compliance system of ethical standards and regulatory compliance initiatives, TSMC established not only the Ethics Code embodying our core value of "Integrity", but also the internal policies and procedures in major areas of law. We also track and identify any relevant regulatory changes to ensure that TSMC’s internal policies and procedures are effective and up to date. For example, the "TSMC Anti-corruption Rules" provide specific requirements regarding our zero-tolerance policy prohibiting corruption of any kind. As another example, in 2017, TSMC revised its "TSMC Rules of Privacy and Personal Data Protection" to reflect the changes of the personal data protection regulations in the European Union.

Training and Promotion Activities

Multiple training programs as well as awareness promotions through multiple channels, such as posters throughout our facilities, internal webpages and company-wide emails, are provided to continuously promote the awareness of relevant regulatory topics. For important topics, face-to-face training sessions, offer the opportunity to provide customized materials and interactive discussions to further strengthen the employee awareness.

In 2017, Legal, Human Resources and Internal Audit departments launched a comprehensive electronic training, the "2017 TSMC Ethics and Compliance Training". This new annual training elaborates on the ethical standards and requirements regarding anti-corruption, avoidance and reporting of conflict of interests, privacy protection, export control, insider trading, reporting channels and whistleblower protection. With a completion rate of 97%, approximately 29,000 employees (including employees from our wholly-owned subsidiaries) received this training. Ethics and compliance training was also offered to more than 5,000 employees who work on the production lines at 300mm fabs, and we plan to expand the group of teamees to all our fab production staff (around 13,000 employees) in 2018.

TSMC also provided training and awareness promotion for other regulatory compliance topics. For example, to further enhance employee’s awareness of export control requirements incurred by technology transfers, in 2017 the Legal department provided around 25 face-to-face training sessions to approximately 200 manager-level employees in R&D and other relevant functions. The Legal department also organized the “Patent Week” and invited external experts to provide 8 face-to-face seminars during the event, which successfully strengthened employees’ understanding of this professional area.

### Regulatory Compliance and Policies/Procedures

- **Regulatory Inventory Check**
- **Regulatory Update**
- **Regulatory Identification**
- **Compliance Review**
- **Necessary Establishment and/or Update of Internal Rules**

### Ethics and Regulatory Compliance Training Promotion

<table>
<thead>
<tr>
<th>Category</th>
<th>2016</th>
<th>2017</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethical Standards (to Employees)</td>
<td>around 29,000 employees</td>
<td>around 36,000 employees</td>
<td>• Includes anti-corruption, avoidance of conflict of interests, reporting channels and whistleblower protection • Includes both face-to-face training and electronic training Note: The Legal department provided face-to-face training to select group of overseas assignees and departments for enhancement of awareness</td>
</tr>
<tr>
<td>Ethical Standards (to suppliers)</td>
<td>719 suppliers</td>
<td>888 suppliers</td>
<td>• Includes anti-corruption, avoidance of conflict of interests, reporting channels and whistleblower protection • Face-to-face training only</td>
</tr>
<tr>
<td>Regulatory Compliance</td>
<td>around 26,000 employees</td>
<td>around 29,000 employees</td>
<td>• Includes export control, personal data protection, insider trading and record retention and disposal • Includes both face-to-face training and electronic training</td>
</tr>
</tbody>
</table>
Annual Self-assessment and Declaration of Conflict of Interest

A conflict of interest declaration is made by each newly hired employee during newcomer orientation and by a select group of employees annually. Employees with specific job grades or job responsibilities are required to complete the annual declaration, regardless whether an actual conflict of interest exists. In 2017, more than 15,000 employees completed the declaration and certified their compliance with TSMC’s ethical standards.

TSMC also evaluates employees’ awareness of the Ethics Code and major laws through an annual Control Self-Assessment (CSA). Specifically, in 2017 CSA used the completion rate of the above mentioned “2017 TSMC Ethics and Compliance Training” as a key indicator for the assessment of employees’ (including employees of our wholly owned subsidiaries) ethical and regulatory compliance awareness. The annual CSA and annual declaration of conflict of interest for 2017 were completed in November and December respectively. The result of both the annual conflict of interest declaration and the CSA are reported to the Audit Committee.

Supplier Management

TSMC not only emphasizes that each and every employee shall comply with the Ethics Code, it also takes concrete actions to urge our suppliers to have a key role in TSMC’s Ethics Code implementation. Through continuous promotional activities to our major suppliers, TSMC enhances suppliers’ understanding of TSMC’s ethical standards and demonstrates its determination to uphold the behavioral standards adopted in its Ethics Code and “TSMC’s Supplier Code of Conduct” “TSMC’s Supplier Code of Conduct” is a TSMC policy that aims to ensure suppliers full compliance with the TSMC’s ethical and regulatory compliance requirements. In 2017, the Procurement department invited the Legal department to provide face-to-face training sessions to our suppliers, including reviews of actual ethics violation cases, to further communicate with our suppliers TSMC’s commitment to uphold high ethical standards.

Promotion Focus

“Integrity” is TSMC’s core value

TSMC does not tolerate corruption of any kind

Suppliers should take the initiative to avoid all possible conflicts of interest with TSMC employees

Suppliers should use reporting channels provided by TSMC and understand anti-retaliation protections for whistleblower activity made in good-faith

Suppliers should promptly notify TSMC of suspected violations of TSMC’s ethical standards and provide relevant evidence

In 2017, 906 facility and spare parts suppliers were invited to 6 face-to-face training sessions, 888 attended the training sessions.

98%
Up to 98% participation rate

Suppliers participating in face-to-face training sessions in 2017 provided positive feedback on this training. 95% of the participants considered the promotion provided by TSMC helped them understand TSMC’s ethical standards, and confirmed that they are aware of the reporting channels provide by TSMC. Nearly 97% of the participants expressed their willingness to assist and cooperate with TSMC in conducting investigations of ethical violations. In addition, a regular survey to over 2,000 suppliers in 2017 revealed that 96.2% of the suppliers believe TSMC’s employees’ ethics is extremely high or high.

97%
Up to 97% positive feedback
Tasks of 2018

- Update course materials for annual ethics and regulatory compliance training
- Develop a suppliers ethics guidelines manual

**Reporting Channels and Whistleblower Protection**

TSMC's "Complaint Policy and Procedure for Certain Accounting & Legal Matters" provides multiple channels for reporting business conduct concerns. Employees may report a suspected violation either through "the Audit Committee Whistleblower System" or the "Ombudsman System." In addition, with respect to sexual harassment, an independent Sexual Harassment Investigation Committee was formed. Alternatively, any whistleblowers may report a suspected violation anonymously through the "Irregular Business Conduct Reporting" page on our official website. Any form of retaliation against an individual who in good faith reports a suspected violation or participates in an investigation is prohibited. We do not tolerate any violation of the Code and treat every received case and possible violation incident seriously. Any violator of the Code (or relevant regulations) will be severely disciplined to the full extent of our policies and the law, under the supervision of the Ethics Committee, up to and including immediate dismissal, termination of the business relationship, and judicial prosecution as appropriate.

**Reporting Channels and Investigation Management**

- Employees
  - Sexual Harassment Reporting Channel
  - Audit Committee Whistleblower System
  - Ombudsman System
- External Parties
  - Irregular Business Conduct Reporting

**Sexual Harassment Investigation Committee**
- Supervise investigations of reported complaints
- Determine disciplinary action for violations

**Ethics Committee**
- Supervise investigations of reported complaints
- Determine disciplinary action for violations

**Reporting**
- Periodically report investigation results and related disciplinary action to the Board, Audit Committee & Management

**Improvement & Prevention**
- Review past cases to improve management and internal controls and avoid recurrence of similar incidents
- Regularly conduct awareness promotion activities to prevent incidents
In 2017, reporting channels and whistleblower protection were both key communiccation points during the face-to-face training sessions to employees, the electronic training of 2017 TSMC Ethics and Compliance Training, and the face-to-face training sessions to suppliers. Through the open reporting channels, TSMC receives reports on various issues from time to time from both employees and external parties. Below is a summary of the number of reported incidents over the past five years. No incidents related to finance or accounting matters were reported in 2017.

### Summary of Incidents Reported to and as Founded by the Reporting Channels from 2013~2017

<table>
<thead>
<tr>
<th>Year</th>
<th>Incidents Reported to the Audit Committee Whistleblower System</th>
<th>Incidents Reported to the “Irregular Business Conduct Reporting”</th>
<th>Incidents Reported to the Ombudsman System</th>
<th>Total Incidents Investigated as Founded</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2014</td>
<td>9</td>
<td>22</td>
<td>16</td>
<td>41</td>
</tr>
<tr>
<td>2015</td>
<td>1</td>
<td>35</td>
<td>80</td>
<td>126</td>
</tr>
<tr>
<td>2016</td>
<td>1</td>
<td>32</td>
<td>79</td>
<td>122</td>
</tr>
<tr>
<td>2017</td>
<td>2</td>
<td>32</td>
<td>79</td>
<td>133</td>
</tr>
</tbody>
</table>

Note 1: Among the 32 cases, 18 cases related to ethics matters.  
Note 2: Among the 79 cases, no incidents related to ethics matters.  
Note 3: After investigation of the 4 cases, 9 employees confirmed their violation of the Ethics Code. All 9 employees were severely disciplined by the Company and 3 were dismissed.

### Summary of Incidents Reported to and as Founded by the Sexual Harassment Investigation Committee from 2013~2017

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Incidents Reported</th>
<th>Total Incidents Investigated as Founded</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>2014</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2015</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>2016</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2017</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: After the investigation by TSMC’s Sexual Harassment Investigation Committee, 3 employees involved in these 3 cases received severe discipline from the Company.

As an international company, TSMC operates in multiple regions. Through the establishment and robust implementation of company-wide ethical standards, TSMC’s operation sites have developed a set of common core values. This culture of regulatory compliance, and our relentless pursuit of continuous improvement supports our excellent records of compliance with laws and regulations in the countries where we operate. In addition, by empowering our supply chain to get involved in our ethics and regulatory compliance efforts, TSMC will continue to keep its commitment to high ethics and regulatory standards.
Innovation and Service

An Innovation Pioneer

As the founder and leader of the dedicated semiconductor foundry segment, TSMC actively promotes innovations in every part of our business. TSMC continues to invest in research and development to maintain our leadership position as an innovation pioneer. We consider product life cycle to help customers produce sustainable products with higher quality and lower energy consumption. At the same time, TSMC listens to our customers’ needs and actively collaborate with them to take advantage of emerging opportunities.

5,000 / 8,000
More than 5,000 patent applications were filed worldwide and over 8,000 trade secrets were registered in 2017 to protect intellectual property.

10.1bn (NT$)
Continuous Improvement Team (CIT) completed 42,056 grassroots-level improvement proposals and 2,020 projects for total benefit of NT$10.1 billion.

93.3%
The annual customer satisfaction survey at TSMC reached over 90% satisfaction for four consecutive years, demonstrating our good relationship with customers.
Innovation Management

Technology Leadership
Continue to develop leading-edge technologies to maintain TSMC’s technology leadership in the semiconductor industry.

Intellectual Property Protection
- Patent Protection: TSMC continues to expand its patent portfolio with strategic patent filing goals, which are in close alignment with its R&D resources, so as to ensure full protection of R&D achievements.
- Trade Secret Protection: Strengthening the company’s operations and intellectual property innovation through the registration and management of trade secrets, which involves recording and integrating applications for trade secrets that are competitive advantages for the company.

TSMC 2020/2025 Goals
- Increase the number of worldwide patent filings by about 5% YoY 2020
- Increase the number of trade secrets registered by 10% per year 2020
- Exceed the total number of patents granted worldwide (45,000) 2025
- Over 55,000 trade secrets registered 2025
Production ramp-up of industry leading 7nm technology, the 4th generation of technology to make use of 3D FinFET transistors.

2017 Achievements

- >5,000
  More than 5,000 patent applications were filed worldwide

2018 Targets

- >5,000
  File more than 5,100 patent applications worldwide

- >8,000
  Over 8,000 trade secrets registered

2017 new item
“Being everyone’s foundry” is the core of TSMC’s strategy. Through the expansion of our technology and services, we built an open platform that welcomes all innovators in the semiconductor industry to realize their innovations and to quickly introduce their products to market in volume.

Innovative Management Framework

In an innovative business model, Dr. Morris Chang founded the world’s first dedicated IC foundry, which significantly reduces the barriers to entry into the semiconductor industry and contributes to the growth and prosperity of the global fabless IC design industry. Since its establishment, TSMC has actively built a culture of innovation and a work environment that is finely tuned to the ever-changing characteristics of the semiconductor industry.

In addition to continuing to develop leading-edge technologies to maintain TSMC’s technology leadership in the semiconductor industry in 2017, TSMC also developed an internal reward mechanism, encouraging employees to practice in their work a wide range of innovation to continuously strengthen the organization’s vitality. Meanwhile, TSMC also assists customers, industry and academics in cross-domain exploration, including product innovations in collaboration with customers, academics, and “green” suppliers.

Innovative Values

- Encouraging Innovation
- Innovation Initiative
- Innovation Collaboration


TSMC University Collaboration Programs

- TSMC University Research Centers Program
- TSMC University Shuttle Program

Open Innovation Platform®

Cooperation with World-class R&D institute

Innovative Management Framework

- Technology Leadership
- Green Product
- Intellectual Property Protection
- Intelligent Precision Manufacturing
- Green Innovation Cases
  - Develop Intelligent Chilled Water System
  - New Water Conservation Measures for Production Tools
  - Project Big Green
  - Refinement and Enrichment of Ammonium Sulfate Dewatering Technology
  - Application of Hydro-membrane

Note: TSMC is a core partner of IMEC (Interuniversity Microelectronics Center), Europe’s leading semiconductor technology research and development center, and continues to sponsor the world’s top universities in nanotechnology research to drive invention and the advancement of nanoelectronics.
R&D headcount increased to 6,145, up about 13% from the previous year.

In 2017, TSMC continued to invest in research and development, with total R&D expenditures amounting to US$2,651 million, up about 19% from the previous year, accounting for 8% of total revenue. R&D headcount increased to 6,145, up about 13%, a level that equals or exceeds the R&D investment of many other leading high-tech companies.

TSMC recognizes that the technology challenge of continuing to extend Moore’s Law is becoming increasingly complex and difficult. The efforts of the R&D organization are focused on enabling the Company to continuously offer customers first-to-market, leading-edge technologies and design solutions that contribute to their product success in today’s competitive market environment. In 2017, TSMC completed the transfer to manufacturing of the industry leading 7nm technology, the 4th generation of technology to make use of 3D FinFET transistors, and continued to fuel the pipeline of technological innovation needed to maintain industry leadership. TSMC’s 7nm technology is on track to ramp up volume production in 2018. TSMC 5nm technology is in full development stage, and the definition and intensive early development efforts have been progressing for nodes beyond 5nm.

In addition to CMOS logic, TSMC conducts R&D on a wide range of other semiconductor technologies that provide the functionality customers require for mobile SoC and other applications.

Technological Leadership

TSMC is Committed to Investment in Technology Advancement

<table>
<thead>
<tr>
<th>Year</th>
<th>R&amp;D Headcount (number)</th>
<th>R&amp;D Expense (US$ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>684</td>
<td>2,069</td>
</tr>
<tr>
<td>2009</td>
<td>657</td>
<td>2,479</td>
</tr>
<tr>
<td>2010</td>
<td>943</td>
<td>2,881</td>
</tr>
<tr>
<td>2011</td>
<td>1,152</td>
<td>3,392</td>
</tr>
<tr>
<td>2012</td>
<td>1,366</td>
<td>3,901</td>
</tr>
<tr>
<td>2013</td>
<td>1,621</td>
<td>4,367</td>
</tr>
<tr>
<td>2014</td>
<td>1,875</td>
<td>4,766</td>
</tr>
<tr>
<td>2015</td>
<td>2,067</td>
<td>5,123</td>
</tr>
<tr>
<td>2016</td>
<td>2,211</td>
<td>5,423</td>
</tr>
<tr>
<td>2017</td>
<td>2,651</td>
<td>6,145</td>
</tr>
</tbody>
</table>

Technology Leadership

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In addition to CMOS logic, TSMC conducts R&D on a wide range of other semiconductor technologies that provide the functionality customers require for mobile SoC and other applications.

InFO-PoP

The world’s leading volume production of Gen-2 Integrated Fan-Out Package on Package (InFO-PoP) for mobile application processor packaging.

Specialty Technology / Integrated Interconnect & Packaging

- The world’s leading volume production of Gen-2 Integrated Fan-Out Package on Package (InFO-PoP) for mobile application processor packaging
- Successful qualification of Gen-3 InFO-PoP advanced packaging technology for mobile applications
- Started risk production of Integrated Fan-Out on Substrate (InFO-oS) for die-partition and HPC applications
- 40nm high-voltage phase-2 technology readiness for both LCD (Liquid-Crystal Display) and OLED (Organic Light-Emitting Diode) drivers
- Successful development and manufacturing qualification of 650V, 100V E-HEMT, and RF 30V D-MISFET GaN devices
- Completed 40nm high-voltage phase-2 technology readiness for both LCD (Liquid-Crystal Display) and OLED (Organic Light-Emitting Diode) drivers
- Successful production launch of e-Flash 40nm node, NOR-based cell technologies and Split-Gate cell for consumer electronics applications such as IoT, smartcards and microcontroller units
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- Completed 40nm high-voltage phase-2 technology readiness for both LCD (Liquid-Crystal Display) and OLED (Organic Light-Emitting Diode) drivers
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- Successful development and manufacturing qualification of 650V, 100V E-HEMT, and RF 30V D-MISFET GaN devices
Leading Technology and Innovations in IC Foundry Service

- Offered a first-to-market 28nm high-K/metal gate (HKMG) foundry technology portfolio.
- Offered the foundry segment’s first 40nm technology.
- Achieved 28nm 64Mbit SRAM yield breakthroughs of the foundry segment’s highest density cell (0.127 μm²).
- Provided TSMC’s customers with the first-to-market CyberShuttle® for both 45nm and 40nm technologies.

CMOS Logic Technology
- Completed the transfer to manufacturing of the industry-leading 7nm technology, the 4th generation of technology to make use of 3D FinFET transistors.
- Completed the transfer to manufacturing of industry-leading 10nm technology, the 3rd generation of technology platform to make use of 3D FinFET transistors.
- Lead the industry in volume manufacturing of 16FF+ technology, the first integrated technology platform to make use of 3D FinFET transistors.
- Lead the industry in volume manufacturing of 16nm technology, the first integrated technology platform to make use of 3D FinFET transistors.

Specialty Technology/Integrated Interconnect and Packaging
- The world’s leading volume production of Gen-2 Integrated Fan-Out Package on Package (InFO-PoP) for mobile application processor packaging.
- Launched 0.18μm third generation BCD (Bipolar-CMOS-DMOS) technology resulting in the leading performance quick charger and wireless charger.
- 40nm high-voltage phase-2 technology readiness for both LCD (Liquid-Crystal Display) and OLED (Organic Light-Emitting Diode) drivers.
- Completed the transfer to manufacturing of the industry leading 7nm technology, the 4th generation of technology to make use of 3D FinFET transistors.
- Achieved the world’s first high-volume production of InFO PoP for mobile application processor packaging.
- 0.18μm second generation BCD technology resulting in the world’s highest performance quick charger and wireless charger.
- Successfully qualified InFO PoP (Integrated Fan-Out Package on Package) advanced packaging technology, low cost solution for mobile customers.
- The third generation of 0.18μm BCD technology adopted TSMC proprietary device structure which boosts world leading performance higher.
- The first and the only company to offer both 100V and 650V GaN foundry service in 6-inch Fab.
- TSMC qualified for manufacture a new TSV (Through-Silicon Via)-based platform in 2014 for fingerprint sensor applications. This is an important industrial milestone to integrate TSV with active devices.
- First foundry to implement GaN technology in a 6-inch fab.
- Production ramp of the CoWoS® (Chip on Wafer on Substrate) 3D packaging technology.
- The first industry introduction of the BCD (Bipolar-CMOS-DMOS) power technology into a 12-inch fab environment.
- Manufacturing readiness of TSMC’s first wide band gap Gallium Nitride (GaN) semiconductor technology for high frequency power applications.
Green Products

In each new technology generation for IC manufacturing, circuitry line widths shrink, making an IC chip smaller and reducing product power consumption.

More Advanced and More Energy-efficient Electronic Products

TSMC is consistently first among dedicated foundries to provide next-generation, leading-edge technologies. The Company also provides comprehensive specialty technologies and excellent frontend and backend integration capabilities. These help customers produce more advanced, energy-saving and environmentally friendly products to minimize the environmental impact of technology progress. Through TSMC’s manufacturing technologies, customers’ designs are realized and their products are used in a wide range of applications covering various segments of the computer, communications, consumer, industrial and other electronics markets. These chips make significant contributions to the progress of modern society.

Chip Die Size Cross-Technology Comparison

<table>
<thead>
<tr>
<th>Technology</th>
<th>55nm</th>
<th>45nm</th>
<th>40nm</th>
<th>28nm</th>
<th>16/12nm FFC</th>
<th>10nm</th>
<th>7nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Die size</td>
<td>0.53</td>
<td>0.48</td>
<td>0.25</td>
<td>0.11</td>
<td>0.068</td>
<td>0.048</td>
<td></td>
</tr>
</tbody>
</table>

Die size is shrinking as line width shrinks

Data source: TSMC

Chip Total Power Consumption Cross-Technology Comparison

<table>
<thead>
<tr>
<th>Technology</th>
<th>N5SLP (1.2V)</th>
<th>N40LP (1.1V)</th>
<th>N28HPM (1.2V)</th>
<th>16/12FFC (0.8V)</th>
<th>10nm (0.75V)</th>
<th>7nm (0.75V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>0.6</td>
<td>0.3</td>
<td>0.07</td>
<td>0.06</td>
<td>0.04</td>
<td></td>
</tr>
</tbody>
</table>

More power is saved as line width shrinks

Data source: TSMC
Social Contribution Examples by TSMC Foundry Services

Unleash Customers’ Mobile and Wireless Chip Innovations that Enhance Mobility and Convenience

The rapid growth of smartphones and tablets in recent years reflects strong demand for mobile devices, which, in turn, offer remarkable convenience. TSMC contributes significant value to these devices, including: (1) new TSMC process technology helps chips achieve faster computing speeds in a smaller die area, leading to smaller form factors for these electronic devices; (2) new TSMC process technology also helps chips consume less energy. People can therefore use mobile devices for a longer period of time; and (3) TSMC helps spread the growth of more convenient wireless connectivity such as 3G/4G and WLAN/Bluetooth, meaning people can communicate more efficiently and “work anytime and anywhere,” significantly improving the mobility of modern society.

In the first quarter of 2017, TSMC’s leading 10nm FinFET technology started high-volume shipments. Thanks to its aggressive geometric shrinkage, this technology provides excellent density/cost benefits to support customers in various market segments, including mobile, server and graphics.

Unleash Customers’ CIS (CMOS image sensor) and MEMS (micro electro mechanical systems) Innovations that Enhance Human Health and Safety

TSMC continues to enhance or develop innovative CIS and MEMS technologies, which are expanding from traditional sensing to machine sensing, such as NIR (near infrared), ultrasound, and micro-actuators. These new technologies can serve more product applications, from smartphones and consumer electronics to automotive and health services. By combining advantages of traditional sensing and machine sensing, new products using TSMC CIS and MEMS technologies can be made smaller and faster, while consuming less power, and greatly enhancing human convenience, health, and safety. For example, TSMC customers’ CIS and MEMS products are used in a number of advanced medical treatments as well as in preventative health care applications. Examples include early warning systems to minimize the injury from falls for the elderly, systems to detect physiological changes, car safety systems and other applications that greatly enhance human health and safety.
**Intellectual Property Protection**

A strong portfolio of intellectual property rights effectively strengthens TSMC’s technology leadership. TSMC has established a strategic model to create value by leveraging intellectual property rights. This model not only protects TSMC's freedom to operate worldwide, but also enhances TSMC's competitiveness to increase business profits.

**Patent Protection**

TSMC actively develops its patent holdings and strategically sets patent-filing goals in close alignment with the Company’s R&D resource allocations and investment plans to construct an ever-expanding global patent portfolio. Primary measures to achieve these goals include: patent filing within patent battlefields worldwide, in-depth invention mining for comprehensive protection, application monitoring throughout prosecution, patent quality enhancement, regular patent landscape monitoring, and patent strength and stockpile analyses. In terms of patent quantity, TSMC has accumulated over 30,000 patent grants worldwide as of the end of 2017. TSMC obtained an ever-increasing number of U.S. patents in 2017 and was ranked in the top 10 of U.S. patent assignees for the 2nd consecutive year. In addition, TSMC was ranked No. 1 in 2017 with respect to the number of patent filings in Taiwan. In terms of patent quality, the allowance rate of TSMC’s U.S. patent applications was the highest among the top 10 U.S. patent assignees in 2017. These achievements not only strengthen TSMC’s technological leadership, but have also established a solid reputation for its intellectual property while protecting the Company’s ability to conduct business worldwide.

**TSMC Worldwide Patent Rankings**

<table>
<thead>
<tr>
<th>Year</th>
<th>TSMC’s Rank Among U.S. Patent Assignees</th>
<th>TSMC’s Rank Among TW Patent Assignees</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>35</td>
<td>21</td>
</tr>
<tr>
<td>2014</td>
<td>23</td>
<td>13</td>
</tr>
<tr>
<td>2015</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>2016</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Note 1: 2017 Top 50 U.S. Patent Assignees (IFI CLAIMS)
Note 2: Top 100 patent assignees among domestic companies (TIPO)

**Achievements and Honors**

- **1st Annual National Industry Innovation Award**
- **2nd Annual National Industry Innovation Award**
- **3rd Annual National Industry Innovation Award**
- Asia Top 5 Semiconductor Material Innovation Company
- **4th Annual National Industry Innovation Award**
- No. 1 IEEE Spectrum Patent Pipeline Power for Semiconductor sector
- Top 10 Global Innovator
- 5th Annual National Industry Innovation Award
- Top 10 U.S. Patent Assignee (2nd Time)
- No. 1 Patent Filer in Taiwan Among Domestic Companies (2nd Year)
- No. 1 Patent Filer in Taiwan Among Domestic Companies
- Top 10 U.S. Patent Assignee (1st Time)

**30,000**

Accumulated over 30,000 patent grants worldwide as of the end of 2017; ranked in the top 10 of U.S. patent assignees for the 2nd consecutive year.

1

The highest allowance rate among the U.S. patent assignees in 2017.
8,000 Trade Secret Protection

Trade secrets are TSMC’s most important intellectual property, and include the company’s process recipes, process flow, machine parameters, product yield, plant design, customer information, and financial information. Because trade secrets have an inseparable relationship with TSMC’s competitiveness, TSMC initiated its trade secret registration and management system in 2013 to comprehensively and effectively strengthen the company’s operations and intellectual property innovation. This system is intended to record and integrate applications for trade secrets that contribute to the company’s technology leadership, manufacturing excellence, and customer trust.

The trade secret registration and management system is located in an ‘ultra high security’ area, with control by a dedicated organization to ensure secrecy. To enhance the operational effectiveness of the company, TSMC has integrated this system with other Company systems to perform joint applications and has also estimated the economic value of the registered trade secrets.

The Golden Trade Secret Awards, given to inventors of trade secrets that contribute most to the Company’s competitiveness, are granted each year to increase the quality and quantity of trade secrets and to encourage contributions. As of 2017, 795 Golden Trade Secrets have been granted to more than 2,900 inventors. The number of trade secret registered has increased year by year. As for 2017, over 8,000 trade secrets were registered, which was the highest amount since the registration program began. The trade secrets included not only those related to process development and production improvement, but also use of artificial intelligence to optimize manufacturing performance and yield.
Intelligent Precision Manufacturing

TSMC is dedicated to manufacturing excellence, and has been developing its innovative and intelligent Precision Manufacturing system for many years. TSMC pioneered the foundry industry in equipment automation, transportation automation and dispatch automation. Experts' knowledge is integrated in the Precision Manufacturing system to reduce potential errors from human judgments and improve productivity. Machine Learning and Deep Learning are thoroughly studied and these algorithm-based artificial intelligence analysis techniques are applied in the system to achieve a manufacturing environment of self-diagnosis and self-feedback.

Machine Learning is the essence for intelligent manufacturing development. To speed up machine learning applications and sharpen our competitiveness, TSMC has a plan to train 300 machine learning experts starting from 2017 and build up its own machine learning development platform with high performance computing power, comprehensive wafer process big data and an open source machine learning software library to support fast function development. There have been numerous machine learning applications developed by TSMC, including smart scheduling and precise dispatching, people productivity improvement, equipment utilization optimization, process and tool control and quality defense, all to effectively improve production efficiency with the best product yield and performance guaranteed.
Open Innovation Platform®

TSMC’s Open Innovation Platform® (OIP) is a resource integrated platform that drives innovation. It encompasses the semiconductor design community, TSMC’s ecosystem partners, TSMC’s Intellectual Property (IP), design implementation, Design For Manufacturability (DFM) capabilities, process technology and backend packaging & testing services. OIP’s comprehensive design infrastructure promotes our customer’s speedy design implementation and improves first-time silicon success. Through 2017, TSMC developed more than 1,000 technology files and 200 methodology innovations for its latest advanced technologies of 7nm, 12nm and 3D IC design enablement platforms within two years. EDA tools, features, and IP solutions are readily available for customers to adopt to meet their product requirements at various design stages.

TSMC held Open Innovation Platform® (OIP) Ecosystem Forum in September 2017 in California, USA. Dr. Cliff Hou, TSMC Vice President of Design and Technology Platform, highlighted that to help our customer products’ time-to-market, TSMC has expanded design ecosystem solutions to address market demands with four application specific design platforms consisting of Mobile, High Performance Computing (HPC), Internet of Things (IoT) and Automotive. In addition, TSMC continues to enhance 3D IC solutions to integrate High Bandwidth Memory (HBM) on Integrated Fan-Out (InFO) design flows to meet customer’s system integration and high memory bandwidth requirements. Furthermore, machine learning is being leveraged to enhance customer design Power, Performance, Area (PPA) and productivity.

Throughout the integration of various R&D resources, TSMC’s OIP partners can be more focused on developing more innovations by leveraging the comprehensive ecosystem. Even smaller customers can leverage OIP to overcome obstacles they are facing, and accelerate their product roadmap.

For more details, please refer to our website: “TSMC Assists Customers to Improve First-time Silicon Success”

Effectiveness Analysis of Elite Seeds Camp

- Highest Rate: 5
- Overall satisfaction
- Understanding of semiconductor (After camp)
- Understanding of semiconductor (Before camp)

<table>
<thead>
<tr>
<th>Year</th>
<th>Overall satisfaction</th>
<th>Understanding of semiconductor (Before camp)</th>
<th>Understanding of semiconductor (After camp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>4.3</td>
<td>3.2</td>
<td>4.3</td>
</tr>
<tr>
<td>2016</td>
<td>4.5</td>
<td>3.1</td>
<td>4.5</td>
</tr>
<tr>
<td>2017</td>
<td>4.5</td>
<td>3.2</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Case Study

Elite Camp

TSMC Elite Camp is held annually to motivate top talents to pursue nanoelectronic-related research projects starting from their undergraduate years. Through research centers, 60 outstanding undergraduate students are invited to explore the semiconductor industry from the perspective of applications in daily life and future development of technology. Academic exchange and company visit activities are designed to inspire participating students’ interest in semiconductor. Statistics of 2015 – 2017 also show that, by attending Elite Camp, the participants’ understanding of semiconductors was significantly increased.
TSMC University Collaboration Programs

University Research Center

TSMC is committed to talent development in the semiconductor industry. Starting from 2013, four research centers have been established at National Chiao Tung University, National Taiwan University, National Cheng Kung University, and National Tsing Hua University, with 1,840 students participating. Through industry-academia cooperative projects, high-caliber talents are nurtured for semiconductor industry development, and professors are encouraged to initiate new research programs. As of 2017, over 100 patents have passed TSMC internal verification process, and filed for U.S. patent application. In 2017, TSMC invested over NT$100 million in industry-academia research, supporting the work of 1,181 students on semiconductor-related research projects across Electronic, Physics, Materials Engineering, Chemistry, Chemical Engineering, and Mechanical Engineering fields.

Furthermore, TSMC partners with world's top universities including Stanford, Massachusetts Institute of Technology, and the University of California at Berkeley among others to conduct strategic research programs that aim to develop innovative transistors, wire technology, mask technology, simulation and special process technology research.

University Shuttle Program

TSMC University Shuttle Program is one of the most important design platforms in the world to provide professors and students at leading research universities worldwide with access to advanced silicon process technologies to implement innovative circuit designs. With the University Shuttle Program, TSMC links motivated professors and graduate students in 23 universities worldwide with enthusiastic managers at TSMC. The University Shuttle Program provides the chance for graduate students to implement exciting designs and achieve silicon proof points for innovations in various end-applications and nurturing new generations of engineering talent in the semiconductor field. In 2017, there were 39 publications about "Big Data," "high speed file transfer technology," "SRAM Technology," "Wireless," "Bio" and "Power saving" in International Journals (e.g. ISSCC, ASSCC, JSSC, ISCAS, IEEE VLSI) and International conferences (VLSI Circuits Dig Tech) to expand knowledge of design and innovation on circuit design.
Material Issue

Sustainable Products

**Product Life Cycle Thinking**
Based on comprehensive thinking on product life cycle, we evaluate environmental impacts in each stage to raise product environmental and social friendliness, and improve energy conservation effects for the use and application of semiconductor products.

**Product Hazardous Substance Management**
Continue to promote hazardous substance replacement projects.

**Strategies**

<table>
<thead>
<tr>
<th>TSMC 2020/2025 Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ Complete establishment of methodology for energy saving contribution assessment for semiconductor products application [2020]</td>
</tr>
<tr>
<td>○ 100% compliance for product hazardous substance free legal and customer requirements [2020]</td>
</tr>
<tr>
<td>Strategies &amp; 2020/2025 Goals</td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>Complete establishment and renew of product life cycle assessment of all fabs</td>
</tr>
<tr>
<td><strong>100% Compliance for product hazardous substance free legal and customer requirements</strong></td>
</tr>
<tr>
<td>Target: 100%</td>
</tr>
<tr>
<td><strong>82% Note Verification of PFOA related substances replacement</strong></td>
</tr>
<tr>
<td>Target: 100%</td>
</tr>
<tr>
<td><strong>Complete process used NMP (N-Methylpyrrolidone) phase-down project</strong></td>
</tr>
</tbody>
</table>

Note: The number of runs for process validation requested by special customers was more than the number required by standard practice.
TSMC has the broadest range of technologies and services in the dedicated IC foundry segment of the semiconductor manufacturing industry. We also take into consideration of reducing product environmental and social impacts and energy consumption, and carefully evaluate low hazardous raw materials selection to provide customers with sustainable products that combine innovation and environmental protection.

**Product Life Cycle Thinking**

TSMC considers, clarifies and compares environmental impacts of each stage based on product life cycle, including product design, raw material mining, production and transportation, product manufacturing and transportation, usage, and waste disposal. Therefore, we require good hazardous substance management, pollution prevention, energy saving, water saving, waste reduction and other clean production measures in our own factories. We also require and assist suppliers to do so, and even ask suppliers to have their suppliers do so and establish a semiconductor green supply chain together. These efforts can help customers produce sustainable products with low carbon footprint, low hazard, and use sustainable products with no conflict minerals and no human rights disputes.

In 2017, TSMC completed the revision of its Life Cycle Assessment (LCA) procedure, which stipulated that new fabs should complete the product life cycle, carbon footprint and water footprint inventory and verification within 18 months after the actual production capacity reached 80% of their design capacity. Existing fabs need to be updated at least once every five years in order to truly grasp the environmental impacts of each fab’s product life cycle, and to promote relevant continuous improvement programs.

TSMC continues to encourage and assist suppliers to set up greenhouse gas (GHG) and water inventory procedures. We have collaborated with raw material suppliers and integrated circuit assembly vendors to complete 12-inch wafer and packaged integrated circuit product carbon footprints, which passed third party certification based on the ISO14067 product carbon footprint standard and the ISO14046 product water footprint standard. We not only can provide related information to customers but also continue to promote carbon reduction and water saving in the supply chain and TSMC from a life cycle point of view.

**TSMC Product Life Cycle Environmental / Social Impacts Consideration**

- **Raw material supplier**: Hazardous substance management
- **TSMC fabs**: Responsible business alliance and its code of conduct
- **Assembly and testing factories**: Product hazardous substance free
- **TSMC Customers and End Product Customers**: Product carbon footprint, Product life cycle assessment
- **ICT Products Assembly and Sale**: Energy saving of products, Product application enables energy saving
- **ICT Products Use**: Pollution control, Waste disposal properly
- **Waste disposal and recycling vendors**: Mobile calculation and wireless communication bring convenience to life
- **Waste disposal and recycling**: Responsible business alliance and its code of conduct
- **Social Impact Consideration**: Occupational safety and health
- **Environmental Impact Consideration**: Greenhouse gas reduction, Energy saving, water saving, Waste reduction, Pollution prevention

TSMC continues to encourage and assist suppliers to set up greenhouse gas (GHG) and water inventory procedures. We have collaborated with raw material suppliers and integrated circuit assembly vendors to complete 12-inch wafer and packaged integrated circuit product carbon footprints, which passed third party certification based on the ISO14067 product carbon footprint standard and the ISO14046 product water footprint standard. We not only can provide related information to customers but also continue to promote carbon reduction and water saving in the supply chain and TSMC from a life cycle point of view.
According to TSMC wafer product carbon footprint and water footprint inventory results, the wafer manufacturing stage and raw material mining, production and transportation account for about 70% and 30%, respectively. TSMC continues to improve carbon reduction, water saving and waste reduction. TSMC also asks aggressively for green actions from suppliers although their carbon and water footprint are relatively low.

For more TSMC sustainable supply chain measures, please refer to “Supplier Sustainability Management” in this report.

**Product Hazardous Substance Management**

TSMC’s principles to highly hazardous materials are (1) avoid use if possible (2) use less if possible. By practicing QC 080000 to establish its internal hazardous substance management system, TSMC prevents using hazardous substances contained raw materials in process and ensures that finished wafer and assembly products comply with international regulations and customer requirements. In the raw material procurement stage, TSMC’s Quality & Reliability Organization collaborates with procurement organization and corporate environment, safety and health organization to develop green procurement procedure, and strictly controls supplier engineering changes, includes green manufacturing as one of the important items of our supplier audit, and extends TSMC’s green products quality requirements to raw material suppliers so as to prevent using harmful substances in TSMC from sources. At the product production stage,
besides carefully reviewing the engineering change to avoid misusing hazardous substances contained raw materials, TSMC’s Quality and Reliability organization has worked closely with operation organization and corporate environment, safety and health organization to implement process improvement to phase out raw materials that might be listed as banned or restricted hazardous substances in the future year by year to ensure TSMC’s green manufacturing capability.

In recent years, as Perfluorooctanesulfonic Acid (PFOS) and perfluorooctanoic acid (PFOA) and its related substances may harm human body and the environment, the international legislation has gradually led to regulation. TSMC led the global semiconductor industry and has completely stopped using raw materials containing PFOS and PFOA in year 2010 and 2015 respectively, and all products do not contain these substances. Although PFOA related substances include its precursors and derivatives have not yet been restricted to be used in semiconductor manufacturing processes in the world, TSMC has initiated chemical replacement projects in 2016. As of 2017, we have completed 82% of the verification process for alternative substances. It is expected to be 100% completed in 2018.

In addition, in order to respond to the requirements of Article 14-1 of the Water Pollution Control Act of Taiwan, factories must reduce the hazardous substances discharged into the wastewater to reduce the environmental and health risks. TSMC has conducted N-Methylpyrrolidinone (NMP) - hazardous substance used in process reduction program since 2016 to prevent it from being discharged into the wastewater. This project was conducted on schedule in 2017 and is expected to be completed in 2018.

### Gating Hazardous Substance from the Sources – TSMC Green Procurement for Hazardous Substances

#### Prohibited or Restricted Substances
- 25 categories of prohibited or restricted substances including legal, customer requirements and TSMC voluntary.
  - Prohibit or restrict containing in process raw materials or products

#### Controlled Substances
- Carcinogenic, mutagenic or toxic for reproduction (CMR) substances.
  - "Not use" as the principle, but to be used following environmental, safety and health requirements and approval of R&D, Operation Vice Presidents and Corporate ESH unit if no available alternatives.

#### Reportable Substances
- Required to report by regulations
  - Use after confirming related information
Tasks of 2018

Complete establishment or renewal of product life cycle assessments, carbon footprints and water footprints in all fabs, and continue to promote product life cycle environmental impacts reduction projects.

Complete all PFDA related substances alternative chemical verification and replacement gradually.

Continue to collaborate with ITRI Industrial Economics and Knowledge Center and MIT to further study the energy conservation contribution of global information and communications technology and semiconductor products to other industries and smart households.

**Case Study**

**Assist Customers in Producing Sustainable Products that Consume Less Energy and Enable Global Energy Conservation**

With the continuously vigorous development of global information and communications technology (ICT) industry, and in various ICT products including computers and communication equipment, integrated circuit (IC) plays a key role. TSMC is not only the world’s largest dedicated semiconductor foundry and an important component of ICT industry. To understand better efficiency of energy consumption and the enablement of potential energy saving to other industries and livelihood by using advanced ICT products, TSMC collaborated with IEK and the U.S. Massachusetts Institute of Technology (MIT) to conduct a research on the contribution of the application of ICT products to Taiwan overall energy conservation. From the result, it can be inferred that when R&D in the ICT industry increased by 1.0%, energy consumption decreased by approximately 0.27~0.31%, whereas TSMC's R&D expenditure was 21.8% of the entire ICT industry in Taiwan. In addition, smart applications of ICT products in various fields have an effect of saving 2%-7% energy.

For more details, please refer to TSMC CSR website: “TSMC Assists Customers Manufacturing Lower Energy Consumption Products and Enabling Global Energy Saving Sustainable Solutions.”

ICT Products

Various Smart Applications

Enable Global Energy Conservation
Material Issue
Product Quality

Quality Culture Enhancement
- Enhance internal quality culture by promoting continual improvement programs
- Enhance local supply chain’s quality culture and competitiveness by promoting their participation in National Quality Control Circle competition

Quality Capability Enhancement
- Increase employees’ productivity by establishing 12-inch wafer outgoing visual inspection defect automatic classification system with machine learning methodology
- Ensure employees’ health and safety by establishing chemical lab’s capability for hazardous substance analysis

Quality Application Realization
Complete reliability qualification for leading technologies and specialty technologies at design and development stage according to the technology roadmap

- Create NT$10 billion benefit from continual improvement programs annually
  2020
- 90% local suppliers participate in the National Quality Control Circle competition (original goal “80%” is planned to be achieved in 2018)
  2020
- Increase visual inspector’s monthly productivity for 12-inch wafers to 5,670 pieces
  2020
- Establish 100% (813) materials’ analysis capability for carcinogenic, mutagenic, or toxic for reproduction (CMR) substances
  2020
- Complete reliability qualification for 5nm technology and characterize the process window
  2020
2017 Achievements

42,056 Suggestions were issued from basic level
- Target: Issue 38,000 suggestions

10.1 billion Benefit created from suggestions and continual improvement cases
- Target: Create NT$10 billion benefit

4,747 Increased visual inspector’s monthly productivity for 12-inch wafers to 4,747 pieces
- Target: 4,500 pieces 12-inch wafer

23% (183 materials’ analysis capability)
- Target: Established 18% (146) materials’ analysis capability
- Completed the second generation Integrated Fan-Out (InFO) assembly technology and reliability qualification for application processor with integrated passive device
- Completed the Chip on Wafer on Substrate (CoWoS) assembly technology and reliability qualification for advanced silicon technology chip with High Bandwidth Memory
- Completed the Diffractive Optical Element (DOE) process development and reliability qualification to support mobile phone with 3D sensing and facial recognition application
- Completed reliability qualification for 7nm technology and characterized the process window

2,020 Continual improvement cases were completed
- Target: Complete 1,850 continual improvement cases

74% Of local suppliers participated in the National Quality Control Circle competition
- Target: 60% of local suppliers

Completed the second generation Integrated Fan-Out (InFO) assembly technology and reliability qualification for application processor with integrated passive device
Completed the Chip on Wafer on Substrate (CoWoS) assembly technology and reliability qualification for advanced silicon technology chip with High Bandwidth Memory
Completed the Diffractive Optical Element (DOE) process development and reliability qualification to support mobile phone with 3D sensing and facial recognition application
Completed reliability qualification for 7nm technology and characterized the process window

2018 Targets

Issue 41,228 suggestions from basic level
- Target: Complete 1,957 continual improvement cases

Create NT$10 billion benefit from suggestions and continual improvement cases
- 80% of local suppliers participate in the National Quality Control Circle competition

Increase visual inspector’s monthly productivity for 12-inch wafers to 4,860 pieces

Establish 49% (396) materials’ analysis capability for carcinogenic, mutagenic, or toxic for reproduction (CMR) substances
- Target: Create NT$10 billion benefit

Establish 49% (396) materials’ analysis capability for carcinogenic, mutagenic, or toxic for reproduction (CMR) substances
Quality is the critical factor for TSMC’s sustainable development. To continuously provide excellent product quality while providing a green, healthy, safe and enjoyable working environment, and also establish a customer-oriented approach to quality – these are what the Quality and Reliability Organization have always insisted upon.

The sciences and technologies change with each passing day. In addition to traditional 3C (Computer, Communication, Consumer) products, with the increasing popularity of new electronic products – Mobile Device, Internet of Things (IoT), Smart Car, Virtual Reality (VR) and Artificial Intelligence (AI) – our safety and convenience are closely linked with the quality and reliability of electronic products. Semiconductors are the soul of electronic products, and TSMC is the world’s largest integrated circuit technology and services provider. We lead in technology development, achieving our commitment to our customers to provide them with the quality and reliability they count on, along with low power and high performance.

To ensure sustainable development with excellent product quality, the Quality and Reliability organization promotes continual improvement activities for TSMC’s quality culture enhancement and deploys them to supply chains for management consideration, introduces new methods for quality capabilities enhancement, and collaborates with other organizations to have strict reliability qualifications for ensuring each product application.

**Quality Culture Enhancement**

In TSMC, quality is the basis for all work and services. All employees are dedicated to increasing quality in all aspects of our business. The benefits are not only product quality improvement but customer satisfaction enhancement.

To enhance corporate quality culture with continual improvements on product quality, production efficiency, cost reduction and customer satisfaction, TSMC fully promoted the "Suggestion" in basic levels and the activities of "Continual Improvement Team (CIT)". TSMC also held a corporate-level "Total Quality Excellence and Innovation Conference." With the public rewards and praises, we expect to provide a cross-department communication and study platform with continual improvement cases sharing. It aims to enhance employees’ problem solving and innovation capabilities for achieving the win-win goal of TSMC’s competitiveness and customer satisfaction. In 2017, there were 42,056 suggestions issued by the basic levels and a total of 2020 continual improvement team activities were registered and implemented. The benefits from these improvement cases were NT$10.1 billion. Among them, 45% (915 cases) of continual improvement team activities were related to product quality enhancement.

**Quality Culture Enhancement**

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**Continual Improvement Team (CIT) Program**

<table>
<thead>
<tr>
<th>Unit: case</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013: 1,252</td>
</tr>
<tr>
<td>CIT Cases (Actual)</td>
</tr>
</tbody>
</table>

**Suggestion Program**

<table>
<thead>
<tr>
<th>Unit: thousand cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suggestion Cases (Actual)</td>
</tr>
</tbody>
</table>

**Benefit from Suggestion Program and CIT**

<table>
<thead>
<tr>
<th>Unit: NT$ billion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefit</td>
</tr>
</tbody>
</table>

Note 1: Suggestion – Employee identifies ways to improve routine jobs and initiates action with the manager. The scope of suggestion includes Quality, Cost, Transportation, Production Process, Service, Safety, Facility and Equipment.

Note 2: Continual Improvement Team (CIT) – A cross functional task force formed with three to 10 member solves the same work related problems. The improvement targets are related to Quality, Cost, Delivery, Service, Productivity, Process Technology and Safety.
In addition to internal cross-department communication and study, TSMC also participates in the National Quality Control Circle (NQCC) competition to share and learn continual improvement methods in a cross-industry communication and study setting. Other local industries can adopt improvements learned from TSMC’s sharing, and TSMC employees can also enhance capabilities of problem solving and innovation with the learning from others’ sharing. In 2017, TSMC secured six gold and two silver medals in the National Quality Control Circle competition and Fab 6 was the team with the most gold medals since the inception of these awards. With their perfect mechanisms for continual improvement, TSMC also won first prize for “Excellent Promotion for Continual Improvement Activities in Taiwan” over the past 30 years.

Example in 2017 Total Quality Excellence and Innovation Conference

<table>
<thead>
<tr>
<th>Group</th>
<th>Cases</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality Enhancement</td>
<td>To improve the methods in Lithography processes</td>
<td>99.7% Enhanced product yield to 99.7%</td>
</tr>
<tr>
<td>Quality Enhancement</td>
<td>To improve the methods in Integrated Fan-Out (InFO) clean process</td>
<td>88% Improved test reject rate 88%</td>
</tr>
<tr>
<td>Quality Enhancement</td>
<td>To improve the methods in Furnace process</td>
<td>75% Reduced specific product defect rate 75%</td>
</tr>
<tr>
<td>Quality Enhancement</td>
<td>To improve the methods in 3D image sensor Etching process</td>
<td>50% Enhanced image resolution 50%</td>
</tr>
<tr>
<td>Customer Satisfaction</td>
<td>To develop 40nm Ultra Low Power technology</td>
<td>80% Improved customer product standby power performance 80%</td>
</tr>
<tr>
<td>Customer Satisfaction</td>
<td>To establish innovative design service platform for stacked CMOS image sensors</td>
<td>70% Shortened customer product development schedule for image analysis and test 70%</td>
</tr>
<tr>
<td>Environment, Safety, Health</td>
<td>To reduce 8-inch Fab carbon emissions and save energy</td>
<td>63,500 metric tons Reduced CO2 emission 63,500 metric tons and saved the use of electricity 60,290,000 kWh annually</td>
</tr>
</tbody>
</table>

TSMC’s Cases in 2017 National Quality Control Circle Competition

- To improve the transportation in 10nm Fab: Gold Medals
- To establish the Mask automated production line: Gold Medals
- To improve the metal etching process quality: Gold Medals
- To enhance the thin film resistance stability: Gold Medals
- To reduce the carbon emission from wafer processes: Gold Medals
- To improve the quality of wastewater: Gold Medals
- To enhance the product yield stability: Silver Medals
- To improve 16nm Lithography and Grind processes capacity: Silver Medals

Note 1: In Taiwan, the National Quality Control Circle competition is held by Corporate Synergy Development (CSD) Center which is commissioned by the Industrial Development Bureau of the Ministry of Economics. The purpose of the National Quality Control Circle competition is to promote the continual improvement team activity to public and private organizations for their enhancement. With the competition, organizations among different industries have a communication and study platform to learn improvement methods from others and enhance their international competitiveness.

To strive for a win-win between TSMC and local suppliers, the Quality and Reliability organization not only enhances TSMC’s corporate quality culture, but also coaches local suppliers to participate in the National Quality Control Circle competition for suppliers’ quality culture and capability enhancement by applying the practices of continual improvement. In 2017, local suppliers’ participation rate in National Quality Control Circle competition was 74% and suppliers secured two Silver Medals and seven Bronze Medals.

**Quality Capability Enhancement**

The failure analysis capability plays an important role to support advanced and specialty technology development, reliability qualification and mass production timing. To help customers meet their time-to-market requirements, the Quality and Reliability organization collaborates with academics, suppliers and customers to develop failure analysis techniques, enrich advanced material and chemical analysis capabilities and enhance fault isolation methods. TSMC continually enhances its manufacturing capabilities. To reduce product defects, enhance process controls, detect abnormalities early and prevent quality events affecting customers, the Quality and Reliability organization and Operation organization collaborate to establish real-time defense systems by applying advanced statistical methods and quality tools. In 2017, the deep machine learning methodology had successfully been applied for advanced spectral analysis to detect differences among processes and equipment, and triggered improvement actions. With machine learning methodology, an automatic defect classification system for 12-inch wafers outgoing visual inspection was also established to enhance the consistency of visual inspection and enrich a visual inspector’s monthly productivity to 4,747 pieces.

### Suppliers’ National QCC Participation Rate

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>2%</td>
<td>26%</td>
</tr>
<tr>
<td>2015</td>
<td>20%</td>
<td>43%</td>
</tr>
<tr>
<td>2016</td>
<td>40%</td>
<td>68%</td>
</tr>
<tr>
<td>2017</td>
<td>74%</td>
<td></td>
</tr>
</tbody>
</table>

### 12-inch Wafer Outgoing Visual Inspector Productivity

**Unit:** wafer (piece)

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>3,500</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>4,076</td>
<td>4,000</td>
</tr>
<tr>
<td>2015</td>
<td>4,247</td>
<td>4,150</td>
</tr>
<tr>
<td>2016</td>
<td>4,441</td>
<td>4,325</td>
</tr>
<tr>
<td>2017</td>
<td>4,747</td>
<td>4,500</td>
</tr>
</tbody>
</table>

**Highlights in 2017**

- Enhanced 35% resolution of fault isolation equipment
- Completed fault isolation capability buildup for 7nm, extendable to support 5nm
- Established scanning and transmission electron microscopy laboratory in Nanjing site and executed failure analysis since Nov. 2017
- Enhanced trace metal impurity analysis capabilities to Part Per Trillion (PPT) level for 10 chemicals
- Established organic impurity analysis capabilities for 10 chemicals
- Coached suppliers to enhance their analysis capabilities for trace metal impurity in chemicals to Part Per Trillion (PPT) level
- Coached suppliers to establish organic impurity analysis capabilities for chemicals
On the other hand, to prevent carcinogenic, mutagenic and reprotoxic (CMR) substances in materials affecting employees’ health and safety, Quality and Reliability organization enhanced the chemical laboratory’s ability to detect and analyze hazardous substances. With risk assessment, the Quality and Reliability organization collaborated with the Environmental Safety and Health organization to establish a sampling plan for analyzing suspicious materials used in TSMC. For new material control, suppliers were also required to declare their compliance and a sampling inspection was executed by TSMC to validate suppliers’ declarations. In 2017, the Quality and Reliability organization established 23% (183) suspicious materials’ analysis capability for CMR substances.

In addition to meeting customers’ requirements, striving for customers’ satisfaction and creating customers’ value, product quality must be balanced with environmental sustainability to ensure environmental and ecological stability, and sustainable development. To comply with the European Union’s regulations and the customer’s green product requirements, TSMC integrated the IECQ QC 080000 hazardous substance process management system developed by the International Electrotechnical Commission Quality Assessment System with automotive quality management system IATF 16949. The hazardous substance management requirements were built-in the operations of process design and development, material procurement, supply chain management and process controls. In 2017, suppliers were required to provide materials with non-PFOA (Perfluorooctanoic acid) derivatives for replacement of existing materials with PFOA derivatives. Additionally, a third-party audit verified the effectiveness of TSMC’s hazardous substance process management system and quality management systems in compliance with IECQ QC 080000 and IATF 16949. Equally important, the products made by TSMC complied with European Union regulations and customer requirements with the sampling validation by a third-party external laboratory.

Quality Application Realization
To provide excellent and reliable product quality for customers’ requiring timely delivery, ensuring users’ safety and product applications, and preventing post-production recalls, the Quality and Reliability organization assists customers in the technology developmental stages and product design stages to design-in superior product reliability. An automotive quality improvement program is in place to meet automotive customers’ low Defect Parts Per Million (DPPM) requirements.

In 2017, the Quality and Reliability organization collaborated with R&D to complete reliability qualifications for leading-edge 7nm technology (the third FinFET generation), the second generation Integrated Fan-Out (InFO) assembly technology for application processors with integrated passive devices, the Chip on Wafer on Substrate (CoWoS®) assembly technology for advanced silicon technology solutions with High Bandwidth Memory, and the Diffractive Optical Element (DOE) supporting mobile phone with a 3D sensing and facial recognition application. In addition, the design rules for automotive products were also enhanced and the Automotive Quality System migrated to version 2.0 which enhanced Fab in-line and Wafer Acceptance Test process capability and strengthened maverick wafers handling. TSMC also provided dedicated resources for customer return analysis and timely physical failure analysis (PFA) for process improvement. With these efforts, TSMC did not have any product recalls in 2017.

Tasks of 2018

Add “New Quality Tool Application” competition group in Total Quality Excellence (TQE) & Innovation Conference

Enhance outgoing visual inspection defect automatic classification system and chemical laboratory’s capability for material analysis

Complete 7nm technology and specialty technologies reliability qualification

Materials’ analysis capability for CMR substances

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2014</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>2017</td>
<td>23</td>
<td>0</td>
</tr>
</tbody>
</table>

For more details, please refer to TSMC’s 2017 Annual Report “5.3.5 Quality and Reliability”.

Actual Goal
Material Issue

Customer Service

**Strategies**

1. **Customer’s Virtual Fab**
   - Provide complete and timely information to facilitate production success; enhance process and security mechanism to ensure customer information protection.

2. **Listen and Respond to Customer Needs**
   - Closely collaborate with customer and conduct meeting/questionnaire to understand and answer customer’s questions, so that we can provide the best customer service.

**TSMC 2020/2025 Goals**

- Align with TSMC technology development roadmap, available technologies through TSMC-Online to reach 370 by 2025.
- Pass customer product information audit without major defect in 2025.
- “Customer Service” score in Quarterly Business Reviews to reach 75% with satisfactory feedback by 2025.
0
Pass customer product information audit without major defect
Target: Pass customer product information audit without major defect

8.8
"Customer Service" score in Quarterly Business Reviews reaches 8.8 points
Target: Reach 8.8 points
To provide the best service to customers, TSMC has a dedicated customer service team as the main contact window for coordination and facilitation. TSMC strives to provide world-class design support, mask making, wafer manufacturing, and backend services. TSMC also protects customers' confidential information with the highest standard. These are aimed at achieving an optimum experience for customers and enable customer success, so TSMC can be a reliable partner customers can trust.

Customer’s Virtual Fab

Customer trust has always been a very important core value in TSMC, and it is also the reason why customers entrust their manufacturing service to TSMC. Real-time interactive information exchange and secure customer information protection are the key factors to win customer trust.

Regarding the real-time interactive information exchange, TSMC has provided the web-based TSMC-Online system which offers customer integrated service for design, engineering and logistics. With this service, customers can have 24/7 access to the most critical information and customize their reports based on their unique requirements and management key index. Through TSMC-Online, TSMC has offered a transparent and complete semiconductor manufacturing information system which serves as a customer's virtual fab. This enables customers to have real-time access and control over the entire production cycle with access to critical information to help them achieve product success. In 2017, TSMC offered a new “Customer Service Package” which allows customers to have fast and convenient access to the corresponding service function based on the product life cycle.

Customer Service Strategy Pyramid

Customer Trust

Virtual Fab

Listen and respond to customer needs

Complete & timely information via TSMC-Online

Customer information protection

Close collaboration
Regarding customer information security, TSMC is committed to protect all customers’ proprietary information. With the Virtual Fab architecture, TSMC has implemented special security controls throughout the customer’s product lifecycle that are examined and refined every year. In 2017, TSMC enhanced customer information access with even more comprehensive control on TSMC-Online. Customers can only access TSMC-Online through pre-defined and verified security paths and are required to update passwords regularly, all aimed for eliminating any security risk. In 2017, TSMC passed all customer audits on product and information protection and specific security products, TSMC has supported customers to pass the ISO 15408 product security audit successfully. Besides, no customer complaints relating to information leakage. In 2018, TSMC plans to certify the security and information protection related audit for specific Fab locations, to ensure the safe production of wafer manufacturing. We aim to pass all customer product and information protection audits each year, and continuously strengthen customer trust and partnership with TSMC.

Listen and Respond to Customer Needs

To assess customer satisfaction and ensure that our customers’ needs are appropriately understood, Quarterly Business Reviews (QBRs), which include technology, quality, yield, design support, customer relationship and customer service, are conducted by the customer service team so customers can give feedback to TSMC on a regular basis. Customer feedback is routinely reviewed and considered by executives and then developed into appropriate improvement plans, all-in-all becoming an integral part of the management process with a complete closed loop.

In 2017, “Customer Service” score in Quarterly Business Reviews with satisfactory feedback is 71%, with 1% loss as compared to 2016. The major reason for this minor decrease is due to the length of time it took for technology collaboration discussion and decision. In the future, TSMC will improve the communication process and enhance the collaboration information sharing in order to facilitate rapid decision making on projects, and move toward the 2025 goal of reaching 75% in customer service satisfaction.
TSMC also conducts the Annual Customer Satisfaction Survey (ACSS) with most active customers, either by web survey or interviews through an independent consultancy. The ACSS is divided into 3 categories: Behavioral, Image and Execution. TSMC uses customer survey data as a base to identify future focus areas for customer relationship development. Through surveys, feedback reviews and intensive interaction with customers, TSMC is able to maintain close contact for better service and collaboration. In the future, TSMC will continue to focus on technology leadership, manufacturing excellence and customer service to enable win-win partnerships with our customers.

TSMC believes that continuous innovation, high quality products, and superior customer service are critical to enhancing customer satisfaction, thereby retaining existing customers, attracting new customers, strengthening customer relationships, all leading to higher levels of retention and expansion. In 2017, TSMC manufactured 9,920 different products for 465 customers, deliver 10.5 million 12-inch equivalent wafers with an 8.8% year-over-year increase. In the global integrated semiconductor industry, TSMC will keep playing its role of the trusted technology and capacity provider and an important partner to customer success.

Proprietary Information Protection

Proprietary Information Protection is a promise from TSMC to customers, shareholders and employees. TSMC responds to the increasing importance of proprietary information protection in regard to maintaining current and future competitive advantage, and devises “Proprietary Information Protection — PIP” policy to define the proprietary information protection and management guidelines. TSMC trade secrets and related undisclosed confidential information are protected under these guidelines in the best interest of company, shareholders, employees, customers, and vendors. TSMC PIP strategy is based on Plan-Do-Check-Act, PDCA management, which continuously upgrades the information protection mechanisms, raises PIP awareness in employees, and mitigates the risk of information disclosure.

TSMC promotes PIP programs continuously, including annual PIP training classes and several promotion channels, not only to employees but also to TSMC 2017 Corporate Social Responsibility Report
vendors. In 2017, TSMC further enhanced vendor information access and badge control, in addition to promoting PIP in annual vendor meetings. TSMC ensures proprietary information protection by forming an alliance with vendors.

2017 Proprietary Information Protection Enforcement Status

8 Promotion Micro Films
8 PIP micro films to deliver PIP major concepts

12 Regulations
Newly created or revised 12 Proprietary Information Protection regulations

1.2% Employee PIP violation rate: 1.2%
Main cause: individual negligence or fail to comply with PIP procedures
Corrective actions:
• Reinforce PIP promotions and training by multiple channels
• Information access control for resigned employees
• Document printing and information access control enhancement.

5 Customer Security Audits
Passed 5 customer security audits and certifications, ensured product information protection during manufacturing.

100% Over 3,000 newcomers completed Proprietary Information Protection training course

100% Over 10,000 new vendors completed 153 Proprietary Information Protection training courses

45,000 Employees
Over 45,000 employees completed Proprietary Information Protection annual refresh e-learning course
Course content:
• PIP policy and core concepts
• PIP milestones and new regulations in 2017
• PIP violation case studies and reminders
• PIP information channels

94 Points
94 points average score for employees PIP engagement
• Conducted PIP engagement survey, collected over 42,000 surveys and over 91% response rate. Survey results show significant PIP engagement with 94 points

3M Checks
3 million PIP checks conducted per month, including:
• PIP prohibited item inspection
• Physical access compliance check
• Proprietary information handling
• E-mail handling
• Vendor PIP compliance check
TSMC Delivers Unrivalled Manufacturing Service

2017 total wafer shipments increased 8.8 percent from 2016 to reach 10.5 million 12-inch equivalent.

TSMC Europe

HQ & Fab 12

Fab 2, 3, 5, 8

Fab 15

Fab 14

WaferTech

TSMC Japan

TSMC Korea

TSMC (Nanjing)

TSMC (China)

TSMC 2017 Corporate Social Responsibility Report
Responsible Supply Chain

A Responsible Purchaser

As a responsible purchaser, TSMC has fully developed a semiconductor green supply chain. TSMC is committed to communicating with and encouraging its suppliers to improve their quality, cost effectiveness, delivery performance and sustainability in environmental protection, safety and health. We not only seek to drive innovation with our suppliers but also enhance their management capabilities to pursue a sustainable future.

100%
100% of the new suppliers signed the Supplier Code of Conduct.

100%
100% of materials sourced from Responsible Minerals Assurance Process (RMAP) conformant smelters.

20.5%
Reduced unit waste production of major local waste-producing suppliers by 20.5% (against the 2014 baseline).
Strengthen Supply Chain Management

- Suppliers comply and sign the Letter of Assurance of TSMC "Supplier Code of Conduct" by 2020.
  - Intensify the promotion of new "Supplier Code of Conduct" and "TSMC whistle blower system" and raise awareness rate to 98% and 95% respectively.
- 100% of first-tier suppliers sign the Letter of Assurance by 2020.
- 80% of the critical second-tier suppliers sign the Letter of Assurance by 2025.
- Intensify supplier audit:
  - Each year, 30 suppliers are selected as potential high-risk for conducting third-party audit with RBA standard, and there will be 240 suppliers participating in all by 2025.
  - Due diligence audit will be conducted for all conflict mineral suppliers by 2025.

Note 1: The Electronic Industry Citizenship Coalition (EICC) is now the Responsible Business Alliance (RBA).
Note 2: Based on a 2017 supplier survey by the third-party company shows that 6.1% of suppliers do not know the TSMC Supplier Code of Conduct, and 17.2% of suppliers do not know the TSMC whistleblower system.
Note 3: The sign-off ratio is determined by spending ratio. The major upper-tier suppliers (top 80% of the first-tier supplier’s spending) of major first-tier suppliers (top 80% of TSMC’s spending) called the critical second-tier suppliers.
2017 Achievements

86.5% Existing Suppliers Signed
Target: 80% of the existing suppliers are to sign Supplier Code of Conduct

100% New Suppliers Signed
Target: 100% of the new suppliers are to sign Supplier Code of Conduct

84% Supplier Site Audits
Target: Conduct 90 supplier audits to ensure the compliance of RBA standards

100% Materials Source from RMAP Conformant Smelter
Target: 100%

2018 Targets

- 90% of all suppliers are to sign the Code of Conduct (new supplier must be 100% compliant and sign the Letter of Assurance before doing business with TSMC)
- 30% of the major second-tier suppliers sign the Code of Conduct
- Intensify supplier man-hour management to ensure the compliance of laws and regulations of supplier employees working at TSMC sites
- Organize responsible supply chain forum and jointly establish the long-term goals against ESG issues
- Require 30 suppliers to cooperate with third-party audit firm and to accept professional audits with RBA standards
- The achievement rate for priority issues improvement must be higher than 80% Note 4
- Conduct documentation audit on at least 3 suppliers to verify its due diligence efforts in ensuring 100% conflict-free sourcing

Note 1: In 2017, TSMC internal audit found that the suppliers’ employees working at TSMC sites had the problem of consecutively working for 7 days. In addition to amplifying the suppliers’ education, TSMC also took the initiative to improve all cases it discovered

Note 2: Due to VAP capacity limitation, only 84 audits were conducted in 2017

Note 3: The priority issues include a grievous breach of ethical standards, significant risk of immediate harm to workers or communities, exploitative violations of worker rights, predefined priority guidance in RBA code of conduct and priority findings in audit protocol

Note 4: The priority issues identified in the fourth quarter of the year would take at least 30 days to improve, making the goal of achievement to be set at more than 80% instead of 100%
Material Issue
Supplier Sustainability Management (2/2)

Strategies

TSMC 2020/2025 Goals

- Counsel suppliers
  - At least 20 suppliers are invited to participate and to observe TSMC emergency response drill every year, and there will be 160 supplier participants in all by 2025
  - Every year, 50 suppliers are selected as potential high-risk for ESH training. There will be 400 suppliers in all trained by 2025
  - Counsel suppliers to improve process and quality, with 38 suppliers counselled in all from 2016 to 2020
  - Reduce waste volume of major local waste-producing suppliers by 24% relative to that in 2014

- Increase local purchasing ratio
  - by 47% for raw material
  - by 70% for spare parts
  - by 38% for backend tools

Improve Supply Chain Resilience
Assist supplier to strengthen capability of emergency response, implement occupational safety and hygiene, improve process and quality

Note 1: Localization plan is currently limited to TSMC Taiwan which has more influential power than in other regions
Note 2: Raw material’s purchasing includes direct and indirect materials. Due to wafer capacity and quality in Taiwan failed to fulfill the requirements of TSMC which is the main reason that the local purchasing of raw material was unable to meet 2017 target. Therefore, the localization target of raw materials in 2020 has been adjusted from 50% to 47%
The waste output of major local waste-producing suppliers will be reduced by 21.5% (compared with 2014).

Note 1: Publish TSMC ESH Guidance, and provide suppliers the new ESH standards for reference.

Note 2: Plan to invite at least 20 suppliers to participate and to observe TSMC emergency response drill.

There will be more than 1,000 man-hours for suppliers to participate in ESH training and to elevate the average score of ESH performance over 160.

Counsel additional 9 suppliers, and there will be 29 suppliers counselled in all.

The waste output of major local waste-producing suppliers will be reduced by 21.5% (compared with 2014).

### 2017 Achievements

<table>
<thead>
<tr>
<th>Objective</th>
<th>Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevated ESH score by counselling</td>
<td>✓</td>
</tr>
<tr>
<td>Reduced unit waste production of major local waste-producing suppliers (compared with 2014)</td>
<td>✓</td>
</tr>
<tr>
<td>Power-efficient tool models assessed</td>
<td>✓</td>
</tr>
<tr>
<td>Localization for raw materials</td>
<td>✓</td>
</tr>
<tr>
<td>Local material suppliers were counselled for process and quality improvement</td>
<td>✓</td>
</tr>
<tr>
<td>Energy saving activities launched</td>
<td>✓</td>
</tr>
</tbody>
</table>

### 2018 Targets

<table>
<thead>
<tr>
<th>Objective</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publish TSMC ESH Guidance, and provide suppliers the new ESH standards for reference</td>
<td>✓</td>
</tr>
<tr>
<td>Plan to invite at least 20 suppliers to participate and to observe TSMC emergency response drill</td>
<td>✓</td>
</tr>
<tr>
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<td>✓</td>
</tr>
<tr>
<td>Counsel additional 9 suppliers, and there will be 29 suppliers counselled in all</td>
<td>✓</td>
</tr>
<tr>
<td>The waste output of major local waste-producing suppliers will be reduced by 21.5% (compared with 2014)</td>
<td>✓</td>
</tr>
<tr>
<td>Verify the design of energy-saving solutions and confirm that the power consumption of the 34 tool models is 10% lower than the original design</td>
<td>✓</td>
</tr>
<tr>
<td>Achieve 45% on localization for raw materials</td>
<td>✓</td>
</tr>
<tr>
<td>Achieve 68% on localization for spare parts</td>
<td>✓</td>
</tr>
<tr>
<td>Sustain at 33% on localization for backend tool</td>
<td>✓</td>
</tr>
</tbody>
</table>

Note 1: The new ESH guidance adopting RBA standards, and the main difference between them is to add up the detailed procedure of “risk reduction for natural disaster”.

Note 2: Man-hour definition: The number of training participants * time (hours).

Note 3: Raw material’s purchasing includes direct and indirect materials. Due to raw wafer capacity and quality in Taiwan failed to fulfill the requirements of TSMC which is the main reason that the local purchasing of raw material was unable to meet 2017 target. Therefore, the localization target of raw materials in 2020 has been adjusted from 50% to 47%.

Note 3: Raw material’s purchasing includes direct and indirect materials. Due to raw wafer capacity and quality in Taiwan failed to fulfill the requirements of TSMC which is the main reason that the local purchasing of raw material was unable to meet 2017 target. Therefore, the localization target of raw materials in 2020 has been adjusted from 50% to 47%.
Implement Responsible Supply Chain Management

TSMC is dedicated to driving a positive cycle of the industry and supply chain. In order to ensure the safety of the semiconductor supply chain working environment, employees should be respected and treated with dignity, and for operations facilitating environmental protection and ethics, TSMC requires a responsible supply chain adhering to four major executional guidelines: Code Compliance, Risk Assessment, Audit Participation and Keep Improvement.

Supplier Code Compliance and Management Progress

In 2017, 86.5% of TSMC’s 1,349 critical suppliers completed the supplier Code of Conduct sign-off. Through strengthening the advocacy and management mechanism, it was expected that not only critical suppliers, but all suppliers, must complete the code compliance by 2025.

With the support of our supplier partners, TSMC has once again brought a new technology to volume production in record time with our 10nm capacity. We extend our heartfelt thanks and hope to continue working side by side to drive technology forward.

J.K. Lin
Vice President, Operations / Mainstream Fabs and Manufacturing Technology, and Materials Management & Risk Management
Four Major Executional Guidelines

**Standard**
- Comply with TSMC Supplier Code of Conduct
- Measure supply chain risk with Code of Conduct
- Participate professional audit by third-party audit firm, Note
- All weaknesses are classified as priority, major and minor issues. The priority issues must be corrected immediately

**Management Guidance**
- All suppliers must comply and sign Code of Conduct
- Ask critical second-tier suppliers to comply and sign Code of Conduct
- Identify supply chain high risks and take action for priority issues
- Confirm supplier adopting same standard for its supply chain management
- Encourage suppliers to engage third-party audit
- TSMC monitors and assists auditors in the role of observers
- Provide necessary counselling or assistance, arrange re-audit to ensure fulfilment
- Reduce transaction or discontinue business relationship for supplier who failed on Code Compliance

Note: Since 2018, TSMC has collaborated with a third-party audit firm for conducting audits with the codes that are higher than RBA standards, and connecting local suppliers to global standards.
Supplier Risk Assessment

To ensure supply chain is meeting RBA standards, TSMC determines its supplier audit list annually based on Risk Assessment Considerations and makes the major suppliers assess with an SAQ (Self-Assessment Questionnaire). To ensure that the weaknesses can be improved properly, the company will conduct on-site audits to measure these high-risk suppliers and follow their improvement progress with the CAR system accordingly. In 2017, a total of 26 major suppliers completed the SAQ assessment of the head office and its supplying facilities. The assessment results showed that two major suppliers were identified with medium risk and the rest were low risk. Two medium risks were planned for audits in 2018 and traced the improvement by CAR system.

Risk Assessment Flow

<table>
<thead>
<tr>
<th>Major Suppliers (Top 80% spending)</th>
<th>Secondary Suppliers (Remaining 20% spending)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Assessment Considerations</td>
<td></td>
</tr>
<tr>
<td>• Production location</td>
<td></td>
</tr>
<tr>
<td>• Service category</td>
<td></td>
</tr>
<tr>
<td>• Is it either a new supplier, a</td>
<td></td>
</tr>
<tr>
<td>sole source or a supplier for</td>
<td></td>
</tr>
<tr>
<td>new nodes?</td>
<td></td>
</tr>
<tr>
<td>• ESH risk level</td>
<td></td>
</tr>
<tr>
<td>• Historical audit results</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>List in Audit Plan</td>
<td></td>
</tr>
<tr>
<td>Determine Audit Priority with Risk</td>
<td></td>
</tr>
<tr>
<td>Level Consideration and Scheduling</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Major Suppliers</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier Assessed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan, USA, and Western Europe</td>
<td>25</td>
<td>26↑</td>
</tr>
<tr>
<td>Headquarters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplying Facilities</td>
<td>83</td>
<td>92↑</td>
</tr>
<tr>
<td>Assessment Method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Based on SAQ score + supplier risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>assessment considerations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment Results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High risk: 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium risk: 1 headquarters and 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supplying facility, listed in priority audit plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low risk: 24 headquarters and 82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supplying facilities, continue to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>monitor supplier’s risks by SAQ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary Suppliers</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier Assessed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>China, Malaysia, and Taiwan</td>
<td>207</td>
<td>210↑</td>
</tr>
<tr>
<td>Assessment Method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Based on supplier risk assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>considerations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment Results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>106 suppliers are classified with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>potential risk, and listed in audit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supplier pool</td>
<td></td>
<td></td>
</tr>
<tr>
<td>84 suppliers are classified with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>potential risk, and listed in audit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>supplier pool</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coverage</td>
<td>51%</td>
<td>40%</td>
</tr>
</tbody>
</table>

Note: The audit arrangement must consider the risk level and supplier’s schedule to determine the priority of auditing.
Exert Supply Chain Influence Power

TSMC has led its supplier partners in their efforts to improve the sustainability of their environmental, social and economic performance. Through supplier risk assessment, audit and counselling, TSMC continues improving its supply chain management performance. In 2017, TSMC proposed two strategies, "strengthen supply chain management" and "enhance supply chain resilience", and five corresponding actions, so as to continuously improve the weaknesses, and form a positive cycle, as well as expand the sustainable impact of the supply chain. It is expected to have more and more first-tier suppliers and critical second-tier suppliers join the Company to achieve these goals in the future, so that we can join with suppliers to become a force for uplifting society.

Audit Supplier with RBA Standards

TSMC has implemented 84 on-site supplier audits in 2017. TSMC personnel audited 74 suppliers located in Taiwan, whereas 10 suppliers in China and Malaysia were requested to conduct VAP (Validated Audit Process) audits by engaging certified third party auditors who are qualified and familiar with local regulations. Based on 2016 audit result, the major issues are working hours and employment fees that do not meet RBA standards. After reaching common consensus of improvement with suppliers, the audit result in 2017 has reached agreement with RBA standards, and the scores of domestic and overseas audits have also elevated significantly. It shows that the management mechanism of TSMC has effectively improved the overall performance of suppliers.
Action Plan of Responsible Supply Chain

- **2016**
  - Set goal for tool energy saving
  - Continuously reduce waste for high-producing waste suppliers
  - Promote supplier ethics standards
  - Audit supplier with RBA standards

- **2017**
  - Continue supplier ethics promotion
  - Counsel suppliers to enhance process and quality
  - Continuing to audit supplier with RBA standards
  - Employer’s custody of foreign workers’ documents has been identified and resolved

- **2018**
  - Publish new Supplier Code of Conduct
  - The second-tier suppliers are also included in the scope of the responsible supply chain action plan
  - Working with third-party audit firms to perform audits with RBA standards
  - Hold responsible supply chain forum to set long-term environmental goals
  - Intensify due diligence audit for conflict mineral suppliers

- **2019**
  - Continuing to hold responsible supply chain forum and to encourage more suppliers to join the action plan
  - Continuing to organize suppliers’ emergency response observation, ESH training, and counseling suppliers to improve production process and quality
  - More second-tier suppliers are to sign TSMC Supplier Code of Conduct

- **2020**
  - Over 90 suppliers completed RBA standard audit
  - The waste output of major local waste-producing suppliers will be reduced by 24%
  - Increase local purchasing amount by 47% for raw materials, 70% for spare parts and 38% for back-end tool
  - 30% of major second-tier suppliers are to sign TSMC Supplier Code of Conduct

- **2025**
  - 100% suppliers and 80% of the critical second-tier suppliers are to sign TSMC Supplier Code of Conduct
  - Over 240 suppliers participate in RBA standard audit
  - 100% implement due diligence audits for conflict mineral suppliers
Strengthen the Supply Chain Management

TSMC looks forward to cooperating with suppliers for sustainable growth. In 2017, TSMC devoted itself to the actions of labor and human right, occupational safety and hygiene, and environmental protection-related issues to deal with labor dignity, conflict mineral management and ESH performance. We extend the inspection of supply chain to ensure that there’s no abuse and violation of human rights. TSMC provides necessary counseling and training for suppliers and asks them to comply with the Supplier Code of Conduct. Based on that, TSMC promotes the sustainable actions of green supply chain, pursuing circular economy of materials, energy and resources across the industries as well as ensuring the positive development of the supply chain.

Note 1: TSMC invited 12 suppliers, including parts cleaning, chemical manufacturing and waste treatment suppliers, to participate in the “Supply Chain Occupational Health Promotion Program.” in cooperation with Dr. Lin Yuwen, Professor of the Occupational Safety and Health Administration of the Ministry of Labor and Professor of Fu Jen Catholic University on October 3, 2017. By documentation review and on-site audit, we made suggestions for suppliers to improve the management procedure and working environment, hardware construction, and to facilitate labor health.

Note 2 TSMC requested suppliers to disclose the waste output in 2014, and collaborated with 10 suppliers who account for 80% output as waste reduction partners.
Improve Supply Chain Resilience

In response to the challenges of climate change and Moore’s Law, TSMC’s supply chain management focuses on the improvement of supplier’s resilience. By intensifying supplier’s capability of emergency response, continuing process and quality improvement, the corporation’s sustainability operation can be assessed accordingly. TSMC keeps promoting “Raw Material Suppliers Capability Upgrade” to suppliers, and engage with suppliers on materials development, quality improvement, transportation management, packaging enhancement and ESH performance. As of 2017, TSMC has successfully counselled 68 local suppliers, including seven foreign suppliers who invested in their manufacturing lines in Taiwan.

The Responsible Supply Chain of TSMC is based on the Supplier Code of Conduct. The Company expects all suppliers to participate in responsible supply chain actions, examine the risk and performance on aspects of the economy, environment, and society. TSMC works together with upstream and downstream suppliers to make commitments and continuous improvement, and to create a world-class semiconductor supply chain that exceeds international standards and serves as a global benchmark.

Advanced Process and Quality Improvement

The challenges of advanced process in metrology technology improvement, quality requirements, and capacity expansion

- Hold material technology forum and deliver three key requirements of Integrated Material Supply Ecosystem to suppliers
- Establish production capacity that meets quality requirement of advanced materials

- Completed quality improvement for 42 advanced materials
- 20 suppliers completed capacity build-up and 100% fulfilled the requirements on 10nm mass production of the advanced node

Strengthen Supplier’s Resilience

The supply chain is concentrated in the Pacific Rim with frequent earthquakes. The lack of emergency response capacity will lead to a higher risk of supply disruptions caused by disasters.

- Each year, suppliers are invited to observe TSMC’s annual emergency response drill
- Communicate with the supplier executives directly to request immediate improvement

- A total of 21 suppliers were invited to observe TSMC emergency response drill in 2017 and a total of 48 suppliers have been participated

Suppliers observe TSMC Emergency Response Drill
Source Conflict-free Raw Materials

TSMC supports the "responsible sourcing" requirements of the Responsible Business Alliance (RBA, the previous EICC) and the Global Sustainable Initiative Geology Initiative (GeSI), and adopts Responsible Minerals Assurance Process (RMAP, the previous CFSP, Conflict-free Smelter Program) to request and to assist our suppliers to source conflict-free materials. All TSMC suppliers whose products contain gold, tantalum, tin and tungsten are required to source conflict-free raw materials from RMAP conformant smelters in compliance with TSMC conflict-free sourcing policy and to sign a Letter of Assurance to assure their compliance. In 2017, the Company even sets up responsible sourcing standards higher than regulatory requirements, requiring our cobalt suppliers to disclose the smelters from which they sourced in order to ensure that the sources of cobalt contained in our products are not involved in mining activities which cause human rights violations.

In 2017, TSMC held a face-to-face communication meeting with our cobalt suppliers to convey the formal requirement that the mining activities of cobalt ore must be free from human rights violations, including use of child labor and unsafe working conditions. At TSMC’s request, all of our cobalt material suppliers have completed the smelter survey and disclosure. TSMC plans to disclose cobalt smelters to its customers in 2018, and to establish a comprehensive framework for the responsible sourcing of cobalt once the independent third party audit program for cobalt provided by the Responsible Minerals Initiative (RMI) and the Responsible Cobalt Initiative (RCI) are ready. TSMC continues its efforts to review its supply chain to ensure that there are no violations of human rights.

Update of TSMC Due Diligence CMRT V.5.11

<table>
<thead>
<tr>
<th>Number of first-tier suppliers</th>
<th>Number of smelters</th>
<th>Number of certified smelters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front-end process</td>
<td>Back-end process</td>
<td>OSAT and subcontractors</td>
</tr>
<tr>
<td>14</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>24</td>
<td>13</td>
<td>235</td>
</tr>
<tr>
<td>24</td>
<td>13</td>
<td>235</td>
</tr>
<tr>
<td>29</td>
<td>235</td>
<td>235</td>
</tr>
</tbody>
</table>

- 29 First-tier suppliers
- 235 3TG smelters
- 100% Sourced conflict-free materials

Note 1: The information above includes TSMC (all wafer fabs in Taiwan, back-end fabs), and the subsidiary WaferTech, TSMC (China), and the direct suppliers of VisEra.

Note 2: The smelters of front-end and back-end suppliers 100% overlapped with the smelters of OSAT suppliers.

Suppliers have required their direct suppliers to be DRC conflict-free.
Case Study

Continue Driving Local Supply Chain Upgrade

TSMC procurement categories are broadly divided into six categories: equipment, spare parts, raw materials, facility, IT and general affairs. In Taiwan, procurement in each plant is unified by headquarters in Hsinchu. TSMC (China), WaferTech and other subsidiaries have their own independent procurement organizations.

In order to strengthen cooperation with suppliers, TSMC has been promoting the localization of procurement for many years. In addition to increasing flexibility, shortening the development of new products and reducing unnecessary costs to ensure the quality and efficiency of service to customers, localization can also reduce supply chain carbon emissions and create more local employment opportunities. This is also why many suppliers have come to Taiwan to invest in production in response to TSMC’s call since 2004.

TSMC’s current main production base is in Taiwan and we view enhancing the sustainability of the local semiconductor industry an important part of corporate social responsibility. We actively counsel major raw material suppliers to upgrade their technology and quality, thereby increasing the amount of local procurement. As an extension of TSMC’s global supply chain, TSMC (China) will actively promote localization and help local suppliers enhance their capacity in a win-win situation.

---

**Table 1: Procurement in Taiwan, United States, and China**

<table>
<thead>
<tr>
<th>Year</th>
<th>Taiwan</th>
<th>United States</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spare Parts</td>
<td>Tools</td>
<td>Raw Materials</td>
</tr>
<tr>
<td>2015</td>
<td>65%</td>
<td>42%</td>
<td>29%</td>
</tr>
<tr>
<td>2016</td>
<td>65%</td>
<td>44%</td>
<td>33%</td>
</tr>
<tr>
<td>2017</td>
<td>66%</td>
<td>44%</td>
<td>33%</td>
</tr>
<tr>
<td>2018</td>
<td>68%</td>
<td>45%</td>
<td>34%</td>
</tr>
<tr>
<td>2018 Forecast</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Note 1: Localized procurement means the supplier is required to be engaged in manufacturing and processing.

Note 2: In TSMC Taiwan, the tools localization plan is simply for back-end tools. Front-end tool’s procurement spending is mainly for process tool expansion and upgrade.

Note 3: In WaferTech (the United States), the tools procurement spending is mainly for process tool expansion and upgrade.

Note 4: In TSMC (China), the tool’s procurement currently 100% relies on imports.
### Tasks of 2018

- **To hold the Responsible Supply Chain Forum and build up the common consensus of collaboration**
- **To align with international standards by introducing third-party audit firm**
- **To survey suppliers waste output, energy and resource consumption so as to set improvement goals**

---

### 2017 Results of Local Suppliers Counselling

<table>
<thead>
<tr>
<th>Category / Supplier Numbers</th>
<th>Problem</th>
<th>Improvement Method</th>
<th>Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacity Build-up and Production Quality Improvement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemicals / 4</td>
<td>Capacity failed to meet the requirement of the advanced node</td>
<td>• Product line expansion</td>
<td>Capacity increased by 2 to 3 times</td>
</tr>
<tr>
<td></td>
<td>Product impurity is too high</td>
<td>• Raw material purification</td>
<td>Impurity reduced by 30%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Product line expansion</td>
<td>Capacity increased by 5 times</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Connector automation upgrade and filling station isolation</td>
<td>Impurity reduced by 50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Product line expansion</td>
<td>Capacity increased by 3 times</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Tank materials upgrade</td>
<td>Impurity reduced by 30%</td>
</tr>
<tr>
<td>Chemicals / 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Photo Resist / 1</td>
<td>Capacity failed to meet the requirement of the advanced node</td>
<td>• Product line expansion</td>
<td>Capacity increased by 3 times</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Capacity increased by 2 times</td>
</tr>
</tbody>
</table>

| **Advanced Metrology Technology** | | | |
| Gases / 2 | Insufficient metrology tools | • Set up new lab | Build up chip material analytical capability |
| Chemicals / 1 | The technology of metrology failed to meet the requirements of the advanced nodes | • Invest in metrology instruments | Increase detection limit of impurity by 50% |

| **ESH Performance Improvement** | | | |
| Parts Cleaning / 2 | Inadequate safety protection of chemical operations | • Top local executives directly participate in the ESH management and projects | ESH score improved by 38% |
| | Partial exhaust capacity may be insufficient | • Actively collaborate with TSMC and consultants to formulate safety protection and exhaust improvement plans | ESH score improved by 27% |
| Furnace Quartz / 1 | The facility department serves as the environmental safety management | • Formed dedicated ESH organization for independent safety inspection and management, and directed the environmental protection project progress and management performance by the regional head in Taiwan | ESH score improved by 33% |
| | Untracked audit improvement | | |
| Chemicals / 1 | The maintenance of firefighting facilities is careless | • The group conducts internal organizational learning. Headquarters lead the factory to set targets for fire protection and seismic improvement, and track progress | ESH score improved by 32% |
Green Manufacturing

A Green Power Practitioner

In addition to pursuing business growth and breakthroughs, TSMC aims to become a practitioner of green power to raise environmental and social value. We incorporate green management into business and implement continuous improvement projects in the areas of climate change, energy management, water management, waste management, and air pollution control. TSMC works to achieve coexistence and mutual prosperity between our business and the environment.

5.1 GWh
Effectively reduced power consumption by 510 GWh through 452 conservation projects.

103.4 million metric tons
Total recycled water quantity was 103.4 million metric tons, about 3.2 times the capacity of Baoshan Reservoir II.

95%
95% waste recycling rate, the 9th consecutive year greater than 90%.
Material Issue

Climate Change and Energy Management

Strategies

- **Promoting Low-Carbon Manufacturing**
  - Continue adopting best practice approaches to mitigate emissions with the goal of being the industry’s Low-Carbon Manufacturing leader.

- **Development of Renewable Energy**
  - Continue to purchase green power and install solar power systems, increase green power usage.

- **Improving Energy Efficiency**
  - Develop new energy-saving measures each year, actively implement energy-saving measures, and increase power usage efficiency.

- **Strengthening Climate Resilience**
  - Build up prevention and emergency reaction plans for climate disaster and reduce the impact of climate disasters.

TSMC 2020/2025 Goals

- Reduce unit wafer GHG emission (Metric tons of CO₂ equivalent /8-inch wafer e mask-layer) to 18% below the year 2010 level
  - 2020

- Reduce unit wafer PFC emission (Metric tons of CO₂ equivalent /8-inch wafer e mask-layer) to 60% below the year 2010. Reduce total PFC emission (Metric tons of CO₂ equivalent) to 20% below the year 2010 level
  - 2020

- Conserve a total of 2,800GWh beginning from 2016
  - 2025

- Zero days of manufacturing interruption caused by climate change disasters
  - 2025

Note: The regulatory and market environment isn’t mature in Taiwan. TSMC purchase renewable energy & set up long-term goal once the conditions are mature.
<table>
<thead>
<tr>
<th>2017 Achievements</th>
<th>2018 Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>13%</strong></td>
<td></td>
</tr>
<tr>
<td>Unit wafer layer GHG emissions were 13% less than 2010</td>
<td>Reduce unit wafer layer GHG emission to 15% below the year 2010 level</td>
</tr>
<tr>
<td>Target: 13%</td>
<td></td>
</tr>
<tr>
<td><strong>55%</strong></td>
<td></td>
</tr>
<tr>
<td>Unit wafer layer PFC emissions were 55% less than 2010</td>
<td>Reduce unit wafer layer PFC emission to 55% below the year 2010 level</td>
</tr>
<tr>
<td>Target: 50%</td>
<td></td>
</tr>
<tr>
<td><strong>6%</strong></td>
<td></td>
</tr>
<tr>
<td>Total PFC emissions were 6% less than 2010</td>
<td>Reduce total PFC emissions to 10% below the year 2010 level</td>
</tr>
<tr>
<td>Target: 4%</td>
<td></td>
</tr>
<tr>
<td><strong>10.4%</strong></td>
<td></td>
</tr>
<tr>
<td>Unit wafer layer power usage were 10.4% less than 2010</td>
<td>Reduce unit wafer layer power usage to 11% below the year 2010 level</td>
</tr>
<tr>
<td>Target: 9%</td>
<td></td>
</tr>
<tr>
<td><strong>510 GWh / 600 GWh</strong></td>
<td>Annual power-saving of 200 GWh</td>
</tr>
<tr>
<td>Annual power savings / Cumulative power savings</td>
<td>Cumulative power-saving of 800 GWh</td>
</tr>
<tr>
<td>Target: Annual power-saving target of 280 GWh Cumulative power-saving of 370 GWh</td>
<td></td>
</tr>
</tbody>
</table>
Climate change has greatly impacted the global ecosystem and people’s lives. After the signing of the Paris Agreement, nations from around the world have affirmed the threat of climate change. TSMC clearly states in its Corporate Social Responsibility Policy and Environmental Protection Policy that adapting to climate change is part of its responsibility to sustainable management. TSMC continues to monitor the status of global climate change as well as changes in international and domestic mitigation efforts, and identifies potential risks and opportunities of climate change by utilizing a risk matrix on the aspect of government regulations, natural disasters and behavioral impact. TSMC has made continuous long-term efforts to serve as an industry benchmark for energy conservation and carbon reduction, and has been strengthening the requirements for its supply chain to do the same. TSMC collaborates with international industry associations and government agencies to promote carbon mitigation and identify the best available technologies to establish industry standards. TSMC aims to raise the supply chain’s ability to respond to climate change and reduce climate risks in operations management.

Note: Science Based Targets Initiative, SBTi is an initiative jointly established by the Carbon Disclosure Project (CDP), the "We Mean Business" Coalition, the UN Global Compact, and the World Wide Fund for Nature (WWF). It aims for companies to set reductions in line with the Paris Agreement.
Types of Climate Risks and Management Measures

**Regulations**
- Mandatory reporting of greenhouse gases
- Implement data inventory: investigate greenhouse gas emissions and energy usage
- Regulatory control of greenhouse gases cap and trading
- Establish procedures on carbon credits and trade in FAB 10

**Natural Disasters**
- Wind damage, flooding, and drought leading to reduced production or disruptions
- Fab 15B designs followed climate resistance guidelines (all new fabs will follow)

**Behavioral Impact**
- Related parties demanding a green supply chain
- Strengthened requirements for supplier-side greenhouse gas monitoring and increased their proportion in audit

**Consideration**

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Measures</th>
<th>Achievements in 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulations</td>
<td>Implement data inventory: investigate greenhouse gas emissions and energy usage</td>
<td>Greenhouse gas inventory 100% completed</td>
</tr>
<tr>
<td>Natural Disasters</td>
<td>Implement carbon management: the Energy Conservation &amp; Carbon Reduction Committee promotes energy saving and conducts quarterly review</td>
<td>Annual energy saving targets 100% completed</td>
</tr>
<tr>
<td>Behavioral Impact</td>
<td>Produce green products: raise product energy efficiency, produce low energy consumption products for customers, analyze key factors for carbon reduction and energy conservation</td>
<td>Established procedures on carbon credits and trade in FAB 10</td>
</tr>
<tr>
<td></td>
<td>Enhance Resilience of business operations: establish crisis management procedures and emergency responses</td>
<td>Energy efficiency of new generation production process raised</td>
</tr>
<tr>
<td></td>
<td>Strengthen collaboration with supply chain; calculate product footprint with suppliers to lower emissions and make purchasing decisions based on emissions. External promotion: support and promote climate change related programs and proposals</td>
<td>Fab 15B designs followed climate resistance guidelines (all new fabs will follow)</td>
</tr>
<tr>
<td></td>
<td>Related parties demanding a green supply chain</td>
<td>Strengthened requirements for supplier-side greenhouse gas monitoring and increased their proportion in audit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proposed semiconductor energy conservation and carbon reduction benchmarks</td>
</tr>
</tbody>
</table>
Total Risk Management of Climate Change – Carbon Management Platform

In response to global climate change and the Green House Gas Reduction and Management Act, TSMC established a cross-organizational platform for carbon management in 2016. The three main directives of the platform are: regulatory compliance, energy conservation and carbon reduction, and carbon asset management. TSMC planned and executed short, mid, and long-term reduction plans through the Energy Conservation and Carbon Reduction Committee, led by Vice Presidents of Operations with the support of the Corporate Environmental Safety Division in regulatory discussions around the country. Following the TSMC subsidiary in China, the American subsidiary WaferTech will also be required to lower greenhouse gas emissions in accordance with the Clean Air Act of Washington State in the United States. Faced with tightening rules and regulations regarding carbon emissions and trading, the Finance Department has decided to evaluate carbon asset risk, and devise mid to long-term plans based on energy conservation and carbon reduction goals, carbon credits, and renewable energy options.

- GHG inventory (ISO 14064)
- Phased Regulatory Goals
- Product emission standard
- Cap and allocation principle
- ISO 50001
- Science Based Target
- Facility energy saving
- Process tool energy saving
- F-GHG abatement
- Green building

TSMC stands by its environmental promises, and continues to follow through on its many sustainability measures. Promoting energy conservation, carbon reduction, water saving, and circular economy are all important parts of our efforts to demonstrate the effectiveness of our environmental management and corporate social responsibility. TSMC will continue to share its green manufacturing experience, help the industry gain the competitive advantages of green enterprises, and contribute to the sustainable development of the earth.

J.K. Wang
Vice President, Operations/300mm Fabs
Promoting Low-Carbon Manufacturing
Aiming to Be the Leading Global Benchmark

In response to the global mission of the Paris Agreement, TSMC continues to participate in the Carbon Disclosure Project (CDP™) and joined Commit to Action, a voluntary enterprise carbon reduction initiative in 2017. The most important step in the initiative is to set reduction targets to keep the global temperature rise below 2 degrees. TSMC is the first semiconductor company in Taiwan to join the Science Based Targets Initiative, SBTi. Under the 2 degrees scenario, the semiconductor industry aims to lower greenhouse emissions intensity to 87% below 2010 levels before 2050.

TSMC successfully reached its targets by reducing gas used in the production process as well as exhaust gas. Due to these efforts, the greenhouse gas emission per product unit decreased 3% in 2017 over the previous year, and dropped 13% compared with 2010. In recent years, the increasing complexity of new generations of products has pushed TSMC to find more innovative methods in meeting government and company renewable energy policies to conserve energy and reduce carbon dioxide emissions.

Note: Established in 2003, the Carbon Disclosure Project (CDP) is an independent, London-based, non-profit organization which supports companies to disclose environmental impact through the collection of carbon emission surveys.
Greenhouse Gas Inventory for Upstream and Downstream Supply Chain

TSMC has required all its fabs around the world to establish greenhouse gas inventory and disclosure by the greenhouse gas protocol since 2005. New fabs must begin inventorying greenhouse gases within 1.5 years after initial production. Each year, every TSMC fab must complete scope 1 and scope 2 greenhouse gas inventories for the previous year and pass the external audit of a third-party organization with ISO 14064-1 verification. TSMC began the scope 3 emission inventory and verified by a third-party since 2017. In 2017, TSMC and subsidiaries ramped up production and acquired VisEra. As a result, total greenhouse emissions increased 11% over the previous year. TSMC fabs in Taiwan accounted for 90% of the total carbon dioxide emissions of 8.15 million metric tons. Due to the development of advanced processes and the related power demand, the scope 2 greenhouse gas emission ratio is three times larger than scope 1. In addition to monitoring its own greenhouse gas emissions, TSMC is also concerned with the carbon footprint of final products and looks into the emissions of its upstream and downstream supply chain. The Company requests suppliers to have the ability to conduct their own greenhouse emission inventory. The largest emission in scope 3 emission data is generated by raw materials, followed by fuel and energy related activities and waste disposal.

<table>
<thead>
<tr>
<th>Year</th>
<th>Materials Production</th>
<th>Purchasing Energy</th>
<th>Waste Generated in Operations</th>
<th>Upstream Transportation</th>
<th>Downstream Transportation</th>
<th>Employee Commuting</th>
<th>Business Travel</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1,824</td>
<td>18,414</td>
<td>556</td>
<td>1,594</td>
<td>26,924</td>
<td>1,175,268</td>
<td>2,221,558</td>
</tr>
<tr>
<td>2016</td>
<td>2,042</td>
<td>19,505</td>
<td>504</td>
<td>2,626</td>
<td>27,826</td>
<td>1,173,448</td>
<td>2,544,951</td>
</tr>
<tr>
<td>2017</td>
<td>2,416</td>
<td>20,273</td>
<td>1,357</td>
<td>2,114</td>
<td>29,504</td>
<td>1,349,366</td>
<td>2,806,978</td>
</tr>
</tbody>
</table>

Note: Scope 3 emissions include only data from TSMC fabs in Taiwan
Note: According to the announcement of Energy bureau that 1 kWh emits 0.529 kg of CO2 equivalent and 1kWh = 3,600 Kilojoules.

### Greenhouse Gas Emission Intensity

![Graph showing greenhouse gas emission intensity over time]

<table>
<thead>
<tr>
<th>Year</th>
<th>GHG Emission Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>0.39</td>
</tr>
<tr>
<td>2010</td>
<td>0.35</td>
</tr>
<tr>
<td>2015</td>
<td>0.33</td>
</tr>
<tr>
<td>2020</td>
<td>0.35</td>
</tr>
<tr>
<td>2025</td>
<td>0.38</td>
</tr>
</tbody>
</table>

Note 1: TSMC total annual greenhouse gas emission intensity data includes emissions from all TSMC fabs (as well as advanced backend facilities) in Taiwan and its subsidiaries WaferTech, TSMC China, VisEra.
Note 2: Reduction targets are based on SBTi - Sectoral Decarbonization Approach (SDA)
Note 3: Emission intensity normalized by the baseline data in 2010.
Best Mitigation Results in the Industry

F-GHG is the main source of greenhouse gas emissions in the semiconductor manufacturing process, it accounts for over 80% of emissions. TSMC aims to lower direct emissions by optimizing gas usage and substituting F-GHG with low greenhouse warming potential gases and installing exhaust gas abatement equipment. In 2017, TSMC reduced 2.35 million metric tons of carbon dioxide on F-GHG emission reduction. Nitrous oxide (N₂O) is the second-largest source of direct emissions which TSMC is striving to reduce. Since 2016, TSMC and equipment vendors have been collaborating to develop high-performance N₂O abatement and tail gas reduction equipment, and have completed verification on certain models. TSMC leads the industry by being the first to incorporate N₂O gas abatement equipment into its new equipment standard. In 2017 TSMC’s F-GHG emissions lowered significantly; emissions per unit decreased 6% over the previous year, not only reaching TSMC’s own targets but is far outperforming targets set by the World Semiconductor Council’s voluntary PFC agreement.
Development of Renewable Energy

Owing to its corporate responsibility to protect the environment, TSMC continues to track developments in climate change. In addition to lowering power consumption, TSMC also takes concrete action by adopting renewable energy. TSMC fully supports the government’s policy, and commits to directly purchasing renewable energy once the regulatory and market environment is mature in the future. This move will effectively reduce greenhouse gas emissions and proactively supports the United Nations’ sustainable development goals.

Purchasing Green Power

In response to the government’s renewable energy policy, TSMC has purchased green power as a way of supporting the development of renewable energy. The Company purchased a total of 100 GWh of green power in 2017. This reduced carbon emissions by about 52.9 million kilograms, equivalent to the carbon absorbed by 5.29 million trees in one year.

Installing Renewable Energy Power Generation Equipment

TSMC has also installed solar panels inside its science parks to generate renewable energy for its facilities. In 2017, the Company’s total solar panel capacity expanded by 550 kW and combined with the 30 kW used by its subsidiary, VisEra Technology, total solar panel capacity reached 1,893 kW, generating 1.5 GWh. This reduced carbon emissions by 770 metric tons, equivalent to the carbon absorbed by 77,000 trees in one year. TSMC will continue to expand its solar panel capacity by 1,322 kW in 2018. In 2017, the newly installed Fab 6 solar power plant was certified by the National Renewable Energy Certificate Center. TSMC also obtained 275 renewable energy certificates for the entire year, making it the first semiconductor manufacturer in Taiwan to receive renewable energy certificates. All these pro-active measures highlight TSMC’s commitment towards the development of Taiwan's renewable energy.

TSMC will monitor local renewable energy development aggressively, purchase renewable energy and continue to install renewable energy generation equipment to fulfill our responsibility of global citizenship and support government strategy. We want to support renewable energy through concrete measures to make on impact on the mitigation of climate change.

Improving Energy Efficiency

Comprehensive energy inventory

TSMC's total energy consumption in 2017 was 12,016 GWh, of which power usage accounted for about 94.8% of total energy consumption. This was followed by natural gas, which accounted for about 5.2% of total energy consumption. Diesel consumption is less than 0.03% of total energy consumption.

TSMC’s electric power is mainly used in manufacturing by process equipment and facility systems. The Company uses ISO 50001 for energy management and cross-fab energy efficiency comparisons to find the best operating model and make company-wide adjustments to obtain energy savings.
maximum efficiency from each kWh consumed. TSMC’s unit power consumption was 9.5 (kWh/8-inch e wafer-layer) in 2017, 10.4% lower than 10.6 (kWh/8-inch e wafer-layer) in 2010. Additionally, this was 1.4% lower than the Company’s optimum performance of 9% in 2017. Natural gas is mainly used for boilers, Volatile Organic Compound (VOC) treatment systems and burn-type Point-of-Use Waste Gas Treatment systems to reduce direct fluoride gas emission and greenhouse gas emission. In 2017, TSMC consumed 0.055 cubic meters of natural gas per 8-inch wafer per mask layer. Diesel is primarily used in emergency power generators and fire pumps, which are only engaged during power supply disruptions, scheduled maintenance and emergencies, and is not a direct energy source for production. The Company consumed approximately 409 kiloliters in 2017.

**Enhancing Power Usage Effectiveness**

Due to the expansion and increasing complexity of advanced manufacturing process, TSMC expects power consumption will continue to increase. To maximize energy efficiency, and in response to the government’s energy-saving targets, TSMC has invested heavily in energy-saving measures and had laid out an implementation plan from 2016 to 2025 that targets an average annual energy-saving rate of greater than 1%. By 2025, new energy-saving measures are expected to reduce energy consumption by 2,800 GWh as well as reduce carbon emissions by 1.48 billion kilograms, which is equivalent to the carbon absorbed by 148 million trees in one year. Compared to the absence of energy-saving measures, total power consumption has fallen by 13%.
TSMC's energy management is based on ISO 50001. It develops energy-saving management platforms, implements energy audits, and strives for the most efficient use of each kWh. In 2017, TSMC's Facilities Department became the first to apply Big Data in the analysis of air-conditioning energy-saving parameters. In the process, it was able to develop an optimal control program, which can automatically adjust chilled water system and its auxiliary equipment to the best energy-saving point, effectively improving the efficiency of the chilled water system by 9%. TSMC also held classes on energy saving and carbon reduction to share its knowledge with the industry. The Process Equipment Department has focused on replacing inefficient components and optimizing equipment energy consumption. TSMC's annual energy-saving plan included 452 energy-saving measures across eight categories, reducing consumption by 510 GWh, eliminating 270,000 metric tons of carbon dioxide emission and saving NT$1.28 billion in electricity costs. In addition, reducing carbon emissions also saved NT$400 million in potential external carbon costs\textsuperscript{a}. The energy-saving measures of TSMC's subsidiary companies, such as WaferTech, TSMC (China), VisEra Technology, were mainly focused on using LED lighting, as well as replacing old and worn equipment. In 2017, a total of 4.5 GWh of energy was conserved.

Note: Computed using a NT$1,500 fine per metric ton for direct and indirect carbon emissions (metric tons) levied by the Taiwan government.

\textsuperscript{a}Note: Carbon equivalent coefficient factor= 0.529 kg/ kWh
**Strengthening Climate Resilience**

TSMC assesses climate-related risks annually to protect its operations against climate change and extreme weather. The Company’s standardized guidelines focus on weather-related factors which could disrupt daily operations such as drought, power shortages, flooding, and wind damage. All fabs are required to carry out assessments to prevent all potential damage from natural disasters and avoid any disruption to production. The newly-completed Fab 15B was designed specifically with climate resistance guidelines in mind, and other fabs have also made changes according to these guidelines.

**Leading the Industry in Facing Climate Changes**

TSMC understands the challenges of climate change. It is a difficult mission which requires the cooperation of the entire industry, from upstream to downstream vendors, and adherence to government policies to complete this task. TSMC fully supports the planning and implementation of government policies and acts as industry and trade association representative and committee member of the Energy White Paper and Greenhouse Gas Expert Advisory Committee, offering feasible benchmark solutions and advice. TSMC is also the ESH Committee Chairman of the Taiwan Semiconductor Council and World Semiconductor Council. In addition to hosting regular conferences and forums to discuss best approaches in energy conservation and carbon reduction, TSMC also actively pursues the best feasible benchmarks, including F-GHG Reduction Best Available Approach Guidelines and F-GHG and N2O Abatement Approaches. TSMC possesses a strong resolve to lead the global semiconductor industry through its actions.
Using Big Data Analysis to Develop Intelligent Chilled Water System

In 2017, TSMC analyzed the energy consumption of its plants and discovered that its chilled water system accounted for as much as 20% of its total power consumption. The issue of enhancing its plants' operational efficiency, therefore, became an important concern. Through a study of Big Data and after examining close to 500,000 operational data, TSMC was able to successfully develop "an optimal energy-saving control program" for its chilled water system.

While the conventional method focuses only on enhancing the energy efficiency of a single piece of equipment or device, this new model - the first in the industry - takes things a step further by taking into consideration the entire chilled water system, dynamically adjusting the temperatures of the chilled and cooling water. Furthermore, it automatically adjusts the system to its "optimal energy-saving point" based on varying external air conditions and on-site loads, and in the process, increases operational efficiency by as much as 9%.

In addition to its innovative energy-saving measures, TSMC has always been strict and rigorous in conducting risk assessments. Prior to the full implementation of the "optimal energy-saving control program" for its chilled water system, the Company first tested the program on its Fab 12B plant for six months and monitored 260,000 air-conditioning parameters. After ensuring that no abnormalities were seen in 100% of the parameters, the program was officially incorporated into its production system in the third quarter of 2017. The system is currently part of TSMC's advanced manufacturing process and has helped the Company conserve 58 GWh of electricity in 2017, an estimated 11% of the Company's annual energy savings. The smart energy-saving chilled water system is considered a major breakthrough in the industry for energy conservation.

For more details, please refer to our website: "TSMC Successfully Developed Industry's First Chilled Water System Optimization, Energy-Saving Control Program"
TSMC Generously Shares its Energy-Saving and Waste Reduction Methods

TSMC is fully committed to environmentally friendly actions and integrates green management and development strategies into its corporate culture. Internally, the Company holds competitions for energy-saving proposals, inviting colleagues to brainstorm and share their ideas, with the aim of developing more efficient and more innovative energy-saving projects. Externally, the Company shares its energy-saving and waste reduction experiences with the public through education and training courses. As a continuation of the Company’s successful educational model in the past, TSMC again launched two free classes on “Energy Conservation Practices and Energy Management Strategies” and “Resource Regeneration” in Hsinchu, Taichung and Tainan in 2017. These classes, as well as actual plant visits, were personally handled by highly qualified TSMC employees, who shared their experiences in corporate benchmarking practices. Originally only six classes were scheduled but this was increased to nine due to the number of registered attendees. These talks attracted 357 participants from the manufacturing sector, the medical and healthcare field, as well as college professors and students.

72% of participants, who joined this activity, changed their opinion and concept concerning energy-saving and carbon reduction

48% of participants who joined this activity, claimed that it helped them identify areas where they can conserve energy

TSMC would love to not only share our green management knowledge but also arrange a site tour visit. The various kinds of facility systems are categorized by different colors or shapes clearly indicating on/off. This method could be a reference to THSR for managing valves.

Chia-Ho Chen
Senior Specialist of Taiwan High Speed Rail

2017 Energy-saving and Waste Reduction Course Plan

Energy-Saving
- Energy Monitoring and Management System
- Air Conditioning System Operational Optimization Strategy
- Sharing of AC Energy-saving Practices
- Sharing of TSMC’s Energy-saving Measures

Waste Reduction
- Recycling and Regulatory Practices
- Industrial Water Treatment Technology Enhancement
- Wastewater Classification and Recycling Evolution
- Waste Recycling and Recovery

Feedback from Participants

72% of participants, who joined this activity, changed their opinion and concept concerning energy-saving and carbon reduction

48% of participants who joined this activity, claimed that it helped them identify areas where they can conserve energy

In 2017, TSMC initiated "Tool Energy Saving Workshop". Through competition prizes and praise, TSMC encourages colleagues to brainstorm for innovative and feasible energy-saving solutions. Driven through cross-function study and learning, TSMC improves colleagues’ ability to solve tool energy saving problems.

Each competition proposal has to consider various power applications and process stability in the production process. All were reviewed in three aspects, as "Feasibility", "Energy Saving" and "Innovation" from 16 TSMC internal judges. After the first screening for nine finalists and reexamination, the best proposals stood out.

In 2017, there were 223 energy-saving cases presented in the workshop. Three "Best Energy Saving Awards", three "Innovation Awards" and three "excellent Awards" were chosen. The estimated energy saving from them is 198 GWh annually.

<table>
<thead>
<tr>
<th>Category</th>
<th>Cases</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reasonable Environmental Control in Machine</td>
<td></td>
<td>Energy Saving &gt; 6%</td>
</tr>
<tr>
<td>Optimization Setting on Recipe</td>
<td></td>
<td>Energy Saving &gt; 10%</td>
</tr>
<tr>
<td>Use high performance /low energy components</td>
<td></td>
<td>Energy Saving &gt; 20%</td>
</tr>
</tbody>
</table>

In 2017, TSMC initiated "Tool Energy Saving Workshop". Through competition prizes and praise, TSMC encourages colleagues to brainstorm for innovative and feasible energy-saving solutions. Driven through cross-function study and learning, TSMC improves colleagues’ ability to solve tool energy saving problems.
Carried out the First Independent Ecological Survey of the Domestic Semiconductor Industry in Taiwan

In 2017, TSMC’s aggressive response to the United Nation’s Sustainable Development Goals (SDGs), (UN Sustainable Development Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems...and halt biodiversity loss.) and the Aichi Biodiversity Target, conducting the first independent eco-survey in the domestic semiconductor industry, as well as evaluating the impact of the Company’s operations on the environment and on biodiversity. Results of the study showed that there were more than 493 species of plants and 209 species of animals found within TSMC’s science parks. The results of the ecological survey highlighted not only the extremely abundant and rich variety of species found inside TSMC’s science parks, but showed the balanced and harmonious stewardship of the Company with the environment.

TSMC has produced outstanding results in green sustainability. With its clearly defined ecological development goals and positive actions, the Company has, through its Green, conservation, Eco-Friendly, and Education Policies, sought to protect the country’s natural resources. The Company has carried out multi-level greening within its science parks as well as established a diverse habitat. For example, by establishing ecological zones, channels, and ponds to bring in water, the Company has provided a welcoming habitat for birds and butterflies. In addition, to ensure a balanced biodiversity, the Company has gradually introduced native plants on the ground, cultivating a rich collection of plant species that will attract butterflies and birds by offering copious opportunities to feed.

In 2018, as the Company strives to exert a greater green influence on its environment, it will focus on the conservation of rare and endangered species, including the migration of threatened species such as the Cuora flavomarginata (Chinese Box Turtle) to livable environments and the independent cultivation of Lavandulaefolium dendranthema (delicate native flowers) and other endangered plants.

Four Ecological Sustainability Strategies of TSMC

TSMC’s ecological sustainability of green park

- Design of Green Belt in Series
  - A Series of Disconnected Green Belt
  - Expanding Green Area
  - Planting of Trees

- Ecological Environment Monitoring
  - Ecological Environment Monitoring
  - Non-toxic Maintenance Management
  - Encouraging Environmentally Friendly Farming

Note: UN Sustainable Development Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems...and halt biodiversity loss
Material Issue

Water Management

Strategies

Water Resource Risk Management
Implement programs to reduce climate risks and continue practicing daily water conservation and adjustments for water shortage.

- Reduce 2020 water consumption (liter/8-inch e-wafer-layer) to 30% below 2010 level 2020
- Accumulate 12.77 million metric tons in water conserved through new conservation measures from 2016 to 2025 2025

Diversification of Water Resources
Integrate internal and external resources to develop recycled water technology and continue practicing water conservation and water reclamation during production process.

- Replace at least 28,000 metric tons/day of tap water with recycled water by 2025 2025

Develop Preventive Measures
Improve the effectiveness of water pollution prevention and treatment in order to remove ammonia nitrogen and pollutants from wastewater.

- Reduce ammonia nitrogen concentration in wastewater discharge to <25mg/L 2025

TSMC 2020/2025 Goals

Achievements & Targets
Reduce water consumption to 26% below 2010 level.

Adopt new measures to save 1.28 million metric tons of water.

Reduce the average concentration of ammonia nitrogen in wastewater for the entire company from 35mg/L to below 30mg/L.

The average concentration of ammonia nitrogen in wastewater discharge was reduced to below 20mg/L in the new plant in Taichung.

Target: < 20mg/L

The average concentration of ammonia nitrogen in wastewater discharge was reduced from 80mg/L to 35mg/L in the Tainan facility.

Target: < 60mg/L

The average concentration of ammonia nitrogen in wastewater discharge was reduced from 50mg/L to 35mg/L in both Hsinchu and Taichung plants.

Target: < 60mg/L

Reduce the average concentration of ammonia nitrogen in wastewater for the entire company from 35mg/L to below 90mg/L.

Target: < 20mg/L

Accumulated 1.97 million metric tons in water conserved through new conservation measures.

The average concentration of ammonia nitrogen in wastewater discharge was reduced from 80mg/L to 35mg/L in the Tainan facility.

Target: < 60mg/L

The average concentration of ammonia nitrogen in wastewater discharge was reduced from 50mg/L to 35mg/L in both Hsinchu and Taichung plants.

Target: < 60mg/L

The average concentration of ammonia nitrogen in wastewater discharge was reduced from 50mg/L to 35mg/L in both Hsinchu and Taichung plants.

Target: < 60mg/L

Reduce the average concentration of ammonia nitrogen in wastewater for the entire company from 35mg/L to below 90mg/L.

Target: < 20mg/L

Achieved the goal earlier than expected for 2018.
Water is an important natural resource for TSMC’s operation and development. The risk of water shortage and flooding has increased in recent years due to global climate change, and the stability of water resources has become an important issue for TSMC. Starting from 2017, TSMC has actively addressed this issue through the three dimensions of "Water resource risk management", "Diversification of water resources" and "Development of preventive measures", and ensures the Company’s sustainable development by cultivating new water sources and reducing consumption.

**Risk Management of Water Resources**

**Managing water shortage risk and taking pre-emptive action**

TSMC believes water resources management plays an important role in the risk management of climate change and the adaption to natural disasters. The Company uses a water reporting system to monitor the volume of each water reservoir and the water usage rate of every plant, and water training drills are held every year. Every plant maintains water pools, temporary water sources and water tankers to keep a 2-day supply of water at all times to ensure a stable supply in case of emergency.

From February to April and the month of December in 2017, Taiwan experienced water shortages, and TSMC facilities in some regions entered water restriction Level One (yellow light). TSMC immediately initiated a contingency plan to voluntarily reduce water consumption by 3% by reducing landscape watering by half and reducing water pressure. Due to steady routine preparation, TSMC production at all fabs were not affected by the government’s water restriction measures in 2017.

**TSMC Water Shortage Contingency Measures**

<table>
<thead>
<tr>
<th>Emergency Levels</th>
<th>Water Restrictions by Government</th>
<th>TSMC Contingency Measures</th>
<th>Status in 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Stable supply</td>
<td>Establish a comprehensive water monitoring mechanism</td>
<td>Regulaily checked the status of all water reservoirs reported by the Water Resources Agency and held practice drills</td>
</tr>
<tr>
<td>Adequate</td>
<td>Farms advised to leave fields fallow</td>
<td>Establish a contingency team</td>
<td>Established a contingency team to take inventory of water resources and water tanker capacity</td>
</tr>
<tr>
<td>Level One</td>
<td>Water supply pressure lowered at specific times</td>
<td>Voluntarily reduce water consumption by 3%</td>
<td>Reduced landscape watering by 50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Practice exercises in using water tankers to transport water</td>
<td>Lowered pressure of water supply to achieve 3% voluntary water conservation</td>
</tr>
<tr>
<td>Level Two</td>
<td>Reduce supply to industrial use by 5~20%</td>
<td>Implement water restrictions at all levels and take necessary water conservation measures</td>
<td>Did not occur</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intra-organizational drought emergency response team</td>
<td></td>
</tr>
<tr>
<td>Level Three</td>
<td>Water restrictions by zone</td>
<td>Implement water restrictions at all levels and take necessary water conservation measures</td>
<td>Did not occur</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intra-organizational drought emergency response team</td>
<td></td>
</tr>
</tbody>
</table>

**Water Usage Ratio of TSMC in Three Science Parks**

<table>
<thead>
<tr>
<th>Science Park</th>
<th>TSMC Daily Consumption</th>
<th>Reservoirs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hsinchu</td>
<td>4.5 (9.0%)</td>
<td>Baoshan Reservoir, Second Baoshan Reservoir</td>
</tr>
<tr>
<td>Central Taiwan</td>
<td>3.0 (2.1%)</td>
<td>Liyutan Reservoir, Deji Reservoir</td>
</tr>
<tr>
<td>Southern Taiwan</td>
<td>4.2 (4.4%)</td>
<td>Nanhua Reservoir, Zengwen Reservoir</td>
</tr>
</tbody>
</table>

Note: Daily supply of reservoirs was based on Water Resource Agency data. Reservoirs for Taichung Science Park also supply Taichung and Miaoli area.
Water Recycling

To improve water usage efficiency, TSMC categorizes wastewater from purification equipment and production processes according to the cleanliness of discharge, and the cleanest water is given priority for recycling and purification to return to the production processes. Water in the next grade of cleanliness can be used in the nonmanufacturing processes following treatment. Finally, unrecyclable wastewater is treated at an on-site wastewater treatment plant before discharge. TSMC is committed to building a variety of water recycling systems to enable the reuse of water so that not a drop is wasted.

The Journey of Water in TSMC

- **Municipal tap water**
- **Condensation water from air conditioning**
- **Tap water + ultrapure water reclaim**
- **Water for equipment reduced by 934,000 metric tons**
- **Domestic water Reclaimed water from clean room air scrubber**
- **Wastewater from air scrubber recycled and reused**
- **195% Tap water + reclaimed water = Utilization**
- **Irrigation**
- **Rainwater collection**
- **Wastewater reclaim from air scrubber**
- **Cooling tower**
- **Exhaust scrubber system**
- **Water reclamation system**
- **Improved water production of system for a saving of 179,000 metric tons**
- **Water usage for facilities: Saving of 109,000 metric tons**
- **Water for equipment reduced by 934,000 metric tons**
- **Water usage for facilities: Saving of 99,000 metric tons**
- **Water reclamation plant (advanced oxidation processes system)**
- **Increased wastewater reclaimed from facilities: Saving of 439,000 metric tons**
- **Water usage for facilities: Saving of 114,000 metric tons**
- **2. Reduce system’s drainage loss for a saving of 86,000 metric tons**
- **Water usage for facilities: Saving of 86,000 metric tons**
- **100% Wastewater reclaim from air scrubber**
- **55% Reclaim condensation from air conditioning**
- **Science Park Sewage System**
- **Water treatment system**
- **Clean room air scrubber**
- **Domestic wastewater**
- **Water reclamation plant**
- **Condensation water from air conditioning and rainwater**
- **Condensation water from air conditioning**
- **Tap water + ultrapure water reclaim = Utilization**
- **How a drop of water can achieve 350% utilization**
- **Tap water + Reclaimed water + Tap water = Utilization**
With the increasing number of advanced products on the market, the demand for integrated circuits with smaller critical dimensions and product cleanliness is even stronger. The demand for water needed in the production of wafers continues to rise, and water recycling is growing more difficult, but necessary nonetheless. In 2017, the efficiency of existing recycling practices was improved and the water use of facilities, equipment and production processes were constantly reviewed to find more opportunities for water conservation. The volume of water being recycled and the use rate of recycled water were both improved, further maximizing the efficiency of water resources. In 2017, the average recycling rate of the water used in production processes reached 87.5%, above both the 85% required by the science park administration and the results from 2016, representing a breakthrough against the challenges posed by the increasing use of water. In 2017, TSMC added 15 new water conservation measures as well as continuing previous measures, leading the total volume of recycled water reach 103.4 million metric tons, which was equivalent to the capacity of 3.2 Second Baoshan Reservoirs.

Water Conservation Effectiveness

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average recycle rate of water used in the production process (%) Note 1</td>
<td>86.9</td>
<td>87.6</td>
<td>87.3</td>
<td>87.4</td>
<td>87.5</td>
</tr>
<tr>
<td>Total water saved (million metric tons)</td>
<td>66.9</td>
<td>81.0</td>
<td>85.6</td>
<td>94.3</td>
<td>103.4</td>
</tr>
<tr>
<td>Equivalent number of Second Baoshan Reservoir Note 2</td>
<td>2.12</td>
<td>2.57</td>
<td>2.72</td>
<td>3.00</td>
<td>3.29</td>
</tr>
<tr>
<td>Equivalent number of standard swimming pools Note 3</td>
<td>26,744</td>
<td>32,396</td>
<td>34,252</td>
<td>37,732</td>
<td>41,360</td>
</tr>
<tr>
<td>Number of times each drop of water is used</td>
<td>3.2</td>
<td>3.3</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Note 1: Average process water recycling rate is defined by the Science Park Administration
Note 2: Second Baoshan Reservoir is the main reservoir serving Hsinchu Science Park and its full capacity is 31.49 million metric tons
Note 3: A standard 50x25x2m swimming pool contains up to 2,500 cubic meter of water
New Water Conservation Methods and Achievements in 2017

In addition to the existing water conservation measures, TSMC develops approaches to improve water recycling as well as reduce water consumption, and assesses the water usage in each plant to find opportunities for water conservation. New water conservation measures are designed to achieve reduction in both water use and discharge. In 2017, the implementation of four water conservation aspects was continued - “Reduction of water consumption at facilities”, “Increase facility wastewater recycling”, “Improve system water production rate” and “Reduce loss from system discharge”. Further studies were conducted on “Reduce water used in manufacturing” and it was determined that three actions could be taken: “Shut down inessential supplementary tools”, “Reduce water used in production processes” and “Improve water supply to tools”.

In total, 15 water conservation measures were taken in 2017. 1.97 million metric tons of water were saved, equivalent to a savings of NT$25.17 million, which was enough to provide 1 full year of water to nearly 20,000 people.

Note

City Water Consumption and Water Consumption per Wafer-Layer

Unit: million metric tons

<table>
<thead>
<tr>
<th>Year</th>
<th>Water Consumption (Taiwan)</th>
<th>Water Consumption (Overseas)</th>
<th>Water Consumption Per Wafer Layer (liters/8-inch e wafer-layer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>29.7</td>
<td>3.5</td>
<td>47.7</td>
</tr>
<tr>
<td>2014</td>
<td>34.9</td>
<td>3.3</td>
<td>44.6</td>
</tr>
<tr>
<td>2015</td>
<td>34.0</td>
<td>3.5</td>
<td>47.2</td>
</tr>
<tr>
<td>2016</td>
<td>38.6</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>45.2</td>
<td>3.8</td>
<td></td>
</tr>
</tbody>
</table>

Note: The indicator for water usage per wafer layer represents the statistics for all wafer fabs of TSMC and its subsidiaries.
Diversification of Water Resources

TSMC’s sources of water include municipal tap water, condensation water from air conditioning, and rainwater. Municipal tap water is used in production processes and domestic purposes. Recycled condensation water is used in the production processes and landscaping irrigation. Rainwater is used for irrigation. In order to reduce reliance on municipal tap water, TSMC has been developing reclaimed water technology since 2015. Currently, recycled water generated in-house has successfully reduced the total organic carbon (TOC), urea, conductivity and other major factors related to water quality, conforming to the standards required for the water used in production processes. The quality of wastewater also meets discharge standards. These are milestones for the development of reclaimed water at TSMC, and in the future, the Company will continue working with the government to promote the use of reclaimed water, taking actions to support the national policy on industrial-use reclaimed water. In 2017, TSMC’s approach toward streamlined development process and water quality successfully reduced the unit cost of water by 40%. Although it is 5 times the price of municipal tap water, it has demonstrated the future availability of reclaimed water.

Development of Reclaimed Water at TSMC

- Began developing recycled water technology
- Fab 14 (P5) establishes “Wastewater Effluent Recycling Pilot Plant”
- Quality of reclaimed water meets production line standards
- Unit price of water drops by 40%
- Work with the Southern Taiwan Science Park Administration to build a reclaimed water supply network
- Expected to replace 20,000 metric tons of tap water per day
- Tainan municipal wastewater reclamation project, which added Yong-Kang reclaimed water plant as water source
- Continued to increase the use of recycled water, replaced 28,000 metric tons of tap water per day

Note: The actual schedule for the introduction of reclaimed water in the future will be adjusted based on the government’s reclaimed water plant development.
Development of Preventive Measures
Classification of sources is the key to pollution prevention. Only a robust classification of sources at the beginning can result in effective prevention of pollution afterward.

Wastewater Classification and Recycling
TSMC has adopted the industry’s strictest classification and diversion strategy for front-end wastewater. To improve treatment efficiency, 36 diversion systems are established according to the composition and concentration of process wastewater, and further detailed classification can provide even more appropriate treatments based on water quality and characteristics. Wastewater from all fabs can be divided into hydrofluoric acid wastewater\(^\text{Note 1}\), acid and alkaline wastewater\(^\text{Note 2}\), chemical-mechanical planarization wastewater and high-concentration wastewater. All go through robust classification at the manufacturing tool and then enter processing facilities for specific types of wastewater through diversion pipes. Reusable portions are recycled for further use. The detailed classification is shown in the figure below.

Note 1: wastewater containing fluorine
Note 2: containing normal acid, alkali, ammonia nitrogen and tetramethylammonium hydroxide (TMAH)
Wastewater Monitoring and Pollutant Emissions

Wastewater Discharge

The amount of wastewater discharged is closely related to the usage of municipal tap water and the amount of water recycled. With the increasing proportion of products involving advanced processes, both the volumes of water required and wastewater discharge per product unit are also increasing. TSMC adheres to the principle of “Optimal Efficiency in Water Use”, and in 2017 water recycling was improved to reduce wastewater discharge. The discharge volume per product unit was reduced to 31.1 (liter/8-inch e wafer-layer), down 1% from 2016.

Wastewater Discharge Quality

All of TSMC’s plants have continuous monitoring systems for water quality and volume installed at the discharge outlets of wastewater processing equipment, enabling immediate action in the event of abnormal conditions. Every year, TSMC performs off-line sampling and testing at least four times on all types of water discharge. Online detection equipment is available for calibration to ensure that the quality meets the standards of the Science Park Administration. In 2017, the suspended solids, chemical oxygen demand, ammonia in water and other controlled items of water discharged from all of TSMC’s plants were far better than the standards required by the Science Park Administration.

Comparison of Wastewater Discharge Quality

<table>
<thead>
<tr>
<th>Standards of the Science Park Administration</th>
<th>TSMC 2025 Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspended Solids</td>
<td>30</td>
</tr>
<tr>
<td>CTSP: 30</td>
<td>30</td>
</tr>
<tr>
<td>STSP: 250</td>
<td></td>
</tr>
<tr>
<td>Chemical Oxygen Demand</td>
<td>104</td>
</tr>
<tr>
<td>CTSP: 500</td>
<td>100</td>
</tr>
<tr>
<td>STSP: 450</td>
<td></td>
</tr>
<tr>
<td>Ammonia Nitrogen</td>
<td>35</td>
</tr>
<tr>
<td>CTSP: 50</td>
<td>25</td>
</tr>
<tr>
<td>STSP: 60</td>
<td></td>
</tr>
</tbody>
</table>

Note: pH and suspended solids

Statistics of Chemical Oxygen Demand for TSMC

<table>
<thead>
<tr>
<th>Chemical Oxygen Demand</th>
<th>Unit: mg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>123.0</td>
</tr>
<tr>
<td>2014</td>
<td>124.0</td>
</tr>
<tr>
<td>2015</td>
<td>128.0</td>
</tr>
<tr>
<td>2016</td>
<td>124.4</td>
</tr>
<tr>
<td>2017</td>
<td>119.9</td>
</tr>
</tbody>
</table>

Note: Hsinchu Science Park (HSP), Central Taiwan Science Park (CTSP), Southern Taiwan Science Park (STSP)
Reduction of Ammonia Nitrogen in Wastewater

In 2017, TSMC found that it was difficult to prevent ammonia-nitrogen solution from being mixed in a small proportion into other diverted wastewater. Therefore, the Company re-examined the ‘Ammonia-nitrogen wastewater recycling system’ developed in 2016 and continued to implement even more precise diversion to successfully guide low-concentration ammonia-nitrogen wastewater into the recycling system, before further treatment by the wastewater system. This action solves the problem with low-concentration ammonia nitrogen, which is difficult to remove, improves the treatment efficiency of wastewater and also achieves the goal of reducing ammonia nitrogen in wastewater for every plant.

Note 1: Measures to reduce ammonia nitrogen wastewater: Refine the diversion and reduce ammonia nitrogen in wastewater.

Note 2 and 3: Measures to reduce waste: Sodium sulphate enrichment (please refer to the Waste Management).

Note 4: TSMC converts ammonium sulfate into industrial-grade ammonia water via deamination of the ammonia nitrogen recycling system, and the water undergoes a refining procedure to become electronic-grade ammonia solution. The used chemicals are recycled to other industries for further uses.
New Water Conservation Measures for Production Tools to Reduce the Water Consumption by 47.5%

In 2017, TSMC’s water conservation measures had another breakthrough. It was determined that by taking three innovative approaches, "Shut down inessential supplementary tools", "Improve water supply to production tools" and "Discharge recycling during tool standby", the water consumption of production tools were successfully reduced by 47.5%.

**Shut Down Inessential Supplementary Tools**

In 2017, improvements in process quality reduced reliance on supplementary tools that handle low-concentration ozone (O₃) and hot water (HDWI). Repeated verification and comparison showed that product quality was maintained even after shutting down supplementary tools. Water consumption was also reduced, achieving both water and electricity conservation.

**Improve Water Supply to Production Tools**

Advanced processes have higher requirements for both the quality and quantity of ultrapure water. To seek balance between product quality, efficiency of water consumption, and reduction in discharge frequency, TSMC in 2017 changed the water supply method for acid tank wafer scrubber systems. Through thorough verification and analysis of water quality and testing of wafers from various stages of processes by precision instruments, the optimal amount of water for each step was successfully derived, achieving the best operation approach to water consumption and product quality. In 2017, the total volume of water conservation reached 200,000 metric tons.

**Discharge Recycling During Production Tool Standby**

To keep the system clean and stable, ultrapure is constantly replenished during tool standby. In the past, this unused ultrapure goes directly into the wastewater treatment system. In 2017, a different approach was taken by recycling the water back to the ultrapure system for reuse, increasing the recycle volume of discharge. At the same time, the operating flow rate of production tools were also adjusted to maintain the optimal amount of water. In 2017, the total volume of water conservation reached 170,000 metric tons.

**Tasks of 2018**

Source diversion from production tools

Improve the efficiency of ammonia nitrogen treatment system
Material Issue

Waste Management

Strategies

Source Reduction
- Continue promoting source classification and reduction and encourage vendors to provide tools with lower chemical consumption.
- Outsourced unit waste output < 0.32 kg/8-inch e wafer-layer 2020
- Outsourced unit waste output < 0.30 kg/8-inch e wafer-layer 2025

Circular Economy
- Collaborate with raw materials suppliers and develop recycling technology to convert waste into electronic-grade chemicals for use by TSMC 2025

Auditing and Guidance
- Conduct auditing and guidance of joint evaluation based on the standards required for waste from high-tech industries.

TSMC 2020/2025 Goals

Achievements & Targets
### 2017 Achievements

<table>
<thead>
<tr>
<th>Metric</th>
<th>Target</th>
<th>Surpassed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.36kg</td>
<td>Outsourced unit waste output reduced</td>
<td>✔️</td>
</tr>
<tr>
<td>212,904 metric tons</td>
<td>Annual waste reduced</td>
<td>✔️</td>
</tr>
<tr>
<td>814 NTS million</td>
<td>Saved in waste disposal cost</td>
<td>✔️</td>
</tr>
<tr>
<td>404,195 metric tons</td>
<td>Waste recycled</td>
<td>✔️</td>
</tr>
<tr>
<td>250 NTS million</td>
<td>Waste recycled and resold</td>
<td>✔️</td>
</tr>
</tbody>
</table>

### 2018 Targets

- Outourced unit waste output (8-inch e wafer-layer) < 0.35 kg
- Recycling rate > 95%
- Waste landfill rate < 1%
- In-house regeneration and recycling of resources > 30%
- Recycled copper tubes which regenerated from waste copper sulfate are successfully converted into electronic-grade electroplating materials and reused in TSMC’s production processes.
- Complete 100% auditing and guidance of the vendors that handle waste disposal and recycling.

### Strategies & 2020/2025 Goals

- Completed the amendment of the Company’s Articles of Incorporation and added four scopes of business for chemicals. By working together with material suppliers, recycled copper tubes which regenerated from waste copper sulfate are successfully converted into electronic-grade electroplating materials and reused in TSMC’s production processes.
- Further expand in-house regeneration equipment to convert process chemicals into reclaimed products for reuse.
- Introduce additional copper sulfate regeneration equipment.
- Introduce additional ammonium sulfate regeneration equipment.
TSMC understands the importance of waste management in green manufacturing and our supply chain. In order to achieve sustainable use of resources and ensure proper disposal of waste, TSMC continues to promote source minimizing waste disposal by maximizing recycling. Besides persisting in doing sustainable in business, TSMC has established a strict "Waste Vendor Control and Operating Management Procedure" and conducts regular audits to ensure that recycled products are legally regulated.

To achieve sustainable use of resources, TSMC is shifting our management strategy from conventional "waste management" to "sustainable materials and resources management", with the goal of reducing environmental impact and preserving natural resources. TSMC continues to assess the minimization of resources usage at sources (Reduce), and evaluates the reuse of raw materials after processes (Reuse) to mitigate outsourced waste disposal. Only after these steps will material recycling (Recycling), energy recovery (Recovery) and waste incineration and disposal in landfills (Disposal) take place. At TSMC, the usage of all chemicals is reviewed and differentiated for its ultimate treatment after use. Through 25 different types of chemical waste treatment systems to improve waste recycling, the usage of all chemicals is reviewed and differentiated for its ultimate treatment after use. Using a comprehensive diversion system for 36 types of wastewater and solutions, the mixed collection of wastewater and solutions is prevented, so that chemical waste can be reused and recycled by our contractors to make a variety of recycled products that will be circulated for use in other industries.
### Waste Quantity and Treatment Status Statistics

#### Outsourcing Disposal Waste

<table>
<thead>
<tr>
<th>Year</th>
<th>TSMC</th>
<th>Subsidiaries</th>
<th>Unit: Metric Tons / Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>143,280</td>
<td>6,671</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>201,050</td>
<td>7,763</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>265,787</td>
<td>7,309</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>291,984</td>
<td>6,777</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>361,968</td>
<td>7,777</td>
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</tbody>
</table>

#### General Waste

<table>
<thead>
<tr>
<th>Year</th>
<th>TSMC</th>
<th>Subsidiaries</th>
<th>Unit: Metric Tons / Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>42,180</td>
<td>5,156</td>
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</tr>
<tr>
<td>2014</td>
<td>132,427</td>
<td>5,097</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>61,026</td>
<td>5,436</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>158,899</td>
<td>4,685</td>
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</tr>
<tr>
<td>2017</td>
<td>195,077</td>
<td>5,037</td>
<td></td>
</tr>
</tbody>
</table>

#### Hazardous Waste

<table>
<thead>
<tr>
<th>Year</th>
<th>TSMC</th>
<th>Subsidiaries</th>
<th>Unit: Metric Tons / Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>101,100</td>
<td>1,515</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>140,024</td>
<td>1,727</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>133,360</td>
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</tr>
<tr>
<td>2016</td>
<td>133,085</td>
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<td></td>
</tr>
<tr>
<td>2017</td>
<td>165,891</td>
<td>2,740</td>
<td></td>
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</tbody>
</table>

#### In-house Recycling Waste

<table>
<thead>
<tr>
<th>Year</th>
<th>TSMC</th>
<th>Subsidiaries</th>
<th>Unit: Metric Tons / Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>0.2</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>0.2</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>0.2</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>

#### Waste Recycling Rate

<table>
<thead>
<tr>
<th>Year</th>
<th>TSMC</th>
<th>Subsidiaries</th>
<th>Unit: %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>92</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>93</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>95</td>
<td>79</td>
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</tr>
<tr>
<td>2016</td>
<td>95</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>95</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>

#### Waste Landfill Rate

<table>
<thead>
<tr>
<th>Year</th>
<th>TSMC</th>
<th>Subsidiaries</th>
<th>Unit: %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>0.2</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>0.2</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>0.2</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>

**Note 1:** Waste quantity includes TSMC (all fab plants and backend packaging and testing plants) and its subsidiaries (WaferTech, TSMC (China) and VisEra).

**Note 2:** Total waste = Outsourcing disposal waste + General waste + Hazardous waste.

**Note 3:** Hazardous wastes are defined by local governments.

**Note 4:** Difference in previously disclosed 2015 and 2016 hazardous waste is due to subtraction of waste recycled in-house.

---

**95% 2017 Waste Recycling Rates**

- **Recycled Waste:** 404,195 Metric Tons
- **Total Waste:** 425,626 Metric Tons

95% Recycled Waste (404,195 Metric Tons)

- 19% In-house reused
- 0.4% Converted to products for resale
- 74.6% Outsourced recycled
- 1.0% Outsource energy recycle (Alternative fuel)

5% Non-recycled Waste (21,431 Metric Tons)

- 4.9% Incineration/Treatment
- 0.08% Landfill

---

**Our Business**

**Focus One**

- Ethical Management

**Focus Two**

- Innovation and Service

**Focus Three**

- Responsible Supply Chain

**Focus Four**

- Green Manufacturing

**Focus Five**

- Inclusive Workplace

**Focus Six**

- Common Good

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**Appendix**

TSMC 2017 Corporate Social Responsibility Report
Source Reduction

As a result of the increasingly strict environmental protection regulations and TSMC’s significant increase in demand for raw materials and the expansion of advanced production processes, the Company expects that the amount of waste outsourced for 2020 will increase substantially. To effectively curb the growth of outsourcing waste disposal and reduce the impact on local environment, TSMC established a “Waste Management Task Force” in 2015 to actively implement a variety of reduction and improvement activities. In 2017, a total of 252 waste reduction projects were taken. In the same year, TSMC set short-, intermediate- and long-term reduction goals for the purpose of lowering the amount of waste outsourced per 8-inch e wafer-layer to 0.32 kg for 2020. The goal for 2025 was set even higher at 0.30 kg. To achieve these goals, the Committee members discuss waste reduction proposals at the beginning of each year with managers responsible for their respective production processes and monitor the progress monthly. The major categories of wastes such as sulfuric acid and ammonium sulfate have been effectively reduced and recycled. In 2017, the unit waste output to be outsourced for disposal was reduced to 0.36 kg from the original estimate of 0.59 kg. TSMC will continue to expand improvements on source reduction to other chemicals and the scope of in-house recycled waste.
Case Study

"Project Big Green" – Source Reduction of Process Chemicals

TSMC launched "Project Big Green" to reduce the use of process chemicals. The database managing the in-house use of raw materials and waste output is available to all production units to monitor the usage of wafer materials and waste output in real time. Comparisons can be run between fabs to find more improvement opportunities for waste reduction, and the validated results and efficiency can be promoted to every facility.

Through membrane contactor technology, TSMC is able to regenerate ammonia nitrogen in wastewater and waste sulfuric acid into ammonium sulfate solution after production processes. As ammonium sulfate solution has a water content of 75% after recycling and the subsequent recycling processes require much energy to remove moisture during crystallization, TSMC adjusted the parameters for processing ammonia nitrogen wastewater to find optimal conditions through continuous testing. The application of reflow technology improves membrane distillation of ammonia nitrogen, and sulfate concentration is adjusted to absorb ammonia more efficiently, further increasing the concentration of ammonium sulfate. The water content was reduced to 67% from 75% originally. In 2017, the total ammonium sulfate waste output was reduced by 5,003 metric tons, for a savings of NT$15 million in waste disposal per year.

Other Case Studies in Source Reduction

Reduction of Cleaning Fluid for VOC Carousel Rotor

Zeolite rotor maintenance produces a great deal of organic waste liquid with high water content. TSMC built three concentration systems at its Hsinchu, Taichung and Tainan sites to reduce the waste liquid by 70%. In 2017, total organic waste chemical was reduced by 1,020 metric tons.

<table>
<thead>
<tr>
<th>Metric Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of Cleaning Fluid for VOC Carousel Rotor</td>
</tr>
</tbody>
</table>

Reduction of Sludge the Water Content

With a robust diversion system at the source, waste water content is kept simple, and waste water treatment systems can be set up in accordance with the characteristics of each water source. By comparing the data from each plant, the optimal dosage parameters can be adjusted for different types of sludge, further reducing their water content. In 2017, total sludge volume was reduced by 1,450 metric tons.

<table>
<thead>
<tr>
<th>Metric Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of Sludge the Water Content</td>
</tr>
</tbody>
</table>

Refinement and Enrichment of Ammonium Sulfate Dewatering Technology

Breakthrough in the Enrichment of Ammonium Sulfate

Optimization of operating parameters

Adjust the concentration of sulfate to absorb ammonia, thus increasing the concentration of ammonium sulfate.

<table>
<thead>
<tr>
<th>Conc. 25% ammonium sulfate solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conc. 33% ammonium sulfate solution</td>
</tr>
</tbody>
</table>

Concentrate for ammonia nitrogen wastewater

Membrane distillation for deamination

Sulfuric acid circulation tank

Reflow technology

Reflow part of the ammonium sulfate that has lower concentration to wastewater containing ammonia to enrich the concentration of raw water, thus increasing the concentration of ammonium sulfate.

Collaborate with raw material suppliers to develop new environmental friendly chemicals intended to replace the existing chemicals with non-hazardous substances

Adjust temperature parameters to reduce chemical use

Prolong chemical life time

Collection tank for ammonia nitrogen wastewater

1,020 Metric Tons

1,450 Metric Tons

TSMC 2017 Corporate Social Responsibility Report

Our Business

Focus One

Ethical Management

Focus Two

Innovation and Service

Focus Three

Responsible Supply Chain

Focus Four

Green Manufacturing

Focus Five

Inclusive Workplace

Focus Six

Common Good

Appendix
Circular Economy

To improve product traceability, reduce risks of outsourcing vendors not handling materials properly and enlarge recycling opportunities for the used raw materials, TSMC completed the amendment of the Company’s Articles of Incorporation and added four scopes of business for chemicals in 2017 and successively invested in a number of in-house recycling facilities. With the development and introduction of various recycling technologies, wastes produced from diverse production processes are converted into products which can be reused in-house or sold to other companies. The accumulated experience and technologies can be shared with other industry players, in hopes of improving the recycling capabilities of Taiwan’s manufacturing sector, transforming manufacturers from waste producers to participants in the circular economy.

In 2017, TSMC introduced regenerated copper tubes converted from the copper sulfate produced from in-house production processes. The company further cooperated with raw material suppliers to add refining processes and successfully converted the regenerated copper tubes into electronic-grade electroplating materials that can be recycled back to the Company’s manufacturing processes. TSMC also continued to expand and assess in-house waste recycling and regeneration facilities. TSMC expects that further equipment will be introduced to convert the aforementioned waste into reclaimed products, such as the ones that convert recycled ammonia nitrogen wastewater into ammonium sulfate powder, and low-concentration solvents dewatering to industrial grade solvent, meeting the objective of circular economy.

Note: Other chemical materials manufacturing / other chemical products manufacturing / other fabricated metal products manufacturing / other plastic products manufacturing.
Case Study

The First in the Industry to Regenerate Copper Sulfate into Electronic-Grade Copper Materials

In 2016, TSMC cooperated with vendors to develop and implement in-house copper extraction and waste regeneration technology to reduce the amount of copper sulfate outsourced for treatment. Some 1,942 metric tons of waste copper sulfate intended for outsourcing treatment were regenerated in-house into 42 metric tons of copper tubes. Based on this successful experience, TSMC continued to invest in regeneration systems for copper waste at each plant in 2017 and further collaborated with vendors to develop additional production processes to make regenerated copper tubes that can be manufactured into electronic-grade electroplating copper. At the end of 2017, the regenerated materials were successfully returned to TSMC’s product processes in small-volume validation, and it is expected that in 2018 the validation will be expanded, keeping the Company’s journey toward circular economy on schedule.

In 2015, TSMC developed a waste sulfuric acid pretreatment system and expanded its application to all plants in 2017. Waste sulfuric acid is recycled and reused in-house then combined with ammonia nitrogen wastewater to convert the wastewater into usable ammonium sulfate. In addition to reducing the volume of waste sulfuric acid outsourced for treatment, it also reduced the purchase of industrial-grade sulfuric acid. In addition, the waste sulfuric acid also replaced hydrochloric acid as materials used for resin regeneration; this approach expanded the opportunities for improvement and reduced the purchase of raw materials. In 2017, the amount of waste sulfuric acid to be outsourced for treatment was reduced by 62,595 metric tons (equivalent to the amount of industrial-grade sulfuric acid that had to be purchased in the past), and outsourced treatment expenses were reduced by NT$150 million per year.

Other Case Studies of Source Reduction

On-site Regeneration and Reuse of Waste Sulfuric Acid

In 2015, TSMC developed a waste sulfuric acid pretreatment system and expanded its application to all plants in 2017. Waste sulfuric acid is recycled and reused in-house then combined with ammonia nitrogen wastewater to convert the wastewater into usable ammonium sulfate. In addition to reducing the volume of waste sulfuric acid outsourced for treatment, it also reduced the purchase of industrial-grade sulfuric acid. In addition, the waste sulfuric acid also replaced hydrochloric acid as materials used for resin regeneration; this approach expanded the opportunities for improvement and reduced the purchase of raw materials. In 2017, the amount of waste sulfuric acid to be outsourced for treatment was reduced by 62,595 metric tons (equivalent to the amount of industrial-grade sulfuric acid that had to be purchased in the past), and outsourced treatment expenses were reduced by NT$150 million per year.
With TSMC’s waste traceability checks and annual counseling programs, we remind ourselves to keep an eye on the operation of equipment in the factory and monitor the flow of waste both upstream and downstream of the supply chain.

Juang Horng Cheng
Production Manager
E-shine Advanced Chemical Co., Ltd

Auditing and Guidance

Waste Cleanup and Disposal Vendor Management Process

TSMC uses its “New Waste Vendor Selection Procedure” and “Waste Vendor Auditing Program” to manage waste treatment vendors and revises the content of the auditing program in accordance with results from on-site auditing. This allows vendors to implement best practices in their daily routine through standardization of auditing requirements. The audit covers not only proper waste treatment but also the environmental protection, safety, health and risk management of the entire plant.

New Waste Vendors

All Existing Waste Vendors

Vendor Audit

Note 2: Vendors are required to perform self-evaluation checklist and review their management performance on their own.

Note 3: Monthly waste flow mapping and seasonal on-site inspection to continuously improve the disposal measures and reduce the frequency of fines and penalties.

Note 4: Continue to guide vendors to obtain ISO certification and improve their operations and management.

Corporate ESH Division
Procurement Division
Waste Management Section

Evaluation Result

Unit: Number

Note: Public or municipal waste treatment facility were not included in audit process.
Tasks of 2018

Continue to promote optimization of process parameters and source reduction.

Continue to collaborate with vendors to work on development and application of recycling and regeneration of waste, thus reducing the risk of outsourced vendors not properly conducting waste disposal

Policy Consultation and Social Engagement

In addition to handling internal waste management, TSMC assigns environmental protection personnel to actively participate in briefings, seminars and policy consultation symposiums hosted by government agencies, and international conferences on waste management issues. The Company also participates in the "Research Conference on Recycling and Reuse of Industrial Waste Sulfuric Acid" held by the Industrial Development Bureau, mainly to share its experience in the use of sulfuric acid, feasibility assessment on recycling and implementation in the semiconductor industry, and to connect with the world's environmental protection advocates. TMSC also shares its experience in waste management with other industry players. In 2017, the Company participated in various seminars and forums related to circular economy organized by the Science Park Administration, SEMICON Taiwan, the Association for Taiwan Science Park Industries, and CTCI Foundation, in hopes of collaborating with the industry, government and academia sectors to improve the overall standard of waste disposal and the sustainable development of Taiwan.
Material Issue

Air Pollution Control

Strategies

Best Available Technology (BAT)
Using BAT to deal with operational pollution and reduce its environmental impact

Zero Failure of Control Equipment
Use backup systems and dual-track management to ensure normal operation of control equipment and prevent abnormal events

TSMC 2020/2025 Goals

- To decrease air pollutant emissions per unit product by 27%, compared to 2015 level
  - Note: 2020

- To decrease air pollutant emissions per unit product by 30%, compared to 2015 level
  - Note: 2025

Note: Currently, the average reduction rate of volatile organic gases in each factory area has reached more than 95%. Because the expected target for 2020 was reached ahead of schedule, therefore it has been amended to pursue an even higher goal for air pollution prevention and control.
**2017 Achievements**

<table>
<thead>
<tr>
<th>Strategies &amp; 2020/2025 Goals</th>
<th>2017 Achievements</th>
<th>2018 Targets</th>
</tr>
</thead>
</table>

**96.4%**  
Reduction rate of volatile organic gases was 96.4%  
Target: >90%

To decrease air pollutant emissions per unit product by 25%, compared to 2015 level.

Note: Air pollutants include a total of 8 chemicals: total hydrocarbons, sulfuric acid, hydrochloric acid, nitric acid, hydrofluoric acid, phosphoric acid, chlorine, and ammonia.
The air pollution brought about by the semiconductor manufacturing industry is composed mainly of volatile organic compounds, as well as acidic and alkaline gases. In the field of pollution prevention and control, TSMC adopts the best available technology of source separation and multiple processing to deal with air pollutants effectively, so that when they are discharged in the atmosphere, they meet or surpass government regulations. Moreover, in order to maintain the effectiveness of control equipment and the discharge of pollutants, equipment is supplied with real-time monitoring systems and an N+1 backup system. The relevant monitoring results are transmitted to the facility monitor control system room and the industrial safety emergency response center simultaneously to ensure that air pollutants are treated appropriately when the system is not running normally.

**Best Available Technology**

TSMC has spared no effort to reduce air pollution. In order to achieve the best available technology in the prevention and control process, TSMC has adopted the method of “effective reduction of exhaust sources and enhanced treatment of terminal control equipment”. In the first stage, high-efficiency air treatment equipment (local scrubber) will be installed to treat specific acid-alkaline process exhaust materials, which are toxic, corrosive, flammable or greenhouse perfluorinated compounds depending on their process characteristics. Special equipment such as combustion, plasma, or other types of equipment will treat the remaining process exhaust gas. Finally, the exhaust gas, left with trace amounts of inorganic acids and alka, is sent to the central processing equipment (central scrubber) for second-stage water rinsing and neutralization treatment. Two-stage processing and multi-stage treatment can improve the efficiency of air emission treatment.

For organic exhaust, the highly efficient Zeolite Rotor Concentrator is used to concentrate pollutants and then introduced into a regenerative thermal oxidizer to be burned before being discharged into the atmosphere. The reduction rate of organic emissions gas by the regenerative thermal oxidizer (RTO) alone can reach 95%, exceeding the 90% specified by regulations. If first stage site-based processing equipment is included, the total organic emission gas reduction rate can reach above 99%.

Note: Calculation of total reduction rate after two-stage control equipment:

\[ 1 - [(1 - \text{Local scrubber reduction rate}) \times (1 - \text{Central scrubber reduction rate})] \]

Two-stage type scrubber

---

**Air Pollution Control Process**

<table>
<thead>
<tr>
<th>Sources of Process Exhaust Gas</th>
<th>1st Stage: Local Scrubbers</th>
<th>2nd Stage: Central Scrubbers</th>
<th>Dual-track Emission Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry process</td>
<td>Plasma + Wet</td>
<td>Acid &amp; alkaline gases</td>
<td>Monitor operating conditions</td>
</tr>
<tr>
<td>Chemical storage tank</td>
<td>Burning + Wet</td>
<td></td>
<td>Emission by stack</td>
</tr>
<tr>
<td>Wet process</td>
<td>Thermal + Wet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organic process</td>
<td>Wet (FAC site)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wet (process site)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zeolite Rotor Concentrator</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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TSMC 2017 Corporate Social Responsibility Report
Effective Elimination of Exhaust Source – Local Scrubbers
TSMC classifies high-concentration exhaust gas into seven categories for in-site treatment according to pollutant characteristics. These are then treated by one of seven different local scrubbers, including thermal type, burning type, plasma type, washing and dosing type, adsorption type, condensation type, and washing type. Third-party certification has verified that the reduction of target pollutants by in-site air pollution treatment equipment can reach more than 95%. At present, the proportion of advanced process products continues to increase and TSMC will continue to cooperate with supplier partners for the introduction of new local scrubbers for different pollutants so as to enhance the total reduction of pollutants.

Terminal Control Equipment Enhanced Processing – Highly-efficient Central Processing Equipment
After the first phase of emission gas treatment, which consists of low concentrations of inorganic acid and alkali components, it is sent to a two-stage scrubber for neutralization; in the case of volatile organic components, it is sent to the Zeolite Rotor Concentrator terminal control equipment for concentrating, burning and then is discharged into the atmosphere. In 2017, the average reduction rate of volatile organic gas by TSMC’s Zeolite Rotor Concentrator was 96.4%, which was significantly above the 90% required by regulations.

In addition to embracing the most advanced and suitable pollution reduction technology, TSMC has continuously improved the effectiveness of its existing pollution control facilities. Under these enhancement measures, in 2017 the emission per unit product from TSMC was 0.3 (g/8-inch e wafer-layer) compared to 0.4 (g/8-inch e wafer-layer) in 2015, a decrease of 24%. The Company expects its target objective of 30% can be achieved in 2025. Based on actual test results over the years, the concentration of air pollutants emitted by TSMC is lower than the emission standards set by the Science Park Administration and the domestic Environmental Protection Bureau.

Classification of In-site Air Treatment Equipment and Facilities

<table>
<thead>
<tr>
<th>Process exhaust gas sources</th>
<th>Target pollutants</th>
<th>Control technology</th>
<th>Equipment pictures</th>
<th>Reduction rates</th>
<th>Instant monitoring parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxic gases</td>
<td>Adsorption</td>
<td>&gt; 95% or Outlet less than 50 ppb</td>
<td>Scrubber pressure difference, Inlet Pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrosive gases, perfluorocarbons, combustible gases</td>
<td>Plasma + Wet</td>
<td>&gt; 99%</td>
<td>Current amperage, Circulation water, Inlet Pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrosive gases, perfluorocarbons, combustible gases</td>
<td>Burning + Wet</td>
<td>&gt; 95%</td>
<td>Natural gas flow, Oxygen flow, Circulation water, Inlet Pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrosive gases, perfluorocarbons, combustible gases</td>
<td>Thermal + Wet</td>
<td>&gt; 95%</td>
<td>Reactor temperature, Circulation water, Inlet Pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facility Chemical Storage Tank</td>
<td>Corrosive gas</td>
<td>Wet (FAC site)</td>
<td>&gt; 95%</td>
<td>Scrubber pressure difference, Circulation water, Inlet Pressure</td>
<td></td>
</tr>
<tr>
<td>Wet Process</td>
<td>Corrosive gas + organic gas</td>
<td>Wet (process site)</td>
<td>&gt; 95%</td>
<td>Scrubber pressure difference, Circulation water, Inlet Pressure</td>
<td></td>
</tr>
<tr>
<td>Organic Process</td>
<td>High boiling point organic gas</td>
<td>Condensation</td>
<td>Specific high boiling point organic gas &gt; 95%</td>
<td>Scrubber pressure difference, Condensation temperature</td>
<td></td>
</tr>
</tbody>
</table>
Zero Failure of Control Equipment

TSMC's air pollution control capability complies with Taiwan's "Air Pollution Control and Emission Standards for Semiconductor Manufacturing" and the "Air Pollutants Emission Standards for Fixed Pollutants", and overseas subsidiary companies also meet local regulatory standards. To ensure stable 24-hour and 365-day operation of pollution control equipment, all equipment is provided with at least one set of backup systems (N + 1 design). In addition, TSMC has also established automatic monitoring systems to grasp the effectiveness of the exhaust gas treatment at all times. Relevant information is provided to the facility monitor control center and the industrial safety emergency response center at the same time, so gas emissions are tracked under a dual-track independent monitoring system, ensuring that chimney exhaust gas is in compliance with specifications. Under the control of early warning systems and immediate response, there were no unusual events that required TSMC to inform relevant authorities in 2017.

Annual Emission Reduction Rates of Volatile Organic Gases from Central Processing Facilities

<table>
<thead>
<tr>
<th>Year</th>
<th>TSMC</th>
<th>Subsidiaries</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>94.9</td>
<td>93.1</td>
<td>94.0</td>
</tr>
<tr>
<td>2014</td>
<td>95.0</td>
<td>95.3</td>
<td>95.6</td>
</tr>
<tr>
<td>2015</td>
<td>94.0</td>
<td>93.7</td>
<td>95.4</td>
</tr>
<tr>
<td>2016</td>
<td>95.3</td>
<td>95.9</td>
<td>96.5</td>
</tr>
<tr>
<td>2017</td>
<td>95.5</td>
<td>96.4</td>
<td>97.0</td>
</tr>
</tbody>
</table>

Note: Annual emission reduction rates of volatile organic gases in TSMC includes TSMC (included in all wafer fabs and packaging and testing plants in Taiwan) and subsidiary company (included in WaferTech, TSMC (China) and VisEra. VisEra taked into account in 2017).

Annual Emissions of Air Pollutants and Emissions Per Unit Product

<table>
<thead>
<tr>
<th>Year</th>
<th>THC</th>
<th>NH₃</th>
<th>Cl₂</th>
<th>HF</th>
<th>HNO₃</th>
<th>HCl</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>0.32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>0.36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>0.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>0.36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>0.36</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Note: The air pollutants emissions in TSMC refer to the total amount of emissions reported to the governing authority, including in all wafer fabs and packaging and testing plants in Taiwan. Subsidiary companies (WaferTech, TSMC (China) and VisEra) were not included in the air pollutants emissions data due to different items declaration.

Note: Total air pollutant emission includes total hydrocarbons (THC), sulfuric acid (H₂SO₄), hydrochloric acid (HCl), nitric acid (HNO₃), hydrofluoric acid (HF), phosphoric acid (H₃PO₄), chlorine (Cl₂) and ammonia (NH₃), a total of 8 kinds.

Note: Air pollutant emissions per unit product in TSMC excludes packaging and testing plants (because they do not have actual wafer output to calculate).
Case Study

Application of Hydro-membrane to Enhance Pollutant Removal Efficiency Up to 47%

In order to improve the performance of air pollution control equipment, TSMC continues to cooperate with supplier partners to introduce the latest technologies. In 2016, “hydro-membrane” technology was installed in the scrubber of Fab 14, Phase 5 in Tainan Science Park. It was found that the removal efficiency of acid and alkaline pollutants can be improved 5-47% depending on their different physical and chemical characteristics. In 2017, the technology was extended to all 12-inch wafer fabs in Taiwan and is expected to be included in the standard design for new sites in 2018.

After modularizing the installation mode of the hydro-membrane and changing the membrane material, results from Fab 14 Phases 5, 6, and 7 showed that the sulfuric acid (H₂SO₄) concentration of the scrubber was reduced up to 47%. The removal efficiency of other acid and alkaline pollutants can also be improved up to about 5~38%.

Note: “Hydro-membrane” is a slight hydrophilic filler made of monofilament, the main material being polyamide fiber (nylon). The design principle is mainly to transfer mass with larger specific surface area. Compared with the traditional Raschig Ring, the “hydro-membrane” has a larger surface area making it easier for pollutants to come in contact with the “hydro-membrane” and dissolve. In addition, the material is woven into a V-shaped system, by which the circulating water droplets fall into single filaments and immediately collide with another filament, creating a new liquid membrane, increasing the contact efficiency and enhancing the reduction effect of acid and alkaline gas pollutants.

Tasks of 2018

- Installation of the local scrubber at source equipment
- Installation of wet scrubber and dosing system in the facility chemical storage tank
- Effective separation of exhaust source for new process tools

Improvement and Evolution of TSMC Air Pollution Control Equipment

<table>
<thead>
<tr>
<th>Year</th>
<th>Local Air Treatment Equipment</th>
<th>Central Processing Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>Add scrubbers in facility chemical tank</td>
<td>Add 1st Sprinkler and dual defogger in scrubbers</td>
</tr>
<tr>
<td>2014</td>
<td>Add scrubbers in wet process</td>
<td>Two-stage vertical scrubbers</td>
</tr>
<tr>
<td>2015</td>
<td>Add water cyclone powder collector in wet process</td>
<td>Three-stage horizontal scrubbers</td>
</tr>
<tr>
<td>2016</td>
<td>Add dosing in scrubbers of facility chemical tank</td>
<td>Adding hydro-membrane in scrubbers</td>
</tr>
<tr>
<td>2017</td>
<td>Installation of high-efficient particulate filter at the terminal equipment</td>
<td>Raschig ring coating with resin</td>
</tr>
<tr>
<td>2018</td>
<td>Installation of high-efficient particulate filter at the terminal equipment</td>
<td>Raschig ring coating with resin</td>
</tr>
</tbody>
</table>

Reduction in scrubber sulfuric acid concentration

Unit: mg/Nm³

1.680 mg/Nm³
0.889 mg/Nm³

47% decline

Before adding hydro-membrane
After adding hydro-membrane
The Most Attractive Employer

Employees are TSMC’s most important asset. Our human resource management practices include providing meaningful work with good compensation, encouraging employees to develop with the Company, complying with international human rights standards and principles, and establishing a safe and healthy workplace. TSMC deeply instills a people-oriented culture and strives to become the most attractive employer.

3,663
Recruited 3,663 new employees globally in 2017 and provided excellent work opportunities

200
All facilities that conducted Validated Audit Process (VAP) audits in 2017 obtained full marks (200)

0
Enhanced occupational safety and health control measures, with no cases of occupational disease caused by chemical exposure in 2017
Material Issue

Talent Attraction and Retention

Strategies

- **Right People with Shared Vision and Value**
  - Recruit talents with proper selection criteria
  - New hires need to pass TSMC selection criteria evaluation 2020

- **Right People for the Right Jobs**
  - Implement internal transfer policy
  - Internal transfer policy implementation rate: 100% 2020

- **Competitive Compensation**
  - Provide competitive total compensation
  - Sustain total compensation at top 25% among high-tech industry peers and take leadership role 2025

TSMC 2020/2025 Goals

Achievements & Targets
New hires need to pass questionnaire and interview evaluation to ensure they are equipped with TSMC's selection criteria.

95% of the employees are willing to contribute their talents to TSMC and grow together with the Company for the next five years.

Internal transfer policy implementation rate: 100%.

Note 2: As the turnover rate remains relatively stable, internal transfer becomes necessary for human resource allocation to meet business needs.

Note 1: According to TSMC's Core Value Survey in 2016.

Target: Between 5~10%
“Right people with shared vision and values” is always the company’s guideline for recruiting talent, designing compensation package, managing employees’ performance and developing training programs while we treat everyone equally regardless his or her gender, religion, race, nationality or political party. Employees are engaged with the company’s vision and live with the same values and code of conduct. The company is devoted to maximizing employee performance and strengths by fitting for the right positions, which enables employees’ development and company’s continuous growth at the same time.

In recent years, with the development of technology and the rise of young talents, TSMC realized that proactively acquiring and retaining talents is the key to sustain long term competitive advantage in this global competition.

Character and qualifications are the most important criteria for talent selection at TSMC. In order to ensure the quality of recruitment, we developed a set of selection criteria, including integrity, resilience, perseverance, initiative, innovation, judgment and etc. Besides professional skills, all applicants shall be evaluated by the selection criteria assessment and structured interviews to ensure we find the right people with shared vision and values.

Workforce Structure

At the end of 2017, TSMC had 48,602 employees, including 31,084 managers, professionals, assistants, and 17,518 technicians. Among all employees, 46.1% hold Ph.D. or Master’s degree, and 76.6% are at the age of between 21 and 40, which helps to equip TSMC with the capabilities of innovation, research and development to adopt to the changing and competitive environment. In a knowledge intensive field such as the semiconductor industry, the innovation of our employees contributes greatly to our leading position. In terms of educational background, over 80% of our managers and professionals hold Master’s degree or above.

In addition to recruiting right people with shared vision and value, TSMC’s fabs in Taiwan create great value obviously. The Expert Market published a survey, which used “Fortune Global 500 List 2017” to analyze those companies’ profit per headcount. The profit per headcount at TSMC’s fabs in Taiwan ranked 9th in the world and was the only Asian company in the top 10, reaching US$218,951.
Based on characteristics of the semiconductor industry and social culture in Taiwan, there are more male managers and professionals in TSMC. In terms of technician group, the female workers' ratio is nearly 80%.

Compared with 2016, the percentage of females in junior management positions increased. Obviously, Female employees have good performance and prospect in TSMC.

<table>
<thead>
<tr>
<th>Workforce Structure</th>
</tr>
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<tbody>
<tr>
<td><strong>Categories</strong></td>
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<tr>
<td></td>
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<tr>
<td><strong>Employee Category</strong></td>
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<tr>
<td><strong>Location</strong></td>
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<tr>
<td><strong>Age</strong></td>
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<tr>
<td><strong>Education</strong></td>
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<tr>
<td><strong>Employment Type</strong></td>
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<tr>
<td><strong>Subtotal by Genders</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

**Female Workers**

Based on characteristics of the semiconductor industry and social culture in Taiwan, there are more male managers and professionals in TSMC. In terms of technician group, the female workers’ ratio is nearly 80%.

Compared with 2016, the percentage of females in junior management positions increased. Obviously, Female employees have good performance and prospect in TSMC.

**Ratio of Female Workers in TSMC**

<table>
<thead>
<tr>
<th>Year</th>
<th>Female Share of Total Workforce</th>
<th>Females in Management Positions</th>
<th>Females in Top Management Positions</th>
<th>Females in Junior Management Positions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>42.5</td>
<td>25.0</td>
<td>11.6</td>
<td>10.0</td>
</tr>
<tr>
<td>2014</td>
<td>42.0</td>
<td>25.0</td>
<td>12.2</td>
<td>11.1</td>
</tr>
<tr>
<td>2015</td>
<td>41.3</td>
<td>26.3</td>
<td>12.6</td>
<td>11.5</td>
</tr>
<tr>
<td>2016</td>
<td>40.1</td>
<td>22.7</td>
<td>12.7</td>
<td>11.7</td>
</tr>
<tr>
<td>2017</td>
<td>39.3</td>
<td>22.7</td>
<td>13.4</td>
<td>12.3</td>
</tr>
</tbody>
</table>

Note 1: Junior management positions include first line manager; Top management positions include Vice President & above, excluding Chairman, Vice Chairman and Co-CEOs

Note 2: Junior & top management positions exclude VisEra since the definition of junior & top management positions is different from TSMC.
Domestic Recruitment

Around 90% of employees’ working location is based in Taiwan, and thus the majority of our talent recruitment occurred domestically. 10% of employees scattered around the branches in China, North America, Europe, Japan, Korea and etc. Moreover, as TSMC gives weight on the diversity of employees, we proactively recruit talents globally while cultivate domestically to boost our long term growth momentum.

With the outstanding business performance and public’s high recognition, TSMC is voted as the best employer for domestic new graduates. In Taiwan, we vigorously recruit talents with shared vision and values via intern program, JDP (Joint Development Program), RDSS (Research Development Substitute Services) and etc. In 2017, TSMC recruited 3,663 new employees, mostly are young generation under 30 year-old.

TSMC provides intern opportunities annually as routine recruitment program, and managers regard this program as a channel to early attract outstanding talents. Our 2017 intern program was promoted through professor encouragement, campus department offices and internal employee referrals, as well as social media and face-to-face interaction with students during campus recruitment. We hope the intern program can give students an opportunity to be involved in semiconductor research and manufacturing in advance.

According to the intern post survey, 96% of interns agreed “the internship experience at TSMC can help future career”, and the overall rating for the program was 94 out of 100. Additionally, out of 265 interns in 2017, 48% received TSMC’s advanced offer after managers’ evaluation. The intern program not only supports TSMC to engage talents in the early stage, but also provides students opportunities to expose to industry practices, which can benefit them by offering a seamless on boarding process and shortening the assimilation into the industry.

Overseas Talent Recruitment

To sustain the diversity and recruit technology and management talents in special domain, TSMC continuously cultivates overseas talents. Over the years, we have hold joint development programs with MIT, Stanford University, University of California, Berkeley and etc. We have gradually expanded the amount of JDP universities and give priority to Electronic Engineering related programs to engage and target students who can join TSMC once they graduate.

Besides overseas students, we also recruit experienced talents. Thus, TSMC visits selective universities and cities periodically every year to look for semiconductor talents. The search regions for semiconductor talents expanded to Europe (UK, Germany, Belgium and Netherland), Canada and Japan. Meanwhile, TSMC participates in the Indian Institutes of Technology campus recruitment annually. In 2017, TSMC recruited 124 overseas talents.

Disable Workers

TSMC spares no efforts on disable workers hiring– in 2017, TSMC continuously collaborated with 43 colleagues to create diversified and high quality job opportunities. Besides existing job positions, TSMC also develops suitable positions for disabilities continuously such as “Recruitment Service Representatives” and etc. In 2017, the total number of disabilities hires is compliance with government regulation.

Overseas New Hires in TSMC

Unit: numbers

<table>
<thead>
<tr>
<th>Year</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>161</td>
<td>204</td>
<td>171</td>
<td>114</td>
<td>124</td>
</tr>
</tbody>
</table>

Note: 1% of 43,449 active employees within TSMC, Taiwan (12/31/2017)

Disabled Workers Hired in TSMC

Unit: numbers

<table>
<thead>
<tr>
<th>Year</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>320</td>
<td>343</td>
<td>346</td>
<td>361</td>
<td>392</td>
</tr>
</tbody>
</table>
Communication and Retention

In order to retain talents proactively, TSMC has integrated communication channels and facilitates the communication in an innovative way to introduce company environment, reinforce company values and mutual commitment among the Company and employees. The channels include interactive websites, microfilms, and videos made by employees, etc.

TSMC’s Core Values are Integrity, Commitment, Innovation, and Customer Trust. To understand the implementation of the Company’s Core Values and employees’ acceptance towards the company, TSMC conducted the TSMC Core Value Survey biennially on all employees.

According to the latest survey in 2016, employees agreed with the implementation of the company’s core values.

The survey reflects that the company’s current policies and promotion programs show positive results. In particular, 97% of employees agreed that they are willing to devote fully to their work to make TSMC an even more successful company, while 95% of them concurred with the statement that they are willing to contribute their talents to TSMC and grow together with the Company for the next five years.

Implement Internal Transfer Policy

Employee Turnover Rate

In order to retain talent effectively, TSMC aims at providing meaningful tasks, safe work environment with competitive compensation. In addition, we emphasize work-life balance and encourage employees to devote time to their family, hobbies and interact with other people in society.

Core Value Survey Sample Size and Response Rate

<table>
<thead>
<tr>
<th>Year</th>
<th>Sample Size</th>
<th>Response Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>34,390</td>
<td>89</td>
</tr>
<tr>
<td>2014</td>
<td>39,798</td>
<td>96</td>
</tr>
<tr>
<td>2016</td>
<td>44,140</td>
<td>91</td>
</tr>
</tbody>
</table>

Core Value Survey Scores

<table>
<thead>
<tr>
<th>Year</th>
<th>Integrity</th>
<th>Commitment</th>
<th>Innovation</th>
<th>Customer Trust</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>4.71</td>
<td>4.68</td>
<td>4.65</td>
<td>4.59</td>
<td>4.66</td>
</tr>
<tr>
<td>2014</td>
<td>4.71</td>
<td>4.70</td>
<td>4.66</td>
<td>4.60</td>
<td>4.68</td>
</tr>
<tr>
<td>2016</td>
<td>4.76</td>
<td>4.72</td>
<td>4.68</td>
<td>4.66</td>
<td>4.72</td>
</tr>
</tbody>
</table>

TSMC Core Value Survey

Note: The survey, conducted biennially, included TSMC fabs in Taiwan, TSMC China, TSMC Nanjing, TSMC North America, TSMC Design Technology Canada Inc., TSMC Europe B.V., TSMC Japan Limited, and TSMC Korea Limited.

2013-2017 TSMC’s Turnover Rate

<table>
<thead>
<tr>
<th>Year</th>
<th>Turnover Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>5.4</td>
</tr>
<tr>
<td>2014</td>
<td>6.2</td>
</tr>
<tr>
<td>2015</td>
<td>5.2</td>
</tr>
<tr>
<td>2016</td>
<td>4.3</td>
</tr>
<tr>
<td>2017</td>
<td>4.2</td>
</tr>
</tbody>
</table>

Note: Including TSMC

2013-2017 TSMC’s Newcomer Ratio

<table>
<thead>
<tr>
<th>Year</th>
<th>Newcomer Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>11.7</td>
</tr>
<tr>
<td>2014</td>
<td>13.2</td>
</tr>
<tr>
<td>2015</td>
<td>8.9</td>
</tr>
<tr>
<td>2016</td>
<td>7.9</td>
</tr>
<tr>
<td>2017</td>
<td>7.5</td>
</tr>
</tbody>
</table>

Note: Including TSMC
Even though the turnover rate in 2017 was lower than previous years, the Company still hired 3,663 employees in 2017 and the newcomer ratio\(^*\) reached 7.5%, making the organization stay energized.

In addition, the Company accelerated talent mobility through the transparency of internal job opportunities to encourage employees to take initiative in arranging and planning their career path. Our goal is to let right people for the right jobs and to further decrease the turnover rate. In the future, TSMC will continue driving internal transfer policy to achieve internal transfer ratio 100%.

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**Competitive Compensation Program**

**Competitiveness of Total Compensation**

TSMC provides competitive compensation packages for attracting and retaining the best talent, and for rewarding employee’s performance and encouraging their long-term contribution. Our total compensation includes base salary, allowance, employees’ cash bonus and profit sharing bonus, which is based on individual expertise, job responsibility, performance, commitment, and the Company’s operational achievement.

TSMC achieved record-high operational performance and profit in 2017. The total amount of employees’ cash bonus and profit sharing bonus in 2017 was expected to exceed NT$46 billion. The total compensation of a newly-graduated engineer with a Master’s degree in Taiwan would be equal to 32 months’ salary, including 12 months’ base salary, 2 months’ year-end bonus and around 18 months’ employees’ cash bonus and profit sharing bonus, outperforming our industry peers.

As the leading independent image sensor foundry provider, VisEra employees’ total compensation would be equal to 17 months’ salary, including 12 months’ base salary, 2 months’ year-end bonus and around 3 months’ employees’ cash bonus and profit sharing bonus which is above the average of industry peers.

---

**2017 Salary Increase and Bonus**

<table>
<thead>
<tr>
<th>Salary Increase</th>
<th>Bonus</th>
</tr>
</thead>
<tbody>
<tr>
<td>• In order to maintain the competitiveness of our total compensation, we appropriately adjust employees’ salaries annually, taking into consideration of the results of global salary surveys, market salary scales, and economic indices.</td>
<td>• Cash bonus and profit sharing for our employees are reviewed by the Board of Directors’ Compensation Committee and are connected to our financial, operational performance and future growth.</td>
</tr>
<tr>
<td>• In April 2017, TSMC completed salary increase for employees in Taiwan and overseas subsidiary. The salary increase rate for employees in Taiwan was 3%~5%, and the salary increase rate for overseas employees shall be in accordance with the compensation competitiveness of each subsidiary, which is around 8%~9% in China and 3%~4% in other regions</td>
<td>• In 2017, the Board of Directors approved distribution of employees’ cash bonus and profit sharing bonus totaling approximately NT$46,038,164,000 in Taiwan. The cash bonus of NT$23,019,082,000 distributed following each quarter of 2017 to balance our employees’ cash flow and provide timely reward.</td>
</tr>
<tr>
<td>• The profit sharing bonus of NT$23,019,082,000 to be distributed in July 2018 to encourage our employees’ continuous contribution.</td>
<td>• In 2017, TSMC employees’ compensation and benefits which includes salary, allowance, cash bonus, profit sharing bonus, pension expenses and benefit programs was NT$1,041.3 billion.</td>
</tr>
</tbody>
</table>

---

**Employees’ Compensation and Benefits**

<table>
<thead>
<tr>
<th>Unit: hundred million</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
</tr>
<tr>
<td>126.3</td>
</tr>
<tr>
<td>126.3</td>
</tr>
<tr>
<td>673.5</td>
</tr>
</tbody>
</table>

---

Note: Newcomer ratio = 2017 Newcomer / 2017 TSMC employee number

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Note: Employees’ wages and benefits mainly are salary, allowance, cash bonus, profit sharing bonus, pension expenses and benefit programs.
Benefit Program

Beyond statutory benefit requirements, TSMC offers additional benefit programs which fit employees’ needs, such as holidays, insurance plan, pension plan, financial assistance for employees who encounter difficult circumstances, subsidies for marriage, childbirth, and funerals, or discounts provided by designated vendors.

The comprehensive benefit program is the foundation of employee retention. TSMC ensures employees’ legal rights for parental leave of absence and provides employees with the flexible leave program for family care. Currently, TSMC has four TSMC kindergartens in Taiwan, so that employees can take good care of their children properly.

In order to take care of both personal and family needs, employees can apply for leaves of absence for reasons such as childcare, military service, and medical treatment for serious illness or injury. They can also apply to return to our company before the end date of his or her leave of absence. In 2017, there were 550 employees taking parental leave of absence, and 512 employees returned to work in 2017. The return-to-work rate was 81.9%. Among 427 employees who returned to work in 2016, 355 employees were still employed in 2017. The retention rate was 83.1%, higher than 2016 (78.6%). Obviously, we provide sufficient support for employees returning from leave of absence to adapt to new environment and meet the requirement of their new position.

In 2017, the number of TSMC employees (20-64 years old) in Taiwan accounts for 0.27% of population in Taiwan (20-64 years old); while the number of newborns of TSMC employees was 2,664, equal to 1.4% of the newborns in Taiwan.

Benefit Practices which Exceed the Statutory Requirement

<table>
<thead>
<tr>
<th>Item</th>
<th>Labor Law</th>
<th>Practices in TSMC fabs in Taiwan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holiday</td>
<td>12 national holidays per year</td>
<td>• TSMC holidays include 12 national holidays in accordance with the Labor Standards Act and 7 additional memorial days</td>
</tr>
<tr>
<td>Annual Leave</td>
<td>3 days for 6-month service in the first year</td>
<td>• 1 day for each 2-month service in the first year to look after new hired employees’ leave requirements</td>
</tr>
<tr>
<td>Sick Leave</td>
<td>30 days of half-paid sick leave per year</td>
<td>• 120 hours fully-paid and 120 hours half-paid sick leave per year</td>
</tr>
<tr>
<td>Personal-affairs Leave</td>
<td>14 days of personal-affairs leave per year</td>
<td>• In addition to personal affairs leave, granted based on the Labor Standards Acts, employees are entitled to 90 days of special personal leave with approval by authorized supervisors if they must attend to important personal affairs</td>
</tr>
<tr>
<td>Insurance Plan</td>
<td>Employee shall be insured by Labor and National Health Insurance for their statutory benefits from the first day they come on board</td>
<td>• In addition to the Labor Insurance and National Health Insurance, we provide comprehensive group insurance plans to employees without charge. Coverage includes life insurance, accident insurance, hospital insurance, cancer insurance, and business travel insurance. Besides, employees also have the flexibility to participate in self-pay insurance plans for their family with lower prices. • The coverage will be extended without charge to employees in leave of absence for the purpose identified by labor law. • Visita provides group insurance coverage to employees’ family without charge. The coverage will be extended for six months without charge to employee in leave of absence for the purpose identified by labor law.</td>
</tr>
</tbody>
</table>

Note: TSMC provides localized leave and insurance programs to employees in overseas regions. We grant additional days of annual leave to employees in China, North America and Europe. As for insurance program, the comprehensive life and medical insurance program are also designed in consideration of the local regulations and employee’s needs for each overseas region.
Pension Plan

Our employee pension plan includes Defined Benefit Plan under the Taiwan Labor Standards Act and Defined Contribution Plan under the Taiwan Labor Pension Act as well as the regulations of the labor law in overseas regions. In addition to statutory contributions, we also invite professional accountants and consultants to conduct precise calculations of our company’s pension fund, so as to assure sufficient funding for employee pension payments in the future.

Pension Plan and Pension Allocation in TSMC

<table>
<thead>
<tr>
<th>Defined Benefit Plans</th>
<th>Defined Contribution Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>• TSMC provides a defined benefits plan based on an employee’s length of service and average monthly salary for the six-month period prior to retirement under the Labor Standards Act.</td>
<td>• TSMC provides a defined contribution plan under the Labor Pension Act (the “Act”). Pursuant to the Act, TSMC makes monthly contributions equal to 6% of each employee’s monthly salary to employees’ pension accounts.</td>
</tr>
<tr>
<td>• TSMC contributes an amount equal to 2% of salaries paid each month and VisEra contributes a fixed amount to employee’s respective pension fund, which are administered by the Labor Pension Fund Supervisory Committee (the Committee) and deposited in the Committee’s name in the Bank of Taiwan.</td>
<td>• TSMC’s overseas subsidiaries also make monthly contributions at certain percentages of the basic salary of their employees.</td>
</tr>
</tbody>
</table>

Pension Asset as of year 2017

- The fair value of plan assets was NT$3,923,889,000 as of December 31, 2017. Accordingly, TSMC recognized expenses of NT$2,271,551,000 for the years ended December 31, 2017. Insufficient funding was included in the balance sheet under accrued pension cost and amounted to NT$8,850,704,000 as of December 31, 2017.
- VisEra’s pension reserve amount reached NT$1,396,000 as of December 31, 2017.

- According to TSMC recognized expenses of NT$2,969,940,000 for the years ended December 31, 2017.
### Compensation Ratio between Male and Female

Our total compensation is non-discriminatory without regard to gender, religion, race, nationality or political affiliation.

#### The Ratio of Annual Total Compensation between Female and Male Employees in Each Region of TSMC

<table>
<thead>
<tr>
<th>Region</th>
<th>Position</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taiwan</td>
<td>Manager</td>
<td>1.08</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Professional</td>
<td>1.04</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Assistant Engineer/Clerical</td>
<td>0.92</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Technician</td>
<td>0.85</td>
<td>1</td>
</tr>
<tr>
<td>China</td>
<td>Manager</td>
<td>1.04</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Professional</td>
<td>1.15</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Assistant Engineer/Clerical</td>
<td>1.06</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Technician</td>
<td>1.00</td>
<td>1</td>
</tr>
<tr>
<td>Japan</td>
<td>Manager</td>
<td>1.75</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Professional</td>
<td>1.21</td>
<td>1</td>
</tr>
<tr>
<td>North America</td>
<td>Manager</td>
<td>1.22</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Professional</td>
<td>1.37</td>
<td>1</td>
</tr>
<tr>
<td>Europe</td>
<td>Manager</td>
<td>0.50</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Professional</td>
<td>1.11</td>
<td>1</td>
</tr>
</tbody>
</table>

#### The Ratio of Annual Total Compensation between Female and Male Employees in TSMC Subsidiary

<table>
<thead>
<tr>
<th>Company</th>
<th>Position</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>VisEra</td>
<td>Manager</td>
<td>1.28</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Professional</td>
<td>1.13</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Assistant Engineer/Clerical</td>
<td>1.12</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Technician</td>
<td>0.95</td>
<td>1</td>
</tr>
<tr>
<td>WaferTech</td>
<td>Manager</td>
<td>1.25</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Professional</td>
<td>1.23</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Assistant Engineer/Clerical</td>
<td>1.11</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Technician</td>
<td>0.93</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: TSMC (Nanjing) is at the start-up stage, so China includes TSMC (China) only.

### Encourage Employees’ Outstanding Performance

To encourage employees’ continuous development, TSMC recognizes employees’ performance through performance management, development system, and promotion system. For technical talents, TSMC provides a dual-ladder system as an appropriate evaluation and recognition approach. For entry level employees, TSMC holds Excellent Labor Awards annually and invites awardees’ families to join the ceremony and banquet. In order to appreciate senior employees’ commitment and contribution to the Company, TSMC also provides service awards and retirement acknowledgment.

Apart from the above awards, TSMC strives to recommend employees to participate in external awards. In 2017, TSMC employees continued to be recognized through national awards and competitions such as the National Model Labor Award, the Outstanding Engineer Award, the Excellent Young Engineers Award, and the National Management Excellence Award.

Chairman Dr. Morris Chang publicly presented the “30-year Service Award” to employees at the Company’s annual Sports Day, praising employees’ contribution to the Company.
Material Issue

Talent Development

Enable Self-directed Learning

Providing diverse learning resources, encouraging employees’ self-directed learning, and applying their learning results to the workplace to enhance working effectiveness.

- Over 60% of organizational learning or development programs are embedded the self-directed leaning mechanism [2020]
- Support the training and development for employees of the new plant to achieve the missions of plant set-up, machine installation, or mass production [2020]
- Increase the percentage of open positions filled by internal candidates via JOS or promotion to 65% [2020]

Focus One: Ethical Management
Focus Two: Innovation and Service
Focus Three: Responsible Supply Chain
Focus Four: Green Manufacturing
Focus Five: Inclusive Workplace
Focus Six: Common Good

Our Business
Sustainable Governance
Focus Three
Focus Four
Focus Five
Focus Six
Appendix

Achievements & Targets

TSMC 2020/2025 Goals
Increase the percentage of self-directed learning mechanism to 50% in organizational learning or development programs.

100% support the training for employees of the new sites to achieve the missions of plant set-up, machine installation, or mass production.

Increase the percentage of open positions filled by internal candidates via JOS or promotion to 64%.

63.4% Completion rate of pre-training for Taiwan assignees.

100% Completion rate of orientation for Nanjing newly recruited employees.

5~10% CAGR in Revenue Per Headcount. Target: Based on organizational needs, implement organizational and talent development projects to enhance working effectiveness.

10~15% CAGR in Profit Per Headcount. Target: Based on organizational needs, implement organizational and talent development projects to enhance working effectiveness.

92% Completion rate of pre-training for Taiwan assignees. Target: Continuously support employees in Nanjing site to accomplish the missions.

100% Completion rate of orientation for Nanjing newly recruited employees. Target: Continuously support employees in Nanjing site to accomplish the missions.

63.4% Percentage of open positions filled by internal candidates. Target: 63%.
Enable Self-directed Learning

In view of the rapid advancement in technology, TSMC encourages employees to follow the Company’s growth, organizational needs and individual performance requirement, go into multiple learning activities of unlimited time, places, and forms, and transfer the outcomes to the workplace to enhance their effectiveness. At the same time, we gather more energy for the Company to grow and uplift the society. This is TSMC’s long-term goal for talent development.

In 2017, the compound annual growth rate (CAGR) in revenue per employee reached 5-10%. The CAGR in profit per employee was as high as 10-15%. It shows that the Company’s investments in organization development and people development resulted in substantial benefits. In the future, in addition to encouraging employees to actively implement self-directed learning, the self-directed learning mechanism will be incorporated into the learning and development programs in response to organizational needs and performance requirements.

Learning and Development

Employee’s learning and development is an integral and critical factor for the growth of a company, and it should be ‘goal-oriented, planned and disciplined’. TSMC is committed to cultivating a continuous and diverse learning environment, and established ‘TSMC Employee Training and Education Procedure’ to ensure that the Company’s and individuals’ development objectives can be achieved through the integration of internal and external training resources.

TSMC provides individual development plans (IDPs) which are tailored to individual job requirements, performance assessment results, and career development needs. Based on this, the Company plans and organizes the annual training plan. In 2017, TSMC provided nearly 640,000 hours of training and a total of nearly 550,000 attendees participated. On average, each employee attended over 13.1 hours (coaching during the work and employees’ self-directed learning were excluded) of training and TSMC spent over NT$64 million on the learning and development for employees.

Note: The performance appraisal was conducted in the middle of the year and at the end of the year, and the assessment rate was 100% in 2017.
To ensure the quality of the courses, we measure the training effectiveness through questionnaires and pre- and post-assessment mechanisms to continuously improve the quality. As the quality of the course improved year by year, the average score of trainees’ evaluation (course content, instructor, administration and effectiveness) increased to 95 points in 2017.

In addition to the training or learning and development activities implemented in accordance with the annual training plan, TSMC also plans annual learning and development key projects in response to organizational training or development needs. The top three key learning and development focuses in 2017 were as follows: people management capability enhancement for first-line managers, organization and talent development programs, and new site training.

2017 Key Focuses of Learning and Development

- **People Management Capability Enhancement for First-line Managers**
  - Streamline the people management capabilities required for first-line managers to perform their management responsibilities
  - Ratio of attendees over full-time employees: 11.0%

- **Organization and Talent Development**
  - Timely resolve organizational issues and enhance employees’ working effectiveness
  - Ratio of attendees over full-time employees: 2.9%

- **New Site Training**
  - Implement training for employees located in Nanjing to enable the organization and personnel to complete tasks in the new sites
  - Ratio of attendees over full-time employees: 1.6%

Achievements

- **Enhance the personnel sensitivity of first-line managers in Operations, so as to reduce the risk of people and issue management. There was 89% completion and the ROI of the training reached 96 points**
- **Completed a total of 32 programs which provided substantial benefits to organizations and employees in meeting performance, decision making, communication, and project management, and so forth**
- **Organizational development programs received positive feedbacks from the users. For example, vice president of Quality and Reliability said that he clearly felt in various meetings that his staff made great strides in communication skills that showed in 'Stating clearly with full picture and attractive content' after the implementation of the 'Storytelling Capability Enhancement Project'. The increased management capabilities also reduced the time to handle customer issues by 10%**
- **Carried out the pre-training for Taiwan assignees, the orientation and the core value in-depth training for Nanjing newly recruited employees to accelerate their adaptation to the new jobs**
- **The complete training of personnel enabled employees in Nanjing site to get ready in time and started to install machines in September of 2017**
- **The timeline of mass production in Nanjing will be ahead of schedule by more than one quarter**
Case Study

The Nanjing Site Transplanted Taiwan’s Experiences
The Progress of Mass Production will be Substantially Ahead of Schedule by More Than One Quarter

The first batch of employees hired by TSMC (Nanjing) completed the off-site training in Taiwan and declared to complete the missions before returning to Nanjing.

In order to facilitate the smooth construction of the Nanjing site, and put the personnel in place in the shortest time, Human Resources transplanted the training experiences from headquarters to support employees in Nanjing to quickly upgrade their capabilities to achieve the missions of the Nanjing site. The training includes: pre-training for Taiwan assignees, new comer orientation for Nanjing newly recruited employees, and Core Value in-depth training for the first batch of employees hired in Nanjing.

The solid training enabled employees in the Nanjing site get ready in time and started to install machines in September of 2017. Additionally, learning management system and e-Learning platform were built up as plan to enable self-directed learning.

Training Program for Nanjing Employees

Pre-training for Taiwan Assignees

Taiwan assignees to Nanjing
- Strengthen assignees’ awareness of TSMC Code of Conduct and Proprietary Information Protection
- Accelerate assignees’ adaptation to the environment
- Completion rate: 92%
- ROI: 91 points

Core Value In-depth Training

First batch of employees hired by Nanjing site
- Help employees apply TSMC Core Values in their daily work
- Completion rate: 100%
- ROI: 96 points

New Comer Orientation

Nanjing newly recruited employees
- Accelerate new hires’ adaptation to the environment and assist them in acquiring the needed skills
- Completion rate: 100%
- ROI: 98 points

Training Effectiveness
People Development

In order to retain internal talents, TSMC provides a diverse and comprehensive people development structure for employees, and strengthens the ‘Dual Ladder System’ so that employees can get appropriate development based on their attributes and expertise in managerial, technical or professional fields. Moreover, under the principals of making internal job opportunities transparent and respecting employees’ transfer decisions, the Company encourages employees to plan and arrange their own career path along with organization development.

For the promotion system, TSMC believes that the most important factor to consider is potential. Therefore, ‘Potential’ of an employee is set as an important item when conducting promotion assessment.

In 2017, the percentage of open positions filled by internal candidates reached 63.4%, an increase of 1.2 percentage points over the previous year. In the future, the Company will continue to strengthen the dual-ladder development system and implement internal transfer management so that by the year of 2018, the percentage of open positions filled by internal candidates will be increased to 64%.

2017 Key Focus of People Development

Dual-ladder System

Build a diverse and comprehensive people development structure and reinforce Human Resources policy and procedures to provide employees an appropriate development environment

People Mobility

Respect employees’ transfer decisions, and encourage employees to take initiative to plan and arrange their own career path, which accelerates internal talent mobility simultaneously

Promotion Criteria - Potential

Emphasize the importance of employee’s potential in the promotion system to enhance the quality of promotion decision-making

Achievements

- Clearly define the difference of managerial/technical/professional manager, and apply the definition to performance appraisal and development process
- Provide differentiated training programs for managerial/technical/professional managers
- Regularly promote technical staff to academicians/commissioners of TSMC Academy to encourage the career development of technical staff
- Make internal job opportunities transparent and define the principle of transfer in related procedures. Through clear internal communication to managers, help them understand the regulations and put the regulations into effect
- Define the meaning of potential, identify the assessment approach, and set it as a promotion criterion
- Establish a guidebook for promotion process and assist managers to evaluate employees’ potential for promotions
Material Issue

Human Rights

Proactively implement "TSMC Human Rights Policy"

Other than balancing employee’s welfare and shareholder’s equity, TSMC does the best to contribute to the society. We’re not only an excellent corporate citizen, but also a world-class enterprise. 2020
Check and trace "TSMC Human Rights Policy"

Target: Check and trace "TSMC Human Rights Policy"

- Fully implement RBA Code of Conduct and granted it as internal management goals
Human Rights Policy
TSMC abides by local laws and regulations in all countries and regions where we operate, and the company upholds the human rights of workers, including regular, contract and temporary employees, interns, etc. We treat them 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 (RBA) Code of Conduct.

Human Rights Assessment
As the world’s largest dedicated semiconductor foundry, TSMC is committed to ensuring that working conditions in its facilities are safe, that workers are treated with respect and dignity, and that business operations are environmentally responsible and conducted ethically. In reflection of this commitment, TSMC in December 2014 became a member of the Responsible Business Alliance (RBA, formerly EICC or Electronic Industry Citizenship Coalition), and went through a meticulous due diligence process to make sure that its own code of conduct is consistent with and not less stringent than the RBA Code of Conduct. Every year, TSMC makes use of a standardized risk assessment template called the Self-Assessment Questionnaire (SAQ) developed by the RBA to identify the highest social, environmental and ethical risks in its operations. In addition, TSMC has put together a plan to execute VAP (Validated Audit Process) audits for all its facilities over a two-year period starting 2016. The VAP is the RBA standard for effective, shareable audits carried out by independent, third-party auditors specially trained in social and environmental auditing and the VAP audit protocol. The audit reports, once available, are published transparently through the electronic RBA-Online platform such that TSMC’s customers can easily access them.

Human Rights Policy Concerns and Practices

<table>
<thead>
<tr>
<th>Provide a Safe and Healthy Work Environment</th>
<th>Eradicate Discrimination to Ensure Equal Employment Opportunity</th>
<th>Forbid Child Labor</th>
<th>Eliminate Forced Labor</th>
<th>Promote Employee Physical and Mental Health and Work-life Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Set &quot;zero accident&quot; as safety and health goal</td>
<td>• Follow local government labor act, international norms and &quot;TSMC Human Rights Policy&quot; to implement the rules and regulations</td>
<td>• Complying with &quot;TSMC Human Rights Policy&quot;, the Company amended and implemented &quot;TSMC Candidate Interview Process Control Instruction&quot;. TSMC only accepts applicants over the age of 18 and exam employment to avoid any omissions</td>
<td>• Adhere firmly to local regulations, internationally-recognized protocols and &quot;TSMC Human Rights Policy&quot;, the Company has never forced involuntary labor from any person with menace of any penalty</td>
<td>• To provide a wide range of activities such as arts, sports, family participation and parent-child interaction. Community involvement also helps to broaden the interpersonal interaction among colleagues and enrich the concept of &quot;work-life balance&quot;</td>
</tr>
<tr>
<td>• Adopt strict safety and health management procedures, maintain stringent standards for facility and hardware operations</td>
<td>• Promote and implement internal control procedures by revealing non-discrimination policy – do not discriminate because of race, class, language, thought, region, religion, political party, native origin, birth place, gender, sex, sexual orientation, age, marriage, pregnancy, appearance, facial features or disability</td>
<td>• Adhere firmly to local regulations, internationally-recognized protocols and &quot;TSMC Human Rights Policy&quot;, the Company has never forced involuntary labor from any person with menace of any penalty</td>
<td>• To provide a wide range of activities such as arts, sports, family participation and parent-child interaction. Community involvement also helps to broaden the interpersonal interaction among colleagues and enrich the concept of &quot;work-life balance&quot;</td>
<td>• The Company owns on-site day-care center to assist employees in need and provide counselling services</td>
</tr>
<tr>
<td>• Conduct individual and group management by analysis of health examinations and occupational factors to prevent potential health risks</td>
<td>• To conduct imperative adjustments according to the findings from internal control</td>
<td>• Complying with &quot;TSMC Human Rights Policy&quot;, the Company amended and implemented &quot;TSMC Candidate Interview Process Control Instruction&quot;. TSMC only accepts applicants over the age of 18 and exam employment to avoid any omissions</td>
<td>• To provide a wide range of activities such as arts, sports, family participation and parent-child interaction. Community involvement also helps to broaden the interpersonal interaction among colleagues and enrich the concept of &quot;work-life balance&quot;</td>
<td>• The Company owns on-site day-care center to assist employees in need and provide counselling services</td>
</tr>
<tr>
<td>• Provide health promotion activities and employee assistance programs based on employee's needs to help them implement a healthy life style</td>
<td>• From the very beginning, all application processes are handled according to the law to avoid discrimination</td>
<td>• From the very beginning, all application processes are handled accordingly to the law to eradicate child labor</td>
<td>• All employees</td>
<td>• We draw a lottery to provide services, employees who are not able to join day-care center will be provided additional advice</td>
</tr>
<tr>
<td>• Work-induced cerebral and cardiovascular disease</td>
<td>• From the very beginning, all application processes are handled accordingly to the law to eradicate child labor</td>
<td>• From the very beginning, all application processes are handled accordingly to the law to eradicate child labor</td>
<td>• All employees</td>
<td>• We draw a lottery to provide services, employees who are not able to join day-care center will be provided additional advice</td>
</tr>
<tr>
<td>49</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Human Rights Risk Reduction Measures

To mitigate human rights risks, TSMC actively carries out concrete improvement plans to create a quality work environment. At the same time, TSMC aspires to reverse the stigma associated with factories located in Taiwan. Following the 6 VAP audits conducted in 2016, the remaining facilities completed the audit in 2017 with outstanding results. All our VAP audits in 2017 attained a perfect score of 200, and that translates to an average score of 198.5 for our 16 facilities. The average is markedly higher than the figures published by the RBA for 2016 - worldwide average for initial audits and closure audits were 127.4 and 154.1 respectively.

Human Rights Protection Related Training

<table>
<thead>
<tr>
<th>Year</th>
<th>Times of Attendees who Completed Human Right Protection Related Training</th>
<th>Number of training hours of human rights protection related training</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>20,299</td>
<td>77,810</td>
</tr>
<tr>
<td>2014</td>
<td>21,116</td>
<td>78,651</td>
</tr>
<tr>
<td>2015</td>
<td>18,938</td>
<td>67,712</td>
</tr>
<tr>
<td>2016</td>
<td>16,372</td>
<td>55,913</td>
</tr>
<tr>
<td>2017</td>
<td>61,047</td>
<td>28,622</td>
</tr>
</tbody>
</table>

Note: The data scope includes Taiwan, China and North America.

TSMC Human Rights Protection Related Training Practices

- **Provide Regulatory Compliance Information in New Employee Orientation**
  - Including forced labor prohibition, child labor prohibition, anti-discrimination, anti-sexual harassment, working hours management, human treatment and a healthy and safe environment.

- **Provide Sexual Harassment E-learning**
  - Including the major concept and prevention of sexual harassment, and practical approaches to deal with sexual harassment.

- **Implement Serial Propagandas Regarding the Prevention of Workplace Bullying**
  - Help employees understand what is bullying in the workplace, and know how to avoid bullying behaviors, so as to jointly create a friendly working environment with zero bullying.

- **Provide Comprehensive Occupational Safety Trainings**
  - Including fire training, emergency response training, first-aid training, general environment, safety and health training, occupational safety and health training for new and promoted managers.

Continuous Improvement Process of Labor Conditions

1. SAQ self assessment/VAP audit
2. RBA task force reviews non-compliance(s) and makes suggestions for improvement
3. RBA taskforce reports improvement results to relevant VP(s) regularly
4. Relevant VP(s) approves improvement plan
5. RBA task force monitors execution progress
6. Individual fabs execute the improvement plan
## RBA Worldwide VAP Audit Performed

### Unit: number of audit

<table>
<thead>
<tr>
<th>Year</th>
<th>Initial Audits</th>
<th>Closure Audits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>343</td>
<td>161</td>
</tr>
<tr>
<td>2016</td>
<td>375</td>
<td>163</td>
</tr>
</tbody>
</table>

## RBA Worldwide Average VAP Audit Score

### Unit: score

<table>
<thead>
<tr>
<th>Year</th>
<th>Initial Audits</th>
<th>Closure Audits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>121.7</td>
<td>155.6</td>
</tr>
<tr>
<td>2016</td>
<td>127.4</td>
<td>154.1</td>
</tr>
</tbody>
</table>

## Risk Assessment in 2017

<table>
<thead>
<tr>
<th>Region</th>
<th>Fab 2</th>
<th>Fab 5</th>
<th>Fab 12B</th>
<th>Fab 14B</th>
<th>Fab 15B</th>
<th>Corporate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SAQ</td>
<td>VAP</td>
<td>SAQ</td>
<td>SAQ</td>
<td>SAQ</td>
<td>SAQ</td>
</tr>
<tr>
<td></td>
<td>92.6</td>
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<td>200</td>
<td>92.6</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>SAQ</td>
<td>VAP</td>
<td>SAQ</td>
<td>SAQ</td>
<td>SAQ</td>
<td>95.3</td>
</tr>
<tr>
<td></td>
<td>92.6</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>92.6</td>
</tr>
</tbody>
</table>

### SAQ Full Score is 100  VAP Full Score is 200

- **Low Risk**: ≤85
- **Medium Risk**: ≥65 & <85
- **High Risk**: <65

### Score Improvement

<table>
<thead>
<tr>
<th>Location</th>
<th>In 2017</th>
<th>In 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>33.9</td>
<td>26.7</td>
</tr>
</tbody>
</table>

### Categories

- **Corporate**
- **SAQ VAP**
- **Taiwan**
- **U.S.**

### Regions

- **Taiwan**: Fab 2, Fab 5, Fab 12B, Fab 14B, Fab 15B
- **U.S.**: WaferTech
- **Corporate**: TSMC (China), WaferTech
In 2017, the RBA rolled out a new membership scheme to help members establish their own compliance programs and encourage them to pursue higher sustainability standards. In the new scheme, membership is divided into four different tiers, with the “Full Member” being the highest recognition. After months of preparation, including revamping the shift handover system of direct labor to safeguard their interest, TSMC successfully acquired the “Full Member” status. In other words, TSMC’s CSR-relevant policies, procedures, and management systems are now certified by the RBA.

Internal Communication Channels for Employees

TSMC strives to create harmonious employee relations, values two-way communication and fosters open communication channels for management levels, subordinates and peers. The Company provides a number of voice channels with handling the cases in a fast and confidential manner. Among them, people in charge are the highest executives of human resources organizations, demonstrating our emphasis on employee opinions. Effective communication between the Company and employees creates a high-involvement working environment. Employees are also highly engaged and willing to make commitments to TSMC. In addition, TSMC abides by regulations to hold Labor-Management Meetings periodically, summarizes and publishes business updates, labor conditions, and employee welfare activities for employees.

In 2017, there were 4,363 cases being raised through internal communication channels in Taiwan, including 7 sexual harassment cases from sexual harassment investigation committee, 79 cases via ombudsman system, 645 cases via employee opinion box, and 3,632 cases via fab caring circle. All these cases were well-handled by the designated team. All sexual harassment and ombudsman cases were investigated and reviewed by committee members. As for the employee opinion box, all cases were dispatched and replied by the people in charge based on the questions. Employees can easily access these internal communication channels via myTSMC (an internal employee portal). Internal communications channels were also introduced toward newcomers during the orientation to ensure all Taiwan employees could be well-informed of the channels since very beginning.

The relationship between our management level and employees has been harmonious over the years due to our effective communication channels. TSMC respects the right to form a labor union of employees, but no employees have pursued it so far, underlying the achievement of the Company’s dedication. In 2016, there were no losses resulting from labor disputes.

<table>
<thead>
<tr>
<th>Year</th>
<th>Fab Caring Circle</th>
<th>Employee Opinion Box</th>
<th>Ombudsman System</th>
<th>Sexual Harassment Investigation Committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>7,725</td>
<td>6,425</td>
<td>4,937</td>
<td>4,682</td>
</tr>
<tr>
<td>2014</td>
<td>7,140</td>
<td>5,842</td>
<td>4,317</td>
<td>5,842</td>
</tr>
<tr>
<td>2015</td>
<td>543</td>
<td>540</td>
<td>589</td>
<td>712</td>
</tr>
<tr>
<td>2016</td>
<td>35</td>
<td>39</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>2017</td>
<td>4</td>
<td>7</td>
<td>5</td>
<td>79</td>
</tr>
</tbody>
</table>

Note: The opinion on “113 Caring-dedicated line” and “SMS” will be handled by the designated person and be transferred to other appropriate voice channels.
Material Issue

Occupational Safety and Health

**Strategies**

**Advocate Safety Culture**
- Deeply instill a people-oriented safety culture and establish an intrinsically safe working environment

**Establish an Optimal Healthy Workplace**
- Promote employee health and achieve work-life balance

**Upgrade Industry Safe Workplace Environment**
- Collaborating with external parties to reduce safety and health risks

**TSMC 2020/2025 Goals**

- **Expect to reduce disabling frequency rate to 0.37** 2020
- **Expect to reduce disabling severity rate to 4.55** 2020
- **Expect to reduce work-relative disabling frequency rate to 0.23** 2020
- **Expect to reduce work-relative disabling severity rate to 2.39** 2020
- **Expect the Self-help participation rate of health programs to be equal to or greater than 54%** 2020
- **Expected completion rate for coaching and conducting audits to high risk suppliers to 100%** 2020

**Achievements & Targets**

---

**Note 1:** Boundary of TSMC 2020 vision is applied to TSMC Taiwan operations

**Note 2:** Owing to the unpredictability of "non-work-relative" disability injuries, TSMC decided to stipulate "work-relative" disabling frequency rate and disabling severity rate. Our 2020 goal is 30% lower than the 2017 level for internal continuous improvement.

**Note 3:** Set the "Self-help participation rate of health programs" as a key performance index of participation and effectiveness from employee’s attendance of non-mandatory health programs, which may include some overlaps in participation.

**Note 4:** Revisit target setting. Regarding safety and health management system of high-risk operation suppliers, we will reduce the risk of workplace safety and health through counseling and auditing, and enhance the industrial safety working environment.
### Disabling Frequency Rate (FR)
- **Target:** <0.45
- **Achieved:** 0.56

### Disabling Severity Rate (SR)
- **Target:** <6.0
- **Achieved:** 7.84

### Self-help Participation Rate
- **Target:** ≥47%
- **Achieved:** 50.67%

Note: In 2017, five individual cases of disabling injuries accounted for 64 percent of the cumulative disability days. Among them, four cases were non-work relative, while one was work relative, making TSMC fail to achieve its targets for SR and FR set for 2017.

Completion rate for coaching and conducting audits to high risk suppliers to 30%
TSMC stays abreast of global safety and health topics, meets or surpasses international safety and health regulations and standards. The Company establishes a safe and healthy working environment, pursues zero accidents, establishes an optimal safe and healthy workplace to become a world-class company in safety and health management. In addition to adopting rigorous safety and health control measures, TSMC enhances every employees’ and contractors’ awareness and sense of accountability for safety and health to prevent occupational injuries and diseases. TSMC also collaborates with customers and suppliers to work together towards upgrading supply chain safety and health performance.

Promoting Safety Culture

The first step towards promoting a safety culture is to integrate company internal resource and establish definite responsibilities of Executive Organization to respond to external stakeholders’ expectations of TSMC.

Safety and Hygiene Performance

The standard procedures are established in accordance with the Occupational Safety and Health Act, as well as the requirements of the Occupational Health and Safety Assessment Series (OHSAS-18001), with reference to advanced domestic and international safety and health practices. The occurrence of errors can thus be reduced, periodic inspection performed every year, and modifications made. In order to strengthen the management and control of the risk of chemical exposures, TSMC has built up TSMC’s laboratory safety and health standardization management practices for laboratories with manual operations and high exposure risks.

To ensure that relevant safety and health procedures have been solidly implemented, a Safety Performance Index (SPI) system is formulated; the daily results of carrying out safety and health practices in plants based on quantification management can then be obtained. SPI includes leading indicators and lagging indicators. SPI adopts a “management mechanism using blue, green, yellow and red lights as indicators.” A yellow light suggests a false alarm incident in a plant, and the Industrial Safety and Environmental Protection Department will immediately conduct an investigation. The improvement measures will be synchronously spread to other plants to reduce the recurrence of similar false alarm incidents. Regarding the 2017 yellow light incident, the main cause was that on-site employee did not comply with the procedures for the use of chemicals. The improvement practices focused on strengthening colleagues’ awareness of chemical hazards, and job safety and health training.

Executive Organization
### Safety Performance Index

<table>
<thead>
<tr>
<th>Active Items</th>
<th>Passive Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Numbers of safety management of change</td>
<td>• Numbers of incident</td>
</tr>
<tr>
<td>• Numbers of safety and health executing program</td>
<td>• Numbers of proactive audit defects</td>
</tr>
<tr>
<td>• Numbers of safety and health licenses</td>
<td>• Completed rate of regulation identification</td>
</tr>
<tr>
<td>• Numbers of safety and health promotion activity</td>
<td>• Internal and external defect rates of safety and health</td>
</tr>
<tr>
<td></td>
<td>• Contractor management (Include the numbers of inspection audit defect, proactive audit defect, notify abnormal case to site ISEP proactively, proactive improvement)</td>
</tr>
</tbody>
</table>

### Sample of Four-Level Lights

<table>
<thead>
<tr>
<th>SPI</th>
<th>Performance</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPI ≥ 95</td>
<td>Excellent</td>
<td>Blue</td>
</tr>
<tr>
<td>85 ≤ SPI &lt; 95</td>
<td>Good</td>
<td>Green</td>
</tr>
<tr>
<td>70 ≤ SPI &lt; 85</td>
<td>Warning</td>
<td>Yellow</td>
</tr>
<tr>
<td>SPI &lt; 70</td>
<td>Alarm</td>
<td>Red</td>
</tr>
</tbody>
</table>

### SPI Four-Level Lights Ratio

<table>
<thead>
<tr>
<th>Year</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>84.9</td>
<td>12.3</td>
<td>3.5</td>
<td>2.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>95.1</td>
<td>3.5</td>
<td>1.4</td>
<td>2.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>95.1</td>
<td>4.1</td>
<td>3.4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>94</td>
<td>3</td>
<td>0.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Structure of Safety and Hygiene

**Achievements in 2017**

- Completed 2,742 safety management changes. Zero related incidents.
- Revised occupational health procedure to build up occupational disease prevention and response procedure.
- Zero incident caused by tool installations.
- Zero case of chemical exposure occupational disease.
- Completed 1,827 safety and health management programs.
- Enhanced earthquake response procedure. Revised annual emergency response drill earthquake intensity to 6th grade.
- Traced infectious disease status from Centers for Disease Control, R.O.C.
- Enhanced ergo risk management system to build up manual wafer handling of hand burden evaluation of 6 and 8-inch semiconductor factory.
- Integrated employee health program including hazardous awareness and environment control to build up healthy workplace.
Disabling Injury Statistics

A statistical analysis of TSMC’s occupational injury rate is performed in accordance with leading indicators used in obtaining statistics on disabling injuries released by the Ministry of Labor and GRI 4; lowering the injury frequency rate (FR) and lowering the injury severity rate (SR) are chosen as the bases for the analysis (the statistics exclude traffic accidents occurring outside the plants).

There was no death due to occupational disease or work-related death at TSMC in 2017. There were a total of 44 disabling injury cases and 664 work-relative disability cases. Disabling injuries occurred to a total of 15 male employees over a period of 330 cumulative days, and to a total of 29 female employees over a period of 314 cumulative days. The female disabling injury frequency and severity rates were far higher than those of male. The reason behind this result was that the total number of working hours for male employees was 1.6 times that of working hours for female employees.

Note: In 2017, male employees cumulative working hours is 50,557,053 and female employees cumulative working hours is 31,558,154.

Injury Pattern by Gender

Through analyzing the pattern of injury, falls that were caused by improper movement accounted for 43% of the total disabling injury cases and 18% of the total number of cumulative work disability days. In addition to falls case, an analysis of the number of cumulative work disability days for the top five occupational injuries (as shown in the following table), apart from injuries caused by a fall, suggests that the total accounts for 64% of the number of cumulative work disability days. Among these injuries, four of them were “non-work-relative” and one was “work-relative”. As a result, TSMC failed to achieve its target FR and SR in 2017. For the occupational injury case management, TSMC will proceed the root cause review and improvement on a quarterly basis.

2017 TSMC Types of Occupational Injuries (TSMC Taiwan Operations)

<table>
<thead>
<tr>
<th>Types of occupational injuries</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Loss day</td>
<td>Case</td>
<td>Loss day</td>
</tr>
<tr>
<td>Total working hours yearly: 50,557,053 hours</td>
<td>330 15</td>
<td>314 29</td>
<td>644 44</td>
</tr>
<tr>
<td>Work-related</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Musculoskeletal injury</td>
<td>12 1</td>
<td>140 1</td>
<td>152 2</td>
</tr>
<tr>
<td>Injuries caused by falling objects</td>
<td>3 1</td>
<td>13 2</td>
<td>16 3</td>
</tr>
<tr>
<td>Cut/incision/abration/puncture wounds</td>
<td>17 1</td>
<td>5 1</td>
<td>22 2</td>
</tr>
<tr>
<td>Pinch point and entanglement injuries</td>
<td>23 4</td>
<td>0 0</td>
<td>23 4</td>
</tr>
<tr>
<td>Injuries caused by a bump</td>
<td>2 1</td>
<td>10 6</td>
<td>12 7</td>
</tr>
<tr>
<td>Injuries caused by a fall</td>
<td>0 0</td>
<td>48 9</td>
<td>48 9</td>
</tr>
<tr>
<td>Others</td>
<td>0 0</td>
<td>12 2</td>
<td>12 2</td>
</tr>
<tr>
<td>Non-work-relative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sports injuries</td>
<td>262 3</td>
<td>0 0</td>
<td>262 3</td>
</tr>
<tr>
<td>Traffic accidents occurred inside plants</td>
<td>0 0</td>
<td>29 2</td>
<td>29 2</td>
</tr>
<tr>
<td>Injuries caused by a fall</td>
<td>11 4</td>
<td>57 6</td>
<td>68 10</td>
</tr>
</tbody>
</table>

Types Explanation on disabling injuries suffered by employees

<table>
<thead>
<tr>
<th>Types</th>
<th>Explanation on disabling injuries suffered by employees</th>
<th>Loss day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work-relative</td>
<td>Injuries caused by human factors: long-term and repetitive handling of wafer cassettes that lead to the occurrence of carpal tunnel syndrome in both hands</td>
<td>141</td>
</tr>
<tr>
<td>Non-work-relative</td>
<td>Sprain of left ankle due to participation in a running race at a sporting event</td>
<td>165</td>
</tr>
<tr>
<td></td>
<td>A bone fracture due to a fall when running in a race at a sporting event</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>A bone fracture due to a fall when participating in the Windy City Cup Basketball Tournament</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Falling off a scooter due to skidding when riding through a ditch cover inside a plant on a rainy day</td>
<td>28</td>
</tr>
</tbody>
</table>
Improvements

Operations at TSMC’s 6inc and 8inch factories mostly rely on manual handling. To avoid ergo occupation disease, TSMC controls from three aspects: hardware control, on-site job safety observation and people case to seek improvement opportunities.

- **Non-work-relative**
  - On-site facility check and improvement
  - Post promotion of driving safety awareness in public area
  - Promote employee safety awareness
  - Promote warm-up exercises to avoid sport injuries
  - Promote and remind driving safety concept
  - Arrange tire check service to employee motorcycle

- **Work-relative**
  - Enhance existing electronic ergo risk identification system
  - Adjust distance to alleviate burden on arms
  - Adjust production capacity of machines to alleviate the burden on the body when twisting
  - Introduce collaborative robots to assist manual wafer handling
  - Continue to conduct on-site operational observation, and immediately rectify incorrect operation
  - Cooperate with occupational medical doctor to conduct on-site operational observation
  - Adjust the frequency of conducting a health checkup questionnaire from 3 years to one year
  - Proactive health care medical help on the leave of employee within muscle discomfort

- **Hardware Control**
  - Adjust production capacity of machines to alleviate the burden on the body when twisting

- **On-site Job Safety Observation**
  - Continue to conduct on-site operational observation, and immediately rectify incorrect operation

- **People Case**
  - Cooperate with occupational medical doctor to conduct on-site operational observation
  - Proactive health care medical help on the leave of employee within muscle discomfort
With the rapid development of industrial automation technology, TSMC’s 12-inch wafer manufacturing factories have been automatic. They use Auto Material Handling System (AMHS) to replace the wafer manual handling by employees. As a result, it significantly reduces ergo injuries caused by human factors due to repetitive handling of wafers. Due to limited space, our 6-inch and 8-inch factories introduce collaborative robots instead of installing AMHS.

Introducing Collaborative Robots, Reducing Ergo Injury of 6/8-Inches Wafer Manufacturing Factory

The Ministry of Labor’s regulation regarding the joint operation between robot and human can’t meet current environment, so TSMC and domestic robot-related experts provide advanced countries, national standards, etc., and make a proposal for Ministry of Labor’s reference. The Ministry of Labor adopted our proposal and announced the revision for industrial robot regulation on February, 2018.

In order to meet intrinsically safe design requirements and provide safer work for collaborative robots, TSMC has not only complied with the new revised regulations, but also has stipulated the safety requirements.

Milestone of Collaborative Robot Planning and Introducing

- **2016**
  - Started planning the introduction of collaborative robots into 6- and 8-inch wafer plants to reduce injuries caused by human factors due to repetitive handling of wafers

- **2017**
  - Collaborative robots were introduced to demonstrative production lines of wafer plants to be tested on site for a long period of time, in order to verify that they can safely and effectively engage in product manufacturing after relevant production requirements and safety and protection measures complied with the requirements of TSMC regulations. On site testing and verification were conducted for more than 6 months

- **2018**
  - Mass production officially starts. Collaborative robots are successively introduced to production lines to engage in the handling of wafers

The Ministry of Labor’s regulation regarding the joint operation between robot and human can’t meet current environment, so TSMC and domestic robot-related experts provide advanced countries, national standards, etc., and make a proposal for Ministry of Labor’s reference. The Ministry of Labor adopted our proposal and announced the revision for industrial robot regulation on February, 2018.

In order to meet intrinsically safe design requirements and provide safer work for collaborative robots, TSMC has not only complied with the new revised regulations, but also has stipulated the safety requirements.

**Risks**

- **The risk of being harmed by the arms of a collaborative robot**
  - A collaborative robot must comply with regulations of ISO 10218-1 & 2 (safety requirements for industrial robots) to prevent employees from being hit by it and injured

- **The risk of tipping over during an earthquake**
  - A collaborative robot must not tip over when tested under 657 Gal peak ground acceleration on the earthquake simulation platform in the National Center for Research on Earthquake Engineering; otherwise it will obstruct an evacuation route

- **The risk of fire caused by batteries**
  - A battery cell must pass UL 1642 standard, and a battery pack must pass UL 1972 and UN 38.3 standards to prevent the occurrence of fire
TSMC Taiwan Disabling Injury Data

<table>
<thead>
<tr>
<th>Year</th>
<th>TSMC</th>
<th>Semiconductors Manufacturing</th>
<th>Electronic Parts and Components Manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>0.25</td>
<td>0.54</td>
<td>0.56</td>
</tr>
<tr>
<td>2014</td>
<td>0.36</td>
<td>0.54</td>
<td>0.56</td>
</tr>
<tr>
<td>2015</td>
<td>0.47</td>
<td>0.54</td>
<td>0.56</td>
</tr>
<tr>
<td>2016</td>
<td>0.54</td>
<td>0.54</td>
<td>0.56</td>
</tr>
<tr>
<td>2017</td>
<td>0.56</td>
<td>0.54</td>
<td>0.56</td>
</tr>
</tbody>
</table>

TSMC Subsidiaries Disabling Injury Data

<table>
<thead>
<tr>
<th>Year</th>
<th>TSMC (China)</th>
<th>WaferTech</th>
<th>VisEra</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>6.22</td>
<td>6.03</td>
<td>6.67</td>
</tr>
<tr>
<td>2015</td>
<td>1.60</td>
<td>2.69</td>
<td>4.57</td>
</tr>
<tr>
<td>2016</td>
<td>0.20</td>
<td>1.00</td>
<td>0.00</td>
</tr>
<tr>
<td>2017</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Disabling Frequency Rate (FR) of TSMC Fabs by Gender and Region in 2017

<table>
<thead>
<tr>
<th>Gender</th>
<th>Region</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>TSMC (China)</td>
<td>6.67</td>
</tr>
<tr>
<td>Female</td>
<td>WaferTech</td>
<td>7.95</td>
</tr>
<tr>
<td>Total</td>
<td>VisEra</td>
<td>3.99</td>
</tr>
</tbody>
</table>

Disabling Severity Rate (SR) of TSMC Fabs by Gender and Region in 2017

<table>
<thead>
<tr>
<th>Gender</th>
<th>Region</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>TSMC (China)</td>
<td>24.61</td>
</tr>
<tr>
<td>Female</td>
<td>WaferTech</td>
<td>27.90</td>
</tr>
<tr>
<td>Total</td>
<td>VisEra</td>
<td>10.31</td>
</tr>
</tbody>
</table>

Note 1: Statistic data of FR and SR are based on occupation disaster declaration, and this data did not include contractors.

Note 2: Disabling Frequency Rate is the total number of disabling injuries per every one million hours worked.

Note 3: Disabling Severity Rate is total lost days per every one million hours worked.

Note 4: Data of EE and semiconductor manufacturing.

Note 5: Data collection period of TSMC China and Wafertech US is from 2014 as well as VisEra from 2017.
Contractor’s Disabling Injury Rate Statistics

A statistical analysis has been performed on every contractor’s disabling injury frequency rate (FR) and disabling injury severity rate (SR) since 2017. There was an accident in 2017. When a contractor was building exterior walls, its employee was injured after colliding with a self-propelled vehicle, which pinched his/her fingers while he/she was placing wheel chocks. As a result, 60 work days were lost. TSMC has reinforced education and training, and strengthened promotion and asked the contractor to fully observe accurate operating procedures.

<table>
<thead>
<tr>
<th>Items</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disabling Frequency Rate</td>
<td>0.026</td>
</tr>
<tr>
<td>Injury Severity Rate</td>
<td>1.576</td>
</tr>
</tbody>
</table>

Training

TSMC continued to invest in resources to provide associated training to both employees and contractors to comply with safety and health regulations and meet the requirements of emergency response as well as enhancing employees and contractors’ awareness on safety and health rules. Training Courses including general Safety and Health, Emergency Response and regulatory safety and health professionals training.

<table>
<thead>
<tr>
<th>Identity</th>
<th>Training Course</th>
<th>Persons in 2015</th>
<th>Persons in 2016</th>
<th>Persons in 2017</th>
<th>Regulatory Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Hired</td>
<td>General Safety and Health Training</td>
<td>3,430</td>
<td>3,361</td>
<td>3,023</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Safety and Health Training for New Promoted Manager</td>
<td>310</td>
<td>197</td>
<td>207</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monthly Safety and Health Training</td>
<td>60,243</td>
<td>40,319</td>
<td>50,178</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Annual Department/Division Safety and Health Training</td>
<td>12,651</td>
<td>9,086</td>
<td>10,028</td>
<td></td>
</tr>
<tr>
<td>On-duty</td>
<td>Annual Fire-Fighting Training</td>
<td>18,529</td>
<td>14,130</td>
<td>20,929</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Annual Evacuation Drill</td>
<td>22,916</td>
<td>25,624</td>
<td>27,549</td>
<td></td>
</tr>
<tr>
<td>Employees</td>
<td>Occupational Diseases Prevention and Response Procedure Training (2017 new created)</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Emergency response team members</td>
<td>Emergency Response Training</td>
<td>3,861</td>
<td>8,631</td>
<td>2,039</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IC Commander Training</td>
<td>2,378</td>
<td>2,683</td>
<td>1,410</td>
<td></td>
</tr>
<tr>
<td></td>
<td>First-aid Personnel Training</td>
<td>4,461</td>
<td>4,478</td>
<td>4,338</td>
<td></td>
</tr>
<tr>
<td></td>
<td>External Fire-fighting Training</td>
<td>296</td>
<td>1,031</td>
<td>821</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quarterly Emergency Response Drill</td>
<td>8,202</td>
<td>9,230</td>
<td>13,462</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Annual Emergency Response Drill</td>
<td>820</td>
<td>1,628</td>
<td>1,348</td>
<td></td>
</tr>
<tr>
<td>Contractors</td>
<td>General Safety and Health Training</td>
<td>16,242</td>
<td>21,370</td>
<td>15,708</td>
<td></td>
</tr>
<tr>
<td>New</td>
<td>Personal protective Equipment Training for contractors who are located at TSMC and have chemical exposure risk</td>
<td>1,998</td>
<td>2,608</td>
<td>1,891</td>
<td></td>
</tr>
<tr>
<td>Existing</td>
<td>Annual Emergency Response Drill for contractors who are located at TSMC and have chemical exposure risk</td>
<td>124</td>
<td>205</td>
<td>778</td>
<td></td>
</tr>
</tbody>
</table>
Establish Healthy Workplace

TSMC is committed to breaking through traditional occupational health and building a safe and healthy work environment. In view of the increasing complexity of advanced semiconductor manufacturing processes, the use of tools and chemical substances has become increasingly diversified. In order to promote the health of employees and response and deal with occupational diseases well, TSMC established an “Employee Health Management” Program held by two Vice-Presidents of Operation function in 2017. The members include site directors, site ESH departments, Legal, Human Resource and employee health care departments, etc.

Through the establishment of exposure assessment tools, identification of internal risks, employees and suppliers of occupational disease prevention education training and advocacy, all aspects of health management, actively guarding the health of employees, and then share the experience of TSMC, leading the supply chain, contractors to establish friendly Health workplace.

Build Exposure Assessment Tool to Find out the Highest Exposure Risk

Integrate chemical data to build up the first Semiconductor Industrial “E-Exposure Assessment System”

TSMC continues to improve its management of chemicals; it manages and controls all of its chemicals with standards that are superior to those specified in laws and regulations. Its objective is to maintain its excellent record of zero occupational diseases associated with exposure to chemical contaminants.

In 2016, TSMC established the principle of managing highly hazardous chemicals following that don't use highly hazardous chemicals when it is not necessary; Necessity use, use less; built effective abatement avoiding highly hazardous chemicals contaminate environment.

In 2017, TSMC integrated the electronic data bases including chemical, working environment measurements, and similar exposure group to build up the first Semiconductor Industrial “E-Exposure Assessment System”. The E-Exposure Assessment System can streamline the hazardous chemicals and employees who may be exposed to hazardous chemicals. As a result, it can establish long-term health tracking data applied to Epidemiology analysis to find out the health impact early through the big data technology. In 2018, we will include ergo and physical health hazards to expand the identification of exposure risks.

Employee Health Management Scope

Chemical Management Milestone
Introduce Occupational Medical Experts to Perform On-site Observations

According to exposure assessment system evaluation result, the existing laboratory analysis process is still manual operation. In order to reduce the employee chemical exposure risk, TSMC executed measures to improve safety and health management of laboratory manual operation. TSMC invited the on-site medical doctors and occupational disease doctors to observe the operators handling procedure. Based on the on-site survey result, we establish the "Laboratory Safety, Health and Environment standard operation procedure". We install the ventilation device to improve the laboratory working environment preventing dust and volatile organic compounds exposure risks dramatically to achieve zero exposure of employees.

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### Chemical Management Procedure

1. **Hazard Identification**
   - Before entering factory

2. **Exposure Evaluation**
   - After entering factory

3. **Risk Control**
   - Identify Operator Exposure Risk
     - Find Out High Risk Group to Execute Risk Control
       - Combine external/external experts to execute on site surveillance
       - Improvement of risk environment

### Risk Evaluation
- Lab manual operation
- Medical doctor site surveillance
- Lab ESH internal control procedure
- Training
- Certification

### Training
- Retraining
Occupational Diseases Prevention Training and Promotion

Care First Training

In the Health Management Project, reinforcing employees’ concept of health risks is an important step in the improvement of internal risks. Enabling employees and managers to clearly understand the potential risks associated with the semiconductor manufacturing process environment and their effects on human health can help to raise employees’ awareness of promoting their own health and to implement measures on preventing occupational diseases. The concept of “CARE FIRST” will be strengthened in education and training on preventing occupational diseases, courses which are provided to supervisors working in high risk areas, in the hope that every employee will attach importance to their work environment, thereby achieving the goal of zero occupational disease associated with exposure to chemical contaminants.

Strengthen Contractor’s Chemical Exposure Risk Management and Promote Occupational Disease Prevention

Contractors are important partners to TSMC. In order to create a healthy and safe working environment, based on different chemical exposure groups of contractors, TSMC provides standardized training and hazard notification to ensure that contractors aware related hazards and protective measures. All training records are kept on electronic preservation system for continuous tracking.

Upgrade Industry Safe Workplace Environment

Collaborating with External Parties to Reduce Safety and Health Risks

The booming development of Taiwan’s semiconductor industry is attributed to not only the joint efforts of Taiwan Semiconductor Industry Association (TSIA) members, but also the strongly logistic supports of supply chain vendors. How to enhance the occupational safety and health of supply chain employees is a material issue that TSMC concerned about. In addition, contractors are important partners of TSMC, and continuous enhancement on work environment safety is a key part of contractor management. We plan actively management practices and move forward toward sustainable development.

In order to respond to safety and health policy, we share safety and health experiences with the outside world and enhance the industrial safety and health work environment. TSMC keeps promoting “Continue to Enhance Contractor Management” and “Protect On-site Service Personnel health of Supply Chain” programs. Through cooperation to enhance industrial safety and health performance, TSMC shares knowledge and experience in safety and health with the outside world. We hope to work together to promote a safe and healthy work environment through cooperation with industry and academia and the entire society.

Establishing a Two-way Communication Platform between TSMC and Contractors

For on-site personnel of these contractors, TSMC has begun to standardize safety and health training courses and increased their frequency to enhance training effectiveness and safety awareness. At the same time, depending on risk priority, the retraining frequency has been increased to quarterly or annually from once over a year previously to upgrade on-site facility employee safety awareness and secure workplace safety.
TSMC has established an all-new electronic Vendor Management System (VMS). With the new platform, most updated messages and requirements on safety, health, and environmental protection could be instantly delivered to frontline safety engineers and top management of contractors. Vice versa, every frontline safety engineer could utilize the system to raise questions, suggestions, or concerns, which would then be clarified, investigated, and corrected by an internal committee of TSMC. Responses will also be communicated over the platform. Through such a two-way communication, TSMC aspires to maintain constant awareness on safety, health, and environmental protection for effective migration of operational risks.

Established Industry’s First “Occupational Health Management Guidelines for On-site Service Personnel of Semiconductor Equipment Suppliers”

Given that occupational safety and health management in the supply chain has become an important indicator of corporate sustainability, TSMC took the lead to initiate a proposal in the TSIA board meeting, asking member companies to execute health protection measures for their employees, while the health protection of employees from their supply chains is also equally important. TSMC represented TSIA to issue the industry’s first “Occupational Health Management Guidelines for On-site Service Personnel of Semiconductor Equipment Suppliers” in the 2017 High-Tech Industry Sustainable Development and ESH Management Forum on October 19, 2017. TSIA members and supply chain vendors can follow the guidelines to enhance the occupational safety and health.

After these guidelines were issued, TSMC proactively put them to use for the safety and health of our own supply chain employees. Before entering the operational areas, TSMC clearly explains to on-site service personnel about the potential hazards of workplace environment, makes sure they pass relevant training courses, and wear personal protective equipment correctly. To safeguard their safety, TSMC also executes daily on-site audits and analyzes the health check results for anomaly tracking.

For more details, please refer to our website “TSMC Continues to Enhance Contractor Management”

Comprehensive Health Management

TSMC’s Wellness Centers at each fab are staffed by professional doctors and nurses, providing 24-hour first-aid and a broad spectrum of wellness services beyond government regulation, which includes special protection, health care services, health promotion, and employee assistance program, to prevent occupational injuries and diseases as well as promoting employee’s physical and mental health.

Special Protection

There were 5,172 (including Taiwan, Shanghai, Nanjing, VisEra and WaferTech) employees who received special protection program. The completion rate of health examination for 4,242 special task workers was 100%. Moreover, we conducted prevention and management programs regarding work-induced cerebral and cardiovascular disease and maternal health, which included individual risk assessment, medical assistance, work-related risk factor control, and job adjustment if needed. Regarding ergonomic risk prevention, despite conducted ergonomic improvement forum, we will also provide individual follow up for high risk group.

For more details, please refer to our website “TSMC and OSHA Cooperate to Improve Supply Chain Occupational Health”
Special Protection Programs

Special Health Examinations and Management

- Follow the government regulation to conduct special health examination of pre-job, special task changed, and on-job employees
- The completion rate must be 100%

2017 Achievements

- 4,242 employees completed. The completion rate reached 100%

Visits of Special Health Examination

<table>
<thead>
<tr>
<th>Year</th>
<th>Taiwan</th>
<th>TSMC (China)</th>
<th>TSMC (Nanjing)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>2,780</td>
<td>650</td>
<td>--</td>
<td>3,430</td>
</tr>
<tr>
<td>2016</td>
<td>3,172</td>
<td>802</td>
<td>--</td>
<td>4,474</td>
</tr>
<tr>
<td>2017</td>
<td>3,526</td>
<td>861</td>
<td>203</td>
<td>4,590</td>
</tr>
</tbody>
</table>

Note: The data includes TSMC Taiwan and VisEra in 2017.

Work-induced Cerebral and Cardiovascular Disease Prevention and Management

- Annually identified employees in the risk groups by analyzing Framingham risk scores from 2016 annual health exam results, working hours, and workload. Providing individual assessment, health education, and job adjustment if needed
- 191 employees who were identified as middle and high risk group were followed up, included medical assistance and working hour adjustment etc., in Taiwan site and VisEra

Percentage of Different Risk Group of Work-induced Cerebral and Cardiovascular Diseases

<table>
<thead>
<tr>
<th>Year</th>
<th>Low Risk</th>
<th>Middle/high Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>99.33%</td>
<td>0.67%</td>
</tr>
<tr>
<td>2016</td>
<td>99.38%</td>
<td>0.62%</td>
</tr>
<tr>
<td>2017</td>
<td>99.43%</td>
<td>0.57%</td>
</tr>
</tbody>
</table>

Maternal Health Protection and Management

- HR provides name list of leave for routine prenatal visit
- Attractions: special gift and parking spaces for pregnant employees
- 739 female employees received individual assessment and management of Taiwan site and VisEra. 710 of them also got special gift of information book and baby carrier

Ergonomic Risk Prevention and Management

- 0.3% of employees had suffered muscle pain and took more than 4 days off from questionnaire of annual health examination
- 113 employees who were identified as high risk group will be individually follow up in 2018 to prevent potential risk

Person-times of Maternal Health Protection and Management

<table>
<thead>
<tr>
<th>Year</th>
<th>Level 1 (harmless)</th>
<th>Level 2 (may be harmful)</th>
<th>Level 3 (harmful)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1,642</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2016</td>
<td>801</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2017</td>
<td>739</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: The data consists of TSMC Taiwan and VisEra in 2017.
Health Care Service

37,973 attendees (including Taiwan, Shanghai, Nanjing and VisEra) received health care services. Taiwan and China sites provide annual examinations whose frequency and number of tests are above regulatory requirements. After the examination, health administrators proactively provide health instructions and follow up for abnormality group of 7,936 employees. On-site medical and dental clinics took good care of our employees. In order to take care employee’s health proactively, identified 1,928 employees from equipment maintain, facility, and laboratory received special health examination beyond government base on occupational doctor’s advises. The results were all normal. Looking forward into 2018, the special program will extend to other high risk workplaces that employees may exposure to toxic chemical or heavy metal. Moreover, cancer screening and communicable disease prevention were also provided.

Health Care Service Programs

- **Abnormality of Health Examination**
  - General task employees
  - Providing annual health examination which the frequency and number of tests are above regulatory requirements
  - 7,936 employees in middle and high risk group whose result of health examination
- **Clinic Service**
  - Employees and their family members, vendors, and visitors
  - On-site medical and dental clinic, as well as ultrasound checkups of thyroid, abdomen, and heart
  - 18,327 visits
- **Cancer Screening**
  - All employees
  - Stool test for colorectal cancer, pap smear for cervical cancer, and breast ultrasound for breast cancer
  - 9,536 attendees
- **Communicable Disease Prevention and Management**
  - Employees and their family members, vendors, and visitors
  - Control manners for reported communicable disease
  - 246 person-times. In north of Taiwan, an epidemic outbreak of seasonal flu happened in the summer of 2017. Education and dry-cleaners were provided to response. There were 6 group infection events during April to August at the Taiwan site, 35 infected employees had all smoothly return to work.
- **Special Examination beyond Government Regulation**
  - Special workplace
  - Consult contract occupational doctors to identify health examination items and management manners for employees from special workplace
  - 1,928 employees received noise, heavy metal, and chemical related health check, and the results were all normal
Health Promotion

120,927 participants (including Taiwan, Shanghai, Nanjing and VisEra) had joined a series of activities such as “Infuse Lohas into Your Life”, health lectures, chiropractor, and exercise programs to promote employee’s well-being after the analysis of annual health examination indicated that the key health problems in 2016 were excess weight, hyperlipidemia, hyperglycemia, abnormal liver function, and sleep disorder. Taiwan employees whose BMIs ≥ 24 and had attended weight management got better improvement on lipid, blood sugar, liver function base on the analysis of health examination result of 2016, comparison between 571 had joined weight management and 12,295 free from the program. TSMC provides on-site gyms which included a sport center and comprehensive programs to cultivate employee conduct regular exercise. There were 7,480 employees (106,274 visits) of Taiwan and VisEra used the fitness facilities or participated in exercise programs. Moreover, a total of 12,217 employees of Taiwan have attended activities hosted by our 76 clubs to balance work and life.
## Average Improvement of Each Item

### Total Cholesterol

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participate</td>
<td>196.64</td>
<td>192.84</td>
</tr>
<tr>
<td>Do Not Participate</td>
<td>197.60</td>
<td>197.00</td>
</tr>
</tbody>
</table>

### High-density Lipoprotein

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participate</td>
<td>47.74</td>
<td>48.15</td>
</tr>
<tr>
<td>Do Not Participate</td>
<td>47.85</td>
<td>47.88</td>
</tr>
</tbody>
</table>

### Low-density Lipoprotein

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participate</td>
<td>128.36</td>
<td>126.68</td>
</tr>
<tr>
<td>Do Not Participate</td>
<td>127.26</td>
<td>129.13</td>
</tr>
</tbody>
</table>

### Triglyceride

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participate</td>
<td>136.75</td>
<td>132.00</td>
</tr>
<tr>
<td>Do Not Participate</td>
<td>137.75</td>
<td>139.71</td>
</tr>
</tbody>
</table>

### Fasting Blood Glucose

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participate</td>
<td>96.02</td>
<td>94.36</td>
</tr>
<tr>
<td>Do Not Participate</td>
<td>96.16</td>
<td>95.01</td>
</tr>
</tbody>
</table>

### Liver Function

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participate</td>
<td>35.59</td>
<td>34.26</td>
</tr>
<tr>
<td>Do Not Participate</td>
<td>35.77</td>
<td>38.41</td>
</tr>
</tbody>
</table>

*Note: Reducing indexes here mean health has improved except High density Lipoprotein*

## Health Promotion Programs

### Infuse Lohas into Your Life

- **2017 Achievements**
  - 3,397 participants

  - A series of activities: Weight management, exercise programs, and sleep soundly

  (1) Weight management: 896 employees attended, which increased by 29.7% from 2016. Total reduced weight were 2,867 kilograms, which increased by 47.6% from 2016. Moreover, there were 79 participants and reduced 43.1 kilograms of VisEra

  (2) 1,130 employees joined exercise programs which included stair climbing, fitness testing, and running activity, etc.

  (3) 1,292 participants joined speech of Sleep well by Chinese medicine doctor, mindfulness and relaxing programs, and e-paper of sleep well. And got positive feedback from them

### Health Lecture

- **2017 Achievements**
  - 3,049 attendees

  - Topics included health examination, stress adjustment, communication, chronic diseases, etc.

  Taiwan especially provided 11 sessions of "understand your health check result" for 181 employees before annual health examination

### Chiropractor Service

- **2017 Achievements**
  - 8,207 participants

  - Taiwan site: additional charge for on-site chiropractor service

  - Shanghai site: provide free massage program to direct labors

### Sport Center/Gym

- **2017 Achievements**
  - 106,274 participants

  - Employees and their family members

  - Providing energy lessons such as flywheel, boxing, pilates, yoga, and swimming, etc. at fitness center and swimming pool
Employee Assistance
TSMC has cooperated with professional institutes for a long time, working together to promote and provide professional consultations on issues of family, relationship, marriage, legal and financial matters. The usage trend for these services in recent years indicates that we have created an atmosphere where our employees are willing to ask for help when they need it, and care for the people around them.

Tasks of 2018

Identify risk and establish exposure assessment tool, arrange occupational medical experts to execute on site observation of 24 high risk areas, and occupational disease prevention training and promotion.

Execute job safety observation practice to find out and improve the ergonomic hazards. 8 inches wafer factories introduce collaborative robots to mass production lines to engage in the handling of wafers to reduce ergonomic injury dramatically.

Build up the "Supplier Environment, Safety and Health Guide Book" as a coaching and auditing standard to suppliers.

Employee Assistance Programs

External Counselling and Consultation Service
- On-site counselling and consultation provided by external professional institutes can be book through telephone or internet.

Internal Counselling and Consultation Service
- We have collected employees stress perception via a questionnaire in our annual health examination since 2012. After analysis, we identify moderate and severe groups to arrange interviews with a counseling psychologist or refer them to other institutions by individual.

Attendances of Health Promotion Service: Taiwan Sites

<table>
<thead>
<tr>
<th>Year</th>
<th>Health Lecture</th>
<th>Chiropractor Service</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>2,526</td>
<td>2,806</td>
<td>5,332</td>
</tr>
<tr>
<td>2016</td>
<td>3,094</td>
<td>3,424</td>
<td>6,518</td>
</tr>
<tr>
<td>2017</td>
<td>99,856</td>
<td>113,830</td>
<td>213,686</td>
</tr>
</tbody>
</table>

Attendances of Employee Assistance: Taiwan Sites

<table>
<thead>
<tr>
<th>Year</th>
<th>TSMC (China)</th>
<th>TSMC (Nanjing)</th>
<th>VisEra</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>2,023</td>
<td>114</td>
<td>105</td>
<td>2,242</td>
</tr>
<tr>
<td>2016</td>
<td>2,401</td>
<td>150</td>
<td>213</td>
<td>2,764</td>
</tr>
<tr>
<td>2017</td>
<td>2,673</td>
<td>35</td>
<td>2,551</td>
<td>5,589</td>
</tr>
</tbody>
</table>

Attendances of Health Promotion Service: TSMC (China), TSMC (Nanjing) and VisEra

<table>
<thead>
<tr>
<th>Year</th>
<th>TSMC (China)</th>
<th>TSMC (Nanjing)</th>
<th>VisEra</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>120</td>
<td>5,118</td>
<td>5,238</td>
<td>11,456</td>
</tr>
<tr>
<td>2016</td>
<td>450</td>
<td>4,877</td>
<td>5,527</td>
<td>11,378</td>
</tr>
<tr>
<td>2017</td>
<td>301</td>
<td>4,331</td>
<td>13,267</td>
<td>18,909</td>
</tr>
</tbody>
</table>

Attendances of Employee Assistance: TSMC (China), TSMC (Nanjing) and VisEra

<table>
<thead>
<tr>
<th>Year</th>
<th>TSMC (China)</th>
<th>TSMC (Nanjing)</th>
<th>VisEra</th>
<th>Total</th>
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<td>2,673</td>
<td>35</td>
<td>2,551</td>
<td>5,589</td>
</tr>
</tbody>
</table>

2017 Achievements

- 1,869 participants, which has increased 249 person-times compared with 2016.
- 976 employees, which has increased 45 people compared with 2016 due to providing counselling service for night shift.
Common Good

The Power to Change Society

With the mission of uplifting society, TSMC diligently strives to carry out the responsibilities of a good corporate citizen through the TSMC Education and Culture Foundation as well as the TSMC Charity Foundation. Our actions include supporting culture and arts, promoting aesthetic appreciation, caring for the livelihood and education of the underprivileged, and actively revitalizing traditional values of filial piety. By integrating the internal and external resources of the Company and its employees, we hope to bring positive changes in society.

Our Social Investments

Motive for Contribution

<table>
<thead>
<tr>
<th>Charitable Donations</th>
<th>Community Investments</th>
<th>Commercial Initiatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.74%</td>
<td>25.86%</td>
<td>50.40%</td>
</tr>
</tbody>
</table>

How We Contributed (NT$)

<table>
<thead>
<tr>
<th>Cash Contribution</th>
<th>Time</th>
<th>In-kind giving</th>
<th>Management Overheads</th>
</tr>
</thead>
<tbody>
<tr>
<td>301,223,746</td>
<td>172,238,814</td>
<td>258,777,002</td>
<td>15,486,610</td>
</tr>
</tbody>
</table>

Total 747,726,172 (NT$)

Note: Our social investments include endeavors made by the Company (e.g. University Collaboration Programs, etc.), TSMC Education and Culture Foundation, TSMC Charity Foundation, and TSMC employees (volunteer services and charity donations).
Since its founding in 1987, TSMC has thrived and grown with the support of society. We reciprocate by doing our utmost to realize a prosperous society. TSMC has integrated its cross-departmental resources and strengths, abiding by the vision and principles of the "Corporate Social Responsibility Policy", and actively contributes towards the United Nations Sustainable Development Goals (SDGs). The SDG 1 (No Poverty), SDG 3 (Good Health and Well-Being) and SDG 4 (Quality Education) are increasingly seen as our primary directions of social participation. By setting long-term targets and actions, SDGs are incorporated in our organizational operations.

TSMC strings two important pillars in uplifting society. The "TSMC Education and Culture Foundation" strives to deepen education, enrich artistic pursuits and passes on the torch of culture to all corners of Taiwan. With love at its core, the "TSMC Charity Foundation" has long been concerned about the needs of the disadvantaged and the elderly who live alone. The Foundation also spares no efforts in promoting filial piety and protecting the environment, with the expectation of gathering more warmth and philanthropy.

Stemming from a desire for a bright future, TSMC endeavours to bridge the gap in resources, strengthen the power of goodness, and serves as a positive force in society.
Caring for the Educationally Disadvantaged
Narrowing the urban-rural gap in cooperation with in-system/out-system and different-sized educational institutions.

Supporting Youth with Multiple Educational Platforms
Regularly holding competitions of humanity and science to guide teenagers to explore their development direction beyond the regular education.

Promoting Arts and Culture
Continuously organizing "Hsinchu Arts Festival" and sponsor at least five artists or teams in Taiwan per year.

Continuously providing resources and cooperate with in-system and out-system educational institutions. Contribute not less than NT$10 million per year.

Continuously holding competitions of humanity and science with not less than 500 contestants in each.

Continuously organizing "Hsinchu Arts Festival" and sponsor at least five artists or teams in Taiwan per year.
Collaborated with “Teach for Taiwan” to support young teachers going into rural areas
Target: Add one more external educational partner

452 (23.4% Growth) “TSMC Youth Calligraphy Contest” contestants
Target: No less than 366 contestants (previous year)

616 Note “TSMC Youth Literature Award” articles
Target: No less than 628 articles (previous year)

36 Hsin-Chu Arts Festival Events
Target: No less than 30 events

20,000 Hsin-Chu Arts Festival attendees
Target: No less than 20,000 attendees

Plan “mentor” program for the Rising Sun Scholarship. In addition to providing financial support, this program also gives guidance on learning and life activities

The contestants of each contest are not less than those of the previous year

Sponsor at least five artists or teams in Taiwan

Note: The TSMC Education and Culture Foundation will strengthen the promotion of “TSMC Youth Literature Award” on campus in the future
Education is the foundation of a country, and culture is the soul of a society. TSMC values education and culture, and uses diverse educational programs and moving artistic performances by the TSMC Foundation to fill gaps in regular education, to uplift the spirit of citizens, and to make our society more beautiful.

The TSMC Education and Culture Foundation (TSMC Foundation), chaired by TSMC’s Vice Chairman F. C. Tseng, was founded in 1998. In 2017, the TSMC Foundation contributed nearly NT$76.8 million into three main areas of our core concerns: caring for the educationally disadvantaged, supporting youth with multiple educational platforms, and promoting arts and culture to fulfill the firm’s corporate social responsibility.

The TSMC Foundation established a website www.tsmc-foundation.org to offer the public online lectures, activity information, and details of the Foundation’s projects.

Since 2004, the TSMC Foundation has become the founding charity partner of ‘Hope Reading’ with the CommonWealth Foundation. Every year 100 excellent reading materials are sent to 200 elementary and high schools in the remote rural areas. A total of 230,000 books have been donated and over 260,000 school children have benefited from this initiative.

If we can give one kid a leg-up, we lift one kid out; if we can inspire the passion of one teacher, we spark the fireworks.

Cathy Ling  Secretary-general, CommonWealth Foundation

Mastering calligraphy is just like being human, and it takes a whole life to grasp. In order to gain a foothold in the sea of calligraphy one has to put one’s best foot forward in life.

Ming-de Chen  Calligraphy Master

After the catharsis of cultural rituals, you will experience a kind of elevation, purification and therefore you will want to pay heart-felt homage to cultural heritage.

Hsien-Yung Pei  Writer

Education is the foundation of a country, and culture is the soul of a society. TSMC values education and culture, and uses diverse educational programs and moving artistic performances by the TSMC Foundation to fill gaps in regular education, to uplift the spirit of citizens, and to make our society more beautiful.
Thanks to the long-term and firm support from the TSMC Education and Culture Foundation, Hope Reading is able to continuously promote education in remote rural areas in Taiwan, help the disadvantaged children, and bring hopes of flipping education to the schools in remote areas.

Zhang Chi-Chung
"Hope Reading 2.0" exemplary school Songlin Elementary School President

Caring for the Educationally Disadvantaged: Invest Educational Resources; Eliminate Urban-and-rural Gap

The 2012 Programme for International Student Assessment (PISA) report points out that Taiwan tops all economies and countries in the academic performance disparity between the top and lower bottom students, and the lower bottom students’ performance are deeply affected by their socio-economic background. Research on education in Taiwanese remote rural areas commissioned by the National Development Council in July 2016 also indicates that in Taiwan the educational gap between the urban and the rural continues to widen. Despite a series of reformatory measures by the government, resources investing in rural areas still evidently fall short, while corporate investment will help improve the overall educational environment.

Educational gap has resulted in various social costs and will require attention from all sides. While the causes of inequality are multiple and complex, the TSMC Foundation sponsors diverse educational support initiatives in order to respond to demands at various levels. The "Hope Reading" program encourages teachers of elementary and high schools within the system in the remote rural areas to create feature curriculum and promote reading and digital learning. “Teach For Taiwan (TFT)” calls for young people with a sense of mission and passion to teach full-time and make up for the lack of teachers in rural areas. "Junyi Academy" deploys technology to build a free and excellent educational platform for underprivileged students and to provide the teachers on the front line customized teaching tools that ease their teaching burden. Moreover, in order to eliminate the urban-rural gap, the TSMC Foundation has long been funding reformatory measures by the government, resources investing in rural areas commissioned by the National Development Council in July 2016 also indicates that in Taiwan the educational gap between the urban and the rural continues to widen. Despite a series of reformatory measures by the government, resources investing in rural areas still evidently fall short, while corporate investment will help improve the overall educational environment.

Hope Reading 2.0

In response to the waves of digitalization, the TSMC Foundation reacts to the initiatives of "Hope Reading 2.0" project and provides digital carriers to schools which run the pilot projects, in stages. Apart from guiding pupils to learn programing languages with "Cloud Professor", "Hope Reading 2.0" further introduces digital learning system and encourages school kids to read. 545 participating children from 11 schools running pilot projects have read 10,000 recommended books in four months. The pupils at these schools have apparently formed a better reading culture.

The utmost significance of "Hope Reading 2.0" lies in the opportunity it offers children to make contact with and experience a different world. The reason why I fought tooth and nail for this project is because this project is a system founded in physical books and supported by technology so that the children can keep track of what they have read. Some children who have never read a book now fall in love with reading; now they can read up to 40 to 50 books a year. Children from the remote rural areas can improve literacy, reading fluency and comprehension from reading. You read to gain knowledge and future too.

Zhang Chi-Chung
"Hope Reading 2.0" exemplary school Songlin Elementary School President

Change brought about to Songlin Elementary School by "Hope Reading 2.0"

Their feature curriculum has attracted enrolment from other school districts; the number of overall students has risen from 50 plus to 90 and thereabouts.
School kids at the Yunlin Jeeng-min Elementary School are experiencing the online courses of Yunyi Academy during senior high school and college, young people are actively shaping their identities and exploring the outside world. At the senior high school stage, the TSMC Foundation offers extracurricular opportunities for teenagers to grow in sciences and humanities through hosting diverse competitions, camps, and lectures. At the college stage, the Foundation provides scholarships and support to encourage the students to head for their life goal and realize their dreams.

A survey conducted by the Child Welfare League Foundation in 2017 points out that, apart from teaching, nearly 70 percent of the teachers in the remote rural areas have to be surrogate parents to perform family functions. Teachers have profound impact on school children from underprivileged background; however, schools in the remote areas often struggle to find qualified teachers. Therefore, the TSMC Foundation teams up with “Teach for Taiwan” and “Junyi Academy” to support young people with ideals and leadership to teach in the remote rural areas; moreover, the Foundation offers digital learning tools to ease the teachers’ burden.

The TSMC Foundation supports the full-time teaching project proposed by “Teach for Taiwan”. This project engages young people to devote themselves to teaching at elementary schools with teacher shortage in the remote rural areas and offers the recruits professional training and support system, channelling talents into the teaching scene. A total of 37 teachers were sent out into service in 2017, and five of them were sponsored by the TSMC foundation, each recruit receiving NT$300,000 and the foundation donated NT$1.5 million in total. As a result, we hope more underprivileged school children can enjoy quality education.

After a year’s collaboration, so far Junyi Academy has accumulated 5,952 film clips, 28,257 exercise questions, and 800,000 users on its platform. Research has further discovered if a student logs on to the Junyi platform for 15 minutes per day, they can raise further 14.2 percentage level on their TASA score. This free and open cloud platform can assist the teachers to customize their teaching and help the children to achieve academic success.

**Supporting Youth with Multiple Educational Platforms: Build Educational Platforms; Encourage the Youth to Follow Their Dreams**

During senior high school and college, young people are actively shaping their identities and exploring the outside world. At the senior high school stage, the TSMC Foundation offers extracurricular opportunities for teenagers to grow in sciences and humanities through hosting diverse competitions, camps, and lectures. At the college stage, the Foundation provides scholarships and support to encourage the students to head for their life goal and realize their dreams.

For the first time we moved the spotlight event to Lukang, Changhua county. Echoing the local cultural heritage, we invited students to scribe classic calligraphic inscriptions and form the biggest jigsaw composed of Chinese characters in Taiwan.

The competition now includes two new categories: the “seal characters” and an additional “Scribes’ Group” with extra prizes in order to encourage young people to learn calligraphy.

The competition-and-campaign has attracted nearly 800 participants in total.

- We have received 616 manuscripts of fiction, modern poetry, prose and internet composition.
- Vote for ‘the young’s favorite author’ to paying homage to established writers: this year writer Zhen Jian has won the award.
- It was the first time we utilized popular science fiction and television dramas to make scientific short talk more comprehensible in everyday context, which further attracted the public’s attention.
- Take mathematics for instance, we attracted 700 students from 9th grade to 12th grade to participate, who have formed 212 teams.

**Teaching Talents to Exert völlent Influence**

The TSMC Cup–Competition of Scientific Short Talk

We held Dream Builders of Youth Forum, and inspired 400 members of audience.

The second TSMC Dream Builders of Youth attracted 66 teams from colleges across Taoyuan, Hsinchu and Madi. At the final stage, the 3-million-Dream-Builder-Prize has been awarded to 6 teams.

**2017 KPI**

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Ministry of Culture Arts and Business Awards
“Arts and Culture Talents Cultivation Award”
The premier honor for institutions, awarded by the government’s highest cultural institution.

TSMC Dream Builders of Youth: Dream Builders of Youth Forum

In order to broaden the young people’s horizon of dream-building, the TSMC Foundation holds a special ‘Dream Builders of Youth Forum’ and invites veteran media figure Cathy Ling as the host to lead the short talks and conversations between three pioneering dream-builders and the first three dream-builder teams, and share their moving behind-the-scene dream-building stories with 400 college freshmen and the public. The three pioneers are the founder of Taiwan Black Bear Conservation Association and also the protagonist in the documentary Black Bear Forest, Mei-Hsiu Hwang; the peripatetic artist Belle Chuang, who has traveled to over 20 countries with her painting; the youngest itinerant large animal veterinarian and also co-founder of ILoveMilk, Chien-Chia Kung. The three first dream-builder teams are After Orchid, Dear Storyteller and Kitchen-Troop. In the meantime, the TSMC Dream Builders of Youth Forum responds to societal expectation via questionnaire where the public and the college students are asked of their opinions on the project.

“Arts and Culture Talents Cultivation Award” of Arts and Business Award of the Ministry of Culture: Achievements gleaned from TSMC Youth Calligraphy and Seal-Carving Competition and TSMC Youth Literature Award

Calligraphy is a unique artistic heritage of Chinese culture. It embodies the long historical spirits of the Chinese characters. Since 2008 the TSMC Youth Calligraphy and Seal-Carving Competition has not only offered handsome prizes to attract brilliant young creators, but has invited top calligraphy artists to run workshops on high school campus all over Taiwan so that senior high school students have the chance to see calligraphy art and might be motivated to learn the art. Literature, on the other hand, is a way for many young lives to express themselves. The TSMC Youth Literature Award from 2004 on has offered a platform for senior high school students to exchange their works. The award-winners can meet fellow literature lovers through exchange meetings, and their works are published in the United Daily News, which has been a cradle for many writers of the new generation.

What extent do you agree with the importance to you of this lecture held by the TSMC Foundation?

- Strongly Agree: 35%
- Agree: 95%
- Neutral: 14%
- Disagree: 1%

Does this lecture (topic, contents and inspiration) meet your expectation?

- Strongly Agree: 52%
- Agree: 41%
- Neutral: 6%
- Disagree: 1%
In 2017, the TSMC Youth Calligraphy and Seal-Carving Competition marked its tenth anniversary. This year we didn't follow the past's footsteps: centring the competition and campaigns in Taipei and Kaoshiung and hoping for the ramification into other counties. Instead, for the first time we held the spotlight event “Cultivation and Prosperity” at the Grade-III listed Wenwu Temple in Lukang, Changhua. All local parties in Changhua – Changhua County Government, Senior High School in Lukang and local artists who work in calligraphy – were happy to see this happening and took part in it. The event also invited calligrapher Chun-Chen Lin to perform the art together with the students and faculty of Lukang Senior High School to create the largest Chinese-Character jigsaw in Taiwan. After all pieces of the jigsaw have been inscribed with classic calligraphy texts, they were pieced together to form a giant ten-meter-long character of ten in Chinese. This performing art has turned a new page in the history of Taiwan calligraphy art.

The Tenth Anniversary of TSMC Youth Calligraphy and Seal-Carving Competition: Writing the Largest Chinese Character Together in Lukang

This year the rules of the Competition have been revised: apart from including the seal-character category, “Scribes’ Group” is added to encourage the young learners of the art. This change hopes to introduce the climate of Chinese calligraphy to the young generation.

This year is the last time I attended the TSMC Calligraphy and Seal-Carving Competition. Thanks to the Competition, I’ve matured in the past three years. Calligraphy soothes our soul. I feel so fortunate that I have been able to find time to immerse myself in the world of calligraphy under the tremendous academic stress. In the future, I will go on to train myself in this world and hope to change for the better.

Gia-Yun Lee
The Kaohsiung Municipal Hsinchuang Senior High School, 12th Grader

I observe, I read and therefore I am

In early 2016, I happened to learn of the news of the 8th TSMC Youth Calligraphy and Seal-Carving Competition in the Arts page of the China Times. I gave the paper clipping to our on-campus military instructor and have been seen the “Sailing on the Wind” and “Intrepid Lad” exhibitions of selected calligraphy works at Chiang Kai-Shek Memorial Hall with the instructor for two years in a row.

This year when I was at the exhibition at the Memorial Hall, I overheard commentaries from some Chinese tourists, which really exited me… Here I enclose five photos which show that our military instructor at the 8th and the 9th exhibitions and his joy of receiving the work collection album. One of the photos shows you the instructor's own calligraphic work, “A Visitor on a Chilly Night” and the first page of my pharmacology notes. These photos are reminders of a life-long friendship between the instructor and the student as witnessed by your Foundation's exhibitions.

Wei-Ming Chen
A Letter to F. C. Tseng, the chairman of TSMC Culture and Education Foundation

(Extract)

The complete article is published in the National Defense Medical Alumni quarterly (July 2017). The article's author Wei-Ming Chen becomes an aficionado of calligraphy art under his military instructor's influence. The article details the moving story of their friendship.)
Keep Traditional Classical Culture Alive; Uplift our Spiritual Life

The TSMC Culture and Education Foundation improves the local communities with arts and cultural events. Every year we sponsor international arts and culture exhibitions and performances, support local outstanding groups and artists, hold master talks, produce a radio program on Chinese classical philosophical works, and publish audio books. Since 2004, our annual TSMC Hsinchu Arts Festival brings to the local community feasts of beauty with excellent arts and culture exhibitions and performances such as theater, concerts, children’s plays and literature.

Sponsored Taiwan’s own excellent National Symphony Orchestra to produce Puccini’s Il trittico: Il tabarro, Suor Angelica, and Gianni Schicchi. This production attracted a 3,700 audience

This year’s arts festival brought 35 beautiful performances to nearly 20,000 audiences

TSMC Lectures invited professor Thomas H. C. Lee to give the final talk on Western Civilization. A total of 630 people attended the talk

Gathered questionnaire from the attending audience to evaluate if the arts and cultural events are tailored to meet the community’s needs

The Proportion of the TSMC Foundation’s Sponsorship for National and International Arts and Culture Groups from 1998 to 2017

The 15th Anniversary of TSMC Hsinchu Arts Festival

In 2004 the TSMC Hsinchu Arts Festival has the good fortune to produce selected parts from professor Hsien-Yung Pei’s classic Kunqu (Kun Opera) Peony Pavilion-Young Lovers’ Edition in Hsinchu. In its 15th anniversary of the Arts Festival in 2017, the Foundation teamed up with the National Taichung Theater to produce the complete Peony Pavilion-Young Lovers’ Edition so that our mutual relationship with professor Pei can be continued and presented as a gift to the audience.

Audience Feedback on the TSMC Hsinchu Arts Festival

The 6 talks attracted 755 literature lovers to attend the events

93% of the audience felt that these events are significant for them

As a student I’ve learnt a lot. I’ve come to love writing and am now more willing to look at the world from a different perspective.

My family also has a Green Park

The carnival attracted 4,700 people

95% of the audience believed that this event means a lot to them

It’s a very cheerful event, which fits for the kids and the adults alike. We hope that it will continue.

“Sparks on the Laurels: Nobel Prize in Literature” is a series of talks on the works of the Nobel Prize in Literature winners. The lectures invited a group of famous Taiwanese writers to share with the audience their reading of these works.

“My family also has a Green Park” is an ecological carnival that educates while entertaining. The carnival invites children and their parents to learn about nature and how to protect it through viewing large-scale puppetry and micro cinema, and attend day trips.
TSMC Lectures: History of Western Civilization, the Final Chapter of the Trilogy

The TSMC Culture and Education Foundation has invited specialists in all fields to give various humanities talks in local communities. The topics of the talks encompass eastern and western music, history and philosophy. The "Western Civilisation Lectures", which started from 2004, invites retired Emeritus Professor Thomas H. C. Lee from National Tsing Hua University to give lectures on the history of the West from the Middle Ages to the Modern Age and the historical origins of freedom, democracy and science. These talks are held in the spirits of the 18th century French salons where the local people can exchange thoughts at cafes.

After the lecture series of ‘Renaissance’ and ‘Reformation’, the Lecture invited Professor Lee back to talk about the final chapter in the Trilogy of the Western Civilization: “Enlightenment”. These talks first reviewed Renaissance’s impact on the historical background of Europe’s religion, culture and thoughts, and then discussed the impact and achievements of the following Enlightenment; in the talks the audience were led to reflect on the significance of these historical periods. The 6-talk series has attracted 630 people to attend and the audience’s questionnaires and feedbacks will serve as reference for future lectures and thereby bring more quality feasts of knowledge to the local communities.

What extent do you agree with the importance to you of this lecture held by the TSMC Foundation?

<table>
<thead>
<tr>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Neutral</th>
<th>Effective Questionnaires</th>
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<tr>
<td>53%</td>
<td>53%</td>
<td>14%</td>
<td>278</td>
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</tbody>
</table>

Does this lecture (topic, contents and inspiration) meet your expectation?

<table>
<thead>
<tr>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Neutral</th>
<th>Effective Questionnaires</th>
</tr>
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<tr>
<td>48%</td>
<td>48%</td>
<td>5%</td>
<td>278</td>
</tr>
</tbody>
</table>
TSMC Charity Foundation

**Strategies**

**Take Care of Elder People**
We co-work with some hospitals in northern, middle and southern Taiwan through the Networking of Love system, and provide various resources to support medical organizations to implement medical caring for low income elder people who live alone.

- Serve 8,300 person-time elder people who live alone through the Networking of Love [2020]

**Promote Filial Piety**
We co-work with the Ministry of Education, media and other companies to implement filial piety education at the national elementary schools, and initiate promotion activities. Meanwhile, we establish filial piety volunteers to lead the filial piety activities and share knowledge.

- Integrate filial piety volunteers and companies at the Science Park to promote filial piety education together at no less than 50 elementary schools [2020]

**Care for the Disadvantages**
We provide various resources to underprivileged groups through book reading, community and Fab/Division volunteers, to support underprivileged groups living and education. Meanwhile, we proactively pay attention to the needs of emergency assistance in Taiwan, and provide assistance in a timely manner.

- Invest at least NT$10 million for underprivileged groups every year [2020]
- Over 8,000 book reading service hours every year [2020]

**Protect the Environment**
We provide environment protecting resources and knowledge through energy-saving, ecology and Fab/Division volunteers, and help schools save energies and promote knowledge of protecting environment.

- At least 1,000 person-time environment protecting related volunteers [2020]
7,200 person-time
Elder people who lived alone served through the Networking of Love
Target: Serve 6,500 person-time

Co-worked with the Ministry of Education to successfully add filial piety education material to the education outline in October
Target: Add filial piety education material to the education outline of the Ministry of Education

Completed filial piety teaching material and the demonstration teaching and publishing at the Wu Feng Feng Gu Elementary School
Target: Complete filial piety teaching material and the demonstration teaching

22,128 person-time
Book reading / Community / Fab and Division / Holiday volunteer services
Target: 20,000 person-time care for the disadvantages related volunteer services

Invest at least NT$10 million for underprivileged groups
Over 8,000 book reading service hours

1,134 person-time
Ecology / Energy-saving volunteer services
Target: 1,000 person-time care for the environment protecting related volunteer services

At least 1,000 person-time environment protecting related volunteers
The charity that TSMC’s employees and I do is to feel people’s needs by thinking as we stand at the front line. We work together with love and wisdom, and we also send out our love to give more positivity and beauty in Taiwan society.

Sophie Chang
Chairperson, TSMC Charity Foundation

TSMC Formally Established TSMC Charity Foundation

TSMC established the TSMC volunteer program in 2004, and the program persists on the objective of “long-term commitment to chosen service themes”, encourages our employees to participate in volunteer programs with joy and wisdom, making contributions to the society by actions. In 2017, there were more than 24,000 person-time participated in TSMC’s volunteer program. To better integrate our resources and the volunteer services provided by our employees to bring a bigger influence to the society, TSMC formally established the TSMC Charity Foundation on the 14th June in 2017, led by Chairperson Sophie Chang. According to TSMC’s Corporate Social Responsibility Policy and UN Sustainable Development Goals, the TSMC Charity Foundation defined four key focuses: taking care of elder people, promoting filial piety, caring for the disadvantaged, and protecting the environment to create a better Taiwan Society.

TSMC Charity Foundation’s Four Focuses

Take Care of Elder People
Provide caring and services through Networking of Love

Care for the Disadvantaged
Promote and implement through the volunteer services program

Promote Filial Piety
Co-work with the Ministry of Education to publish teaching material, train the teachers, and establish filial piety promotion volunteers

Protect the Environment
Extend and strengthen the scope of ecology and energy-saving volunteers’ services
In-kind Giving
Volunteer Person-time
Unit: person-time
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<th>2013</th>
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Volunteer Head Count
Unit: numbers
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<th>2014</th>
<th>2015</th>
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<td>5,451</td>
<td>6,812</td>
<td>7,838</td>
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</table>
Volunteer Person-time
Unit: person-time
<table>
<thead>
<tr>
<th>Year</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
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<td>39,390</td>
<td>54,573</td>
<td>93,623</td>
<td>106,176</td>
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</table>
According to the data from the Ministry of Health and Welfare, Taiwan will soon become an aged society in 2018. The population of 65 years old and above will be over 14% of total population, an old age population dependency ratio that means four young adults will raise one older person and is still increasing. The needs of taking care of elder people who live alone is increasing, and it has become an urgent priority.

In 2017, several divisions and factories held projects regarding taking care of elder people who live alone. Nearly 1,000 employees donated over NT$1.5 million, and over 130 employees devoted nearly 700 service hours.

The TSMC Charity Foundation cooperates with external organizations to establish a Networking of Love system which connects several medical organizations in northern, middle and southern Taiwan. Through donating goods and money, helping medical organizations extend their scope of elders caring services and the number of elder people who have been severed, to help elder people who lived alone have better prevention and treatment and promote mental health and well-being, meanwhile having safe, effective, quality and affordable essential medicines and medical services.

### Our Major Achievements

- **Networking of Love**
  - 8 Cooperated with 8 medical organizations
  - 12 Networking of Love partners
  - 7,200 Served 7,200 elder people who live alone
  - Invested over NT$8 million

- **Built the highest altitude day-care center in Taiwan**
  - In 2017, we cooperated with 8 medical organizations, served over 7,200 elder people who live alone. It also helps elder people increase well-being and delays aging from social connection support.
  - Continually supporting round visits in remote areas, in 2017, we donated a medical van for visiting rural areas to Doctor Yang-wei Kao who received a Medical Contribution Award, which assisted him to take care of elder people who live alone in remote areas.
  - We are dedicated to improve the equipment of existing tribe day-care centers in remote areas. For example, we assigned professional employees to help local day-care center to build rehabilitation center in Mudan Township, Pindong County, and provided goods for living.

### Our Business Focuses

- **Focus One** Sustainable Governance
- **Focus Two** Responsible Supply Chain
- **Focus Three** Green Manufacturing
- **Focus Four** Inclusive Workplace
- **Focus Five** Common Good
- **Focus Six** Innovation and Service

### Other Project Based Activities

- **Hualien Mennonite Social Welfare Foundation — Depart with Meal-box with Love**
  - In 2017, the TSMC Charity Foundation responded to the needs of Mennonite Social Welfare Foundation, donating NT$1 million through employee donation as the maintenance fee for delivery cars TSMC No.1 and TSMC No.2 which have already driven for more than 100,000 kilometers for delivering meal-box for elder people who live alone. Part of the donation was also used as the payment for meal-box delivery volunteers.

- **Spreading Love at Year End; Sending Warmth to Elders’ Home**
  - In 2017, Fab 3, Fab 12A, Fab 12B, Fab 15A and Fab 15B all launched Year-end meals projects. A total of 416 employees donated more than NT$30,000. Year-end meals, Chinese New Year couplet, and red pockets had been passed to around 270 elder people who live alone. We also spent Chinese New Year eve with these elder people with joy, and learnt the importance of showing our love to elder people in a timely manner.

- **Networking of Love**
  - In 2017, several divisions and factories held projects regarding taking care of elder people who live alone. Nearly 1,000 employees donated over NT$1.5 million, and over 130 employees devoted nearly 700 service hours.

- **I can’t go out due to my foot pain, so I am so happy so many people come to visit me today.**

- **Appreciation from the elderly**
  - Fab 15B, Hugging elders, love infinity, caring elders in Chinese New Year activity
Taiwan will soon become an aged society, and the resources needed for taking care of elder people who live alone are increasing. However, there is limit resources in the society, and taking care of elder people by non-family members is different from their own family members. We believe putting the responsibility of taking care of elder people back to their own families is the root. The data from the Ministry of Health and Welfare of Taiwan shows that the percentage of elder people who live with their children is decreasing in recent years, and the percentage of elder people who live alone is increasing. We believe there is still room for promoting the spirit of filial piety.

The TSMC Charity Foundation expects to promote filial piety culture in Taiwan’s society by co-working with the government, all elementary schools in Taiwan and media, so the responsibility of taking care of elder people could be put back to each citizen. In 2017, we cooperated with the government actively, and expected to promote and revive filial piety in younger generation to increase the welfare of the society, and helped to solve social issues caused by aged society.

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According to the data from the Fiscal Information Agency under the Ministry of Finance of Taiwan, the economic inequality in Taiwan has no tendency to decrease in recent years, and this gap is also present between cities and countryside. The gap of average income of a family between richest and poorest city almost doubled. Education resource and learning result could be different due to the differences of economic situation and the gap between cities and countryside, and the shortage of education resource would bring more negative impact for the society, which is an urgent and important issue.

We focus on “caring for underprivileged groups’ living” and “caring for underprivileged groups’ education” which are mentioned in TSMC’s Corporate Social Responsibility Policy. The TSMC Charity Foundation works with our divisions and factories, actively paying attention to underprivileged groups. We visited every underprivileged group in needs personally to understand their actual needs, and held a series of activities such as donating money and goods, charity buying and donation, volunteer services, construction services and emergency aid, to help underprivileged groups improve their economic and education environment.

Community Volunteer
Community volunteers regularly visit Veterans Home and Children’s center to accompany elder people and children. We connect elder people and children through gathering parties and activities, and around 800 person-time community volunteers provided over 5,000 service hours in 2017. In October 2017, Fab 8 volunteers invited students from the St. Francis Xavier House for Girls and the elderly from the Hsinchu Veterans Home to the Window on China Theme Park, and arranged the students to perform arhu fiddle on the stage, making them more confident through the performance while the veterans could have a joyful day.

Book Reading Volunteer
Book reading volunteers provide book reading, English reading and math teaching services regularly for the elementary schools in rural areas in Hsinchu, Taichung and Tainan. In 2017, around 1,300 person-time book reading volunteers provided over 5,000 service hours. In 2017, 294 students in the Yuandong Elementary School of Chutung Township benefited from English reading services. Around 600 students received one on one math teaching services. 90% of the students in the class caught up the study progress after more than 1,500 math teaching hours.

Dear TSMC teacher,
Thank you for your effort and devotion, and for teaching us with the happiest smile every time, thank you!

Students from English reading services provided by Legal organization
Chiayi Shuishang Chuanai Afterschool Reconstruction —
Turning the Hope of Future

Miss. Que-Dai Shu-wei established the Chiayi Shuishang Chuanai aften school 17 years ago, taking care of nearly 50 low-income and underprivileged students in elementary and junior high schools. She believes the education of children is the foundation of reducing social issues.

In August 2017, TSMC launched a fundraising event on the internal i-Charity platform, and raised nearly NT$6 million within 3 days. Then 300mm TB and 300mm FB helped the afterschool re-construct its classrooms, expanded the room and environment quality, giving the students a better learning environment.

Other Project Based Activities

Love Supply Chain — Create One Supply Chain, Achieve Triple Win

In 2017, Fab 15A connected the underprivileged product producers in the upstream, group buying of TSMC employees in the midstream, and underprivileged people who need the goods in the downstream, to create a brand new triple win charity model. In 2017, our employees purchased nearly 3,000 cabbages and over 100,000 bananas, and donated them to 8 charity foundations and nearly 9,000 families.

Repairing Services

TSMC has professional factory service employees and repairing volunteers with passions, who help disaster affected households and underprivileged people to repair their home. Several repairing projects were launched in 2017. For example, 753 employees from BTSD donated more than NT$1.3 million and over 1,200 volunteer hours to help repair the Jinhu elementary school, and renovated the hardware and school building which were eroded by the sea wind.
200mm TB started the adventure of program design for the children of St. Joseph afterschool in Wufong, Taichung. The children experience program design through games, and build up confidence through actual practices. The students also joined a competition with the games designs by themselves, which aroused unlimited possibility for their future.

200mm TB volunteers invited children from the Meihua elementary school of Hsinchu county to one-day science camp at the National Tsing Hua University. These children experienced dry ice innovated experiment DIY and extremely low temperature, and felt the wonder world of subzero 196 degrees Celsius.

Quality & Reliability volunteers have been accompanying the children of Hsinchu Ren Ai Children's home for a long time, helping them develop a professional skill and build up economic basis from assisting them to make and sell hand-made soaps from nothing.

The Manufacturing Technology Center initiated painting project for the Holy Family for Special Education, and helped them become excellent grade from good grade of the government's evaluation system. It was also the first time they received excellent level in 30 years since they established. Every employees in the Holy Family for Special Education received extra 2% pay raise by the government founding, also increased other funding percentage. These helped the organization to operate and take care of the residents better.

Fab 3 volunteers hold a graduation ceremony for the children of the Sheng-shin kindergarten in Wufong township, Hsinchu county. We prepared lunch boxes, tableware, meal bags, thermos bottles, and the 10 graduates who were going to go to elementary schools have best wishes from teachers, volunteers and children.

The Product Development organization launched a fundraising for the 2017 Silver Grass Cultural and Creativity Association Summer Tour, which performed stage drama “the stories are gone” at 25 rural elementary schools. It is aimed to promote education through drama, connect people with arts, land and society, and create opportunities for rural children to experience the first drama in their life.

Human Resources volunteers helped Ms. Peng, the owner of San Wan pear garden, to pick pears and promoted and sold the pears in our Company. They helped Mr. Peng who live in poverty to maintain her income, and our staff also created joy memories when helping people!
Energy-saving Volunteer

The “energy-saving volunteer team” gathered engineers who have energy saving and professional safety knowledge to actively go to schools in rural areas to implement water saving, energy saving and safety checks, helping every level of schools to evaluate and improve their energy utility, to prevent and slow down climate change. In 2017, around 170 person-times energy-saving volunteers provided 1,050 hours energy-saving check services, and provided professional evaluation report and improvements for schools for further reference for future actions. Fab 6 energy-saving volunteers have provided 25 times services since they were founded, helped the schools to build a safer learning environment.

Ecology Volunteer

TSMC kept certain area for ecology engineering when we built the factories, created an environment with ecological diversity to achieve the goal of protecting ecology environment. Meantime, we established ecology volunteers, provided rural students to reserve ecology tour and taught them green knowledge. In 2017, around 964 person-times ecology volunteers provided over 4,800 hours ecology tour for at least 9,776 person-times students.
Protect the Environment

**Tasks of 2018**

- Initiate two Ministry of Health and Welfare’s hospitals to start intelligence home care research and possible action plan
- Build up TSMC filial piety volunteer team
- Encourage more employees to participate in volunteer activities

**Other Project Based Activities**

- **Earth Day**
  
  On Earth Day on the 22nd April, TSMC co-worked with the Environment Protection Administration of Taiwan to clean up the beaches. A total of 181 employees and their family members devoted nearly 800 hours cleaning up the beaches at the Hsinchu Yongan Fishing Port, the Xinliang Mangrove and the Tainan Anping Beach. The awareness of protecting environment was also been awake when protecting the earth.

- **A Trip of Eco-friendly Farming**
  
  Fab 12A volunteers led students of the Nei Wan elementary schools to experience farming, personally experienced how much effort a farmer make when farming, to introspect the environmental impact of mountain reclamation, and further grew the awareness of protecting environment in their mind.

- **Tainan Jacana Sanctuary**
  
  Tainan Guantian Jacana Sanctuary water chestnut field is the habitat of Jacana. TSMC provides tour services every year. In 2017, the habitat field for Jacana was nearly dried because the water well was broken and not able to provide water due to poor maintenance for years. After personally visiting the Jacana Sanctuary by TSMC professional volunteers, we donated around NT$470,000 for repairing the water well, and we expect the water well digging to be completed in early 2018.

- **TSMC Museum of Innovation and the Power House**
  
  Fab 2 and Fab 5 volunteers led children to visit the TSMC Museum of Innovation and the Power House. Along with the climate change board games provided by the Hsinchu County Environment Protection Bureau, children have better understanding on the contribution of semiconductor industry for the society. They also realize a small action/decision could have an impact on climate changing of the world through the board games.

**Tour Volunteer**

TSMC believes that sharing technology knowledge is one of the important ways to contribute to the society. Except the four key focuses, we hope the knowledge of semiconductor can be known widely by the public, making technology easier to understand. Currently there are volunteers providing tour services in the Taichung National Science and Technology Museum and TSMC’s Museum of Innovation in Hsinchu. In 2017, 1,350 person-times tour volunteers provided over 8,100 service hours.
Appendix

About This Report
Materiality Analysis
Listening to Stakeholders
Participation in Industry Associations and Non-Profit Organizations
CSR Performance Summary
Contact Information
TSMC is the world's largest semiconductor foundry. We not only drive innovation in process technologies and manufacturing capabilities, but also continuously strive for excellence in the economic, environmental and social dimensions of our business. TSMC took the initiative to publish an “Environment, Safety & Health Report” in 2000, and has been publishing a nonfinancial report for 19 consecutive years since then. Starting from 2007, we have annually published our CSR report according to widely-adopted global guidelines set by the Global Reporting Initiative to transparently disclose our values and performance. In addition to tracking international trends and responding to the issues of interest to stakeholders including employees, shareholders/investors, customers, suppliers, government and society, this report is also an important means for our internal management. For the common good of society, we will make every effort to generate the greatest benefit for our stakeholders and drive positive change.

**Reporting Period**

The reporting period is between January 1 and December 31, 2017. This report is published in June, 2018 in both English and Chinese, and is available on TSMC’s CSR website. It mainly covers the topics identified with materiality, while we also report on our practices in the economic, environmental, and social dimensions.

**Reporting Scope**

The report contains CSR-related data and activities of all TSMC fabs located in Taiwan, our overseas subsidiaries including TSMC China, WaferTech in the United States, and other subsidiaries except where noted.

**Feedback**

Corporate Social Responsibility Committee


E-mail: csr@tsmc.com

Phone: +886-3-5636688

Address: 8, Li-Hsin Rd. 6, Hsinchu Science Park, Hsinchu 30078

If you have any feedback, advice or suggestions regarding this report or the sustainable development of TSMC, please feel free to contact us.
TSMC established a systematic model for materiality analysis in line with the GRI Standards and AA 1000 Stakeholder Engagement Standards (SES). Incorporating three phases and seven steps, the analysis is conducted to create TSMC's materiality matrix, and serves as a foundation for further developing TSMC's sustainability strategy and its short-term, medium-term, and long-term corporate sustainability goals. Materiality analysis is also an important reference for identifying material issues to be disclosed in the Company's Corporate Social Responsibility (CSR) Report.

Materiality Analysis

TSMC continued to define employees, shareholders/investors, customers, supplier/contractor, government, and society as the six major categories of stakeholders to engage for the 2017 CSR Report. To provide more focused information disclosure, TSMC reduced the number of sustainability issues from 20 for the 2016 CSR Report, down from 28 for the 2016 CSR Report. The issues removed were corporate governance, risk and crisis management, stakeholder communication, financial performance, and tax, which were considered more of governance- or result-oriented issues, whereas fair competition, anti-corruption, work life balance, and conflict minerals were integrated into other related issues. While the aforementioned issues were not mapped on the materiality matrix, information related to those issues will be disclosed in TSMC’s Annual Report, CSR Report, and CSR website on a regular basis.

Phase 1: Identification

Step 1: Define major stakeholders

TSMC defined major stakeholders as “external and internal groups or individuals who have an impact on or are affected by TSMC.” By that definition, six major categories of stakeholders were identified: shareholders/investors, employees, customers, suppliers/contractors, government, and society (community, academic institutions, media, NGO/NPO, etc.)

Step 2: Identify sustainability issues

20 issues relevant to TSMC were derived from four major sources: the international sustainability standards and regulations (GRI Standards, ISO26000, UN Global Compacts, RBA); sustainable investment institutions (DJSI, CDP, MSCI ESG Index); organization’s internal development goals and vision; and communication with stakeholders.

Phase 2: Define major categories of stakeholders

Step 1: Define major stakeholders

TSMC defined major stakeholders as “internal and external groups or individuals who have an impact on or are affected by TSMC.” By that definition, six major categories of stakeholders were identified: shareholders/investors, employees, customers, suppliers/contractors, government, and society (community, academic institutions, media, NGO/NPO, etc.)

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TSMC Materiality

High

- Occupational safety and health
- Regulatory compliance
- Customer service
- Supplier sustainability management
- Product quality
- Air pollution control
- Talent attraction and retention
- Energy management
- Innovation management
- Human rights
- Social participation
- Climate change
- Waste management
- Ethical Management
- Innovation and Service
- Responsible Supply Chain
- Green Manufacturing
- Inclusive Workplace
- Common Good

Low

- Occupational safety and health
- Regulatory compliance
- Customer service
- Supplier sustainability management
- Product quality
- Air pollution control
- Talent attraction and retention
- Energy management
- Innovation management
- Human rights
- Social participation
- Climate change
- Waste management
- Ethical Management
- Innovation and Service
- Responsible Supply Chain
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Impact on TSMC Business

High

- Occupational safety and health
- Regulatory compliance
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Our Business

Sustainable Governance

Focus One

Ethical Management

Focus Two

Innovation and Service

Focus Three

Responsible Supply Chain

Focus Four

Green Manufacturing

Focus Five

Inclusive Workplace

Focus Six

Common Good

Appendix

TSMC 2017 Corporate Social Responsibility Report

187
Phase 2 Analysis

To prioritize the content of the CSR report, TSMC launched the materiality analysis process to gauge the interest level of stakeholders in different issues and the priority of the issues and map them on the TSMC materiality matrix.

Step 3

Phase 3 Validation

After reviewing the materiality matrix, TSMC’s CSR Committee decided to incorporate “labour management relations” into “human rights,” “industry localization upgrade” into “supplier sustainability management,” and “employee diversity and equal opportunity” into “talent attraction and retention.” Seventeen issues were eventually identified as material issues for TSMC’s 2017 CSR report. These sustainability issues were then mapped into three stages of TSMC’s value chain: upstream, company operations, and downstream. In addition, 27 corresponding aspects in the GRI Standards were identified as relevant to TSMC. Following the reporting requirements, the Company gathered and analyzed internal information, data, and management approach.

920 Valid Samples

Step 4

Investigate the level of interest

Collecting valid feedback from stakeholders is one of the keys to determining material issues. TSMC identified 89 stakeholders within the six major categories of stakeholders based on their interaction with the Company, level of impact, and level of importance to the Company. An online questionnaire survey was conducted among the key stakeholders on the level of interest in different sustainability issues, and a total of 920 valid samples were collected.

89 Employees

Step 5

Analyze operational impact

TSMC, taking into account economic, environmental, and social dimensions, measured the impact of the sustainability issues on the Company’s operations against six factors: innovation/R&D, revenue, cost, customer satisfaction, brand/reputation, and risk. A total of 89 employees who were in charge of corporate sustainability, including a senior vice president, vice presidents, senior plant managers, and vice plant managers, participated in this process.

17 Material Issues

Step 6

Draft materiality matrix

Based on the analysis results of Steps 3 and 4, materiality matrix for 2017 CSR report was drafted and reviewed by TSMC’s CSR Committee. By merging six issues into three, the committee reduced the number of sustainability issues to 17 and determined the 17 as material issues.

4 Stages of Value Chain

Step 7

Determine disclosure boundaries

Procurement, wafer fabrication, packaging/testing, and customer usage are the four main stages of TSMC’s value chain, which were also used to define the disclosure boundaries for the 17 material issues. The boundaries helped the Company understand the impact of sustainability issues on upstream, operations, and downstream stages.

27 Topics

Step 8

Review disclosure content

From the 17 material issues, 27 corresponding topics in the GRI Standards were identified. Following the reporting requirements and management approach of each topic, information on sustainability was gathered and disclosed. Other sustainability issues deemed relevant by TSMC’s CSR Committee were also publicly disclosed.

Note 1: Upstream Boundaries: materials, equipment and related services procured by TSMC.
Note 2: Operation Boundaries: wafer fabrication and packaging/testing provided by TSMC.
Note 3: Downstream Boundaries: products destined for customers provided by TSMC.
In the pursuit of corporate sustainability, stakeholders are the most important supporters and advisers to TSMC. Our stakeholders have high expectations of TSMC regarding global or regional environmental and social issues. Based on real feedback from stakeholders, TSMC can continuously examine and improve its sustainability strategies.

Employing multiple channels, TSMC conducts two-way communications with its six major stakeholders, including employees, shareholders / investors, customers, suppliers, government and society. At each opportunity to communicate with stakeholders, we attentively listen to their feedback to better understand their expectations. We then try to incorporate their expectations into our internal sustainability management strategies and set short-, medium- and long-term goals to track execution and performance. In 2017, these stakeholders continued to set high expectations of TSMC to enhance its role as the semiconductor industry's global leader and at the same time expand its influence as a corporate citizen by addressing serious economic, environmental and social problems.

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### Customers

<table>
<thead>
<tr>
<th>Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continue to develop new technologies, enhance product quality, and implement measures to minimize risk</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication Channels (Frequency)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer quarterly business reviews (quarterly), audits (annually)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation management</td>
</tr>
<tr>
<td>Product quality</td>
</tr>
<tr>
<td>Proprietary information protection</td>
</tr>
<tr>
<td>Occupational safety and health</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquake protection, risk management, and business continuity program</td>
</tr>
<tr>
<td>Leaks of confidential information of key chips or manufacturing processes</td>
</tr>
<tr>
<td>New process technology development</td>
</tr>
<tr>
<td>Continuous product quality improvements</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Responses from TSMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed 111 drills, 38 improvements and revisions of 11 crisis management standard operating procedures in 2017 for all major crisis events</td>
</tr>
<tr>
<td>Passed customer audits on security and obtained ISO 15408 site certification in 2017</td>
</tr>
<tr>
<td>7nm process technology in risk production in 2017</td>
</tr>
<tr>
<td>Introduced machine learning into advanced spectral analysis and established automatic defect classification system for 12-inch wafers outgoing visual inspection in 2017</td>
</tr>
</tbody>
</table>

### Suppliers/Contractors

<table>
<thead>
<tr>
<th>Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus on TSMC’s future technology development the requirements and quality improvement, as well as external supplier audits and their participation in helping TSMC address environmental, safety and health concerns</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication Channels (Frequency)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier meetings / forums (annually), supplier onsite audits (periodically)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethics</td>
</tr>
<tr>
<td>Product quality</td>
</tr>
<tr>
<td>Waste management</td>
</tr>
<tr>
<td>Occupational safety and health</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Key Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements related to quality improvement and new technology development</td>
</tr>
<tr>
<td>Compliance with supplier ethics and code of conduct</td>
</tr>
<tr>
<td>Enhancement of suppliers’ capabilities in environmental, safety and health issues</td>
</tr>
<tr>
<td>Supplier auditing and counseling</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Responses from TSMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosted material technology conference, supplier ESH forum and two Supply Chain Management Forums for TSMC’s 30th Anniversary in 2017; more than 1,000 persons/hours for suppliers to participate in ESH training in 2018 and collaboratively set long-term goals for environmental protection</td>
</tr>
<tr>
<td>Coached 74% of local suppliers to participate in National Quality Control Circle competition in 2017; 90% of local suppliers are expected to participate in the National Quality Control Circle competition in 2020</td>
</tr>
<tr>
<td>Hosted supplier code of conduct training in 2017, with 2018 attendance rate expected to exceed 95%</td>
</tr>
<tr>
<td>Conducted 84 supplier’s on-site audits in 2017 with goal of expanding collaboration with third-party audit firm and strengthened supplier’s compliance with RBA Code of Conduct in 2018</td>
</tr>
</tbody>
</table>
Overview
- Collaborate with TSMC on subjects of environment and occupational safety, and have the Company set nationwide industry standards

Communication
- Labor inspection (periodically), regulations, official correspondence and association communication platforms (periodically)

Issues
- Water management
- Waste management
- Occupational safety and health

Key Concerns
- Usage ratio of recycled water vs. city water
- Supervision of management practices of TSMC waste vendors
- Human-robot interaction at industrial plants

Responses from TSMC
- Developed reclaimed water technology in 2015, and improved reclaimed water production process in 2017; new plants in Tainan are expected to use 8,000 tons of reclaimed water every day by 2022
- Completed assessment of 53 waste disposal and recycling vendors and terminated transactions with two vendors in 2017; expect to complete 100% of the auditing and guidance for waste vendors in 2018
- Tested collaborative robots in 2017 with expectation to replace wafer manual-handling to reduce ergonomic injuries
- Beginning in 2018, a muscle-pain questionnaire will be conducted annually to detect early-stage ergonomic risk

Society
- Provide support and resources for social charities, expand scope and depth of the Company’s engagement, and bring about meaningful social impacts

Communication
- Visits (periodically), correspondence (periodically) and events (periodically)

Issues
- Minority education
- Charity and care for the disadvantaged
- Commitment to education

Key Concerns
- Charity sponsorship and volunteer engagement
- Collaboration with educational institutions
- Assistance in youth development programs

Responses from TSMC
- Established TSMC Charity Foundation with four key themes: taking care of the elderly, promoting filial piety, caring for the disadvantaged, and protecting the environment; and involved over 8,000 volunteers who contributed over 106,000 service hours and donated over NT$40 million in 2017
- TSMC Culture and Education Foundation dedicated over NT$76.79 million in 2017 to support the educationally disadvantaged, multiple youth educational platforms, and arts and culture

TSMC has been dedicated to taking action on mitigating climate change and recycling resources. Its performance leads the semiconductor industry. TSMC also unselfishly shares and cooperates with all sectors in Taiwan to create a ripple effect that amplify its environmental protection achievements. It is a role model of corporate sustainable development.

Dr. Eugene Chien
Chairman, Taiwan Institute for Sustainable Energy

A big thank-you to the uncles and aunts from TSMC for coming to the He-Shing Elementary School every week to teach me math. You helped me get better score, and I’m not scared of math anymore!

Students from math teaching service provided by Product Development Organization

TSMC 2017 Corporate Social Responsibility Report
Participation in Industry Associations and Non-Profit Organizations

TSMC’s Corporate Social Responsibility vision is to uplift society, and our mission is integrity, strengthening environmental protection, and caring for the disadvantaged. Under this vision and mission, TSMC participates in a variety of industry associations and non-profit organizations to promote industry dialogue and development, as well as track key issues such as technology innovation, corporate governance, environmental sustainability, human rights, and supply chain management. In 2017, TSMC participated in more than 30 industry associations and non-profit organizations, with expenditures of over NT$21.2 million.

As a leading semiconductor company, TSMC aims to use its influence in the industry to join hands with other enterprises to work for our mutual benefit in order to adapt to changes in the industry and the international environment, as well as improve the Company's quality and competitiveness. The issues covered by the industry associations and non-profit organizations which TSMC participates in are categorized as follows:

- Industry Dialogue and Development
  - Technology Innovation
    - Technology innovation is the key driving force moving the technology industry forward. TSMC not only cares for and invests in technology innovation and participates in the definition of technical standards, it also calls on the government and private sector to protect the results of innovation together so that it can gain appropriate economic value and encourage further innovation, creating a fair competitive environment. Industry associations that TSMC participates in in the area of technology innovation include:
      - The Epoch Foundation
      - The Taiwan Association for Trade Secrets (TATS)
      - The Peripheral Component Interconnect Special Interest Group (PCI SIG)
      - TSMC Vice President and General Counsel Sylvia Fang has served as the President of the TPSF, and was a driving force in the founding of the association.
  - Corporate Governance
    - The robustness of a company’s corporate governance not only affects that company's development, it can also affect the economic stability of a region. TSMC places great importance on corporate governance, and has invited invitations to speak on Chairman Dr. Morris Chang's principals and methods for corporate governance, as well as discuss the results of TSMC's 30 years of corporate governance. Industry associations that TSMC participates in in the area of corporate governance include:
      - The Asian Corporate Governance Association (ACGA)
      - The Taiwanese Corporate Governance Association (TGCA)
      - TSMC’s Senior Director of the Corporate Communications Division, Elizabeth Sun currently serves as a member of the ACGA Council
  - Environmental Sustainability
    - As TSMC’s business continues to grow, its requirements for sustainable measures such as energy conservation, carbon reduction, water saving, and waste reduction all continue to increase, as well as the company devotes much attention to its participation in the associations and organizations related to the issue of environmental sustainability. In addition to sharing our experiences with the organizations below, TSMC has appointed more than 10 internal experts to serve as members of the TSMC’s Supplier Code of Conduct, ensuring that TSMC employees and suppliers follow high ethical standards. Industry associations that TSMC participates in in the area of environmental sustainability include:
      - The Science and Technology in Society Forum
      - The Taiwan Institute for Sustainable Energy/ The Taiwan Center for Corporate Sustainability
      - The Business Council for Sustainable Development of Taiwan
      - TSMC Senior Vice President and Chief Financial Officer Lora Ho currently serves as member of the TSMC’s Supplier Code of Conduct, ensuring that TSMC employees and suppliers follow high ethical standards. Industry associations that TSMC participates in in the area of environmental sustainability include:
  - Human Rights and Supply Chain Management
    - TSMC is an official member of the Responsible Business Alliance, and in addition to meeting the alliance’s requirements in auditing suppliers regarding labor, health and safety, environment, ethics, and management systems, we have also led our suppliers to join this alliance to expand its effectiveness. TSMC also requires all suppliers to submit to the “Assurance to Comply with TSMC’s Code of Ethics and Business Conduct and TSMC’s Supplier Code of Conduct” ensuring that TSMC employees and suppliers follow high ethical standards. Industry associations that TSMC participates in in the area of human rights and supply chain management include:
      - The Responsible Business Alliance (RBA)
      - The Responsible Minerals Initiative

Note 1: Non-profit organizations in the areas of charity and education are not included here. For details of TSMC’s participation in the TSMC Charity Foundation and TSMC Education and Culture Foundation, please see pages 163 to 184 of this report.

Note 2: By law, TSMC is not permitted to make political donations as the Company is majority-owned by foreign shareholders. TSMC has always followed this legal requirement and maintained political neutrality, but encourages employees to fulfill their civic duty.
### CSR Performance Summary

#### Key Indicators

<table>
<thead>
<tr>
<th>Economic</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Revenue (NT$ billion)</td>
<td>597</td>
<td>763</td>
<td>843</td>
<td>948</td>
<td>977</td>
</tr>
<tr>
<td>Net Income Attributable to Shareholders of the Parent (NT$ billion)</td>
<td>188</td>
<td>264</td>
<td>307</td>
<td>334</td>
<td>343</td>
</tr>
<tr>
<td>Income Tax Expense (NT$ billion)</td>
<td>27</td>
<td>38</td>
<td>44</td>
<td>52</td>
<td>53</td>
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<tr>
<td>R&amp;D Expenses (NT$ billion)</td>
<td>48</td>
<td>57</td>
<td>66</td>
<td>71</td>
<td>81</td>
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<tr>
<td>Capital Expenditures (NT$ billion)</td>
<td>288</td>
<td>289</td>
<td>258</td>
<td>328</td>
<td>331</td>
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<table>
<thead>
<tr>
<th>Environmental</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenhouse Gas Emission (Metric Ton - CO2 equivalent) (Scope 1 and Scope 2)</td>
<td>5,222,778</td>
<td>6,356,130</td>
<td>6,670,291</td>
<td>7,413,953</td>
<td>8,153,658</td>
</tr>
<tr>
<td>Scope 1</td>
<td>1,715,808</td>
<td>2,113,858</td>
<td>2,027,645</td>
<td>2,035,510</td>
<td>2,073,447</td>
</tr>
<tr>
<td>Taiwan Sites</td>
<td>1,443,218</td>
<td>1,655,498</td>
<td>1,566,662</td>
<td>1,648,268</td>
<td>1,638,051</td>
</tr>
<tr>
<td>Overseas Sites</td>
<td>272,590</td>
<td>458,360</td>
<td>460,983</td>
<td>387,242</td>
<td>435,396</td>
</tr>
<tr>
<td>Scope 2</td>
<td>3,506,970</td>
<td>4,242,272</td>
<td>4,642,646</td>
<td>5,378,443</td>
<td>6,080,211</td>
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<tr>
<td>Taiwan Sites</td>
<td>3,211,022</td>
<td>3,939,172</td>
<td>4,315,766</td>
<td>5,030,647</td>
<td>5,702,511</td>
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<tr>
<td>Overseas Sites</td>
<td>295,948</td>
<td>303,100</td>
<td>326,880</td>
<td>347,796</td>
<td>377,700</td>
</tr>
<tr>
<td>Scope 3</td>
<td>–</td>
<td>–</td>
<td>3,446,447</td>
<td>3,767,411</td>
<td>4,242,521</td>
</tr>
<tr>
<td>Energy Consumption (GWh) (Including electricity, nature gas and diesel)</td>
<td>6,604</td>
<td>7,968</td>
<td>8,925</td>
<td>9,848</td>
<td>12,016</td>
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<tr>
<td>Direct Energy Consumption (GWh) (Including electricity, nature gas and diesel)</td>
<td>375</td>
<td>423</td>
<td>455</td>
<td>489</td>
<td>628.2</td>
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<tr>
<td>Indirect Energy Consumption (GWh) (Electricity)</td>
<td>6,229</td>
<td>7,545</td>
<td>8,470</td>
<td>9,358</td>
<td>11,388</td>
</tr>
<tr>
<td>Water Consumption (Million Metric Tons)</td>
<td>33.2</td>
<td>38.2</td>
<td>37.5</td>
<td>42.0</td>
<td>49.0</td>
</tr>
<tr>
<td>Taiwan Sites</td>
<td>29.7</td>
<td>34.9</td>
<td>34.0</td>
<td>38.6</td>
<td>45.2</td>
</tr>
<tr>
<td>Overseas Sites</td>
<td>3.5</td>
<td>3.3</td>
<td>3.5</td>
<td>3.4</td>
<td>3.8</td>
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<tr>
<td>Process Water Recycling Rate (%) (Taiwan Sites)</td>
<td>86.9</td>
<td>87.6</td>
<td>87.3</td>
<td>87.4</td>
<td>87.5</td>
</tr>
<tr>
<td>Total Water Saving (Million Metric Tons) (Taiwan Sites)</td>
<td>66.9</td>
<td>81.0</td>
<td>85.6</td>
<td>94.3</td>
<td>103.4</td>
</tr>
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<table>
<thead>
<tr>
<th>Key Indicators</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Generated (Metric Tons)</td>
<td>149,951</td>
<td>208,213</td>
<td>273,096</td>
<td>298,761</td>
<td>369,745</td>
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<tr>
<td>General Waste Generated (Metric Tons)</td>
<td>47,336</td>
<td>66,462</td>
<td>137,524</td>
<td>163,584</td>
<td>201,114</td>
</tr>
<tr>
<td>Taiwan Sites</td>
<td>42,180</td>
<td>61,026</td>
<td>132,427</td>
<td>158,899</td>
<td>196,077</td>
</tr>
<tr>
<td>Overseas Sites</td>
<td>5,156</td>
<td>5,436</td>
<td>5,097</td>
<td>4,685</td>
<td>5,037</td>
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<tr>
<td>Hazardous Waste Generated(^{Note1}) (Metric Tons)</td>
<td>102,615</td>
<td>141,751</td>
<td>135,572</td>
<td>135,177</td>
<td>168,631</td>
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<tr>
<td>Taiwan Sites</td>
<td>101,100</td>
<td>140,024</td>
<td>133,360</td>
<td>133,085</td>
<td>165,891</td>
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<td>Overseas Sites</td>
<td>1,515</td>
<td>1,727</td>
<td>2,212</td>
<td>2,092</td>
<td>2,740</td>
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<tr>
<td>Waste Recycling Rate (%)</td>
<td>91</td>
<td>93</td>
<td>95</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>Taiwan Sites</td>
<td>92</td>
<td>93</td>
<td>95</td>
<td>95</td>
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<tr>
<td>Overseas Sites</td>
<td>79</td>
<td>79</td>
<td>79</td>
<td>79</td>
<td>80</td>
</tr>
<tr>
<td>Numbers of Employee</td>
<td>40,483</td>
<td>43,591</td>
<td>45,272</td>
<td>46,968</td>
<td>48,602</td>
</tr>
<tr>
<td>Employee Training Hours</td>
<td>889,184</td>
<td>884,174</td>
<td>780,546</td>
<td>623,711</td>
<td>639,852</td>
</tr>
<tr>
<td>Safety - Injury Frequency Rate(^{Note2}) (Taiwan Sites)</td>
<td>0.25</td>
<td>0.36</td>
<td>0.47</td>
<td>0.54</td>
<td>0.56</td>
</tr>
<tr>
<td>Safety - Injury Severity Rate(^{Note3}) (Taiwan Sites)</td>
<td>1.34</td>
<td>3.48</td>
<td>5.12</td>
<td>7.62</td>
<td>7.84</td>
</tr>
<tr>
<td>Cash Donation (NT$ million)</td>
<td>95.2</td>
<td>99</td>
<td>64.8</td>
<td>89.1</td>
<td>301.2(^{Note4})</td>
</tr>
</tbody>
</table>

\(^{Note1}\): Difference in previously disclosed 2015 and 2016 hazardous waste is due to subtraction of waste recycled in-house
\(^{Note2}\): Safety - Injury Frequency Rate=Injury NumberX1,000,000/Total hours worked
\(^{Note3}\): Safety - Injury Severity Rate= Lost Work DaysX1,000,000/Total hours worked
\(^{Note4}\): Amounts donated by TSMC, TSMC Education and Culture Foundation, TSMC Charity Foundation and TSMC employees