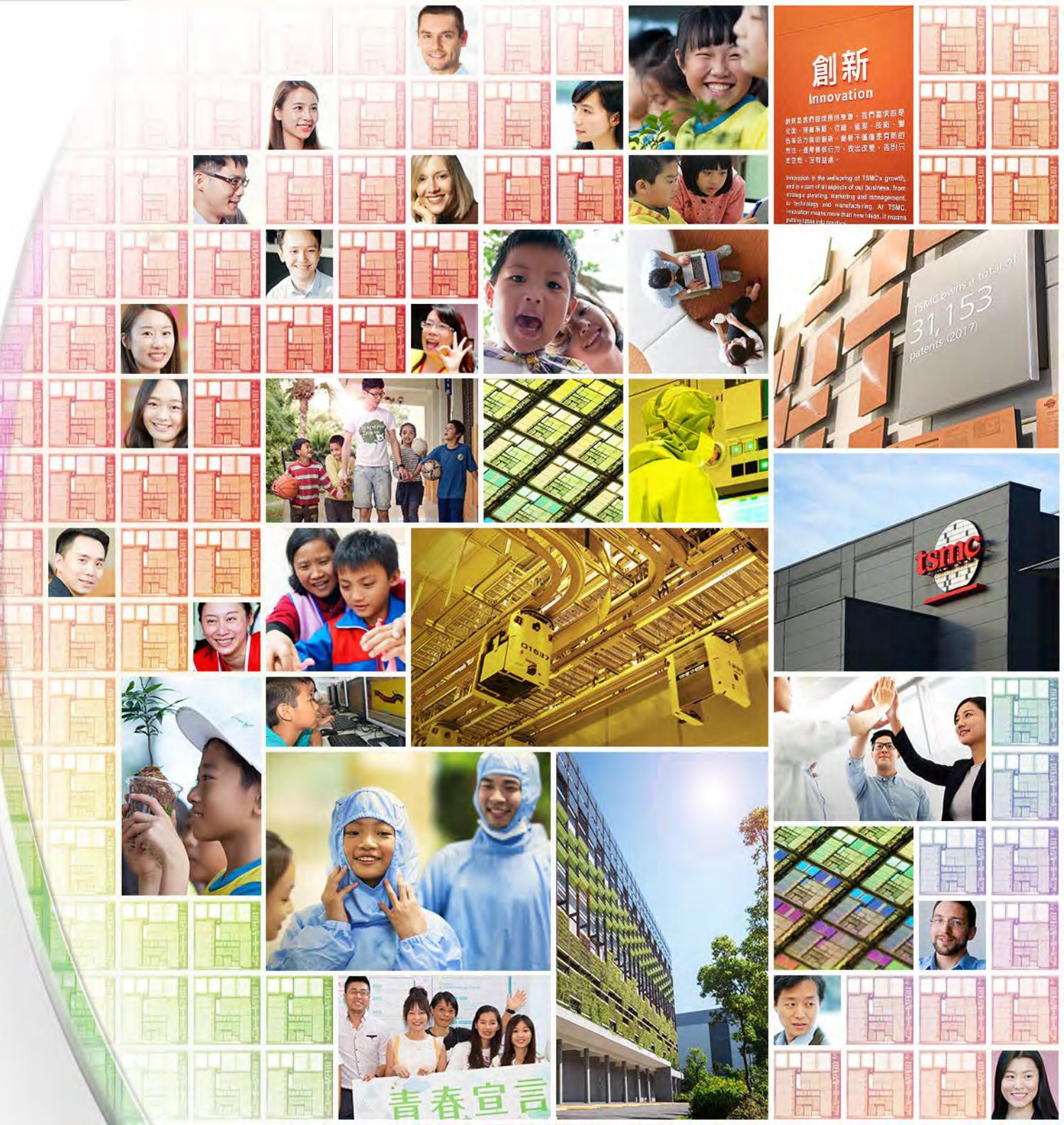




# TSMC 2017

## Corporate Social Responsibility Report



# Driving Positive Change

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

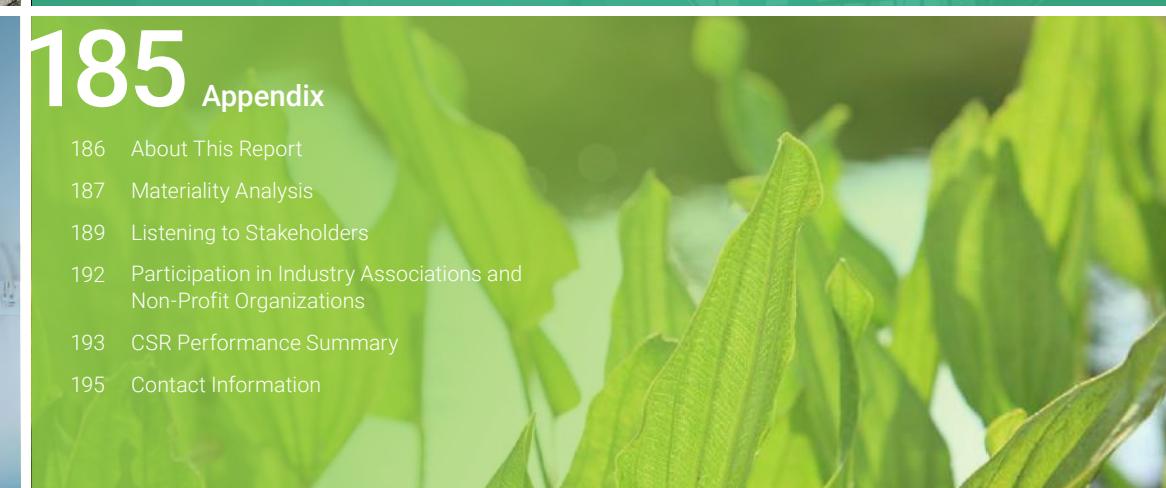
Since its founding by Dr. Morris Chang in 1987, we at TSMC have applied technology and innovation to uplift society and overcome the challenges faced by humankind for over 31 years.

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.



## Letter from the CSR Committee Chairperson

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

**1**

The largest green power buyer in Taiwan

**2.37 bn**

Completed 719 environmental projects and generated economic value of NT\$2.37 billion in 2017

**330,677**

Cumulative number of beneficiaries in 2017

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.


**Lora Ho**

Senior Vice President and Corporate Social Responsibility Committee Chairperson

## Sustainability Performance

### Economy

- 343.11 bn (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

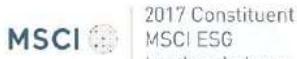
# Awards and Recognitions



Membership in the Dow Jones Sustainability World Index for the 17<sup>th</sup> consecutive year



RobecoSAM Sustainability Award - Gold Class



Selected as component of MSCI ESG Leaders Indexes



Selected as component of MSCI SRI Indexes



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



Selected as FTSE4Good Emerging Index component  
Selected as FTSE4Good TIP Taiwan ESG Index component



Climate Change Scoring Level: Leadership



Selected as one of the Global 100 Most Sustainable Corporations



Rated "Prime" by oekom Corporate Rating



Most Honored Company (Technology/Semiconductor) - All Asia

<b>Newsweek</b>	Selected by Newsweek Green Rankings as one of the Top Green Companies in the World
<b>Clarivate Analytics</b>	Top 10 Global Innovators in Semiconductor Industry
<b>Nikkei</b>	Nikkei Asia 300 Indexes
<b>Institutional Investor Magazine</b>	Best CEO (Technology/Semiconductor) – 1 <sup>st</sup> Place – All Asia Best CFO (Technology/Semiconductor) – 1 <sup>st</sup> Place – All Asia Best Investor Relations Program (Technology/Semiconductor) – 1 <sup>st</sup> Place – All Asia Best Investor Relations Professional (Technology/Semiconductor) – 1 <sup>st</sup> Place – All Asia Best Analyst Days (Technology/Semiconductor) – 1 <sup>st</sup> Place – All Asia
<b>Taiwan Stock Exchange</b>	Ranked in top 5% in Corporate Governance Evaluation of Listed Companies
<b>Taiwan Institute of Sustainable Energy</b>	Taiwan Corporate Sustainability Awards - No.1 for Domestic Corporates
<b>Cheers Magazine</b>	Most Admired Company in Technology/Manufacturing Group for the New Generation

For more details of 2017 CSR awards and recognitions, please refer to [TSMC's 2017 Annual Report](#).

# Our Business



## 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.

**Headquarters**

**Hsinchu Science Park, Taiwan**

**Founded**

**1987**

**Net Income**

**343.11**

2017  
NT\$ bn

**Market Share**

**56%**

The foundry segment of the global semiconductor industry in 2017

# 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

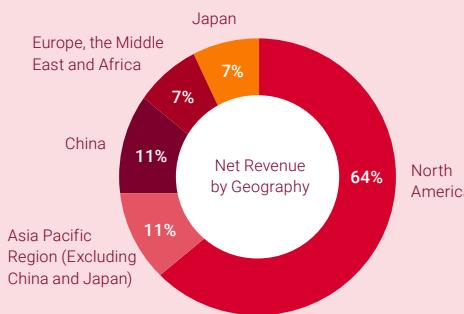
Manufactured 9,920 different products using 258 distinct technologies for 465 different customers

# 48,602 employees

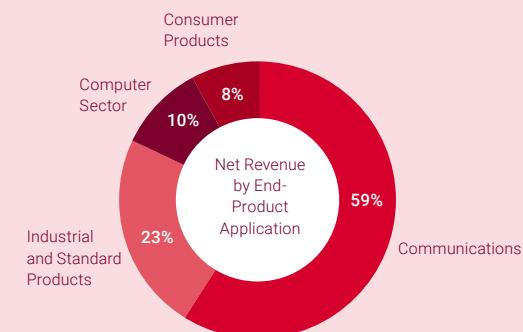
Employed about 48,000 people worldwide at the end of 2017, and recruited 3,663 new employees

TSMC operates wafer fabs, subsidiaries, and engineering service offices in Taiwan, North America, Europe, Japan, China and South Korea. TSMC Nanjing Company Limited is scheduled to commence production of 16nm process technology in 2018

**Net Revenue by Geography**



**Net Revenue by End-Product Application**



# >11 million

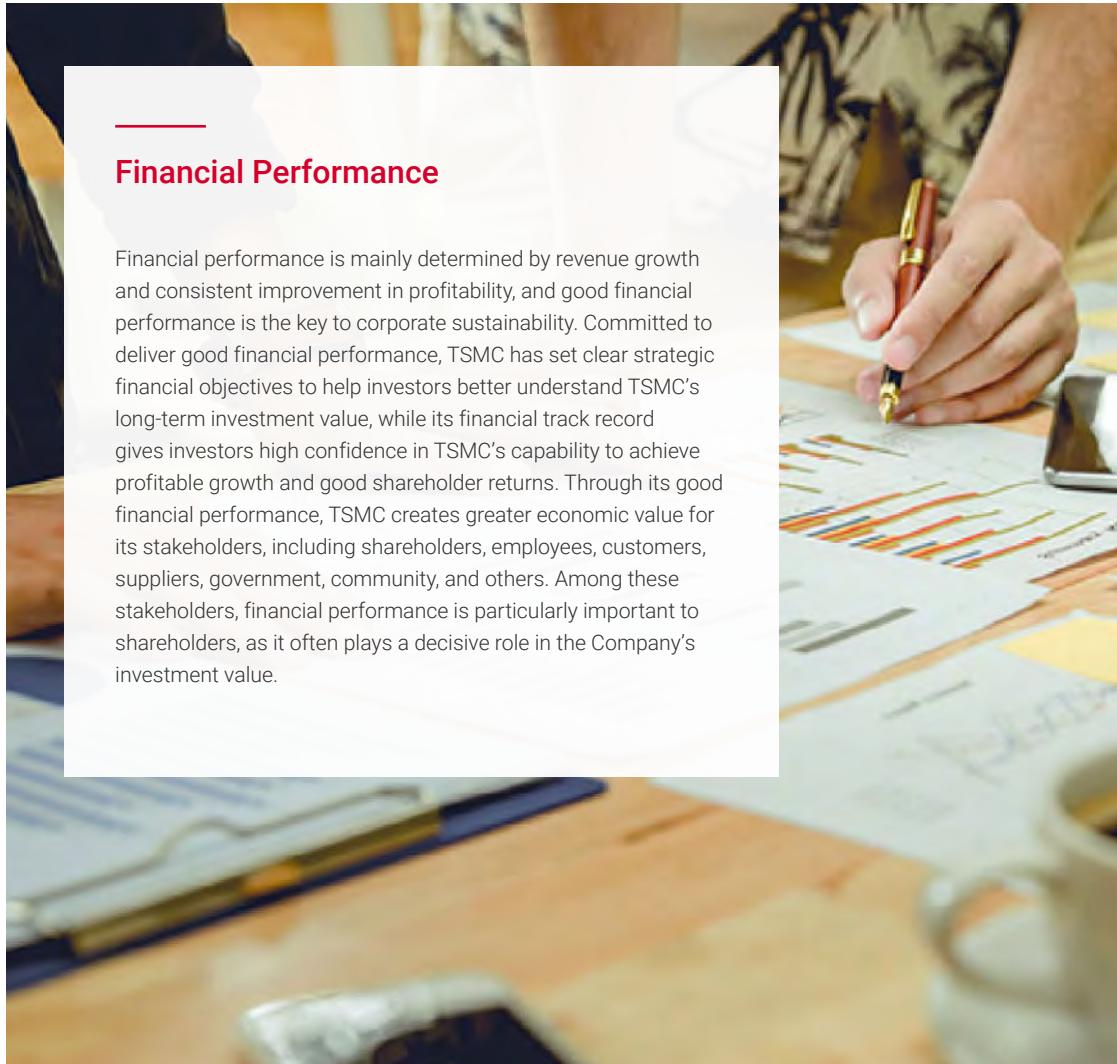
Annual capacity of the manufacturing facilities managed by TSMC and its subsidiaries reached above 11 million 12-inch equivalent wafers in 2017

# 1

The world's largest wafer capacity provider for logic ICs

# 3

The world's third largest semiconductor company

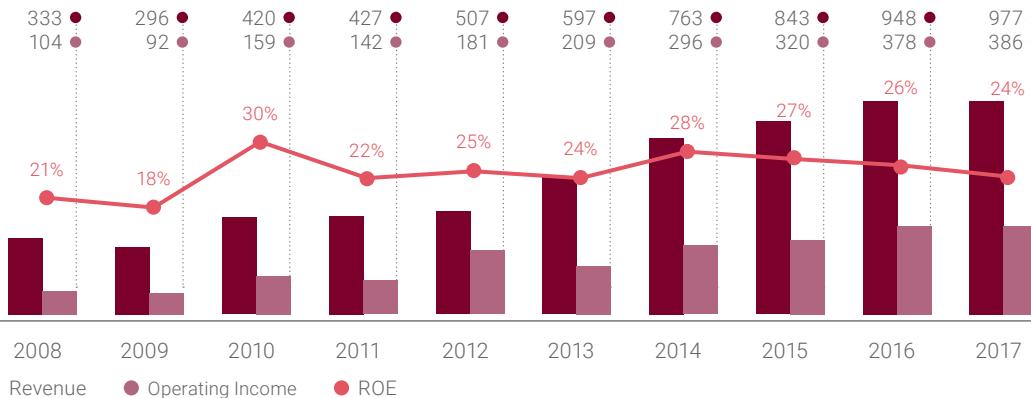


## Financial Performance

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.

### Financial Performance

Unit: NT\$ billion



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".

A+

Standard & Poor's (S&P) Ratings

Aa3

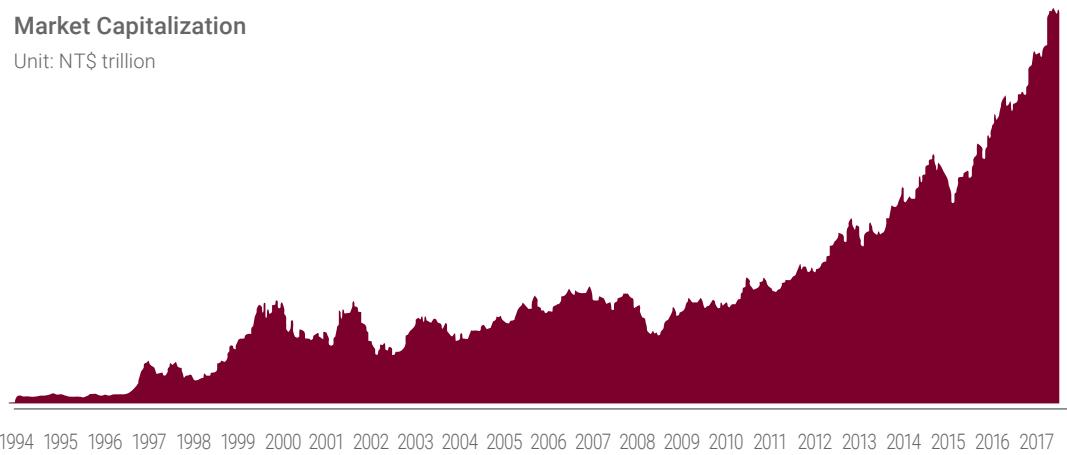
Moody's Ratings

twAAA

Taiwan Ratings

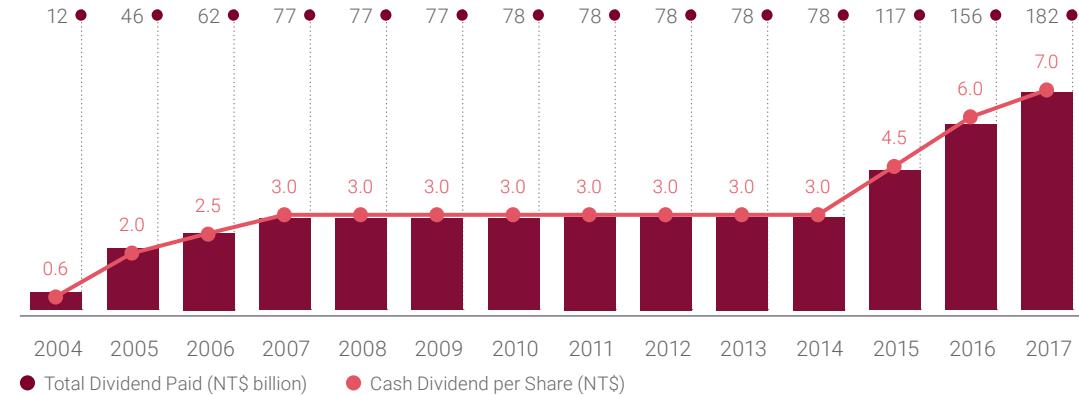
**Market Capitalization**

Unit: NT\$ trillion



1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017

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.

**Cash Dividend**

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.

**24%**10-Year Averaged ROE  
(2008-2017)**12%**10-Year Net Income CAGR  
(2008-2017)**6 trillion (NT\$)**Market Capitalization at the  
End of 2017**30.7%**

Total Shareholder Return in 2017

**1.2 trillion (NT\$)**Cumulative Cash Dividends from  
2004 to 2017**8 (NT\$)**Proposed Cash Dividend for 2017  
Earnings, to Be Paid in 2018

## Tax Policy

**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.**

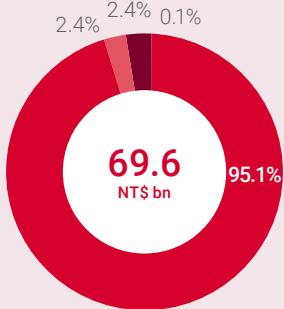
### Our Commitments

- 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. Effective from 2018, the R.O.C. Income Tax Law was amended to abolish the imputation system, raise the corporate income tax rate from 17% to 20%, and reduce the rate of surtax imposed on unappropriated earnings from 10% to 5%. However, since we are still eligible for the five-year tax exemption mentioned above, we do not expect the R.O.C. tax amendment to have a significant impact on our effective tax rate for 2018.

### 2017 Taxes Paid Breakdown<sup>Note</sup>



● Taiwan R.O.C.      ● Asia (Exclude R.O.C.)  
● North America      ● Others

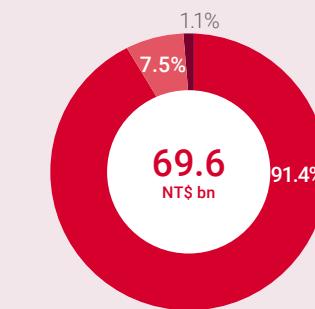
Note: We categorize our tax paid geographically based on the country in which TSMC and subsidiaries are located

**69.6 bn (NT\$)**

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

**>90%**

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.



● Corporate Income Tax  
● Labor and Health Insurance, Social Security  
● Others

**1**

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

**12.2%**

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



## Corporate Social Responsibility Policy

CSR

TSMC's vision for corporate social responsibility is to uplift society. We hope to serve as a model for sustainability in the way we do business, and to be a positive force in society.



**Morris Chang**  
Chairman

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 Matrix

"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.



## Corporate Governance

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.

### Governance Structure



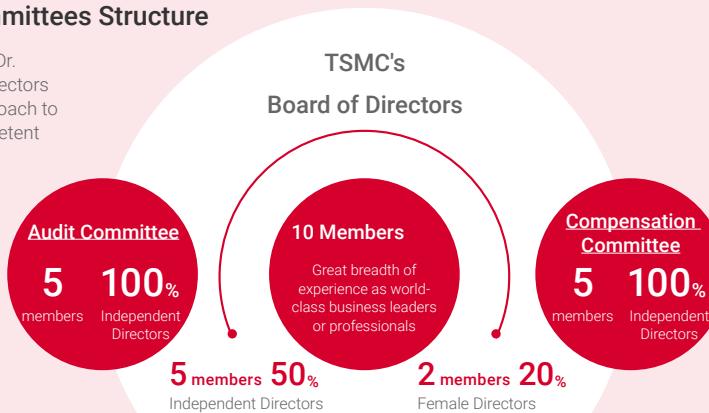
### Transition of Responsibilities

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.

### Board of Directors, Committees Structure

Under the leadership of Chairman Dr. Morris Chang, TSMC's Board of Directors takes a serious and forthright approach to its duties and is a dedicated, competent and independent Board.

- 4 Board responsibilities
- Supervise
- Evaluate the management's performance and appoint and dismiss officers
- Resolve the important, concrete matters
- Provide guidance to the management team



### Ethics and Regulatory Compliance

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](#)".

### Risk Management

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](#)".

## Corporate Social Responsibility Committee



For TSMC, the CSR Report is not just a simple report, but an important tool for aligning with international standards, managing sustainability performance, and meeting benchmarks.

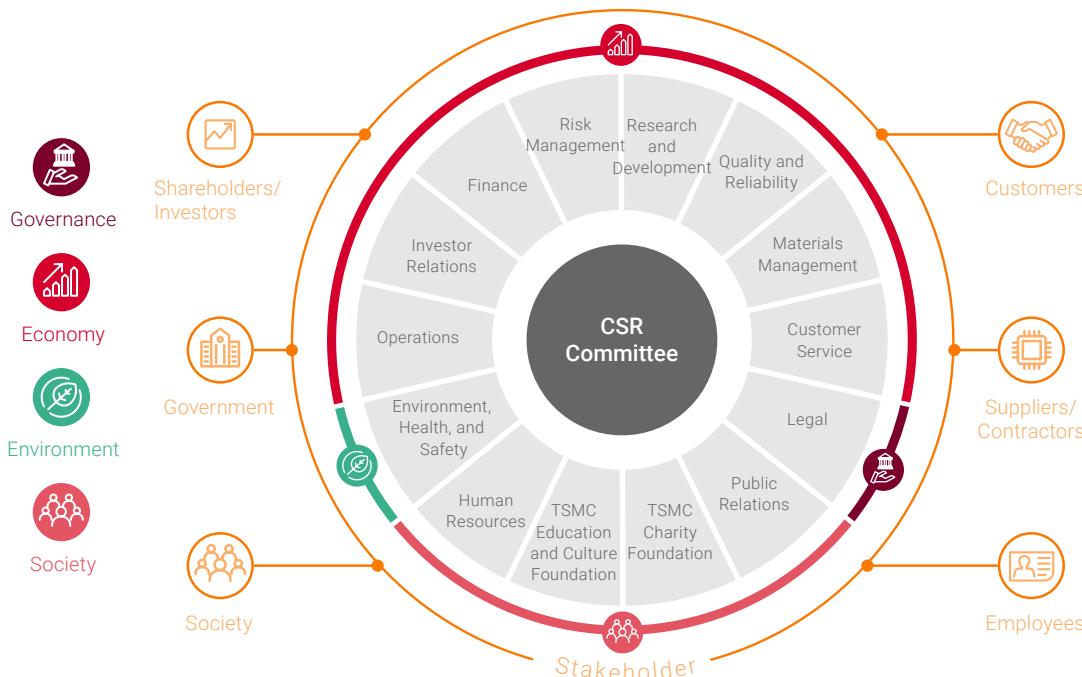


**Lora Ho**  
Corporate Social Responsibility Committee Chairperson

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

- Chairperson** • The CFO was appointed by the Chairman to be the committee chairperson
- Members** • Representatives from each functional unit related to economic, environmental, social and corporate governance
- Major Projects**
  - **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.



### Main Points of 2017 Chairperson's Report to the Board of Directors

- |  |   |
|--|---|
| <b>Implementation Results for the Year</b> <ul style="list-style-type: none"> <li>✓ The strategies and performance of green manufacturing</li> <li>✓ Fulfilled RBA Code of Conduct requirements with respect to supply chain management</li> <li>✓ Set targets to drive local procurement</li> <li>✓ The achievements and highlights of TSMC Education and Culture Foundation, as well as TSMC Charity Foundation</li> </ul> | <b>Work Plan for the Following Year</b> <ul style="list-style-type: none"> <li>✓ Continue to align its sustainability targets with the United Nations Sustainability Development Goals (SDGs)</li> <li>✓ Expand its coverage of CSR management for TSMC's overseas fabs and major affiliates</li> <li>✓ Execute social impact valuation projects</li> </ul> |
|--|---|

### 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

## Sustainable Value Creation

**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 in 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 guidepost 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

#### Junior Management Involvement

Junior managers are the driving force behind the Company's advocacy for sustainability, conducting inter-organizational and inter-departmental cooperation in the face of complex sustainability issues in order to bring about material changes

#### 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

### Sustainable Value

Value measurement is mainly derived from positive and negative impacts. In order to measure TSMC's impact on interested parties, TSMC adopted international methodologies of impact valuation to develop the Profit and Loss (P&L) evaluation method with the foundations based on the economic, environmental, and social dimensions (Triple Bottom Line, TBL). In 2017, we emphasized on the economic and social dimensions of P&L, while the environmental dimension started with estimating social costs from greenhouse gases emissions. In the future, we will prioritize on developing a methodology for evaluating environmental impacts and extend the concepts of TBL and P&L to both the upstream and downstream stages of TSMC's value chain, presenting the complete picture of sustainable value.

Unit: NT\$ million

Economy	Value	Icon
Cash Dividend	181,513	
Net Income	343,147	
Operating Revenue	977,447	
Output Value Driven by the Supply Chain <small>Note1</small>	1,275,200	
Depreciation and Amortization	260,143	
GHG <small>Note2</small>	-12,195	
Air Emissions	Developing methods	
Waste	Developing methods	
Water Discharge	Developing methods	
Water Consumption	Developing methods	
Work Injury <small>Note3</small>	-65	
Employees Development and Training <small>Note4</small>	322	
Taxes	69,574	
Employee Compensation	104,130	
Talent and Community Development <small>Note5</small>	831	
Shareholders/ Investors		
Customer		
Community		
Supplier/Contractor		
Employee		

Note 1: The output value driven by the supply chain is evaluated by the Industrial Economics and Knowledge Center with reference to the "2011 Input-Output Table (including imports)" published by the Directorate-General of Budget, Accounting and Statistics of Executive Yuan.

Note 2: GHG value = Greenhouse Gas Emissions ( $tCO_2e$ ) x Excess Emissions Fine per Unit (\$/ $tCO_2e$ )

Note 3: Work Injury value = Work Injury Cost + Medical Cost + Willingness-to-pay of Occupational Injury

Note 4: Regarding Employee Development and Training value, please refer to "[TSMC 2016-2017 Social Impact Valuation Report](#)".

Note 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](#)".

## Responding to the UN Sustainable Development Goals

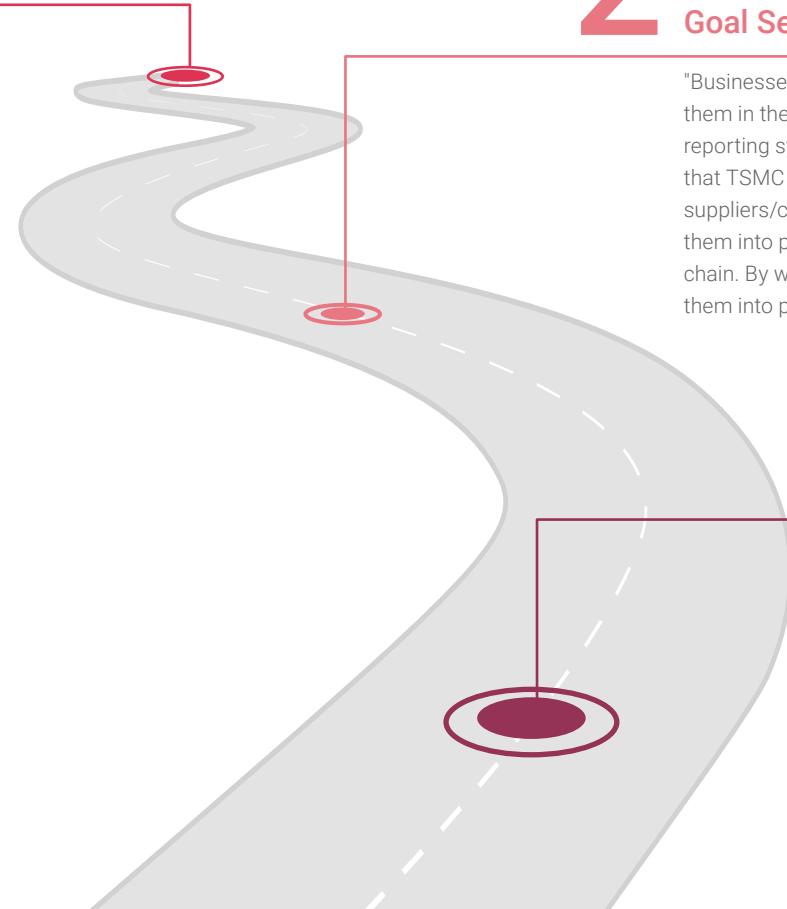
In 2017, TSMC continued to deepen its understanding and practice of the Sustainable Development Goals Compass (SDG Compass) through implementing the prescribed five steps of "Understanding the SDGs," "Defining Priorities," "Setting Goals," "Integrating," and "Reporting and Communicating." Accordingly, 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.

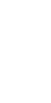
### 3



#### 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's Material Issues to UN SDGs

TSMC Focuses	Value Chain			SDGs
	Procurement	TSMC Operations	Customer Usage	
<b>Ethical Management</b>  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				        
<b>Innovation and Service</b>  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				        
<b>Responsible Supply Chain</b>  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				        
<b>Green Manufacturing</b>  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				        
<b>Inclusive Workplace</b>  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.				        
<b>Common Good</b>  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				        

## Linking SDGs to TSMC 2020/2025 Goals



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.

 Case Study

## 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

### 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

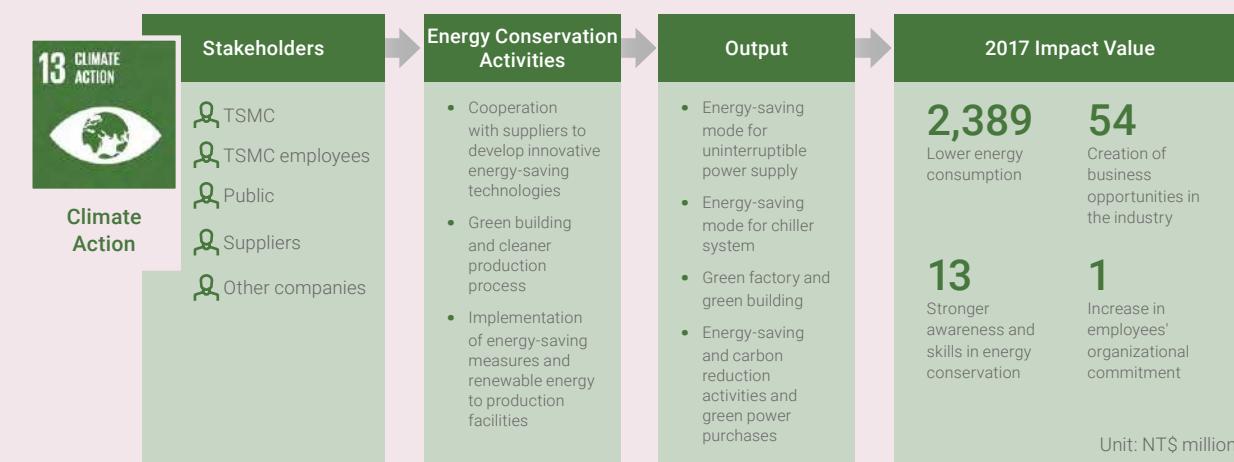


#### Calculating Social Impact

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

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 quantitative performance in addressing climate change and the cultivation of technological and managerial talents in the semiconductor industry. 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.

**23** Ethical Management  
A Trusted Company

**31** Innovation and Service  
An Innovation Pioneer

**63** Responsible Supply Chain  
A Responsible Purchaser

**78** Green Manufacturing  
A Green Power Practitioner

**122** Inclusive Workplace  
The Most Attractive Employer

**163** Common Good  
The Power to Change 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.

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**29,000**

29,000 employees completed "2017 TSMC Ethics and Compliance Training"

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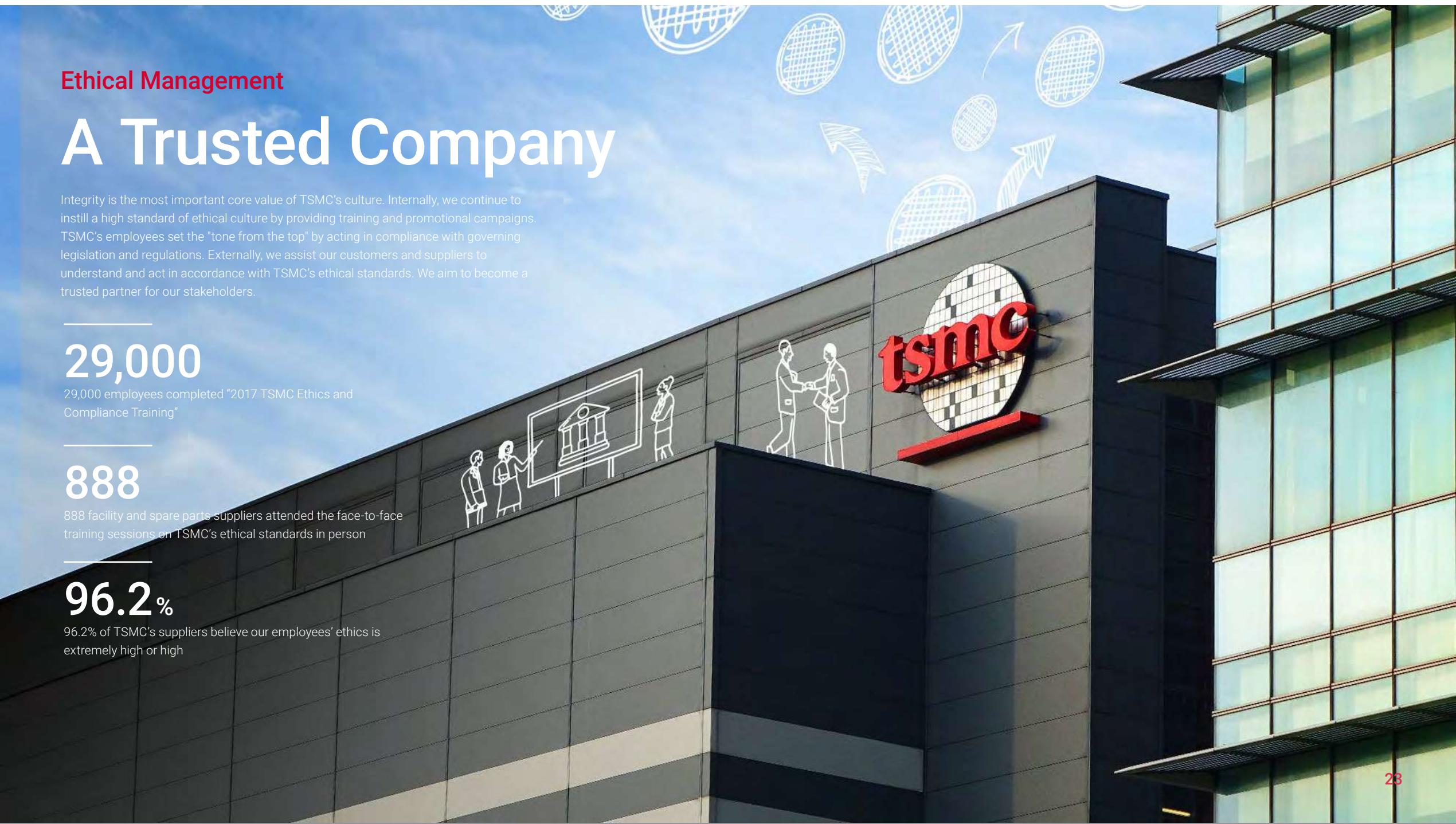
**888**

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

---

**96.2%**

96.2% of TSMC's suppliers believe our employees' ethics is extremely high or high



## Material Issue

# Ethics and Regulatory Compliance



## Strategies

## TSMC 2020/2025 Goals

Achievements & Targets

### Reinforce Both Internally and Externally

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

Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets

**97%****Completion rate for employee annual training of ethics and regulatory compliance**

Target: 95%

**98%****Participation rate for communicating with major suppliers in person**<sup>Note</sup>

Target: 95%

**0****Material violation**Target: No material regulatory violation  
(where the fine exceeds NT\$1 million)

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)

Note: 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.

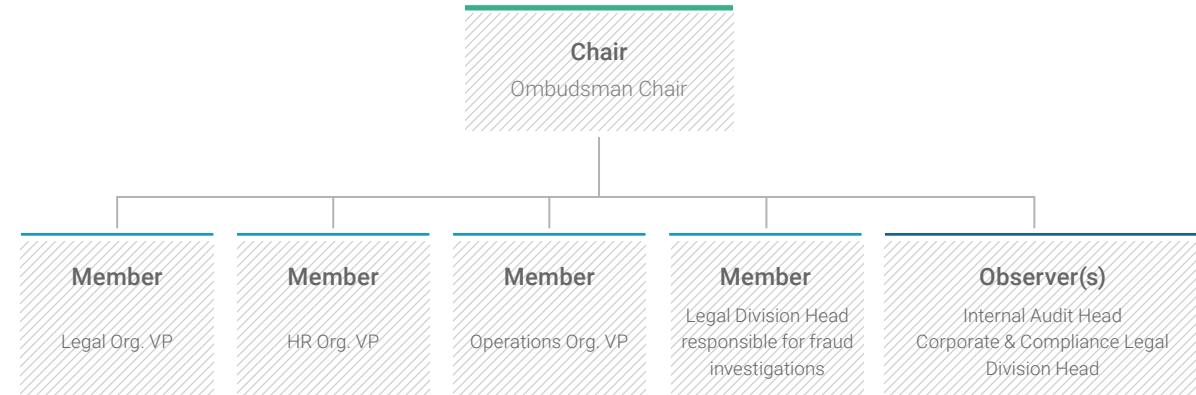


## Tone from the Top

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.

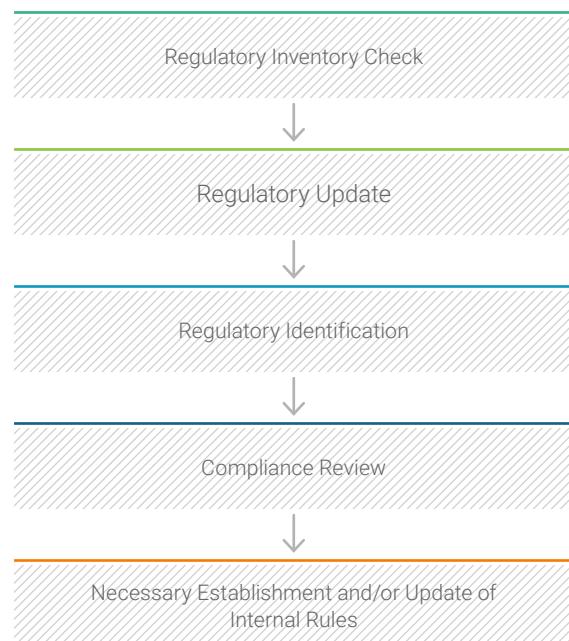
## Ethics Committee



## 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.

### Regulatory Compliance and Policies/Procedures



## 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 trainees 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.

### Ethics and Regulatory Compliance Training Promotion

Category	2016	2017	Notes
Ethical Standards (to Employees)	around 29,000 employees	→ 36,000 employees	<ul style="list-style-type: none"> <li>Includes anti-corruption, avoidance of conflict of interests, reporting channels and whistleblower protection</li> <li>Includes both face-to-face training and electronic training</li> </ul> <p>Note: The Legal department provided face-to-face training to select group of overseas assignees and departments for enhancement of awareness</p>
Ethical Standards (to suppliers)	719 suppliers	→ 888 suppliers	<ul style="list-style-type: none"> <li>Includes anti-corruption, avoidance of conflict of interests, reporting channels and whistleblower protection</li> <li>Face-to-face training only</li> </ul>
Regulatory Compliance	around 26,000 employees	→ 29,000 employees	<ul style="list-style-type: none"> <li>Includes export control, personal data protection, insider trading and record retention and disposal</li> <li>Includes both face-to-face training and electronic training</li> </ul>

## 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



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 provided 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



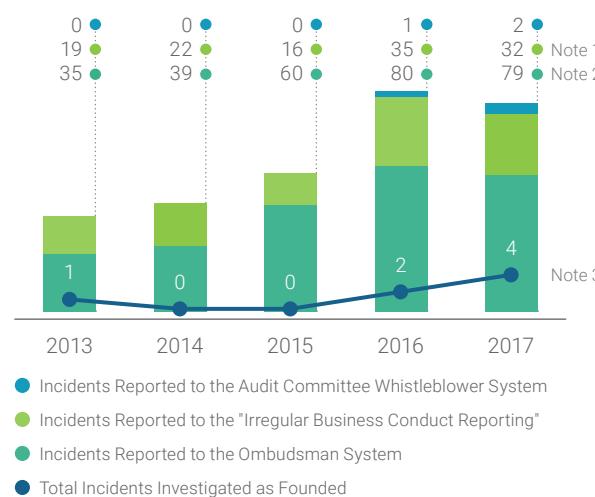


TSMC's legal department participated in a panel to share views on the trends, and importance of whistleblower protection in a 2017 APEC (Asia-Pacific Economic Cooperation) Workshop with delegates from 13 APEC member economies, such as Chile, Japan, South Korea and the U.S.. The workshop provided the APEC member economies useful reference for the improvement of their own whistleblower regulatory regimes.

In 2017, reporting channels and whistleblower protection were both key communication 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

Unit: numbers



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

Unit: numbers



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

---

**10.1 bn (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.



**Material Issue**

# Innovation Management

## 創新 Innovation

創新是我們成長的泉源。我們追求的是全面，涵蓋策略、行銷、管理、技術、製造等各方面的創新。創新不僅僅是有新的想法，還需要執行力，做出改變，否則只是空想，沒有益處。

Innovation is the wellspring of TSMC's growth, and is a part of all aspects of our business, from strategic planning, marketing and management, to technology and manufacturing. At TSMC, innovation means more than new ideas, it means putting ideas into practice.

**Strategies****TSMC 2020/2025 Goals**

Achievements &amp; Targets

**Technology Leadership**

Continue to develop leading-edge technologies to maintain TSMC's technology leadership in the semiconductor industry

- 5nm process technology in volume production [2020]

**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

- 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]

Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets

**Production ramp-up of industry leading 7nm technology,  
the 4<sup>th</sup> generation of technology to make use of 3D  
FinFET transistors**



Target: 7nm process technology in risk production

○ 7nm process technology in risk production

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



Target: File more than 4,500 patent applications worldwide

○ File more than 5,100 patent applications worldwide

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



2017 new item

○ Over 8,800 trade secrets registered



"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.



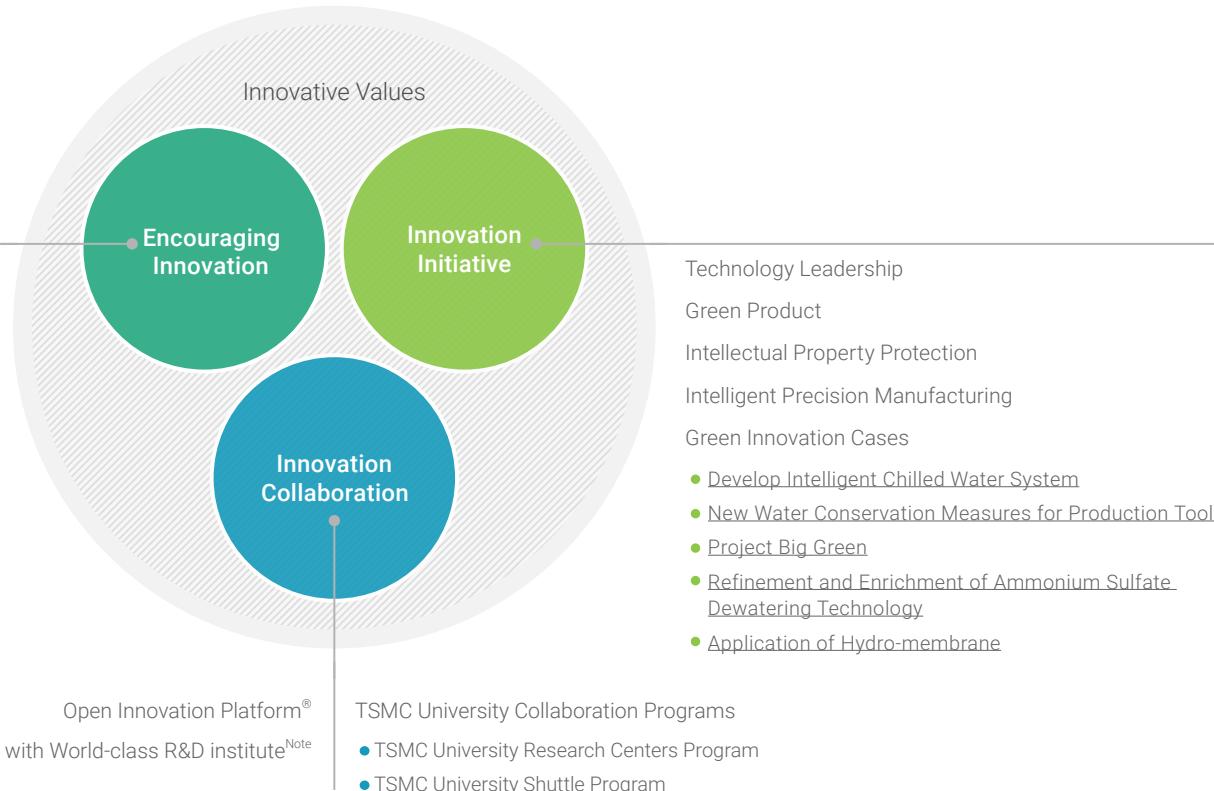
**Morris Chang**  
Chairman

## 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.

Annual Idea Forum competition incl. Operations, R&D, Q&R, Corporate Planning Organization & Finance, Suggestions from grassroots, Continual Improvement Team (CIT), Total Quality Excellence and Innovation Conference, and Tool Energy Saving Workshop.



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.

# 13%

R&D headcount increased to 6,145, up about 13% from the previous year

## InFO-PoP

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

### Technology Leadership

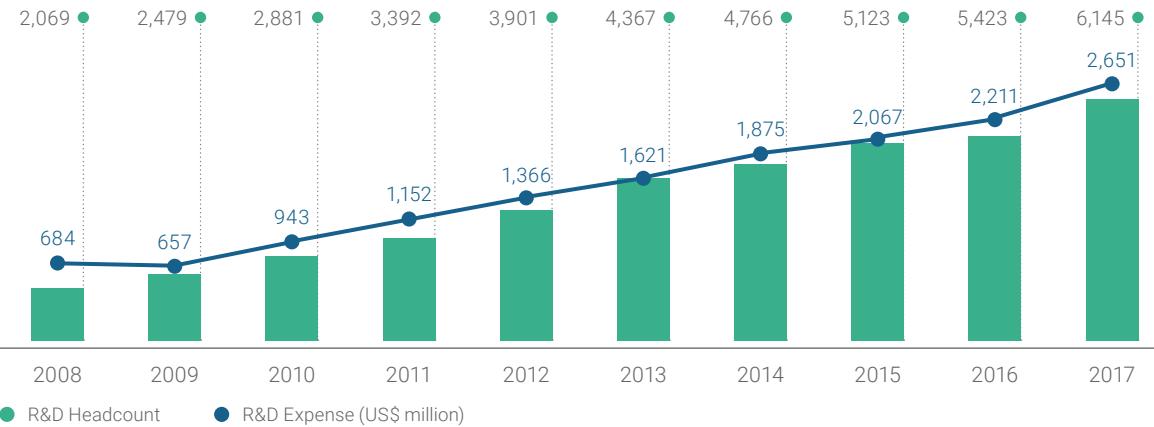
In 2017, TSMC continued to invest in research and development, with total R&D expenditures amounting to US\$2,651 million, up about 19% from the previous year, accounting for 8% of total revenue. R&D headcount increased to 6,145, up about 13%, a level that equals or exceeds the R&D investment of many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

TSMC recognizes that the technology challenge of continuing to extend Moore's Law<sup>Note</sup> 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 4<sup>th</sup> 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.

Note: Moore's law is the observation that the number of transistors in a dense integrated circuit doubles approximately every two years.

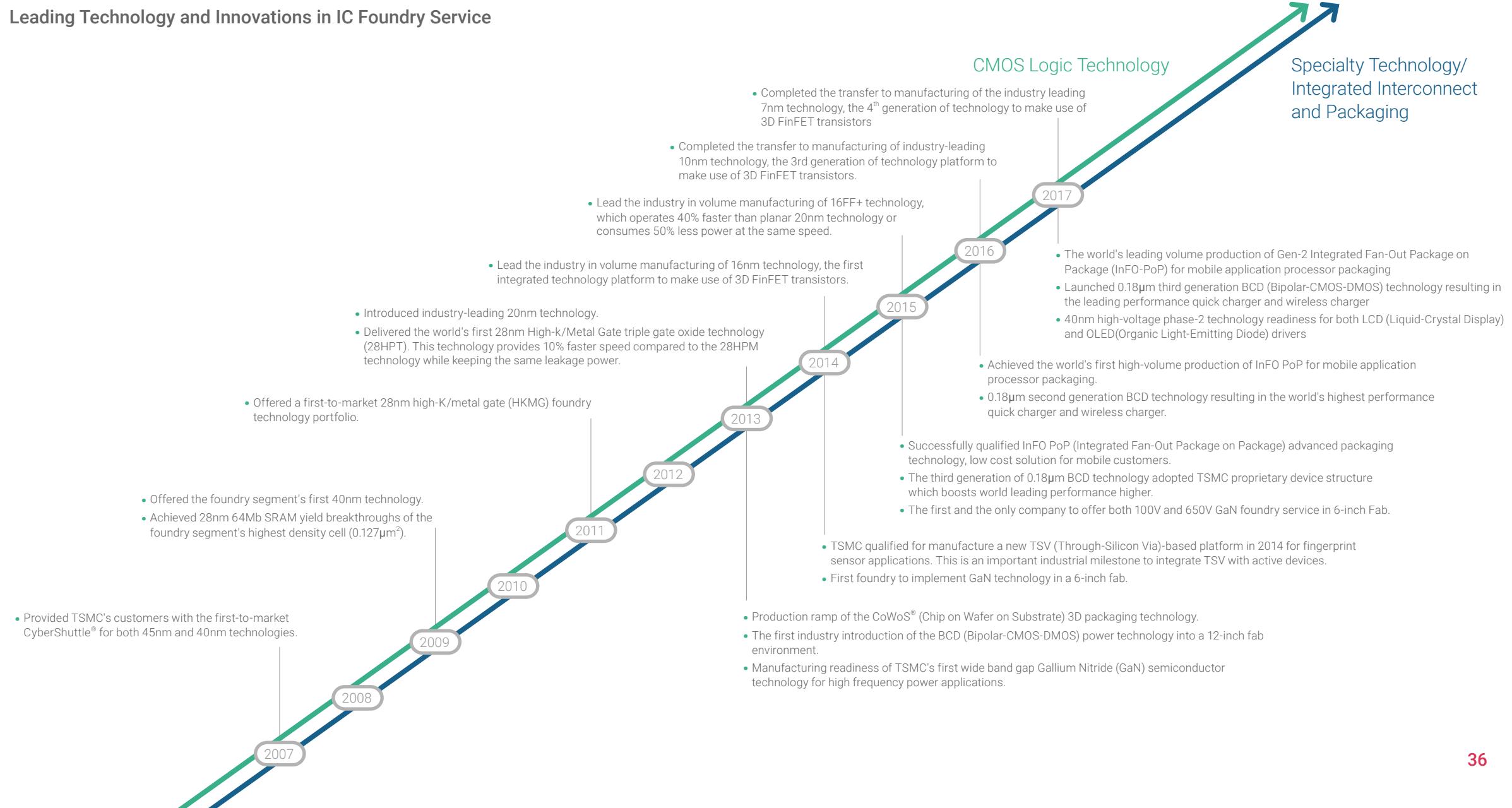
### TSMC is Committed to Investment in Technology Advancement



### Specialty Technology / Integrated Interconnect & Packaging

Advanced Fan-Out Packaging	Power IC/BCD Technology	Embedded Flash Technology	GaN Technology	Panel Drivers
<ul style="list-style-type: none"> <li>The world's leading volume production of Gen-2 Integrated Fan-Out Package on Package (InFO-PoP) for mobile application processor packaging</li> <li>Successful qualification of Gen-3 InFO-PoP advanced packaging technology for mobile applications</li> <li>Started risk production of Integrated Fan-Out on Substrate (InFO-oS) for die-partition and HPC applications</li> </ul>	<p>Launched 0.18µm third generation BCD (Bipolar-CMOS-DMOS) technology resulting in the leading performance quick charger and wireless charger</p>	<p>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 micro controller units</p>	<p>Successful development and manufacturing qualification of 650V, 100V E-HEMT, and RF 30V D-MISFET GaN devices</p>	<p>Completed 40nm high-voltage phase-2 technology readiness for both LCD (Liquid-Crystal Display) and OLED (Organic Light-Emitting Diode) drivers</p>

## Leading Technology and Innovations in IC Foundry Service





Unleash customers' mobile and wireless chip innovations that enhance mobility and convenience



Unleash customers' CIS and MEMS innovations that enhance human health and safety

## Green Products

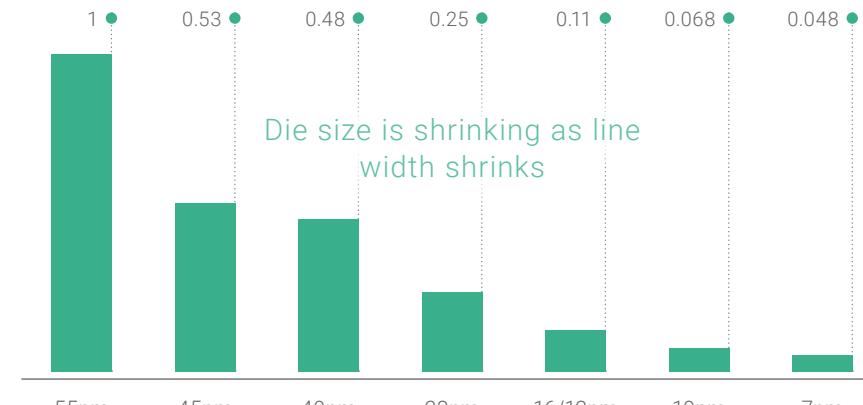
In each new technology generation for IC manufacturing, circuitry line widths shrink, making an IC chip smaller and reducing product power consumption.

### 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

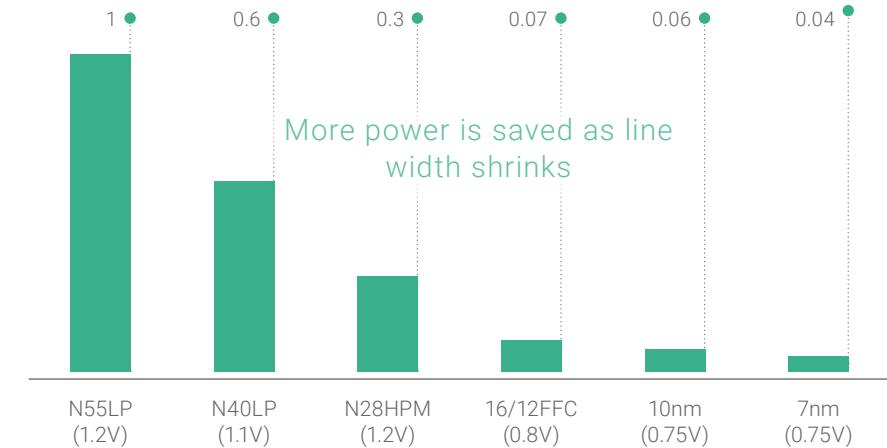
more advanced, energy-saving and environmentally friendly products to minimize the environmental impact of technology progress. Through TSMC's manufacturing technologies, customers' designs are realized and their products are used in a wide range of applications covering various segments of the computer, communications, consumer, industrial and other electronics markets. These chips make significant contributions to the progress of modern society.

**Chip Die Size Cross-Technology Comparison**



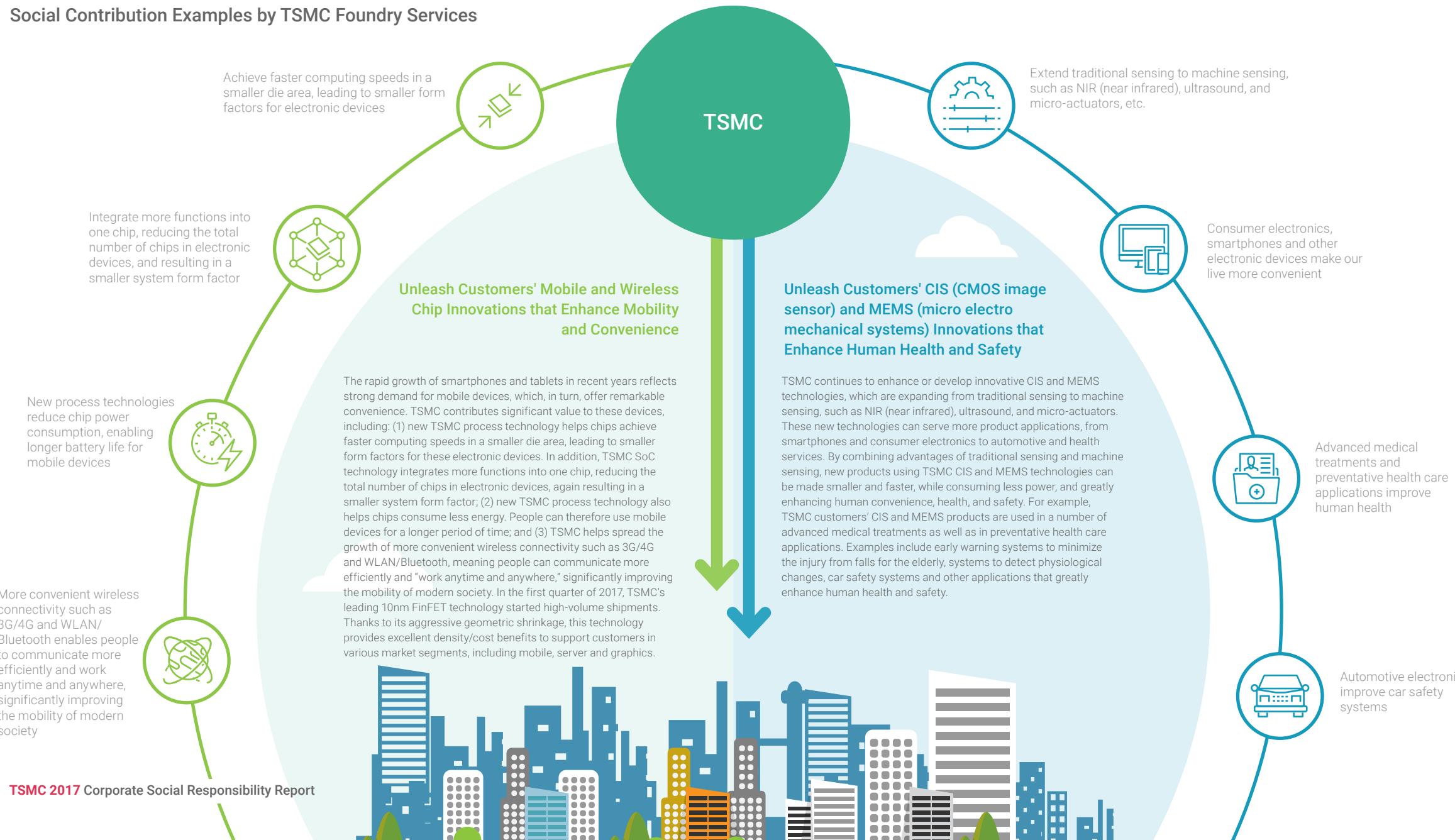
Data source: TSMC

**Chip Total Power Consumption Cross-Technology Comparison**



Data source: TSMC

## Social Contribution Examples by TSMC Foundry Services



# 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 2<sup>nd</sup> consecutive year

# 1

The highest allowance rate among the U.S. patent assignees in 2017

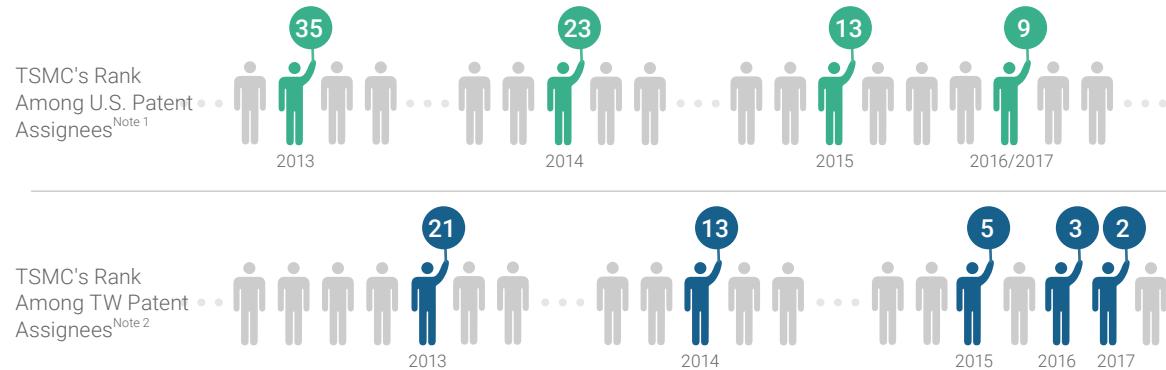
## Intellectual Property Protection

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 2<sup>nd</sup> 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.

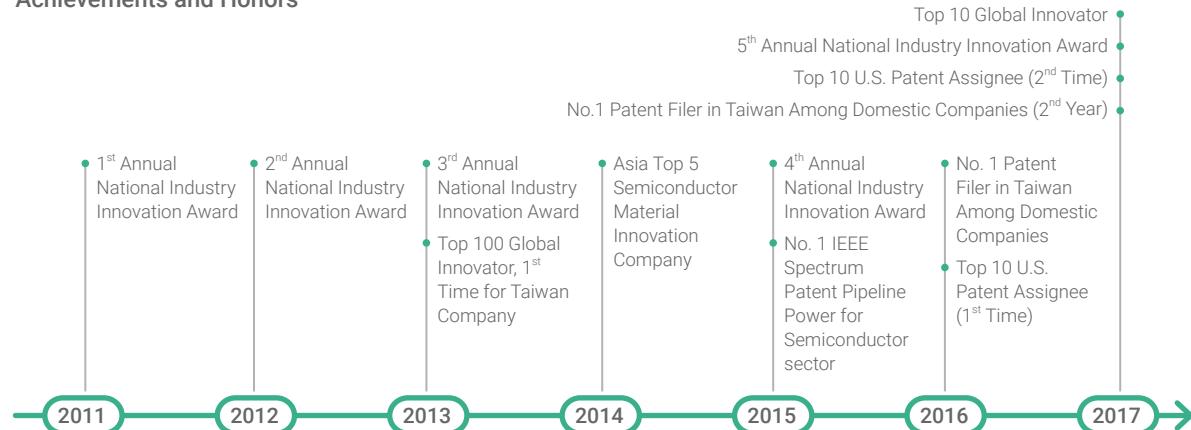
## TSMC Worldwide Patent Rankings



Note 1: 2017 Top 50 U.S. Patent Assignees (IFI CLAIMS)

Note 2: Top 100 patent assignees among domestic companies (TIPO)

## Achievements and Honors



# 8,000

Over 8,000 trade secrets were registered in 2017, which was the highest amount since the registration program began.

## 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.

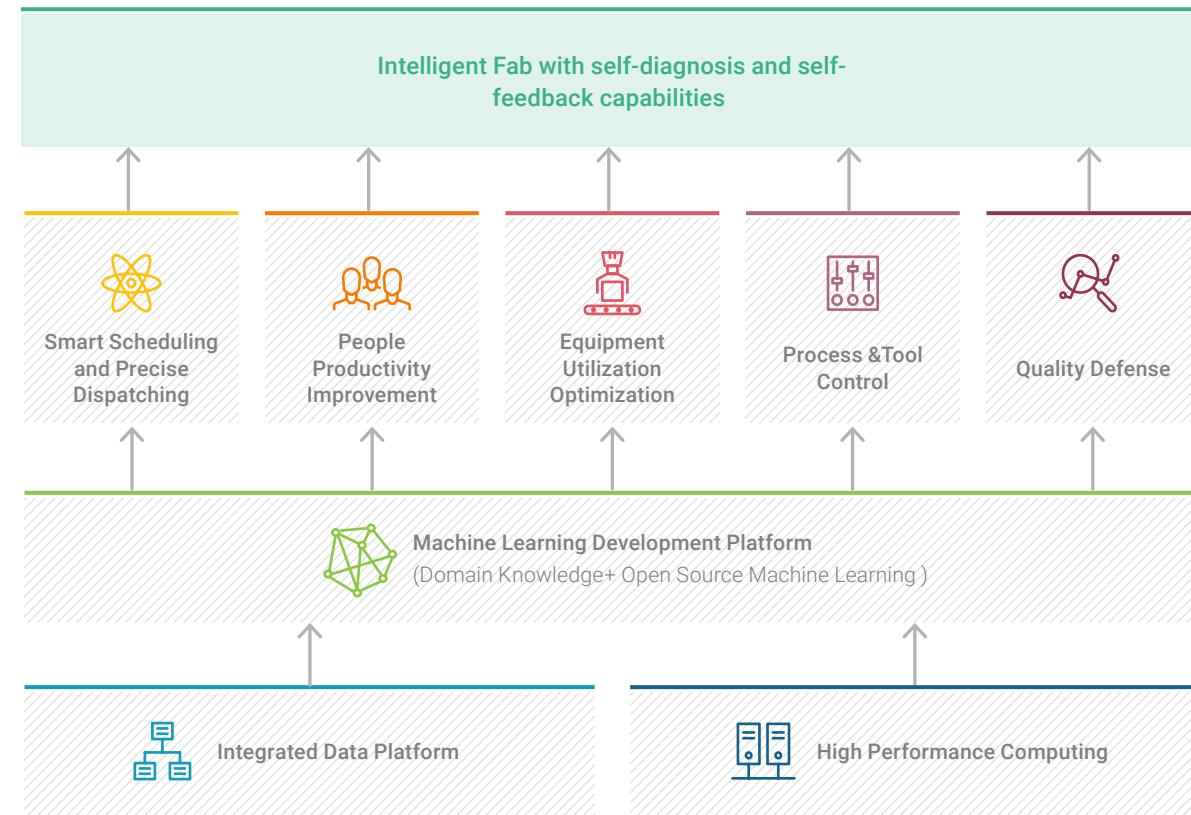
The Golden Trade Secret Awards, given to inventors of trade secrets that contribute most to the Company's competitiveness, are granted each year to increase the quality and quantity of trade secrets and to encourage contributions. As of 2017, 795 Golden Trade Secrets have been granted to more than 2,900 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.





Dr. Cliff Hou delivering the OIP Ecosystem Forum keynote address

## 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"](#)



### 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.

### Effectiveness Analysis of Elite Seeds Camp

Highest Rate: 5





## Tasks of 2018

7nm process technology in production and continue to develop 5nm technology process

Continue to build TSMC's patent portfolio in alignment with R&D development, and hold IP-promotion activities to encourage submission of patent disclosures

Hold the Golden Trade Secret Awards ceremony

## 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.

- NVM
- Micro-electromechanical System Designs (MEMS)
- Analog Circuit
- Digital Circuit
- Mixed-signal Circuit
- RF Designs
- IoT
- High Performance Computing
- 5G mmWave
- MRAM/SRAM
- Neural Network Application
- Machine Learning
- Big Data
- Biosensor

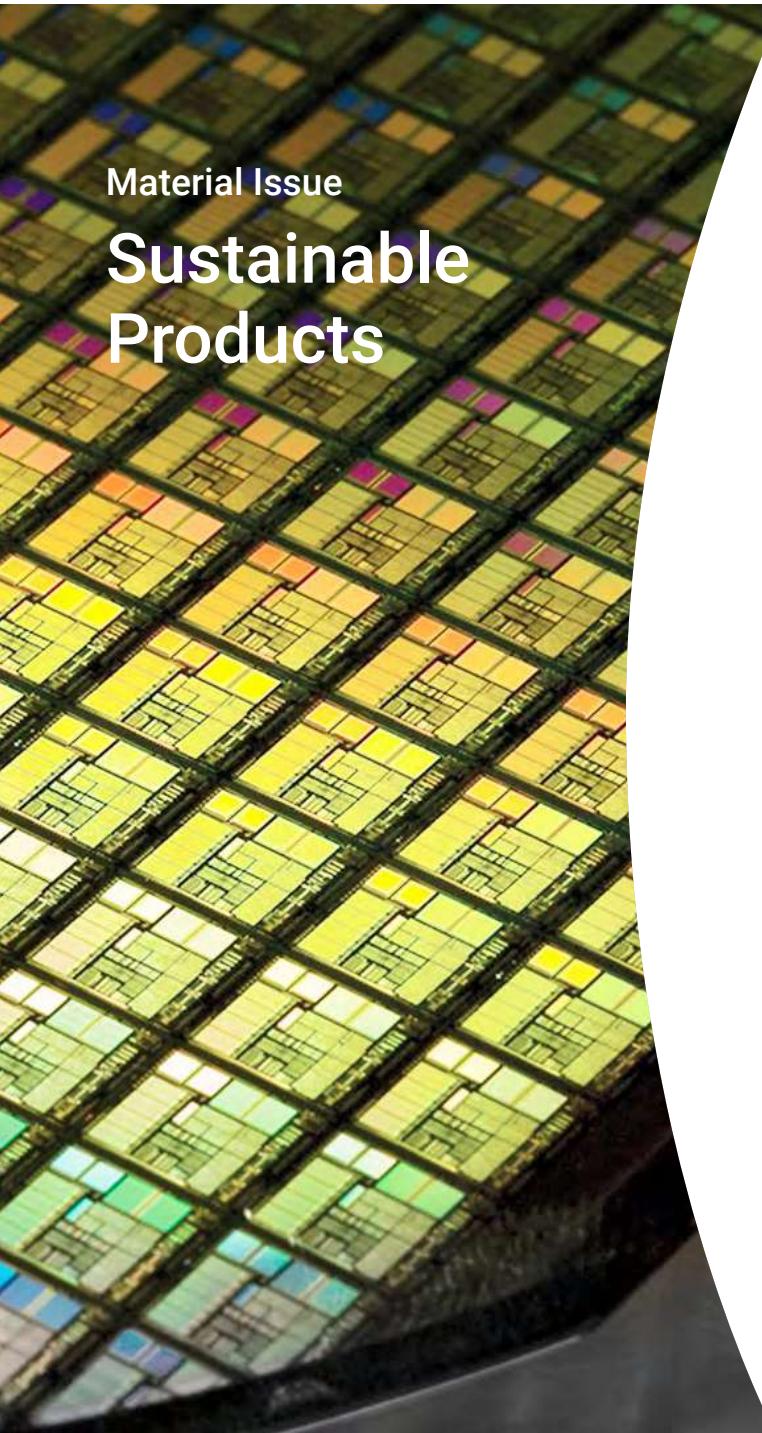


### Technologies for University Design

### Research Application Recent Years

**Material Issue**

# Sustainable Products

**Strategies****TSMC 2020/2025 Goals**

Achievements &amp; Targets

**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

- Complete establishment of methodology for energy saving contribution assessment for semiconductor products application 2020

**Product Hazardous Substance Management**

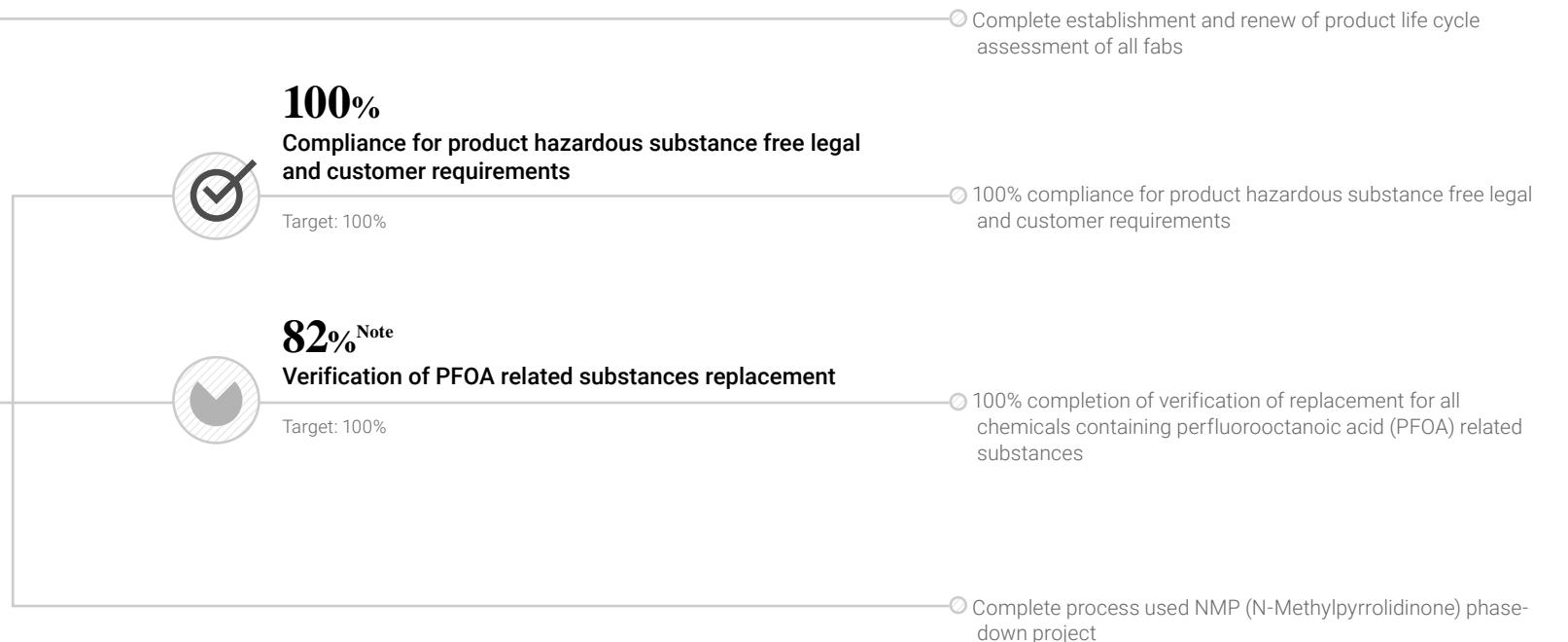
Continue to promote hazardous substance replacement projects

- 100% compliance for product hazardous substance free legal and customer requirements 2020

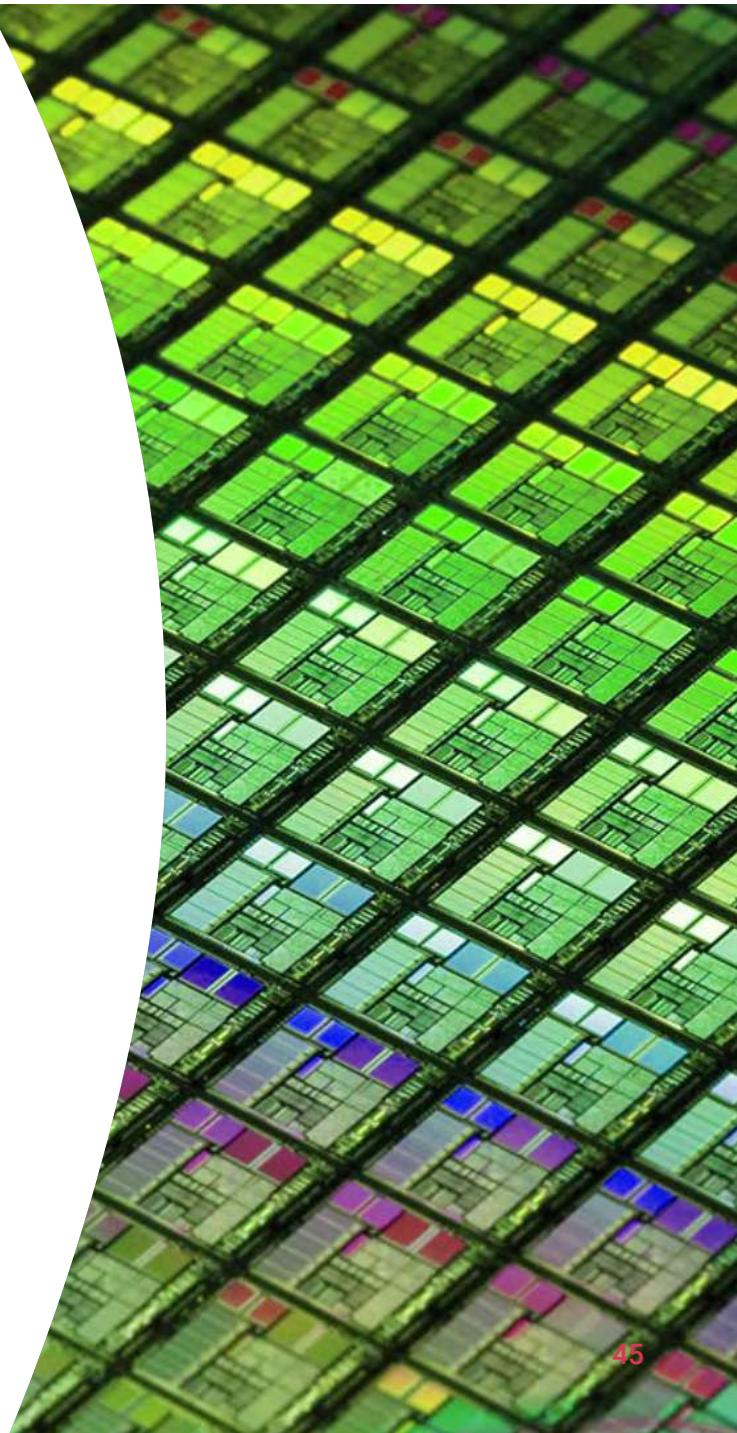
Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets



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.

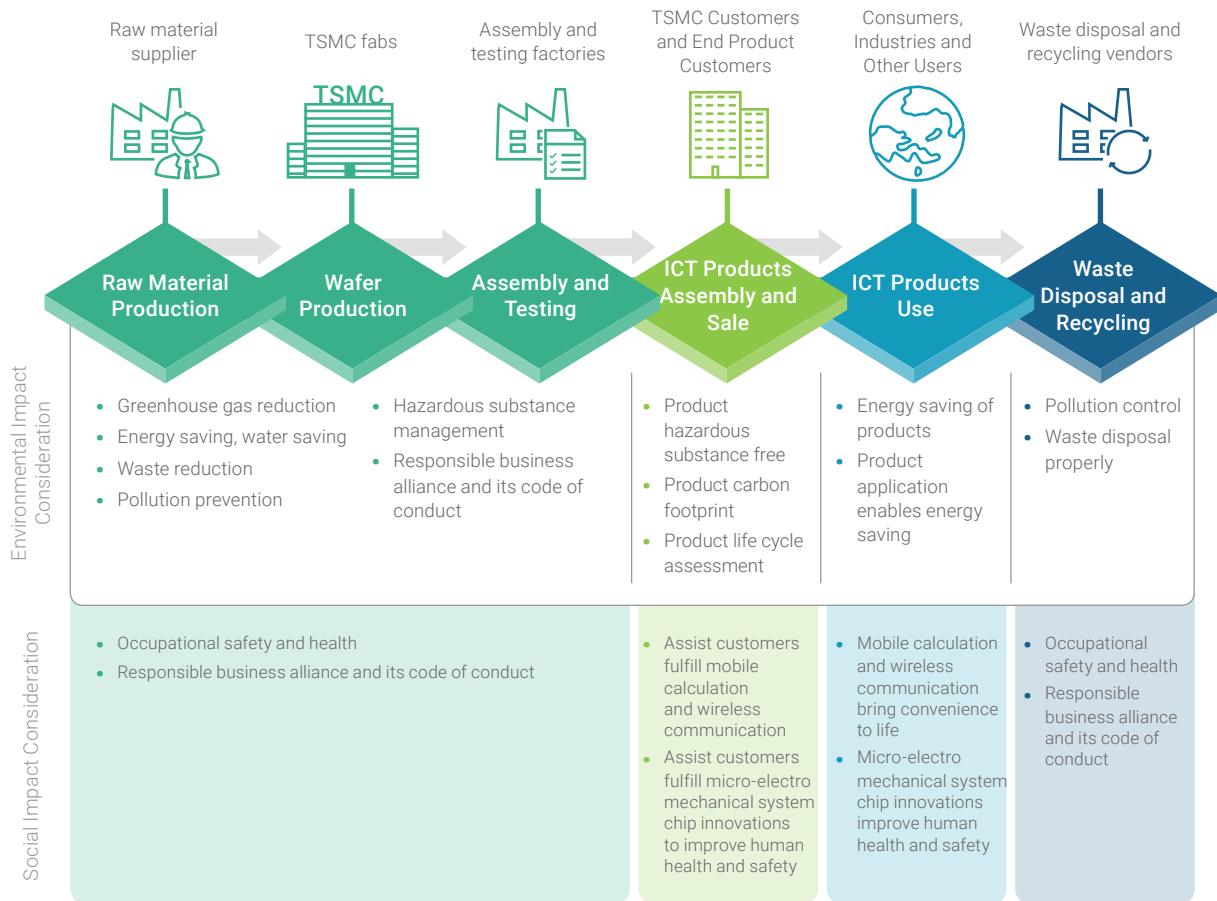
### Product Life Cycle Thinking

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



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.

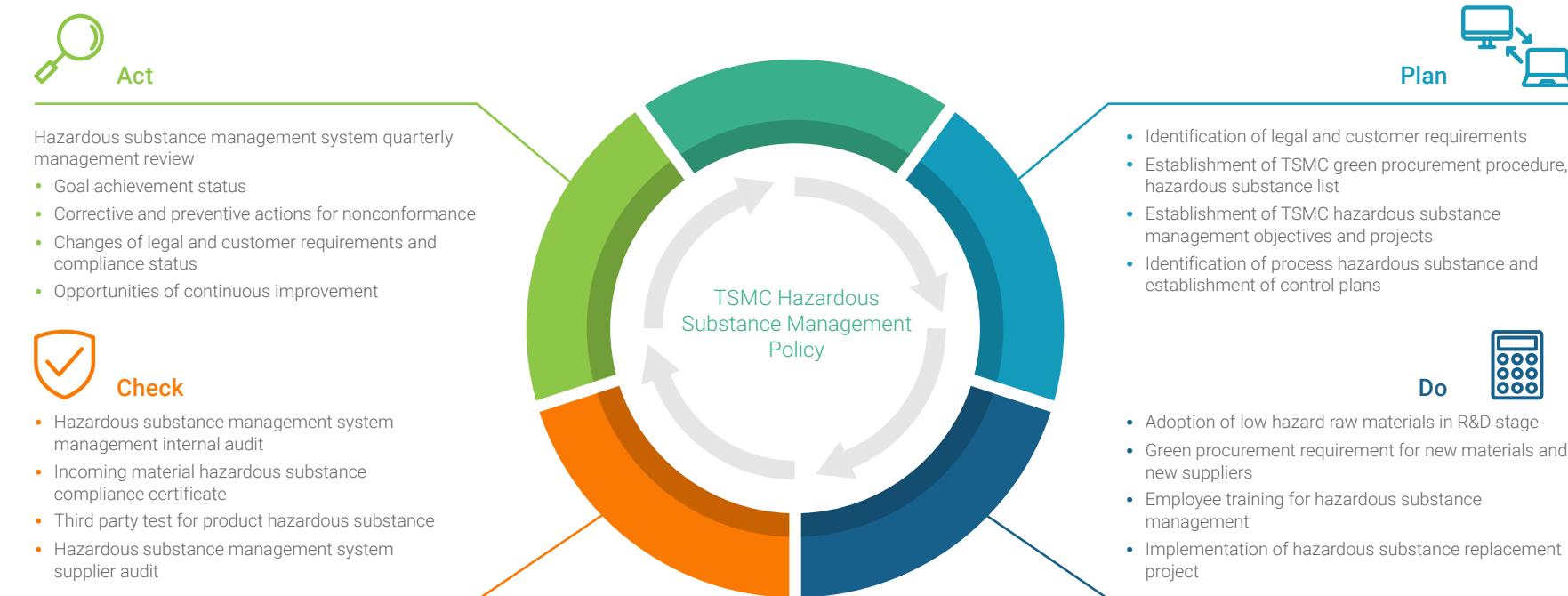
For more TSMC sustainable supply chain measures, please refer to "[Supplier Sustainability Management](#)" in this report.

## 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,

### TSMC Product Hazardous Substance Management Process



# 82%

Completed 82% verification of PFOA related substances replacement

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 perfluoroctanoic 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.

## Product Hazardous Substance Management is Compliant with or Surpasses International Regulations

International Regulations / Customer Requirements	Description of Legal Compliance
European Union Restriction of Hazardous Substance (EU RoHS)	<ul style="list-style-type: none"> <li>TSMC provides lead free bumps to customers. A few customers still need trace lead contained bump which is exempted by EU RoHS</li> <li>Other EU RoHS restricted substances are not used in TSMC process</li> </ul>
Product Halogen Free Requirements	<ul style="list-style-type: none"> <li>All TSMC products are compliant</li> </ul>
Perfluorooctanesulfonic Acid (PFOS), Perfluoroctanoic Acid (PFOA) Restriction in Process	<ul style="list-style-type: none"> <li>TSMC has totally phased out using PFOS and PFOA, and all products also do not contain these two substances</li> </ul>
EU Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) (REACH) Annex XVII	<ul style="list-style-type: none"> <li>All TSMC products are compliant</li> </ul>
EU REACH Substances of Very High Concern (SVHC)	<ul style="list-style-type: none"> <li>All TSMC products are compliant</li> </ul>
EU Waste Electrical and Electronic Equipment (WEEE) Directive	<ul style="list-style-type: none"> <li>TSMC's products are not final products and this law is not directly applicable</li> </ul>

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

Prohibited or Restricted Substances	Controlled Substances	Reportable Substances
<p>25 categories of prohibited or restricted substances including legal, customer requirements and TSMC voluntary.</p> <ul style="list-style-type: none"> <li>Prohibit or restrict containing in process raw materials or products</li> </ul>	<p>Carcinogenic, mutagenic or toxic for reproduction (CMR) substances.</p> <ul style="list-style-type: none"> <li>"Not use" as the principle, but to be used following environmental, safety and health requirements and approval of R&amp;D, Operation Vice Presidents and Corporate ESH unit if no available alternatives.</li> </ul>	<p>Required to report by regulations</p> <ul style="list-style-type: none"> <li>Use after conforming related information</li> </ul>



## Tasks of 2018

Complete establishment or renew 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 PFOA 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

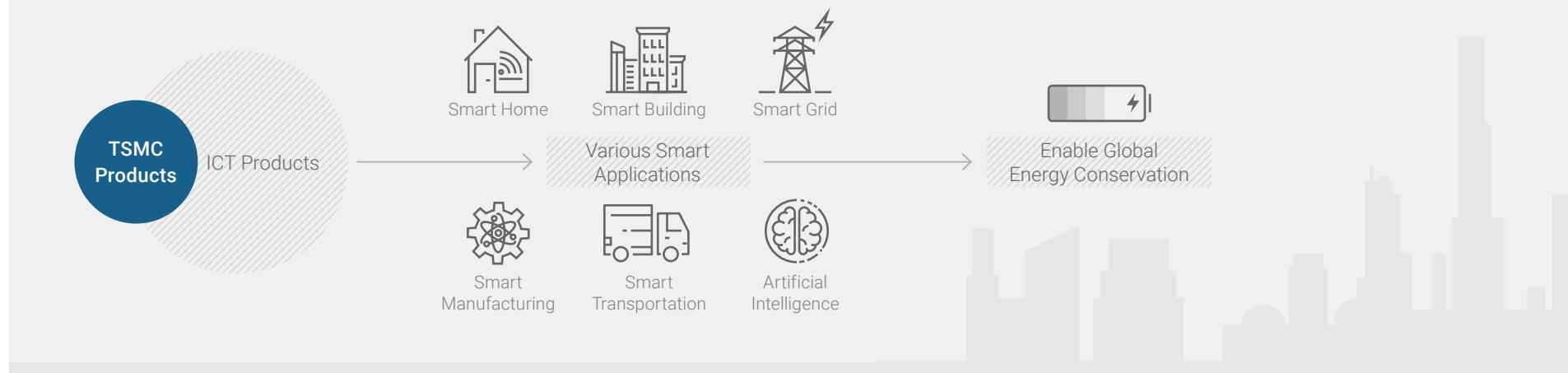
With the continuously vigorous development of global information and communications technology (ICT) industry, and in various ICT products including computers and communication equipment, integrated circuit (IC) plays a key role. TSMC is not only the world's largest dedicated semiconductor foundry and also 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](#)"





## Strategies

## TSMC 2020/2025 Goals

Achievements &amp; Targets

**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

- 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

**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

- 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

**Quality Application Realization**

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

- Complete reliability qualification for 5nm technology and characterize the process window 2020

## 2017 Achievements

## 2018 Targets

**42,056**

Suggestions were issued from basic level



Target: Issue 38,000 suggestions

**2,020**

Continual improvement cases were completed



Target: Complete 1,850 continual improvement cases

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

**10.1 billion**

Benefit created from suggestions and continual improvement cases



Target: Create NT\$10 billion benefit

**74%**

Of local suppliers participated in the National Quality Control Circle competition

Target: 60% of local suppliers

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

**4,747**

Increased visual inspector's monthly productivity for 12-inch wafers to 4,747 pieces



Target: 4,500 pieces 12-inch wafer

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

**23% (183 materials' analysis capability)**

Established 23% (183) materials' analysis capability for carcinogenic, mutagenic, or toxic for reproduction (CMR) substances



Target: Established 18% (146) materials' analysis capability

- Establish 49% (396) materials' analysis capability for carcinogenic, mutagenic, or toxic for reproduction (CMR) substances

Completed reliability qualification for 7nm technology and characterized the process window



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

- Complete reliability qualification for leading technology and specialty technologies according to R&D's goal

Target: Complete reliability qualification for 7nm technology and specialty technologies

Surpassed

Achieved

Unachieved





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.



**Dr. N.S. Tsai**  
Vice President, Quality & Reliability

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" <sup>Note 1</sup> in basic levels and the activities of "Continual Improvement Team (CIT)" <sup>Note 2</sup>. TSMC also held a corporate-level "Total Quality Excellence and Innovation Conference." With the public rewards and praises, we expect

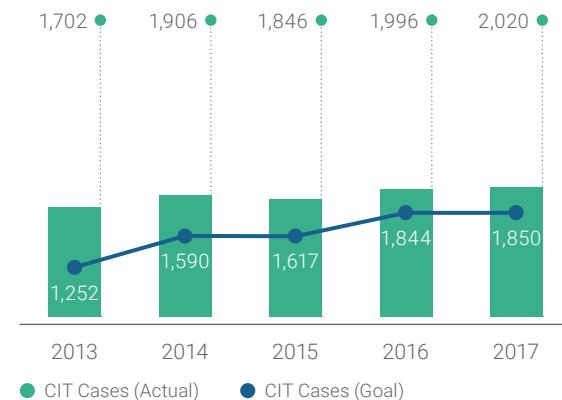
to provide a cross-department communication and study platform with continual improvement cases sharing. It aims to enhance employees' problem solving and innovation capabilities for achieving the win-win goal of TSMC's competitiveness and customer satisfaction. In 2017, there were 42,056 suggestions issued by the basic levels and a total of 2,020 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.

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.

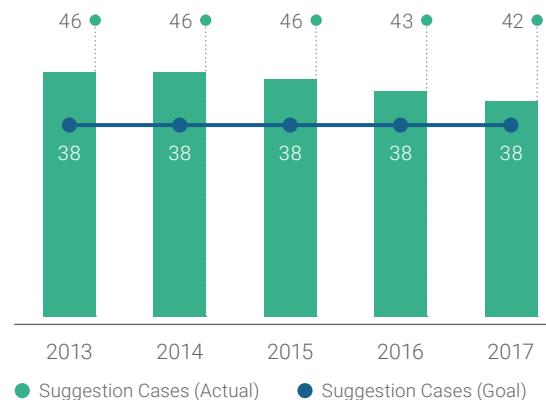
### Continual Improvement Team (CIT) Program

Unit: case



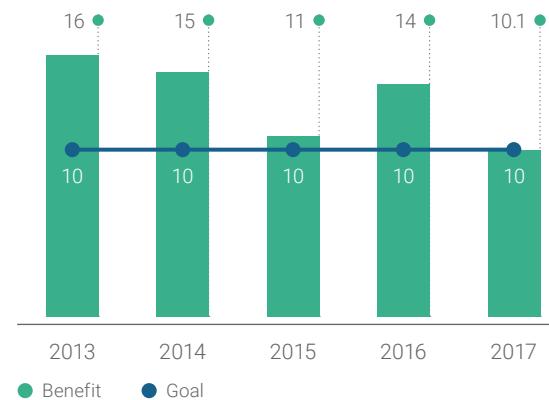
### Suggestion Program

Unit: thousand cases



### Benefit from Suggestion Program and CIT

Unit: NT\$ billion

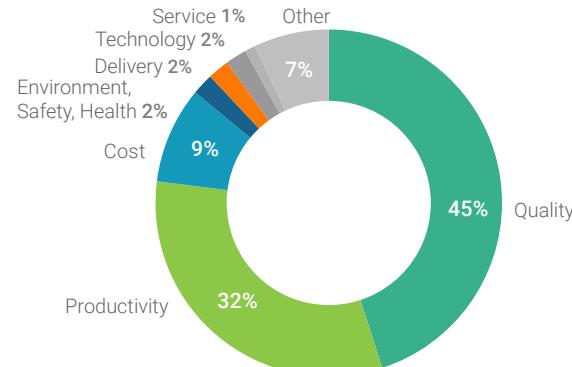




Fab 6 has been honored with the most Gold Medals since the inception of the awards

In addition to internal cross-department communication and study, TSMC also participates in the "National Quality Control Circle" <sup>Note 1</sup> 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 <sup>Note 2</sup> 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.

### 2017 Continual Improvement Team Program



### Examples in 2017 Total Quality Excellence and Innovation Conference

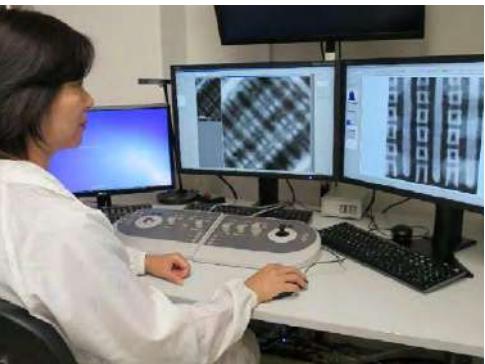
Group	Cases	Benefit
Quality Enhancement	To improve the methods in Lithography processes	<b>99.7%</b> Enhanced product yield to 99.7%
	To improve the methods in Integrated Fan-Out (InFO) clean process	<b>88%</b> Improved test reject rate 88%
	To improve the methods in Furnace process	<b>75%</b> Reduced specific product defect rate 75%
	To improve the methods in 3D image sensor Etching process	<b>50%</b> Enhanced image resolution 50%
	To develop 40nm Ultra Low Power technology	<b>80%</b> Improved customer product standby power performance 80%
Customer Satisfaction	To establish innovative design service platform for stacked CMOS image sensors	<b>70%</b> Shortened customer product development schedule for image analysis and test 70%
	To reduce 8-inch Fab carbon emissions and save energy	<b>63,500 metric tons</b> <b>60,290,000 kWh</b> Reduced CO <sub>2</sub> emission 63,500 metric tons and saved the use of electricity 60,290,000 kWh annually
Environment, Safety, Health		

### 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.

Note 2: 6 times: 2010, 2012, 2014, 2015, 2016, 2017



Transmission Electron Microscopy Laboratory

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.

#### Suppliers' National QCC Participation Rate

Unit: %



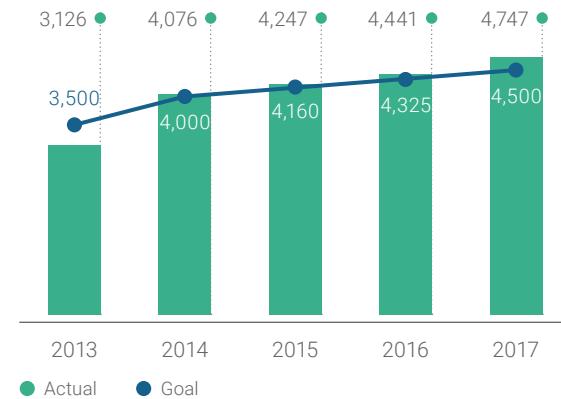
#### Quality Capability Enhancement

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

#### 12-inch Wafer Outgoing Visual Inspector Productivity

Unit: wafer (piece)



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.



#### 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



## Tasks of 2018

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

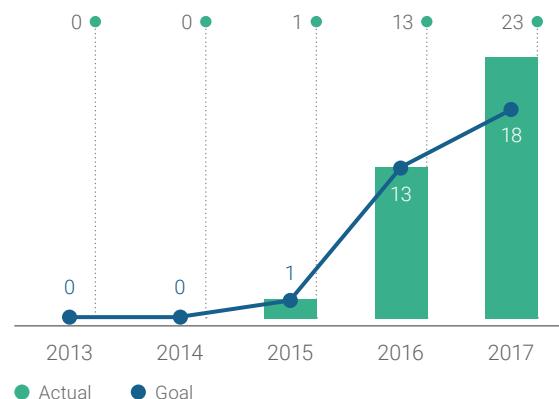
Enhance outgoing visual inspection defect automatic classification system and chemical laboratory's capability for material analysis

Complete 7nm+ technology and specialty technologies reliability qualification

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.

### Materials' analysis capability for CMR substances

Unit: %



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 (Perfluoroctanoic 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.



For more details, please refer to TSMC's 2017 Annual Report ["5.3.5 Quality and Reliability"](#).

## Material Issue

## Customer Service



## Strategies

## TSMC 2020/2025 Goals

Achievements &amp; Targets



- Align with TSMC technology development roadmap, available technologies through TSMC-Online to reach 370 2025
- Pass customer product information audit without major defect 2025



- "Customer Service" score in Quarterly Business Reviews to reach 75% with satisfactory feedback 2025

Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets

**0**  
**Pass customer product information audit without major defect**

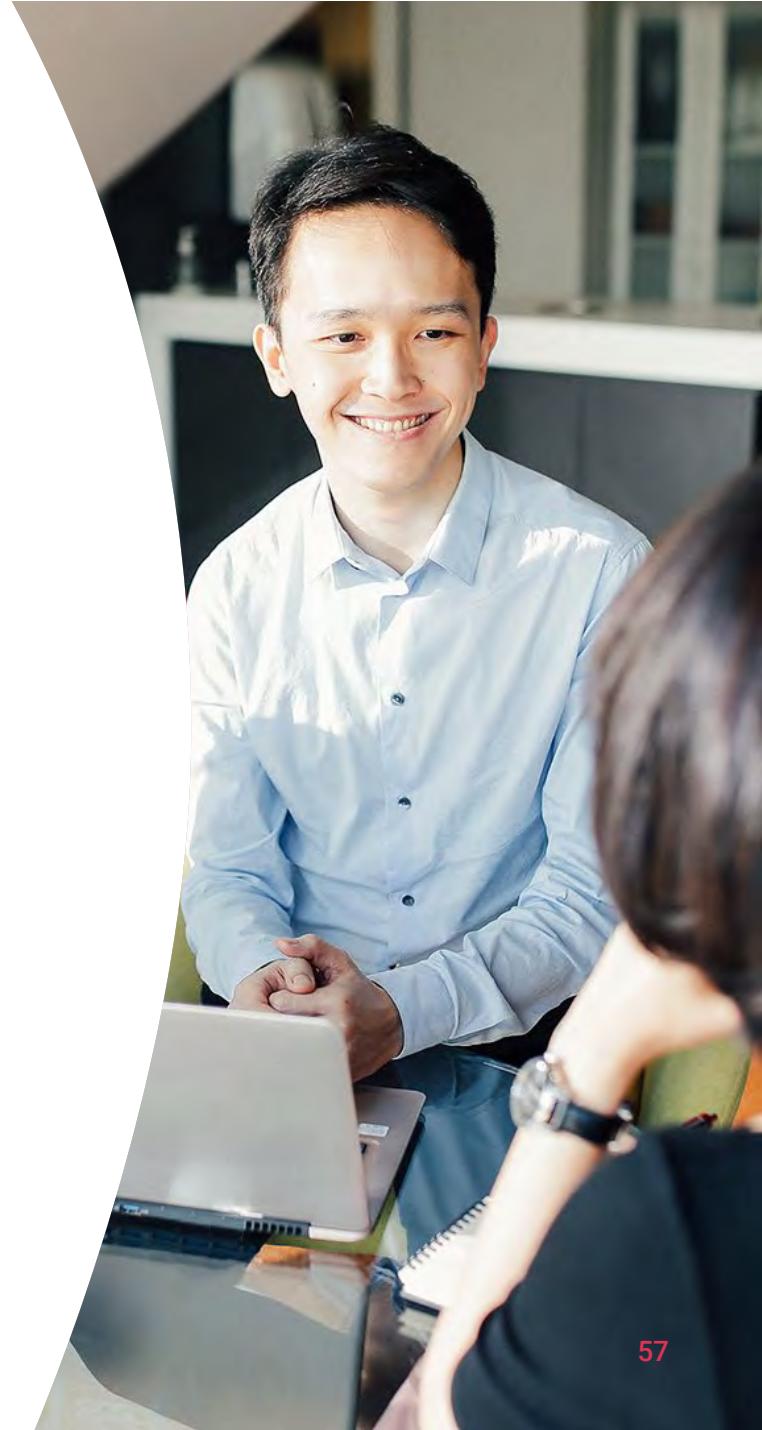
Target: Pass customer product information audit without major defect

- Pass customer product information audit without major defect
- Align with TSMC technology development roadmap, available technologies through TSMC-Online to reach 330

**8.8**  
**"Customer Service" score in Quarterly Business Reviews reaches 8.8 points**

Target: Reach 8.8 points

- Customer Service" score in Quarterly Business Reviews to reach 72% with satisfactory feedback

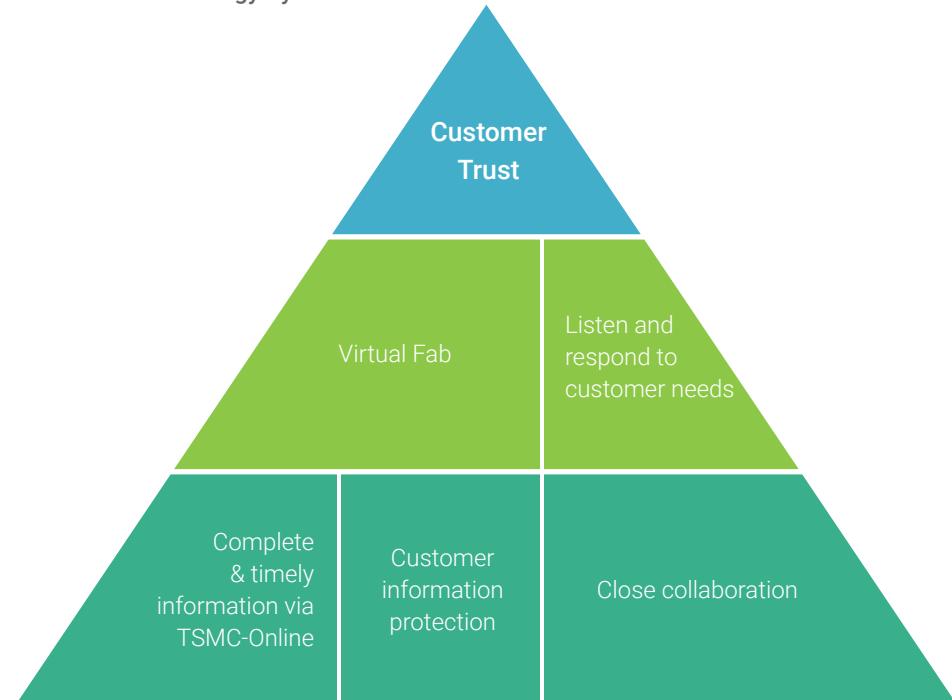


To provide the best service to customers, TSMC has a dedicated customer service team as the main contact window for coordination and facilitation. TSMC strives to provide world-class design support, mask making, wafer manufacturing, and backend services. TSMC also protects customers' confidential information 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.

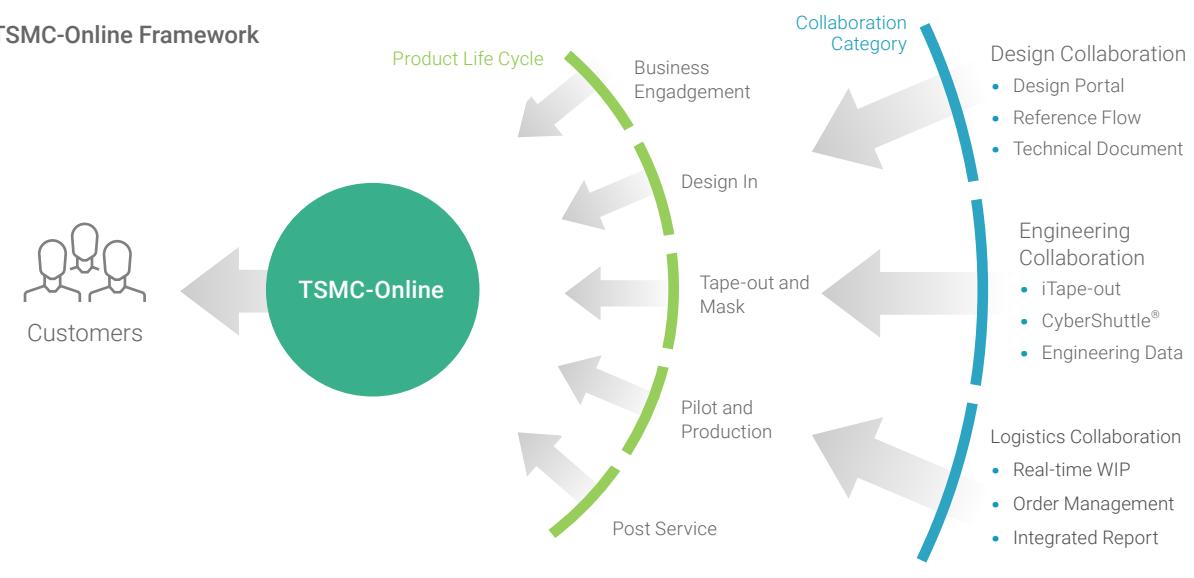
**Customer Service Strategy Pyramid**



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.

**TSMC-Online Framework**



#### 2017 Highlights

**300**

Available technologies offering through TSMC-Online

**9,000**

Available technology files through TSMC-Online

**100,000**

Customer downloads of technology files through TSMC-Online

**400,000**

TSMC-Online access times

# >90%

The annual customer satisfaction survey reached over 90% satisfaction for four consecutive years, demonstrating our good relationship with customers

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.

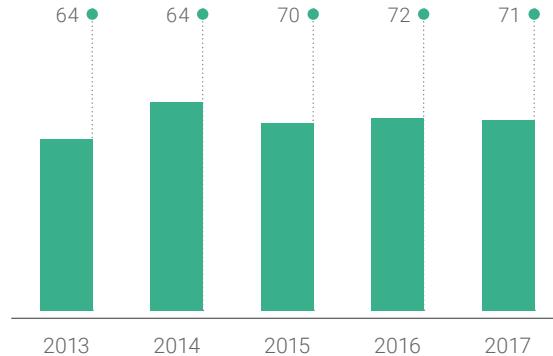
In 2017, "Customer Service" score in Quarterly Business Reviews with satisfactory feedback is 71%, with 1% loss as compared to 2016. The major reason for this minor decrease is due to the length of time it took for technology collaboration discussion and decision. In the future, TSMC will improve the 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-Online Cumulated Technology Offerings  
(Exclude Already Sunset Folders)**



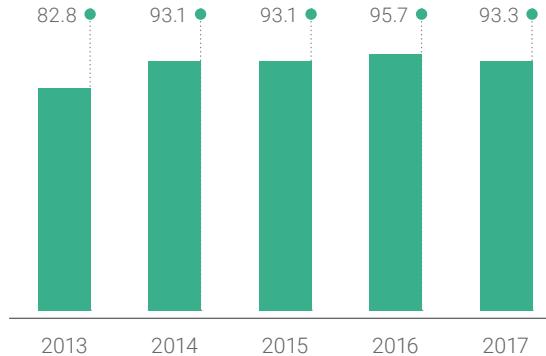
**Quarterly Business Review Customer Service Score**

Unit: %



**Annual Customer Satisfaction**

Unit: %



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

### 2017 Proprietary Information Protection Accomplishment



Continue on next page



## Tasks of 2018

Integrate front-end wafer and back-end package related design documentation in TSMC-Online, to provide one-stop shopping service

Enhance TSMC-Online usage rates in functions of self-customizing production report and "Customer Lot-Handling"

Upgrade system hardware for TSMC-Online information security

Continued from previous page

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

## 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



#### 12 Regulations

Newly created or revised 12 Proprietary Information Protection regulations

## 100%

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

#### 24 Promotion Posters

24 PIP promotion posters to raise PIP awareness

## 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

## 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

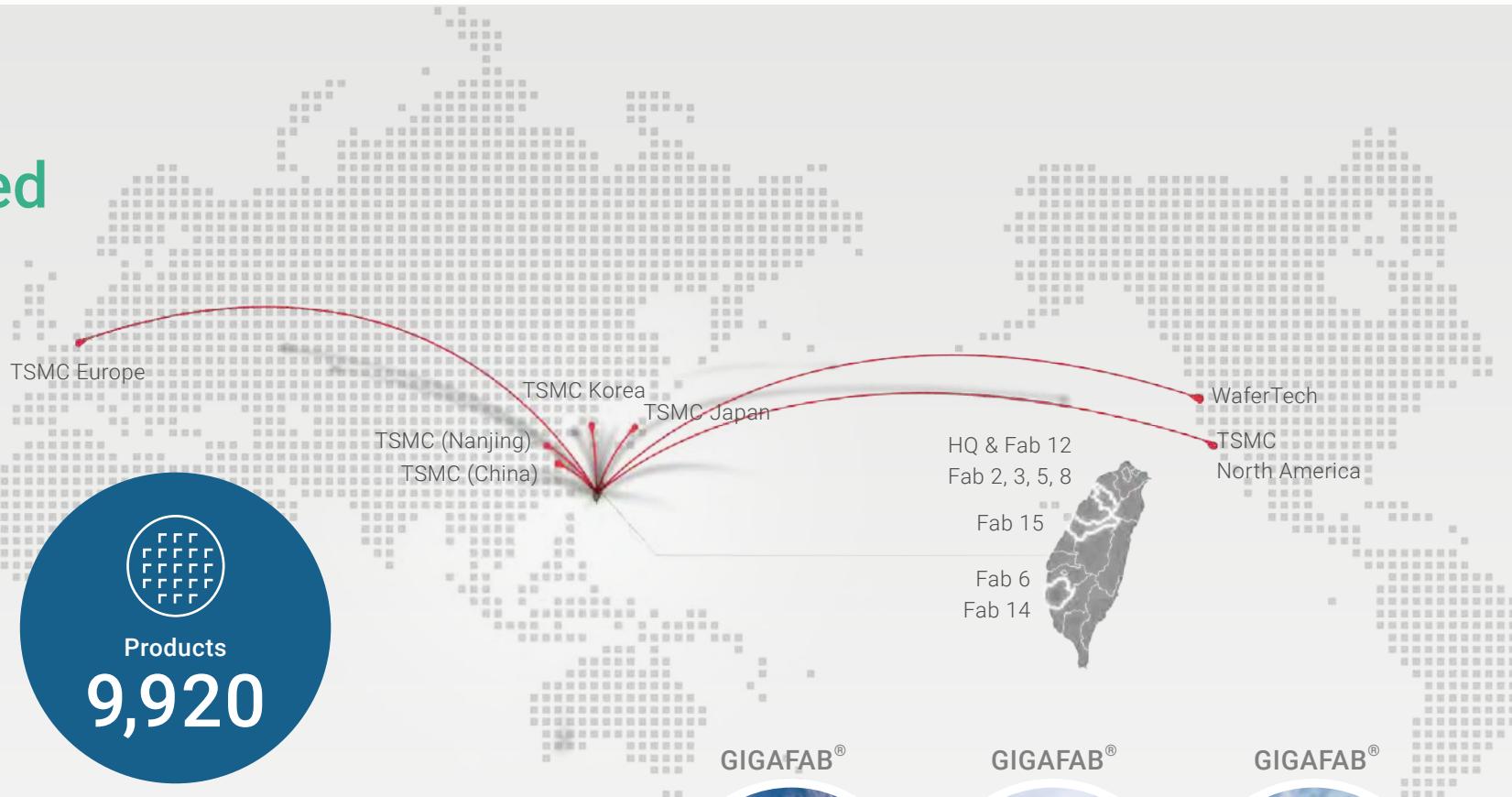
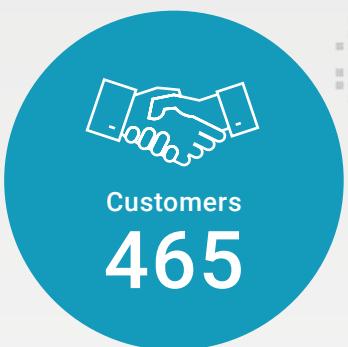
## 3M Checks

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.



Fab 2

- 32
- 82
- 1,203



Fab 3

- 67
- 162
- 1,377



Fab 5

- 21
- 38
- 260



Fab 6

- 54
- 134
- 702
- 1,687



Fab 8

- 49
- 166
- 813



TSMC (China)

- 44
- 133
- 478



WaferTech

- 23
- 39
- 1,053



HQ &amp; Fab 12

- 68
- 123
- 1,657



Fab 14

- 65
- 168
- 1,657



Fab 15

- 14
- 93
- 838

## 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.

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**100%**

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

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**100%**

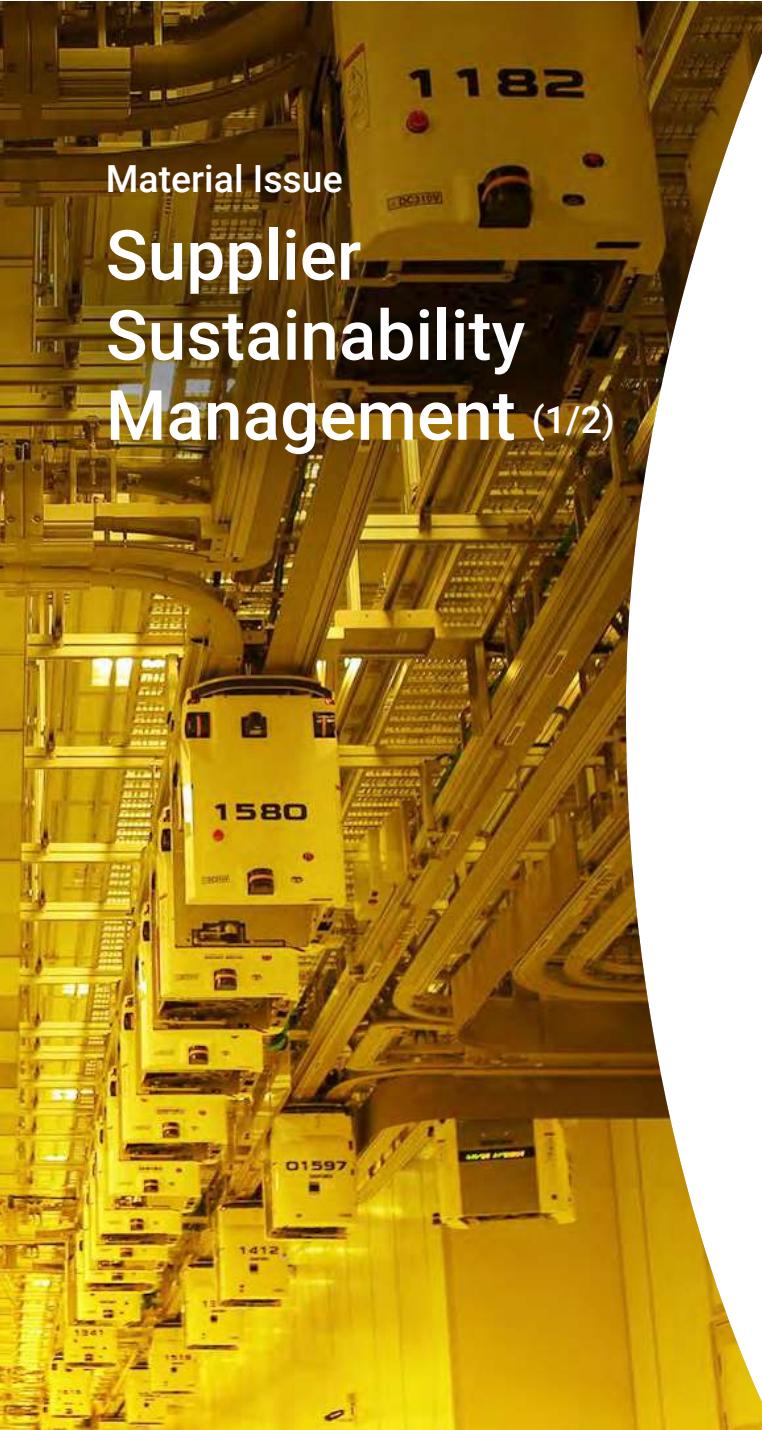
100% of materials sourced from Responsible Minerals Assurance Process (RMAP) conformant smelters

---

**20.5%**

Reduced unit waste production of major local waste-producing suppliers by 20.5% (against the 2014 baseline)





# Material Issue

## Supplier Sustainability Management (1/2)

### Strategies

### TSMC 2020/2025 Goals

Achievements & Targets

#### Strengthen Supply Chain Management

Require suppliers to join in a Responsible Supply Chain of semiconductor industry and collaborate to build a supply chain that meets and even exceeds RBA standards<sup>Note 1</sup>

- Suppliers comply and sign the Letter of Assurance of TSMC "Supplier Code of Conduct"
  - Intensify the promotion of new "Supplier Code of Conduct" and "TSMC whistle blower system" and raise awareness rate to 98% and 95% respectively <sup>Note 2</sup> 2020
  - 100% of first-tier suppliers sign the Letter of Assurance 2025
  - 80% of the critical second-tier suppliers sign the Letter of Assurance <sup>Note 3</sup> 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 2025
  - Due diligence audit will be conducted for all conflict mineral suppliers 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.

Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets

<b>86.5%</b> <b>Existing Suppliers Signed</b>	<b>100%</b> <b>New Suppliers Signed</b>	
Target: 80% of the existing suppliers are to sign Supplier Code of Conduct	Target: 100% of the new suppliers are to sign Supplier Code of Conduct	<ul style="list-style-type: none"> <li>○ 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)</li> <li>○ 30% of the major second-tier suppliers sign the Code of Conduct</li> <li>○ Organize responsible supply chain forum and jointly establish <u>the long-term goals against ESG issues</u></li> <li>○ Intensify supplier man-hour management to ensure the compliance of laws and regulations of supplier employees working at TSMC sites <sup>Note 1</sup></li> </ul>
<b>84</b> <sup>Note 2</sup> <b>Supplier Site Audits</b>		<ul style="list-style-type: none"> <li>○ Require 30 suppliers to cooperate with third-party audit firm and to accept professional audits with RBA standards</li> <li>○ The achievement rate for priority issues improvement<sup>Note 3</sup> must be higher than 80%<sup>Note 4</sup></li> </ul>
<b>100%</b> <b>Materials Source from RMAP Conformant Smelter</b>		<ul style="list-style-type: none"> <li>○ Conduct documentation audit on at least 3 suppliers to verify its due diligence efforts in ensuring 100% conflict-free sourcing</li> </ul>

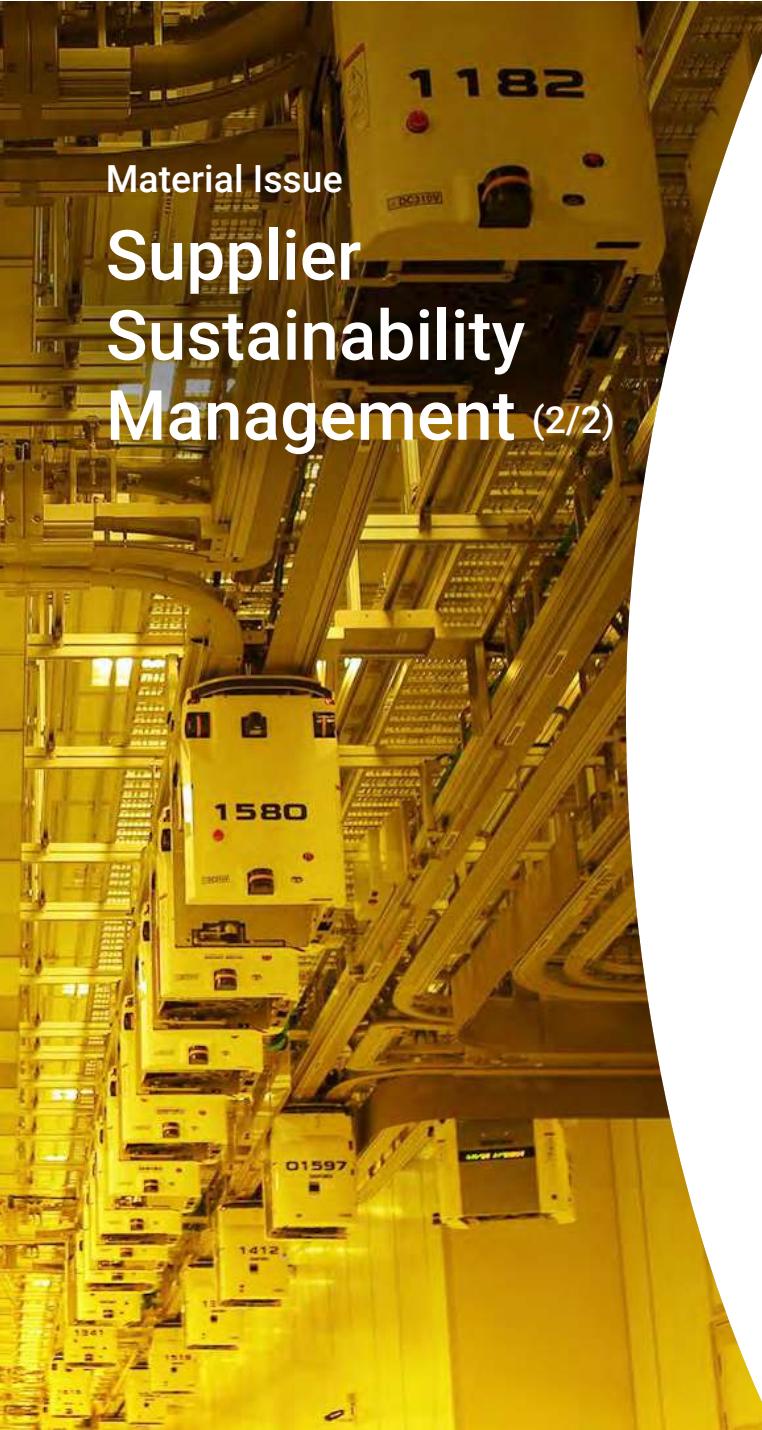
Note 1: In 2017, TSMC internal audit found that the suppliers' employees working at TSMC sites had the problem of consecutively working for 7 days. In addition to amplifying the suppliers' education, TSMC also took the initiative to improve all cases it discovered.

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 &gt;

## TSMC 2020/2025 Goals

## Achievements &amp; Targets



### Improve Supply Chain Resilience

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

## ○ 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 [2025]
- Every year, 50 suppliers are selected as potential high-risk for ESH training. There will be 400 suppliers in all trained by 2025 [2025]
- Counsel suppliers to improve process and quality, with 38 suppliers counselled in all from 2016 to 2020 [2020]
- Reduce waste volume of major local waste-producing suppliers by 24% relative to that in 2014 [2020]

○ Increase local purchasing ratio Note 1

- by 47% for raw material Note 2 [2020]
- by 70% for spare parts [2020]
- by 38% for backend tools [2020]

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 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%

## Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets

**154**Elevated ESH score by  
counselling**20.5%**Reduced unit waste production of major local waste-producing  
suppliers (compared with 2014)**34 (from 5 suppliers)**  
Power-efficient tool  
models assessed**44%<sup>Note 3</sup>**Localization for raw  
materials**9****Local material suppliers were  
counselled for process and  
quality improvement**

Target: 150 or more (full score is 200)

**114 (for 34 models)**  
Energy saving activities  
launchedTarget: Deliver 2025 power-efficient  
equipment development plan**66%**  
Localization for spare  
parts

Target: 66%

**33%**  
Localization for  
backend tool

Target: 33%



- Publish TSMC ESH Guidance, and provide suppliers the new ESH standards for reference<sup>Note 1</sup>
- 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<sup>Note 2</sup> 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)

- 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

- Achieve 45% on localization for raw materials
- Achieve 68% on localization for spare parts
- Sustain at 33% on localization for backend tool

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%.





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

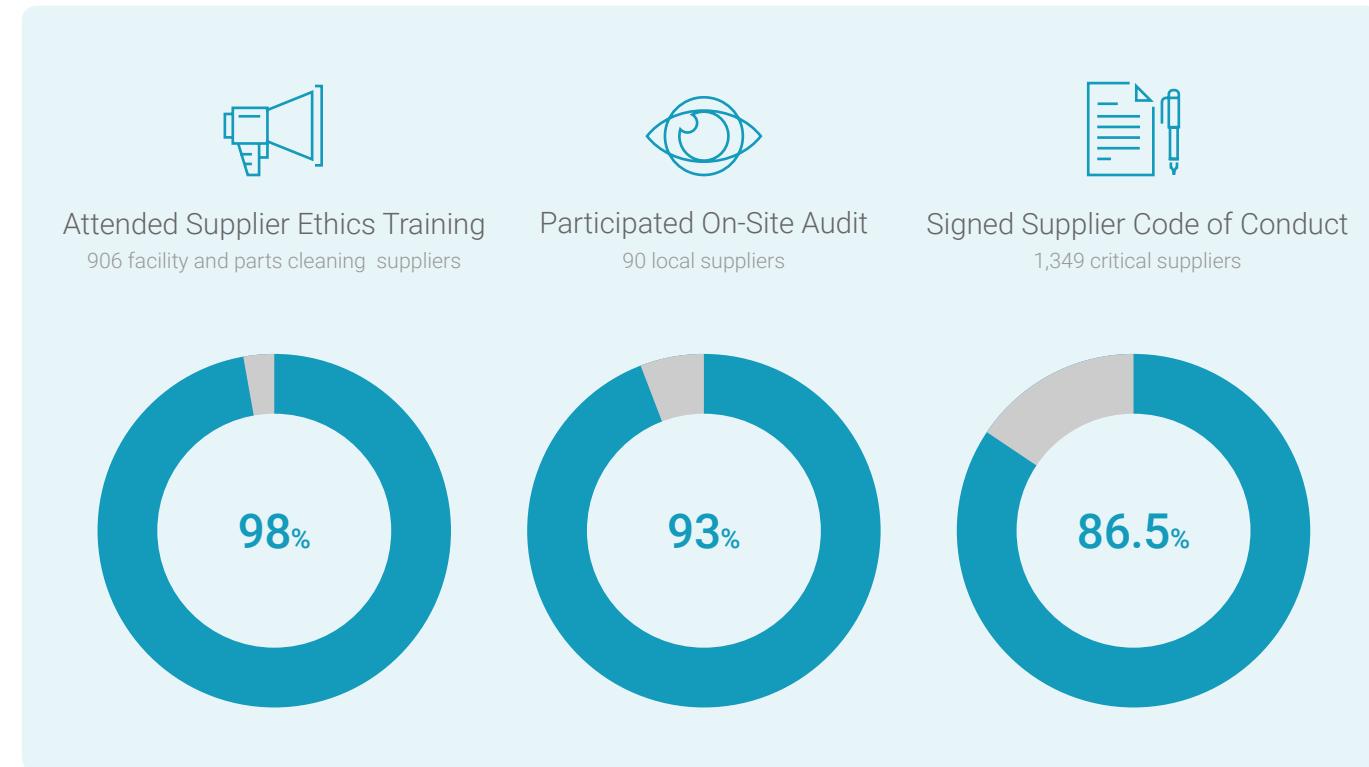
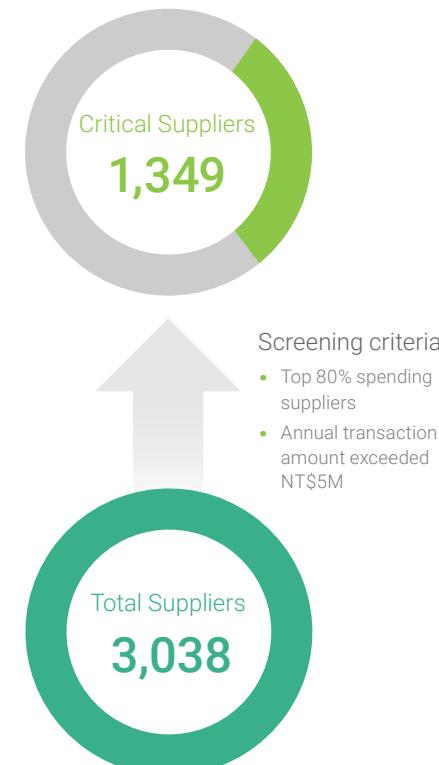
Vice President, Operations / Mainstreamfabs and Manufacturing Technology, and Materials Management & Risk Management

## Implement Responsible Supply Chain Management

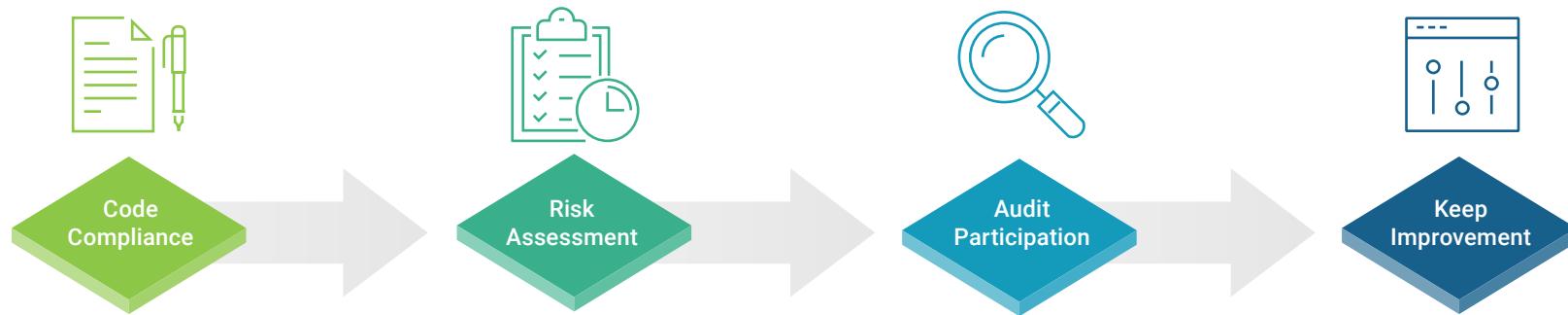
TSMC is dedicated to driving a positive cycle of the industry and supply chain. In order to ensure the safety of the semiconductor supply chain working environment, employees should be respected and treated with dignity, and for operations facilitating environmental protection and ethics, TSMC requires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

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.

### Supplier Code Compliance and Management Progress



### Four Major Executional Guidelines



<p><b>Standard</b></p> <ul style="list-style-type: none"> <li>• Comply with TSMC Supplier Code of Conduct</li> </ul>	<p><b>Risk Assessment</b></p> <ul style="list-style-type: none"> <li>• Measure supply chain risk with Code of Conduct</li> </ul>	<p><b>Audit Participation</b></p> <ul style="list-style-type: none"> <li>• Participate professional audit by third-party audit firm <small>Note</small></li> </ul>	<p><b>Keep Improvement</b></p> <ul style="list-style-type: none"> <li>• All weaknesses are classified as priority, major and minor issues. The priority issues must be corrected immediately</li> </ul>
<p><b>Management Guidance</b></p> <ul style="list-style-type: none"> <li>• All suppliers must comply and sign Code of Conduct</li> <li>• Ask critical second-tier suppliers to comply and sign Code of Conduct</li> </ul>	<ul style="list-style-type: none"> <li>• Identify supply chain high risks and take action for priority issues</li> <li>• Confirm supplier adopting same standard for its supply chain management</li> </ul>	<ul style="list-style-type: none"> <li>• Encourage suppliers to engage third-party audit</li> <li>• TSMC monitors and assists auditors in the role of observers</li> </ul>	<ul style="list-style-type: none"> <li>• Provide necessary counselling or assistance, arrange re-audit to ensure fulfilment</li> <li>• Reduce transaction or discontinue business relationship for supplier who failed on Code Compliance</li> </ul>

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



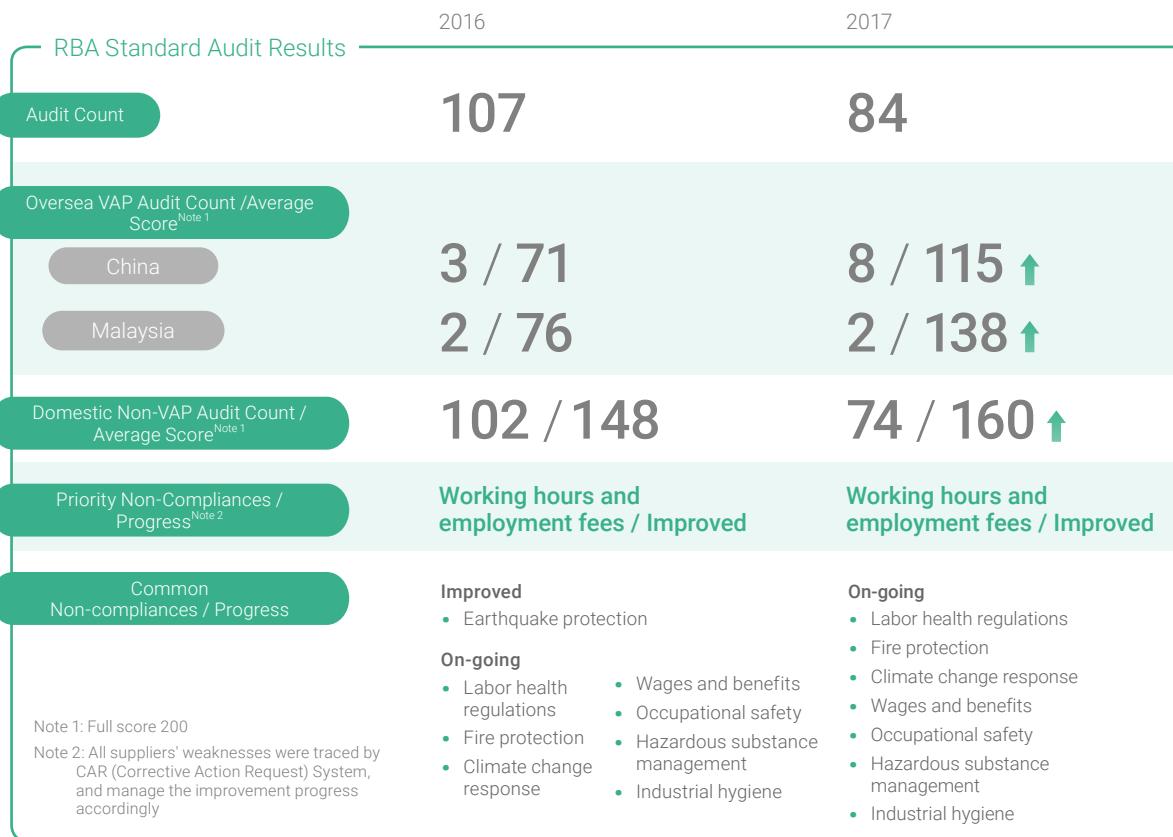
## Risk Assessment Result

	2016		2017	
Major Suppliers	Headquarters	Supplying Facilities	Headquarters	Supplying Facilities
Supplier Assessed	25	83	26 ↑	92 ↑
Based on SAQ score + supplier risk assessment considerations				
Assessment Method				
Assessment Results	<ul style="list-style-type: none"> <li>⚠ High risk: 0</li> <li>⚠ Medium risk: 1 headquarter and 1 supplying facility, listed in priority audit plan</li> <li> ⓘ Low risk: 24 headquarters and 82 supplying facilities, continue to monitor supplier's risks by SAQ</li> </ul>		<ul style="list-style-type: none"> <li>⚠ High risk: 0</li> <li>⚠ Medium risk: 2 headquarters and 1 supplying facility, listed in priority audit plan</li> <li> ⓘ Low risk: 24 headquarters and 91 supplying facilities, continue to monitor supplier's risks by SAQ</li> </ul>	
Secondary Suppliers				
Supplier Assessed	207	210 ↑		
Based on supplier risk assessment considerations				
Assessment Method				
Assessment Results	106 suppliers are classified with potential risk, and listed in audit supplier pool <small>Note</small>	84 suppliers are classified with potential risk, and listed in audit supplier pool		
Coverage	51%	40%		

Note: The audit arrangement must consider the risk level and supplier's schedule to determine the priority of auditing

## 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.

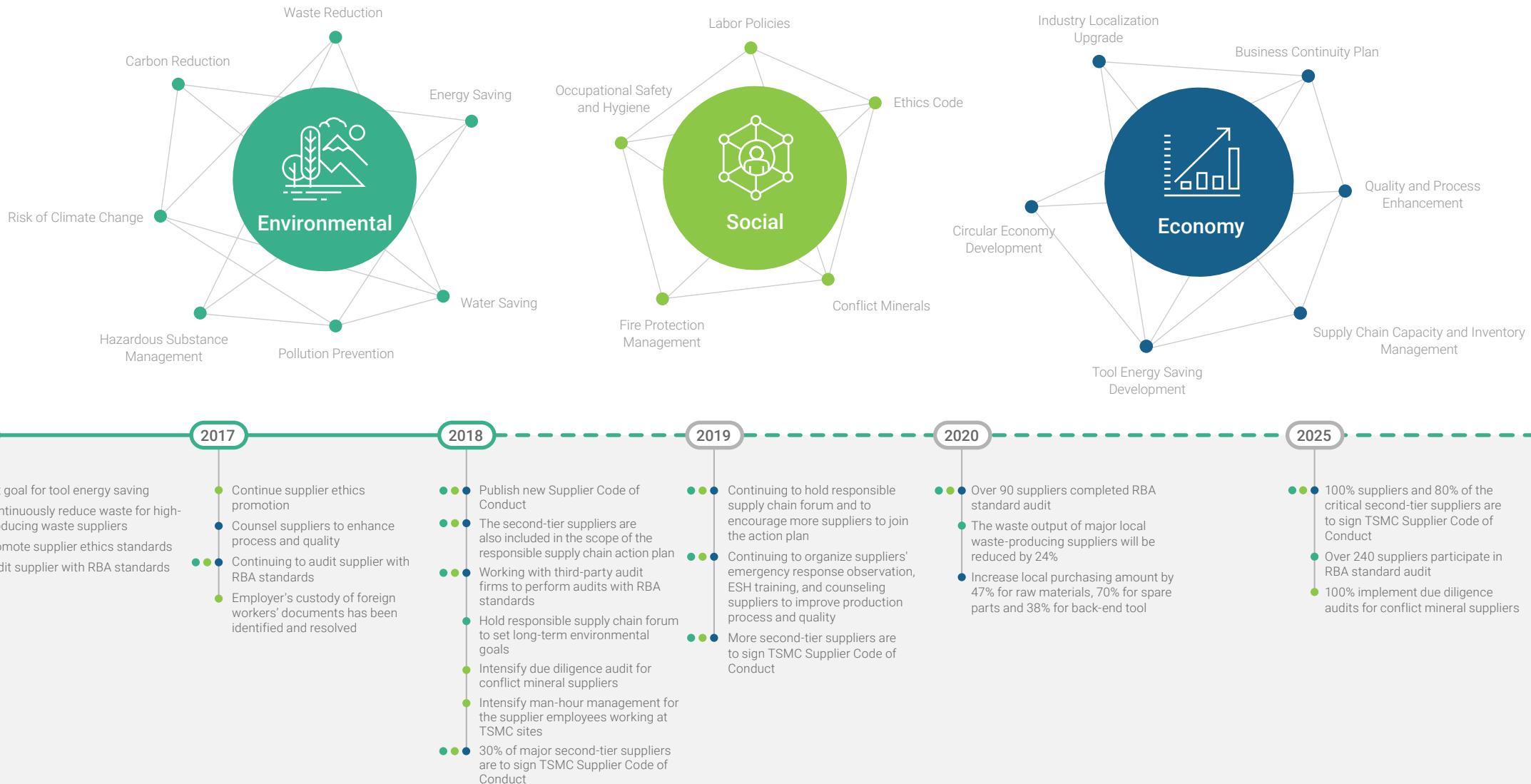


## Exert Supply Chain Influence Power

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.

Strategy	Action Plan
<b>Strengthen the supply chain management</b>	<ul style="list-style-type: none"> <li>• Protect labor and human right</li> <li>• Implement occupational safety and hygiene</li> <li>• Promote environmental protection</li> </ul>
<b>Enhance supply chain resilience</b>	<ul style="list-style-type: none"> <li>• Strengthen supplier's resilience</li> <li>• Advanced process and quality improvement</li> </ul>

### Action Plan of Responsible Supply Chain





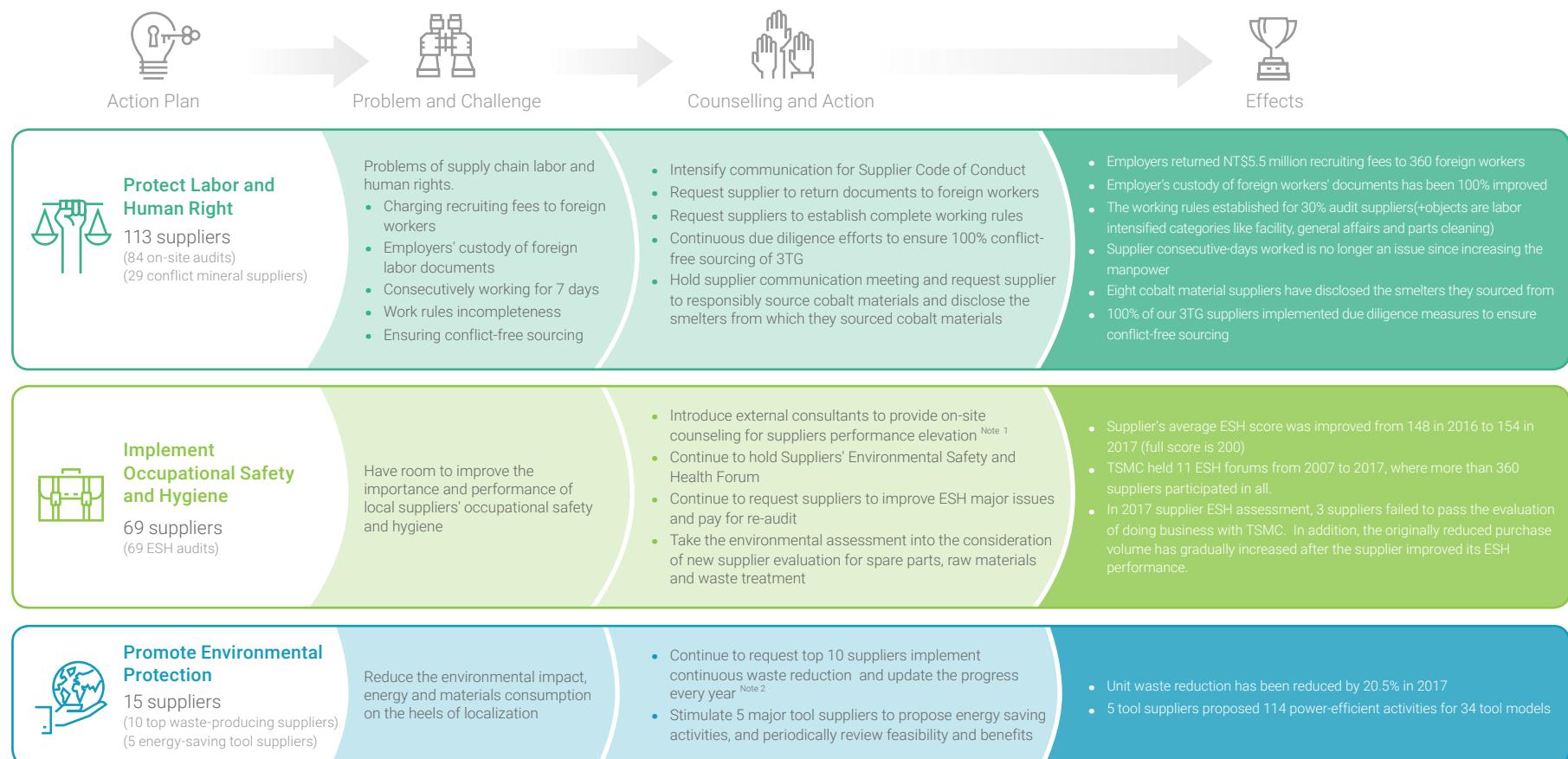
Hold The Kick-off Ceremony in Occupational Health Promotion Forum

## 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



Suppliers observe TSMC Emergency Response Drill

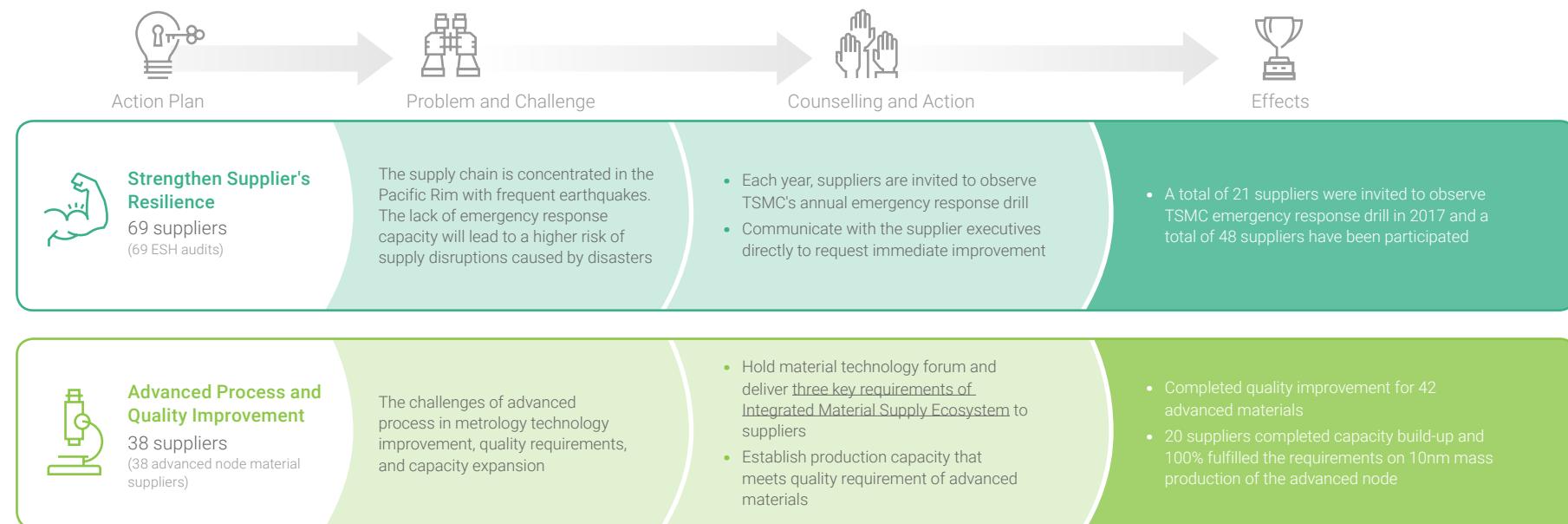
## Improve Supply Chain Resilience

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.



# 100%

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

# 100%

Suppliers required their direct suppliers to source the 3TG from smelters whose due diligence practices have been validated by an independent third party audit program



## Case Study

### Source Conflict-free Raw Materials

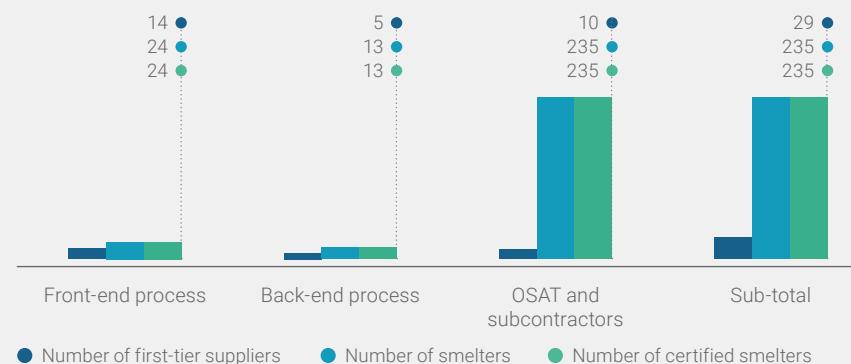
TSMC supports the "responsible sourcing" requirements of the Responsible Business Alliance (RBA, the previous EICC) and the Global Sustainable Initiative Geology Initiative (GeSI), and adopts Responsible Minerals Assurance Process (RMAP, the previous CFSP, Conflict-free Smelter Program) to request and 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



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

## 29

First-tier suppliers



100%

Suppliers implemented due diligence measures for conflict-free sourcing



95%

Suppliers review due diligence information received from upper-tier suppliers against the Company's expectations

## 235

3TG smelters



100%

Suppliers conducted conflict mineral surveys of TSMC's relevant suppliers



84%

Suppliers' review process includes corrective action management

## 100%

Sourced conflict-free materials



95%

Suppliers have established a conflict minerals sourcing policy



79%

Conflict minerals sourcing policy is available on suppliers' website



## 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<sup>Note1</sup> 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.

#### Taiwan

Unit: %



#### United States

Unit: %



#### China

Unit: %



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 mainly relies on imports

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

Continue on next page



## 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

Continued from previous page

### 2017 Results of Local Suppliers Counselling

Category / Supplier Numbers	Problem	Improvement Method	Achievement
 Capacity Build-up and Production Quality Improvement	 Chemicals / 4 <ul style="list-style-type: none"> <li>Capacity failed to meet the requirement of the advanced node</li> <li>Product impurity is too high</li> </ul>	<ul style="list-style-type: none"> <li>Product line expansion</li> <li>Raw material purification</li> </ul>	<input checked="" type="checkbox"/> Capacity increased by 2 to 3 times <input checked="" type="checkbox"/> Impurity reduced by 30%
	 Chemicals / 1  Photo Resists / 1 <ul style="list-style-type: none"> <li>Capacity failed to meet the requirement of the advanced node</li> </ul>	<ul style="list-style-type: none"> <li>Product line expansion</li> <li>Connector automation upgrade and filling station isolation</li> </ul>	<input checked="" type="checkbox"/> Capacity increased by 5 times <input checked="" type="checkbox"/> Impurity reduced by 50%
	 Gases / 2	<ul style="list-style-type: none"> <li>Product line expansion</li> <li>Tank materials upgrade</li> </ul>	<input checked="" type="checkbox"/> Capacity increased by 3 times <input checked="" type="checkbox"/> Impurity reduced by 30%
 Advanced Metrology Technology	 Chemicals / 1	<ul style="list-style-type: none"> <li>Product line expansion</li> </ul>	<input checked="" type="checkbox"/> Capacity increased by 3 times
	 Gases / 2	<ul style="list-style-type: none"> <li>Set up new lab</li> <li>Invest in metrology instruments</li> </ul>	<input checked="" type="checkbox"/> Capacity increased by 2 times
 ESH Performance Improvement	 Parts Cleaning / 2 <ul style="list-style-type: none"> <li>Inadequate safety protection of chemical operations</li> <li>Partial exhaust capacity may be insufficient</li> </ul>	<ul style="list-style-type: none"> <li>Top local executives directly participate in the ESH management and projects</li> <li>Actively collaborate with TSMC and consultants to formulate safety protection and exhaust improvement plans</li> </ul>	<input checked="" type="checkbox"/> ESH score improved by 38%
	 Furnace Quartz / 1	<ul style="list-style-type: none"> <li>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</li> </ul>	<input checked="" type="checkbox"/> ESH score improved by 27%
	 Chemicals / 1 <ul style="list-style-type: none"> <li>The maintenance of firefighting facilities is careless</li> <li>Insufficient seismic protection</li> </ul>	<ul style="list-style-type: none"> <li>The group conducts internal organizational learning. Headquarters lead the factory to set targets for fire protection and seismic improvement, and track progress</li> </ul>	<input checked="" type="checkbox"/> ESH score improved by 33%
			<input checked="" type="checkbox"/> 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 assimilate 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's goal is to facilitate coexistence and mutual prosperity between our business and the environment.

### 5.1 GWh

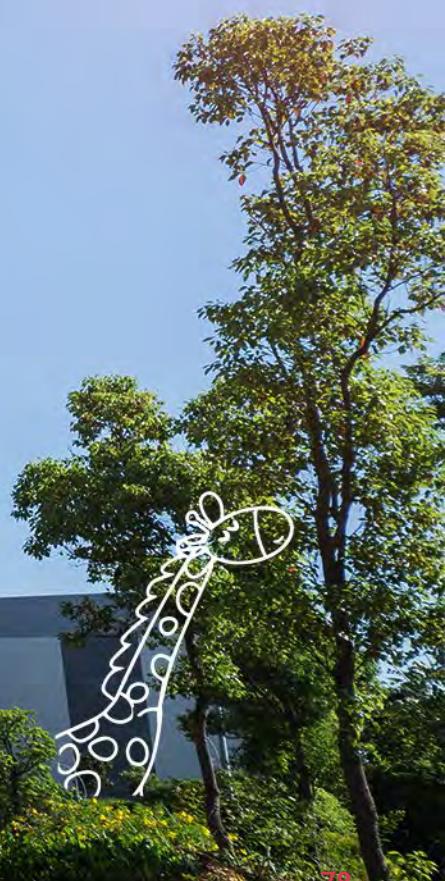
Effectively reduced power consumption by 510 GWh through 452 conservation projects

### 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****TSMC 2020/2025 Goals**

Achievements &amp; Targets



- Reduce unit wafer GHG emission (Metric tons of CO<sub>2</sub> equivalent /8-inch wafer e mask-layer) to 18% below the year 2010 level 2020
- Reduce unit wafer PFC emission (Metric tons of CO<sub>2</sub> equivalent /8-inch wafer e mask-layer) to 60% below the year 2010 ; Reduce total PFC emission (Metric tons of CO<sub>2</sub> equivalent) to 20% below the year 2010 level 2020

**Development of Renewable Energy**

Continue to purchase green power and install solar power systems, increase green power usage

- Continuously purchase renewable energy <sup>Note</sup> 2025

**Improving Energy Efficiency**

Develop new energy-saving measures each year, actively implement energy-saving measures, and increase power usage effectiveness

- Reduce unit wafer power usage (kWh /8-inch wafer e mask-layer) to 12% below the year 2010 level 2020
- Conserve a total of 2,800GWh beginning from 2016 2025

**Strengthening Climate Resilience**

Build up prevention and emergency reaction plans for climate disaster and reduce the impact of climate disasters

- 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

Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets

**13%****Unit wafer layer GHG emissions were 13% less than 2010**

Target: 13%

- Reduce unit wafer layer GHG emission to 15% below the year 2010 level

**55%****Unit wafer layer PFC emissions were 55% less than 2010**

Target: 50%

- Reduce unit wafer layer PFC emission to 55% below the year 2010 level

**6%****Total PFC emissions were 6% less than 2010**

Target: 4%

- Reduce total PFC emissions to 10% below the year 2010 level

**10.4%****Unit wafer layer power usage were 10.4% less than 2010**

Target: 9%

- Reduce unit wafer layer power usage to 11% below the year 2010 level

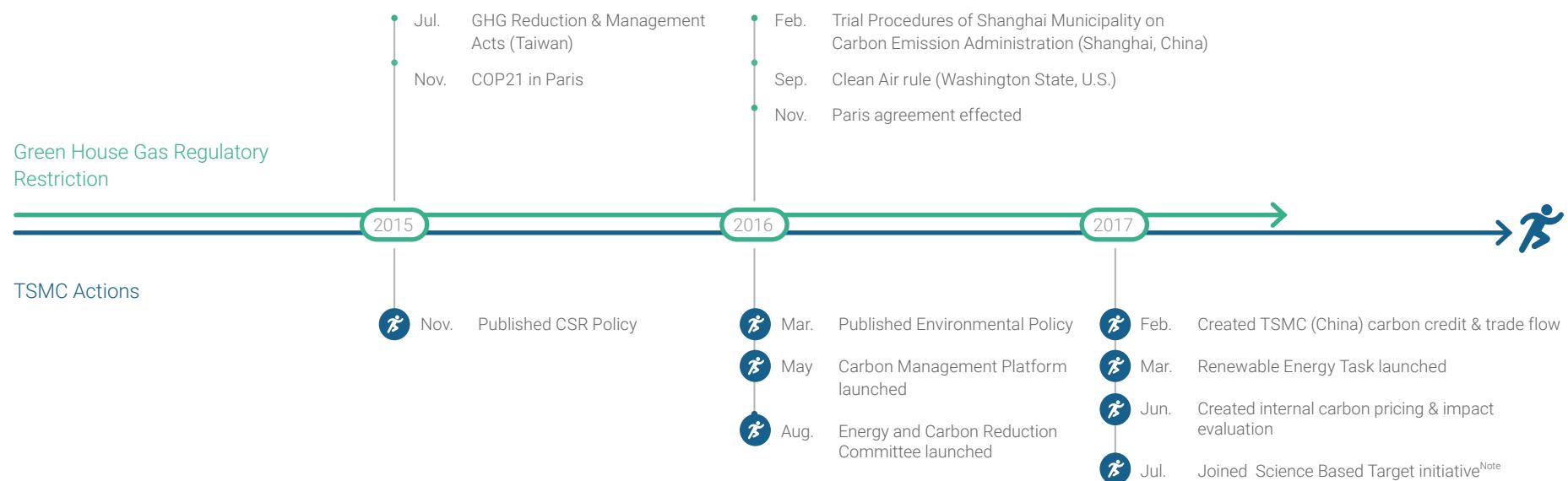
**510 GWh/600 GWh****Annual power savings / Cumulative power savings**Target: Annual power-saving target of 280 GWh  
Cumulative power-saving of 370 GWh

- Annual power-saving of 200 GWh
- Cumulative power-saving of 800 GWh

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

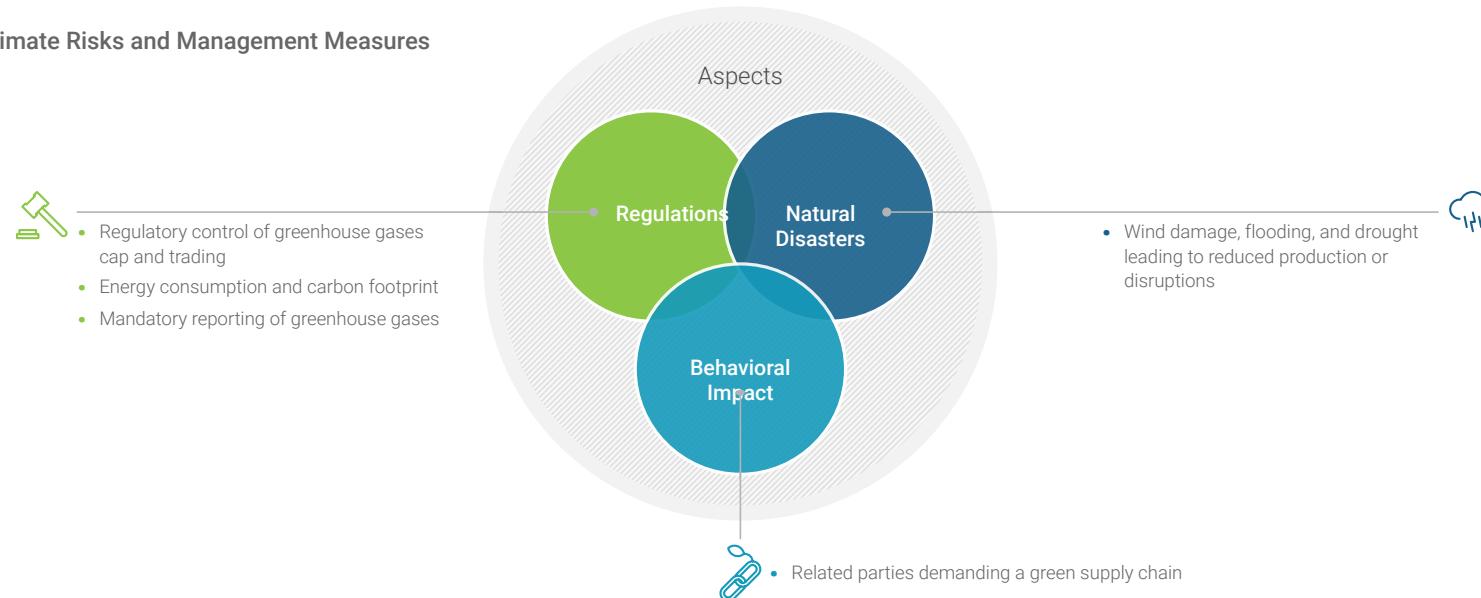
the status of global climate change as well as changes in international and domestic mitigation efforts, and identifies potential risks and opportunities of climate change by utilizing a risk matrix on the aspect of government regulations, natural disasters and behavioral impact. TSMC has made continuous 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



Aspects	Consideration	Measures	Achievements in 2017
<b>Regulations</b>	Mandatory reporting of greenhouse gases	Implement data inventory: investigate greenhouse gas emissions and energy usage	Greenhouse gas inventory 100% completed
	Regulatory control of greenhouse gases cap and trading	Implement carbon management: the Energy Conservation & Carbon Reduction Committee promotes energy saving and conducts quarterly review	Annual energy saving targets 100% completed Established procedures on carbon credits and trade in FAB 10
	Energy consumption and carbon footprint	Produce green products: raise product energy efficiency, produce low energy consumption products for customers, analyze key factors for carbon reduction and energy conservation	Energy efficiency of new generation production process raised
<b>Natural Disasters</b>	Wind damage, flooding, and drought leading to reduced production or disruptions	Enhance Resilience of business operations: establish crisis management procedures and emergency responses	Fab 15B designs followed climate resistance guidelines (all new fabs will follow)
	Related parties demanding a green supply chain	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	Strengthened requirements for supplier-side greenhouse gas monitoring and increased their proportion in audit Proposed semiconductor energy conservation and carbon reduction benchmarks



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

## 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.



Three Aspects of Carbon Management		Achievements in 2017
Regulatory compliance	Adhere to greenhouse gas regulations	<ul style="list-style-type: none"> <li>Participate in public hearings for regulations</li> <li>Member of the Industrial Development Bureau response team</li> </ul>
	Support the carbon management commitments of the global semiconductor industry	<ul style="list-style-type: none"> <li>Member of the World Semiconductor Council greenhouse gas response team and convener of the energy conservation team</li> </ul>
	Establish greenhouse gas database (ISO14064/ ISO14067)	<ul style="list-style-type: none"> <li>Acquire greenhouse gas inventory certification -ISO14064-1</li> <li>Acquire carbon &amp; water footprint certification -ISO14067</li> <li>Establish e-platform</li> </ul>
	Directly reduce greenhouse gas	<ul style="list-style-type: none"> <li>Use low greenhouse warming potential gasses</li> </ul>
	Establish and implement best available practice for greenhouse gas abatement	<ul style="list-style-type: none"> <li>Install best available greenhouse abatement equipment</li> <li>Develop and implement new greenhouse gas abatement technologies</li> </ul>
	Implement energy management system (ISO 50001)	<ul style="list-style-type: none"> <li>Acquire energy management system certification –ISO 50001</li> </ul>
	Initiate equipment energy-saving projects	<ul style="list-style-type: none"> <li>Identify the energy saving potential of production tools, propose energy-saving measures, and include energy-saving features in tool purchasing decisions</li> </ul>
	Construct green fabs	<ul style="list-style-type: none"> <li>Raise performance of fab systems</li> <li>Acquire green building certification</li> </ul>
	Own carbon investments	<ul style="list-style-type: none"> <li>Study Renewable Energy Certificate, REC</li> </ul>
	Carbon trading platforms	<ul style="list-style-type: none"> <li>Study carbon credits and trading systems</li> </ul>
Energy Saving & Carbon Reduction	Energy saving and carbon reduction incentives	<ul style="list-style-type: none"> <li>Programmatic CDM - Clean Development Mechanism for certified emission reduction credits</li> <li>Greenhouse gas emission reduction rewards</li> <li>Continue to work on voluntary carbon reduction</li> </ul>
	Renewable energy usage	<ul style="list-style-type: none"> <li>Study the Electricity Act</li> <li>Continue to purchase renewable energy</li> </ul>
		<ul style="list-style-type: none"> <li>Participated in establishing regulations for Phased Regulatory Goals and greenhouse gas emission rewards</li> <li>Participated in the analysis of industry emission controls and quota for the Phased Regulatory Goals and Greenhouse Gas Emissions Rules.</li> <li>Continued participation and followed the WSC PFC reduction best practice.</li> <li>All fabs completed third-party greenhouse gas inventory verification</li> <li>Not required in 2017 (every 3-5 years)</li> <li>Energy Conservation &amp; Carbon Reduction e-platform Enhancement Project</li> <li>C<sub>2</sub>F<sub>6</sub> &amp; C<sub>3</sub>F<sub>8</sub> (cleaning process) replaced by C<sub>4</sub>F<sub>8</sub></li> <li>Fully installed new equipment in Fab 15B and replaced 62 tools in other fabs</li> <li>Installed nitrous oxide abatement equipment in Fab 15B</li> <li>Fab 12 phase 7 received certification</li> <li>Included energy-saving features in new equipment purchase guidelines</li> <li>Enhanced chiller unit performance by 9%</li> <li>Fab 12 phase 7 received U.S. LEED certification</li> <li>All 12-inch fabs received green building certification</li> <li>Fab 6 solar-powered system is the first semiconductor foundry in Taiwan to receive TREC (received 275 RECs)</li> <li>TSMC (China) purchased 280 thousand metric tons of carbon credits with carbon emissions in 2016</li> <li>Fab 2/5, Fab 5, Fab3, Fab 14B, and Fab 15A applied for Clean Dry Air system (CDA) CDM</li> <li>Applied for greenhouse gas emission reduction rewards in 2018</li> <li>Joined Industrial Development Bureau voluntary reduction project</li> <li>Formed a corresponding task force</li> <li>Purchased 100 GWh of green electricity from Taiwan Power Company</li> </ul>

## 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<sup>Note</sup>) 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

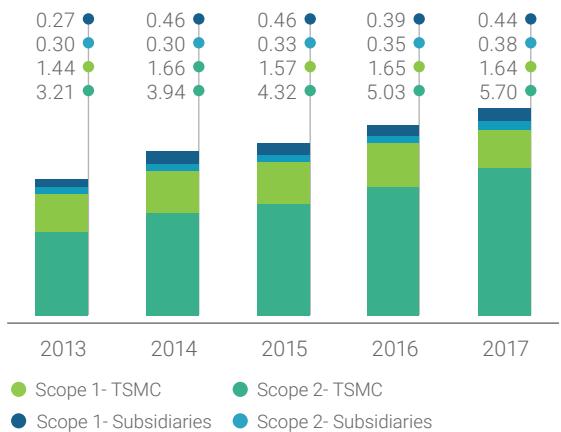
TSMC has required all its fabs around the world to establish greenhouse gas inventory and disclosure by the greenhouse gas protocol since 2005. New fabs must begin inventorying greenhouse gases within 1.5 years after initial production. Each year, every TSMC fab must complete scope 1 and scope 2 greenhouse 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.

### Scope 1 and Scope 2 Greenhouse Gas Emissions

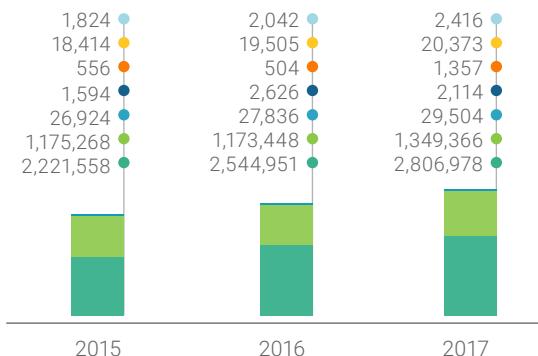
Unit: Million metric ton CO<sub>2</sub>e



Note: TSMC total annual greenhouse gas emission data includes emissions from all TSMC fabs (as well as advanced backend facilities) in Taiwan and its subsidiaries WaferTech, TSMC China, VisEra.

### Scope 3 Greenhouse Gas Emissions

Unit: Metric ton CO<sub>2</sub>e

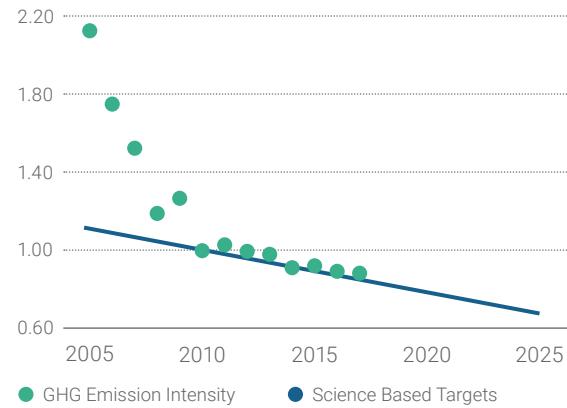


- Materials Production
- Purchasing Energy
- Waste Generated in Operations
- Upstream Transportation
- Downstream Transportation
- Employee Commuting
- Business Travel

Note 1: Scope 3 emissions include only data from TSMC fabs in Taiwan  
Note 2: According to the announcement of Energy bureau that 1 kWh emits 0.529 kg of CO<sub>2</sub> equivalent and 1kWh = 3,600 Kilojoules.

### Greenhouse Gas Emission Intensity

Unit: Metric ton CO<sub>2</sub>e/8-inch e wafer-layer



Note 1: TSMC total annual greenhouse gas emission intensity data includes emissions from all wafer fabs belonging to TSMC and its subsidiaries.  
Note 2: Reduction targets are based on SBTi - Sectoral Decarbonization Approach (SDA)  
Note 3: Emission intensity normalized by the baseline data in 2010.

# 1

Best mitigation results in the industry

## 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 ( $N_2O$ ) 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  $N_2O$  abatement and tail gas reduction equipment, and have completed verification on certain models. TSMC leads the industry by being the first to incorporate  $N_2O$  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.

Scope	TSMC Best Practice Approach	Achievements in 2017
Scope 1 Greenhouse Gas Direct Emissions	ISO 14064-1 inventory and 3rd-party verification annual	<ul style="list-style-type: none"> <li>✓ Includes all annual inventory and third-party verification for TSMC fabs and subsidiaries</li> </ul>
	Gas usage optimization	<ul style="list-style-type: none"> <li>✓ New fabs must adhere to best practices outlined in technical committee guidelines</li> </ul>
	Replace high greenhouse warming potential (GWP) gases (current best available technology: remote plasma $NF_3$ / $NF_3$ / $C_4F_8$ )	<ul style="list-style-type: none"> <li>✓ All 12-inch fabs use remote plasma <math>NF_3</math>; 6-inch and 8-inch fabs use <math>C_4F_8</math> / <math>NF_3</math></li> <li>✓ Subsidiaries to gradually replace <math>C_4F_8</math> / <math>NF_3</math></li> </ul>
	Install point of use (POU) abatement equipment for F-GHG processes	<ul style="list-style-type: none"> <li>✓ New and existing fabs (including subsidiaries) must install POU abatement during new tools move-in</li> <li>✓ Existing fabs abatement installation rate is up to 88%; subsidiaries to gradually replace abatement equipment</li> <li>✓ Existing fabs replaced 62 tools in 2017; 95 tools will be replaced in 2018</li> <li>✓ Lowest F-GHG emission per product unit in the world for semiconductor foundries</li> </ul>
	Other greenhouse gases abatement technologies	<ul style="list-style-type: none"> <li>✓ Continue to develop on-site nitrous oxide abatement technologies</li> <li>✓ Completed nitrous oxide abatement equipment verification on combustive treatment equipment and listed it as standard equipment (first in the world for semiconductor foundries)</li> </ul>
	ISO 50001 Energy management 3rd-party verification	<ul style="list-style-type: none"> <li>✓ All 12-inch fabs completed ISO 50001 inventory and 3rd-party verification; some 6-inch and 8-inch fabs completed ISO 50001 inventory and 3rd-party verification</li> </ul>
	Top-level management	<ul style="list-style-type: none"> <li>✓ Vice Presidents of Operations lead the Energy Conservation &amp; Carbon Reduction Committee as well as set and regularly review company targets</li> </ul>
	New generation process tool development with energy-saving design	<ul style="list-style-type: none"> <li>✓ Initiated energy conservation projects for new generation process tools (first in the global semiconductor industry)</li> </ul>
	Utilize renewable energy	<ul style="list-style-type: none"> <li>✓ Purchased 100 GWh of green electricity from Taiwan Power Company in 2017; largest purchaser of green power from Taiwan Power Company for 3 consecutive years</li> </ul>
	Energy efficiency enhancement	<ul style="list-style-type: none"> <li>✓ Highest energy efficiency in the industry</li> <li>✓ 10-year target of 2,800 GWh of electricity saved; 510 GWh of electricity saved with 452 energy-saving measures in 2017</li> </ul>

# 1

The first semiconductor manufacturer in Taiwan received renewable energy certificates

## 5.29 million trees

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

### 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, which are equivalent to the carbon absorbed by 5.29 million trees in one year. Since 2015, TSMC has been the biggest green power purchaser by cumulatively subscribing for 400 GWh of green energy for the last three years, accounting for 64.4% of the total green power sold in Taiwan.

### 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 an impact on the mitigation of climate change.

### Improving Energy Efficiency

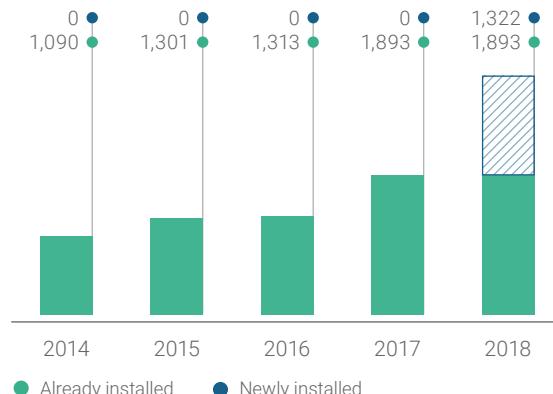
#### Comprehensive energy inventory

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

### Installed Capacity of Renewable Energy

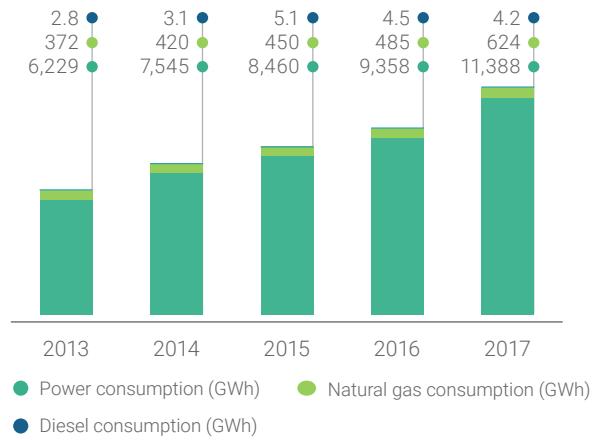
Unit: kW



Note: Total Installed Capacity of Renewable Energy Power Generation Equipment include TSMC (all fabs and packaging and testing facilities located in Taiwan) as well as its overseas subsidiaries (WaferTech, TSMC (China), VisEra Technology)

### Total Energy Consumption

Unit : GWh



Note 1: The total energy consumption includes TSMC (all fabs and packaging and testing facilities located in Taiwan) as well as its overseas subsidiaries (WaferTech, TSMC (China), VisEra Technology)

Note 2: The conversion unit is 1 cubic meter of natural gas = 10.4 kWh, 1kWh = 3,600 Kilojoules

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%.

#### Total Power Consumption

Unit: GWh



Note 1: The total power consumption includes TSMC (all fabs and packaging and testing facilities located in Taiwan) as well as its overseas subsidiaries WaferTech, TSMC (China), VisEra Technology

#### Unit Power Consumption and Goal Completion

Unit: kWh/8-inch e wafer-layer



● Unit Power Consumption (Actual)

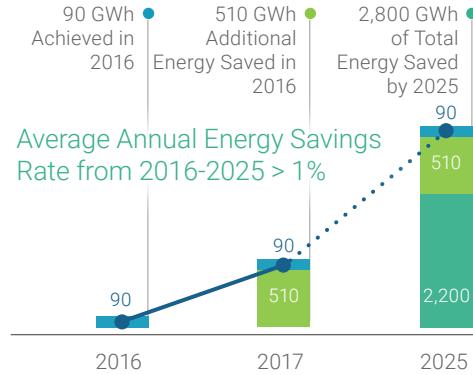
● Unit Power Consumption (Goal)

Note 1: The indicator for power consumption per wafer-layer includes all wafer fabs of TSMC and subsidiaries.

Note 2: This calculation does not include diesel and natural gas, as these are not used for production.

#### TSMC 10-year Energy-Saving Targets

Unit: GWh



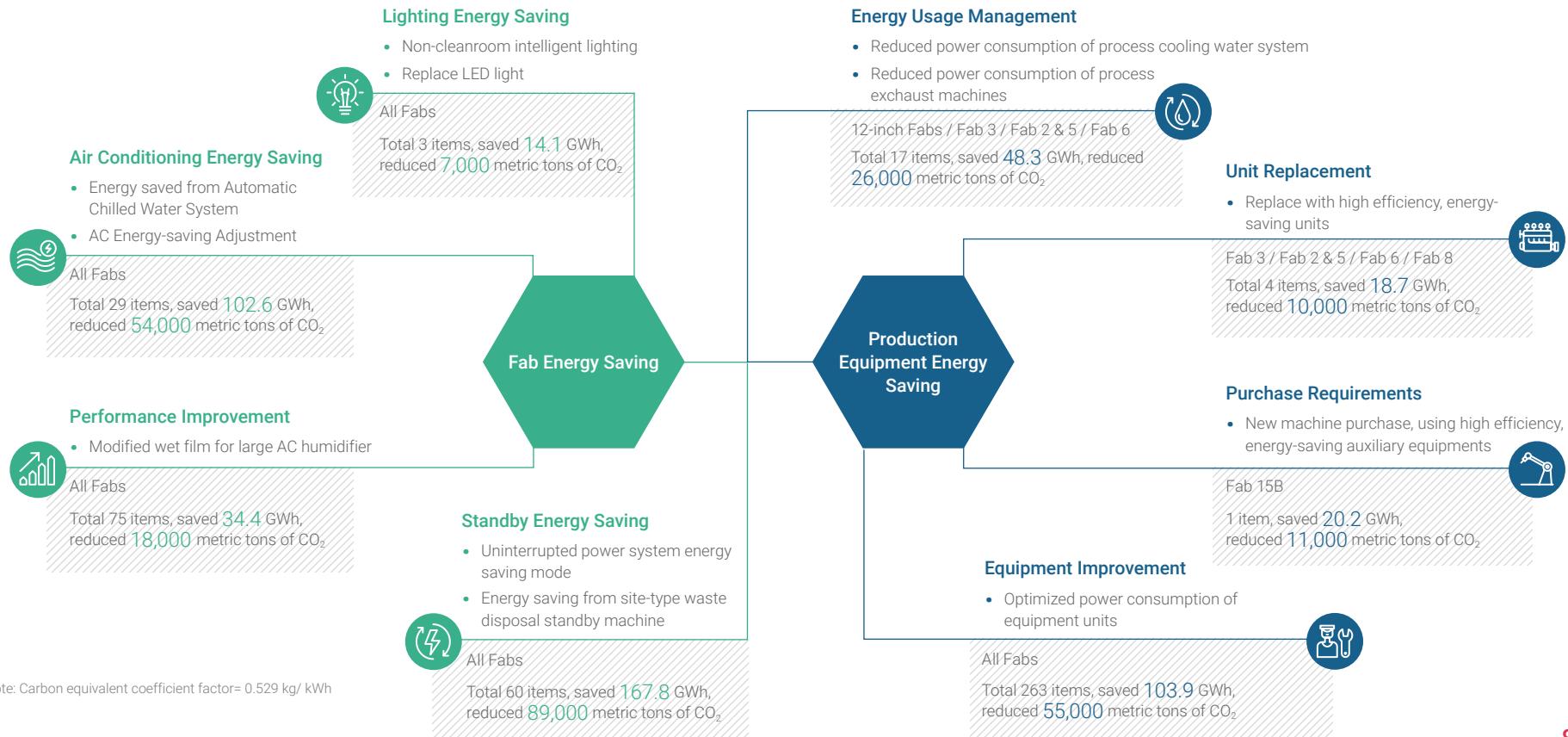
Average Annual Energy Savings Rate from 2016-2025 > 1%

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<sup>Note</sup>. 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

### Additional Energy-Saving Performance 2017





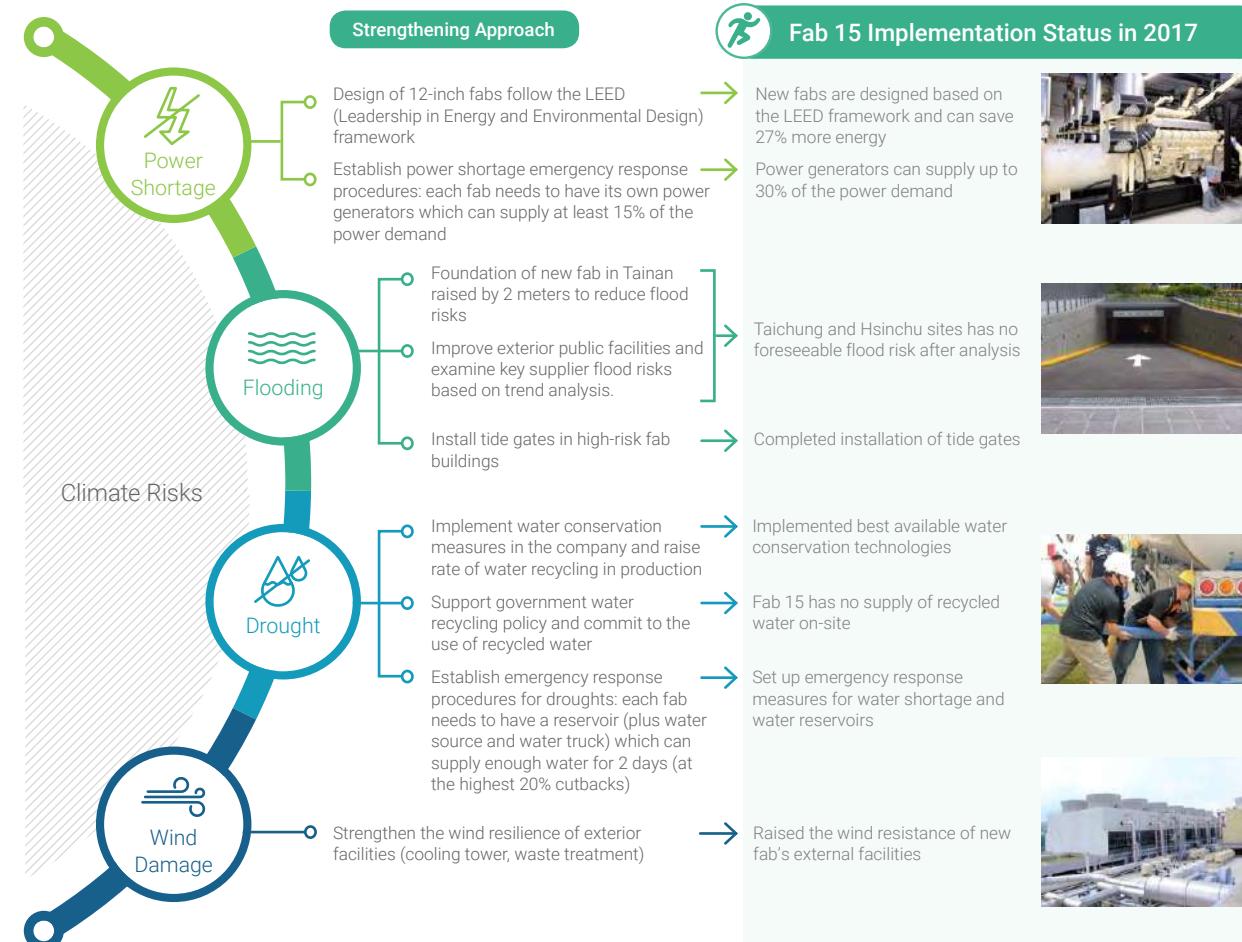
TSMC promotes industry benchmarking by inviting government agencies and academia to attend Energy and Carbon Reduction Committee meetings

## 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 N<sub>2</sub>O Abatement Approaches. TSMC possesses a strong resolve to lead the global semiconductor industry through its actions.



Case Study

## 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.



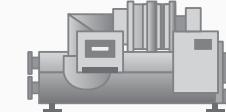
For more details, please refer to our website: "[TSMC Successfully Developed Industry's First Chilled Water System Optimization, Energy-Saving Control Program](#)"

### Traditional Control Point Manual Adjustment

Single equipment energy saving:  
Cooling Tower



Does not consider for power consuming of other equipment: Chiller



### Optimal Control Point Automatic Control

Considering the correlation of power consumption between each equipment

Chiller

Chilled Water Pump

Cooling Water Pumps

Cooling Tower



**58 GWh**

2017 Saving Contribution

**9 %**

Increased efficiency



## Case Study

## 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.



## 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%**

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

**48%**

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

**66**

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 is for reducing miss operation, it could be a reference to THSR for managing valves.

**Chia-Ho Chen**

Senior Specialist of Taiwan High Speed Rail



## Case Study

### Host Tool Energy Saving Workshop, Accumulation of Green Innovation Energy

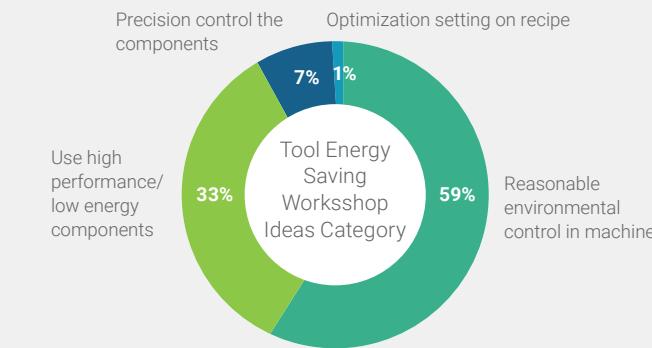
Green innovation is the responsibility of every TSMC employee. Through full implementation of energy reduction activities, hosts of cross-organizational energy-saving ideas competitions encourage their colleagues to continue to identify energy saving opportunities from daily operations and put them into action.

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.

#### 2017 Tool Energy Saving Workshop Ideas Category



#### 2017 Tool Energy Saving Workshop Base Cases

Category	Cases	Benefit
Reasonable Environmental Control in Machine	Correct the temperature control mechanism of furnace tube, find the best energy saving mode	Energy Saving > 6%
Optimization Setting on Recipe	Simplify the running step of the clean tool, find out the optimization model for water and power consumption	Energy Saving > 10%
Use high performance /low energy components	Use high-efficiency, energy-saving motors and heat exchangers, find the most suitable and low-energy configuration	Energy Saving > 20%



## Tasks of 2018

Source diversion to tools in production facilities.

Improve the efficiency of ammonia nitrogen treatment system

### Case Study

## 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 (SGDs), (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

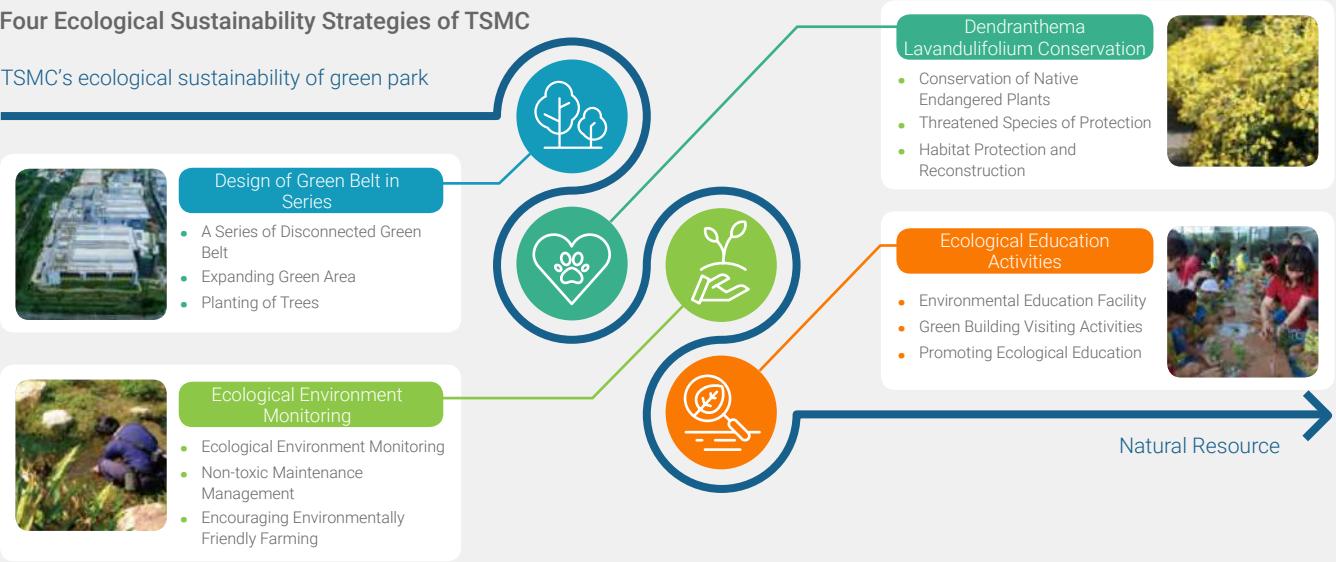
flavomarginata (Chinese Box Turtle) to livable environments and the independent cultivation of Lavandulaleaf dianthus (delicate native flowers) and other endangered plants.



For more detail, please refer to our website: "[TSMC Strikes a Balance between Technology and Ecology](#)"

### Four Ecological Sustainability Strategies of TSMC

#### TSMC's ecological sustainability of green park



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

## Material Issue

# Water Management



## Strategies

## TSMC 2020/2025 Goals

Achievements & Targets

### 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

Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets

**24.7%** Note 1

Reduced water consumption to 24.7% below 2010 level

Target: 21%

○ Reduce water consumption to 26% below 2010 level

**1.97 million**

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

Target: 1.57 million metric tons

○ Adopt new measures to save 1.28 million metric tons of water Note 2**<35mg/L**

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

Target: &lt; 60mg/L

**<35mg/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: &lt; 60mg/L

**<20mg/L**

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

Target: &lt; 20mg/L

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

Note 1: Achieved the goal earlier than expected for 2018

Note 2: The conservation volume for each year is based on the measures scheduled and planned by every plant. Continue water conservation at facility-level and begin tool-level measures in 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 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

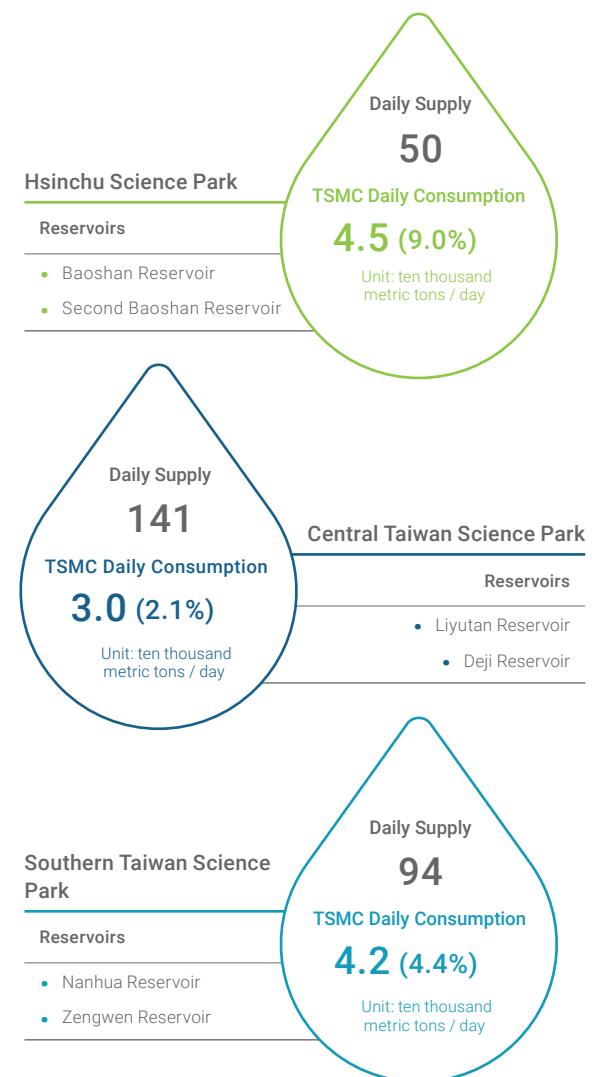
#### TSMC Water Shortage Contingency Measures

Emergency Levels	Water Restrictions by Government	TSMC Contingency Measures	Status in 2017
Blue Normal	Stable supply	Establish a comprehensive water monitoring mechanism  Early warning of long-term trends in water use	<ul style="list-style-type: none"> <li>Regularly checked the status of all water reservoirs reported by the Water Resources Agency and held practice drills</li> </ul>
Green Adequate	Farms advised to leave fields fallow	Establish a contingency team  Assess the demand for water tankers/water reserve	<ul style="list-style-type: none"> <li>Established a contingency team to take inventory of water resources and water tanker capacity</li> </ul>
Yellow Level One	Water supply pressure lowered pressure at specific times	Voluntarily reduce water consumption by 3%  Practice exercises in using water tankers to transport water	<ul style="list-style-type: none"> <li>Reduced landscape watering by 50%</li> <li>Lowered pressure of water supply to achieve 3% voluntary water conservation</li> </ul>
Orange Level Two	Reduce supply to industrial use by 5~20%	Implement water restrictions at all levels and take necessary water conservation measures  Intra-organizational drought emergency response team	<ul style="list-style-type: none"> <li>Did not occur</li> </ul>
Red Level Three	Water restrictions by zone	Implement water restrictions at all levels and take necessary water conservation measures  Intra-organizational drought emergency response team	<ul style="list-style-type: none"> <li>Did not occur</li> </ul>

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.

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



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

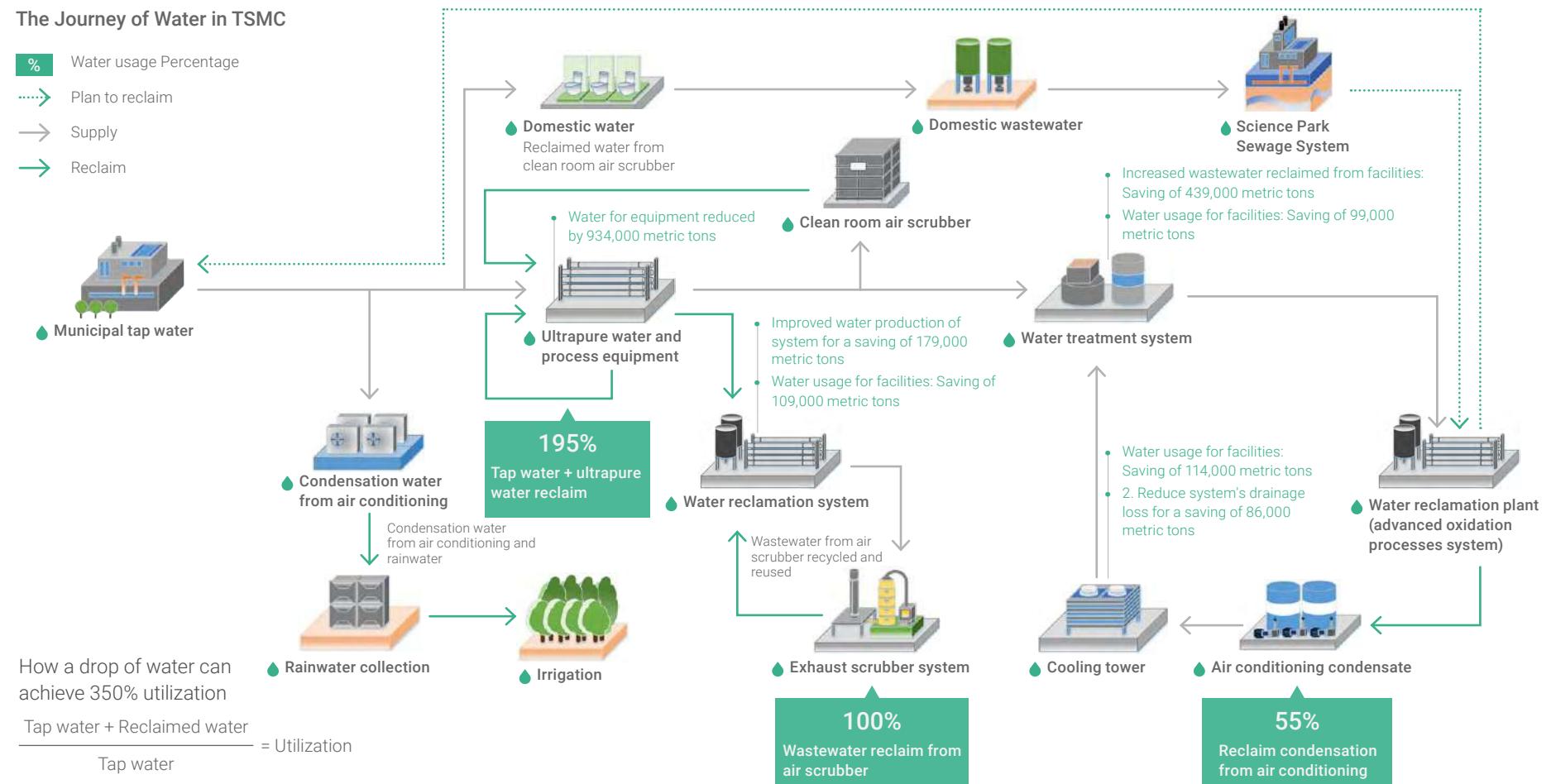
To improve water usage efficiency, TSMC categorizes wastewater from purification equipment and production processes according to the cleanliness of discharge, and the cleanest water is given priority for recycling and purification

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

- % Water usage Percentage
- ⤒ Plan to reclaim
- ⤓ Supply
- ⤔ Reclaim



# 87.5%

In 2017, the average recycling rate of the water used in production processes reached 87.5%, above the 85% required by the science park administration

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

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

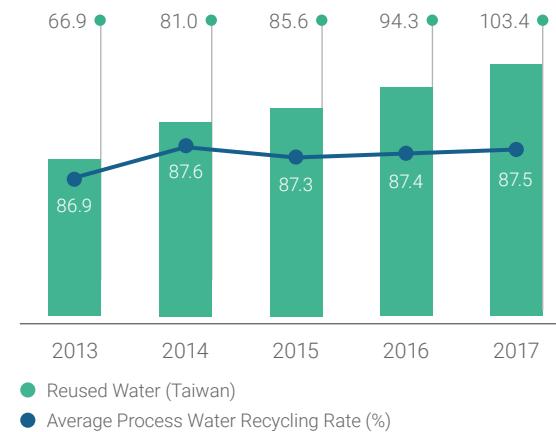
Note 1: Average process water recycling rate is defined by the Science Park Administration

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

## Water Recycling and Usage Efficiency

Unit: Million metric tons



● Reused Water (Taiwan)

● Average Process Water Recycling Rate (%)

Note 1: Total recycled water quantity includes process and scrubbers recycling

Note 2: Total recycled water quantity is about 2.5 times municipal water consumption in TSMC

## 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.<sup>Note</sup>

In 2017, several newly built fabrication plants (Fab 12 P7 and Fab 15B) went operational. Facing the challenge of increasing water use, TSMC continued to offer various innovative water conservation measures to improve the water use for advanced production processes, as well as water recycling rate and volume. The water usage (volume needed per wafer unit) was reduced from 62.6 (liters/8-inch e wafer-layer) in 2010 to 47.2 (liters/8-inch e wafer-layer) in 2017, an achievement of 24.7% reduction. Not only was the goal for 2017 achieved, the 2018 goal was also reached ahead of time.

Note: According to statistics published by the Water Resources Agency, the average daily water consumption per person is 291 liters

### New Water Conservation Methods and Achievements in 2017

#### Reduction of Water Consumption at Facilities

Water Conservation Measures      Volume Saved Per Year (metric tons)

Reduce cooling tower and sand filter backwash water	114,050
Extend the regeneration and backwash time for ultra pure water and reclaim system	84,372
Office cleaning water conservation	15,263

#### Improve System Water Production Rate

Water Conservation Measures      Volume Saved Per Year (metric tons)

Increase reclaimed water RO production	111,899
Improve the usage rate of reclaimed water	68,614

#### Increase Facility Wastewater Recycling

Water Conservation Measures      Volume Saved Per Year (metric tons)

Hydrofluoric acid wastewater recycling	57,203
TMAH system water reclaim	154,736
Reclaim acidic wastewater discharged at the chemical zone	42,320
Wastewater reclaimed from air scrubber	186,188
Reclaimed water is refined into industrial-grade water	109,060

#### Reduce Water Use of the Manufacturing System

Water Conservation Measures      Volume Saved Per Year (metric tons)

Shut down inessential supplementary tools	560,640
Reduce water use of the production processes	200,385
Improve water supply to production tools	174,470

#### Reduce Loss from System Discharge

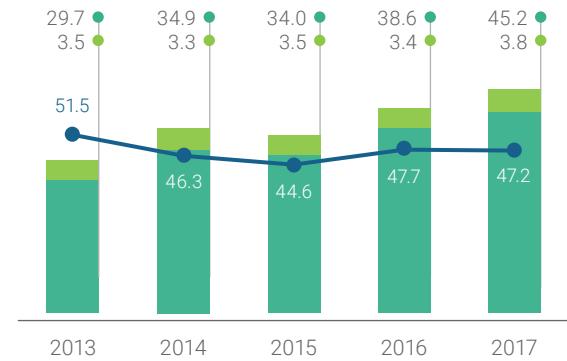
Water Conservation Measures      Volume Saved Per Year (metric tons)

Drainage reclaim from cooling towers	22,850
Reclaim backwash wastewater from activated carbon tower of the recycling system	64,071

Total Saved  
**1,966,121**  
metric tons

### City Water Consumption and Water Consumption per Wafer-Layer

Unit: million metric tons



● Water Consumption (Taiwan)

● Water Consumption (Overseas)

● Water Consumption Per Wafer-layer (liter/8-inch e wafer-layer)

Note 1: Total water consumption includes TSMC (all fabs as well as packaging and testing facilities located in Taiwan) as well as its overseas subsidiaries WaferTech, TSMC (China), and VisEra Technology

Note 2: The indicator for water usage per wafer-layer represents the statistics for all wafer fabs of TSMC and subsidiaries.

**40%**

TSMC enhanced reclaimed water technology and successfully reduced the unit cost of water by 40% in 2017

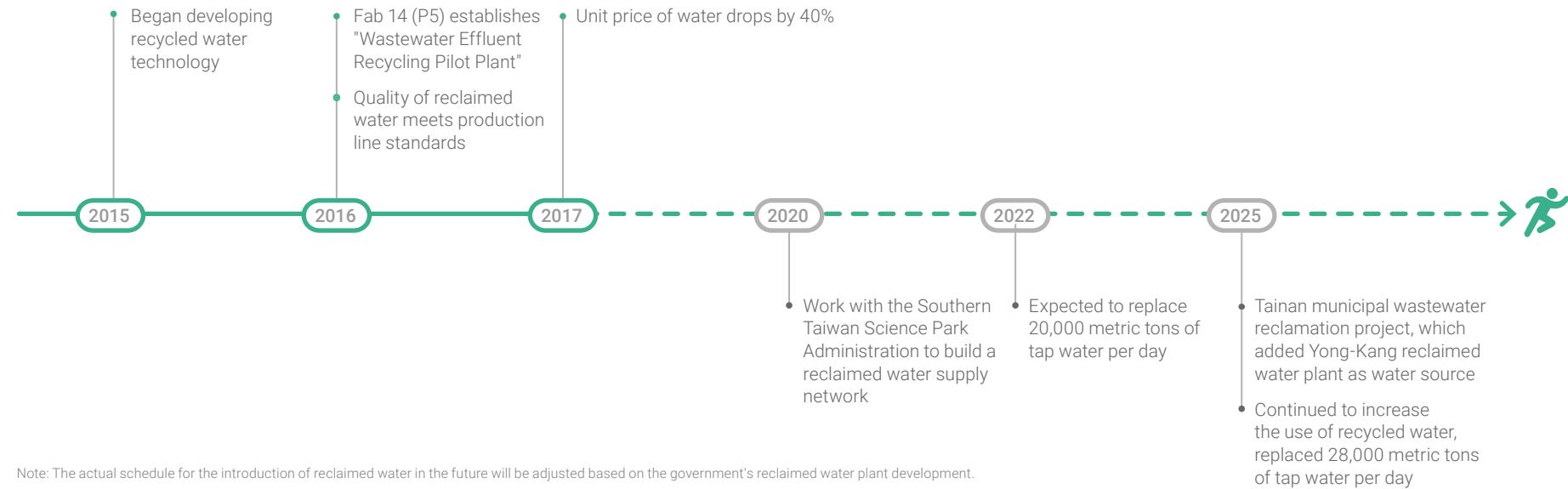
## Diversification of Water Resources

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 milestone for the development of recycled 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 demonstrates the future availability of reclaimed water.

## Development of Reclaimed Water at TSMC



## 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

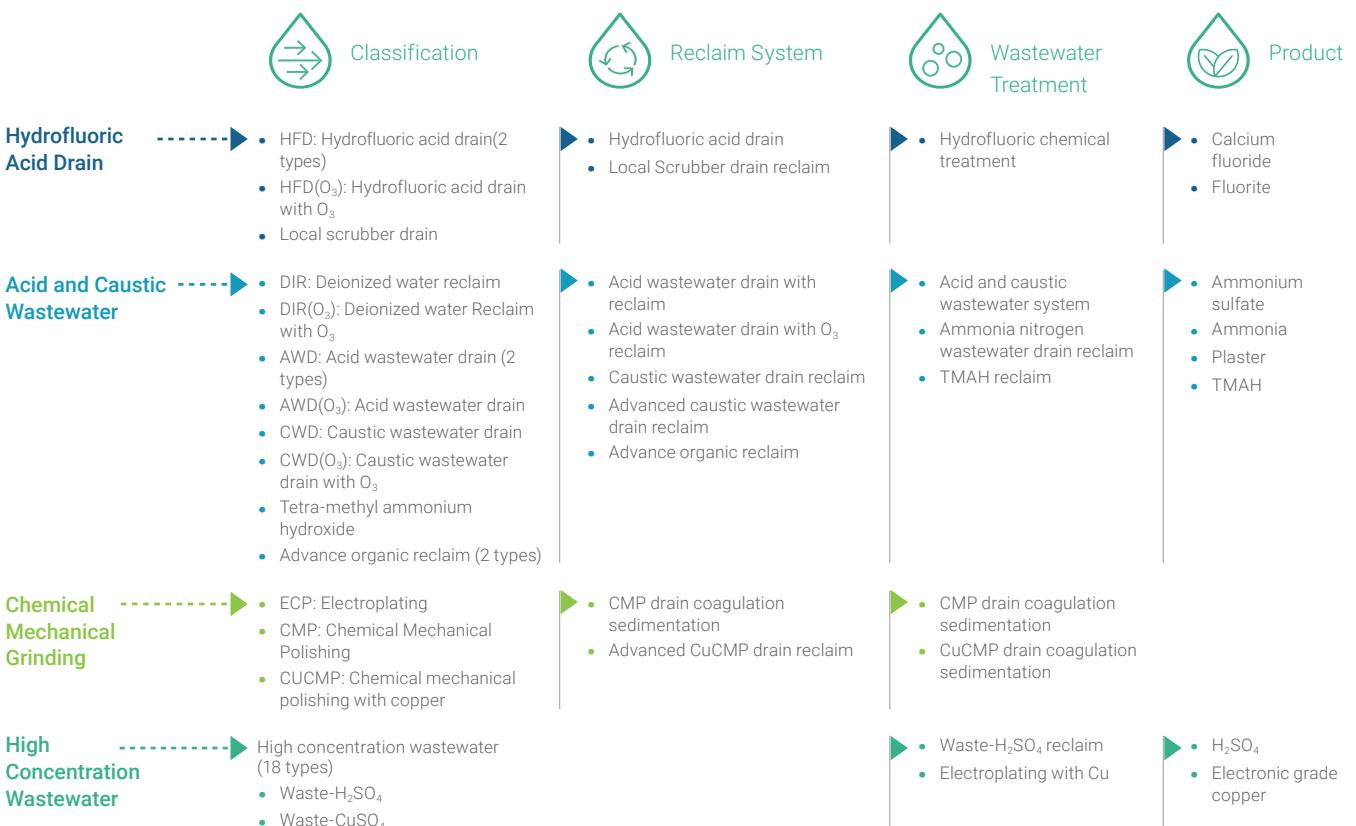
TSMC has adopted the industry's strictest classification and diversion strategy for front-end wastewater. To improve

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<sup>Note 1</sup>, acid and alkaline wastewater<sup>Note 2</sup>, 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)



Note 1: TMAH is the abbreviation for Tetramethyl Ammonium Hydroxide

Note 2: Among the reclaimed products, sulfuric acid and electronic-grade copper are reused at TSMC, and the rest are recycled and provided for other industries

## 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.

Note: pH and suspended solids

### Wastewater Discharge Per Product Unit

Unit: Million metric tons



Note 1: Total wastewater volume includes TSMC (all fabs and backend packaging and testing plants in Taiwan) and its subsidiaries WaferTech, TSMC (China) and VisEra

Note 2: The indicator for wastewater discharge per wafer-layer represents the statistics of all wafer fabs of TSMC and subsidiaries

### Comparison of Wastewater Discharge Quality

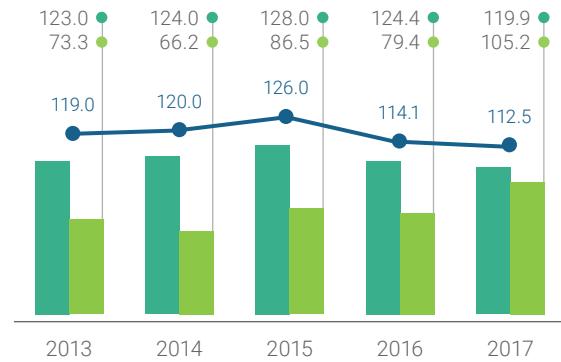
Unit: mg/L

	2017	Standards of the Science Park Administration	TSMC 2025 Goal
Suspended Solids	30	HSP: 300	30
		CTSP: 300	
		STSP: 250	
Chemical Oxygen Demand	104	HSP: 500	100
		CTSP: 500	
		STSP: 450	
Ammonia Nitrogen	35	HSP: 50	25
		CTSP: 50	
		STSP: 60	

Note: Hsinchu Science Park (HSP) Central Taiwan Science Park (CTSP)  
Southern Taiwan Science Park (STSP)

### Statistics of Chemical Oxygen Demand for TSMC

Unit: mg/L



● Taiwan ● Subsidiaries ● All Sites

Note 1: The Hsinchu and Central Taiwan Science Park Administrations set 500 mg/L as the standard for wastewater treatment plants while the Southern Taiwan Science Park Administration sets it at 450 mg/L

Note 2: Statistics for chemical oxygen demand for TSMC (all fabs and backend packaging and testing plants) and its subsidiaries TSMC (China) and VisEra

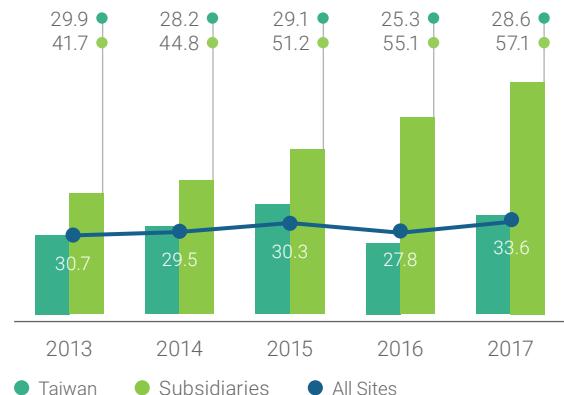
## Reduction of Ammonia Nitrogen in Wastewater

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"<sup>Note<sup>1</sup></sup> 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: the first in the semiconductor industry

### Statistics of Suspended Solids for TSMC

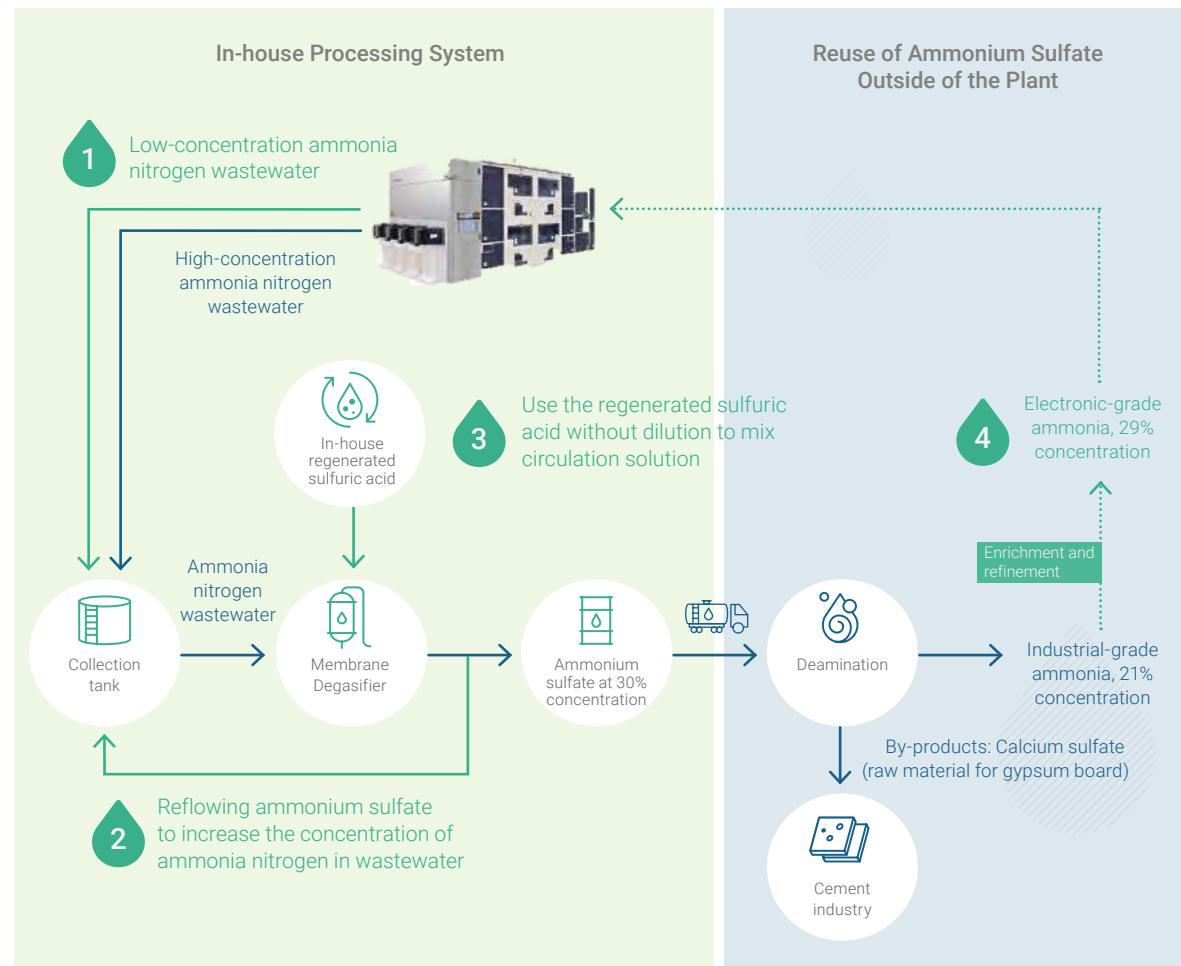
Unit: mg/L



Note 1: The Hsinchu and Central Taiwan Science Park Administrations set 300 mg/L as the standard for wastewater treatment plants while the Southern Taiwan Science Park Administration sets it at 250 mg/L

Note 2: Statistics for suspended solids in wastewater for TSMC (all fab plants and backend packaging and testing plants in Taiwan) and its subsidiaries TSMC (China) and VisEra

## Flowchart of Ammonia Nitrogen Wastewater Reclamation



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.



## Tasks of 2018

Source diversion from production tools

Improve the efficiency of ammonia nitrogen treatment system



### Case Study

#### 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 ( $O_3$ ) and hot water (HDIW). 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

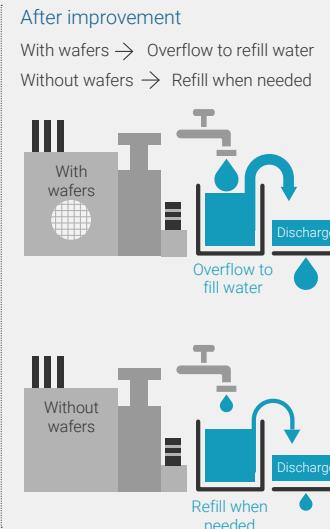
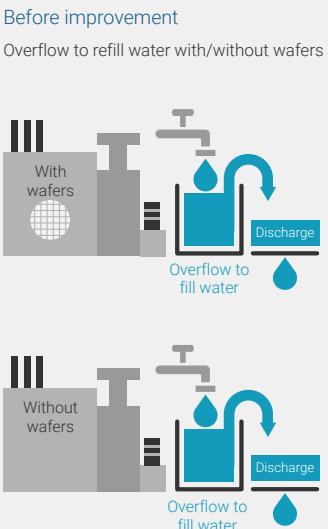
amount of water for each step was successfully derived, achieving the best operation approach to water consumption and product quality. In 2017, the total volume of water conservation reached 200,000 metric tons.

##### Discharge Recycling During Production Tool Standby

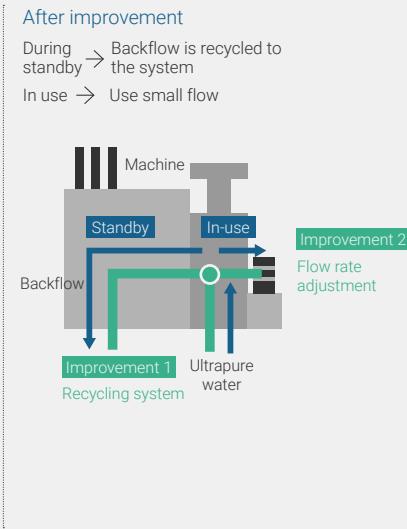
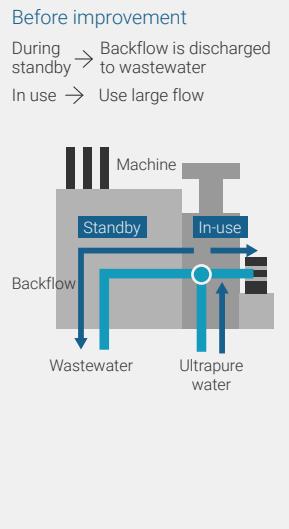
To keep the system clean and stable, ultrapure is constantly replenished during tool standby. In the past, this unused ultrapure goes directly into the wastewater treatment system. In 2017, a different approach was taken by recycling the

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.

##### Schematic showing how water supply to acid tank wafer scrubber system was improved



##### Schematic showing the recycling of water during tool standby



**Material Issue**

# Waste Management

**Strategies****TSMC 2020/2025 Goals**

Achievements &amp; Targets

**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 vendors to develop new waste recycling technologies to reinforce recycling and reuse of waste

- 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

## Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets

**0.36kg**  
Outsourced unit waste output reduced

**212,904 metric tons**  
Annual waste reduced

**814 NT\$ million**  
Saved in waste disposal cost

**404,195 metric tons**  
Waste recycled

**250 NT\$ million**  
Waste recycled and resold

Outsourced unit waste output (8-inch e wafer-layer) < 0.35 kg

Target: Outsourced unit waste output (8-inch e wafer-layer) < 0.36 kg

**95%**  
Recycling rate

**0.08%**  
Waste landfill rate

Target: >95%

Target: <1%

Recycling rate > 95%, Waste landfill rate < 1%, In-house regeneration and recycling of resources > 30%

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

2017 new item

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

Complete 100% auditing and guidance of the vendors that handle waste disposal and recycling



Surpassed



Achieved



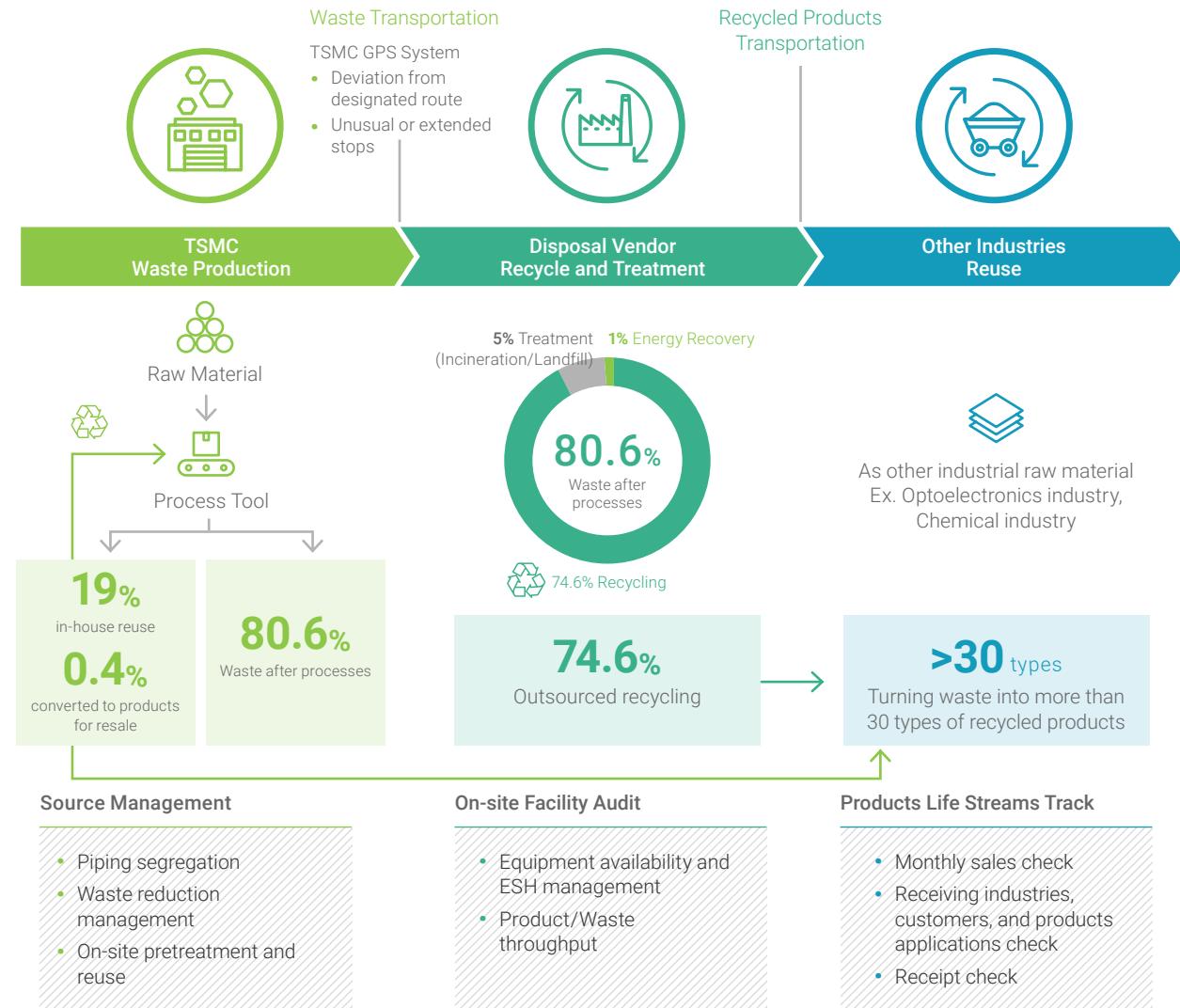
Unachieved



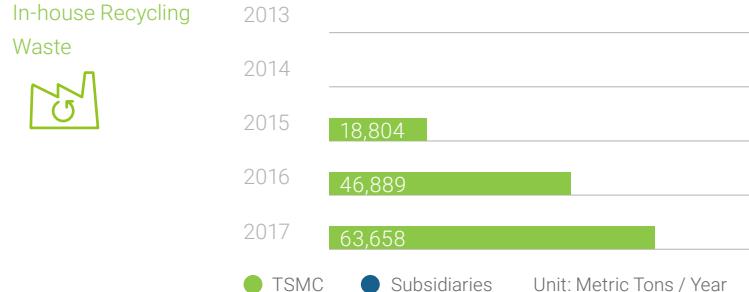
TSMC understands the importance of waste management in green manufacturing and our supply chain. In order to achieve sustainable use of resources and ensure proper disposal of waste, TSMC continues to promote source minimizing waste disposal by maximizing recycling. Besides persisting in doing sustainable 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.

### Life Cycle and Management of Material and Resource Sustainability



### Waste Quantity and Treatment Status Statistics

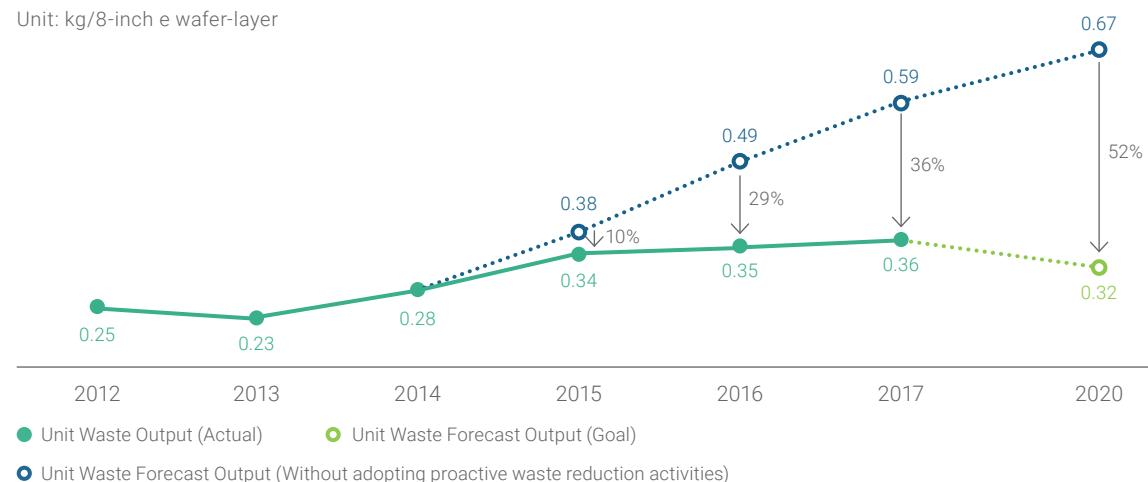


## Source Reduction

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.

### Unit Waste Output Trendchart

Unit: kg/8-inch e wafer-layer



Note 1: Unit waste output has continued to rise due to 1. the increased complexity of TSMC manufacturing process and 2. TSMC transforms NH<sub>3</sub>-N into waste ammonia sulfate to comply with new wastewater regulation standards

Note 2: TSMC has adopted proactive waste reduction measures since 2015, and therefore our waste output forecast is based on 2014 unit waste output estimates

Note 3: Waste quantity includes TSMC (all fabs and packaging and testing facilities located in Taiwan) as well as its overseas subsidiaries WaferTech, TSMC (China), and VisEra Technology

Unit: thousand NT\$

Category	Description	2017
Waste reduction project	Cost saving for waste treatment fee from chemical waste reduction of 120,234 metric tons waste (Chemical waste H <sub>2</sub> SO <sub>4</sub> , H <sub>2</sub> O <sub>2</sub> , (NH <sub>4</sub> ) OH, CuSO <sub>4</sub> , Photoresist solvent Developer...)	814,023
Income from waste recycling	Recycling of used chemicals, wafers, targets, batteries, lamps, packaging materials, paper cardboard, metals, plastics, and other wastes	251,043

Note: Benefits cover all TSMC fabs

 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.

### Source Reduction of Process Chemicals



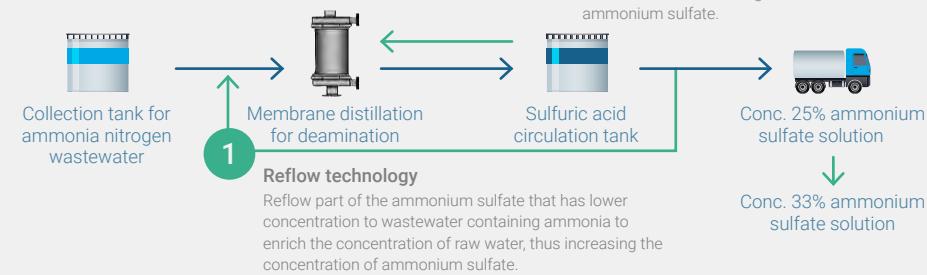
In 2017, various source reduction measures taken by TSMC enabled reduction of unit waste output by 0.1 kg, equivalent to annual waste reduction of 59,139 metric tons and additional savings of NT\$240 million in waste disposal for the year.

## Refinement and Enrichment of Ammonium Sulfate Dewatering Technology

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.

### Breakthrough in the Enrichment of Ammonium Sulfate



## 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.

**1,020** Metric Tons

total organic waste chemical was reduced by 1,020 metric tons

### 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.

**1,450** Metric Tons

Total sludge volume was reduced by 1,450 metric tons

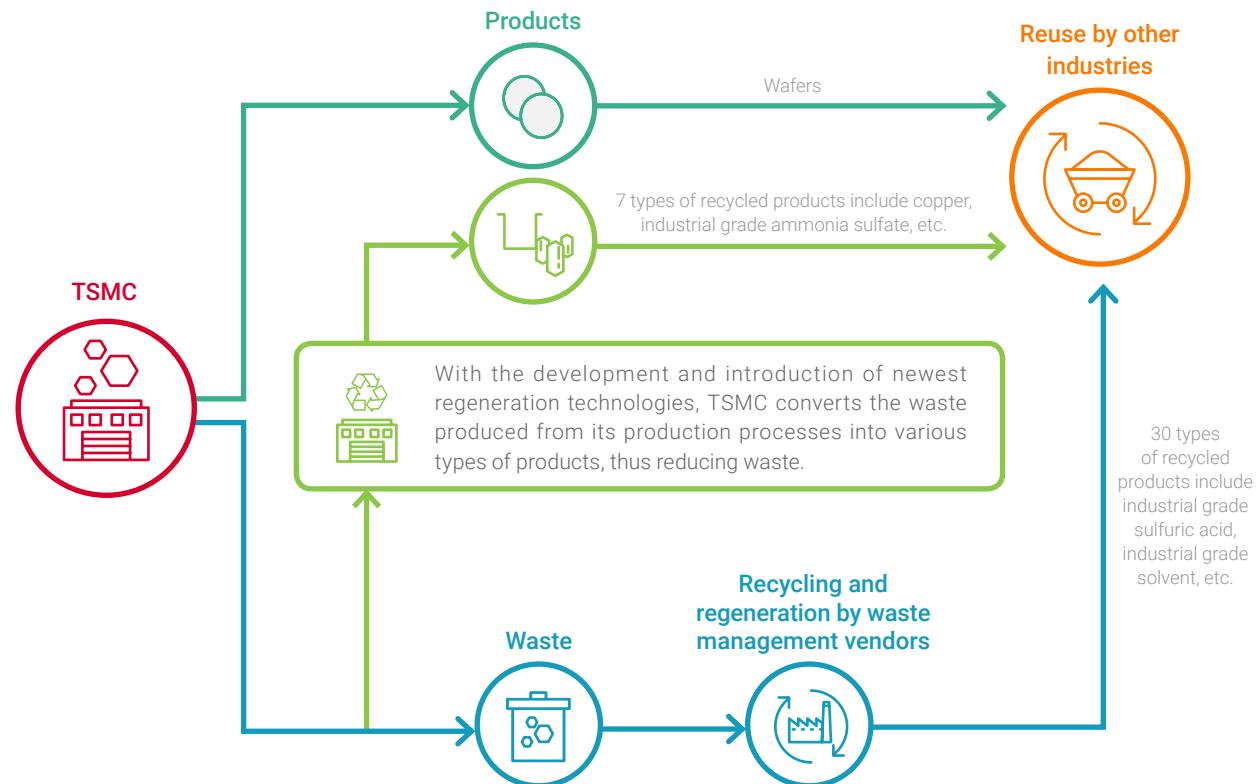
## Circular Economy

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<sup>Note</sup> 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

## TSMC Committed to Becoming a Participant in the Circular Economy





## Case Study

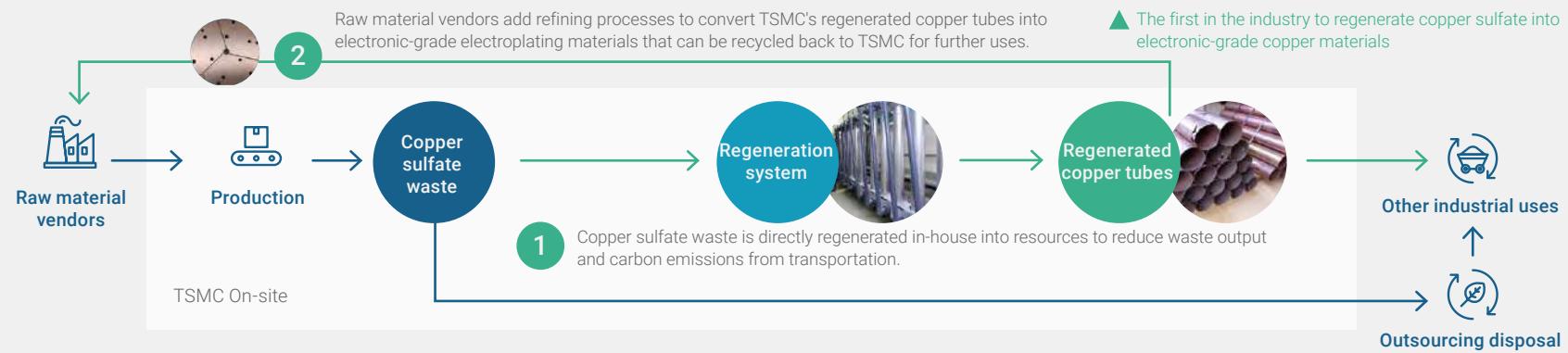
## The First in the Industry to Regenerate Copper Sulfate into Electronic-Grade Copper Materials

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.



## 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.

**62,595** metric tons

The amount of waste sulfuric acid to be outsourced for treatment was reduced by 62,595 metric tons

**150** million

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.

2017 amendments to the auditing articles cover eight major aspects. They are: operations management, waste management, wastewater management, air pollution control, equipment maintenance records, safety and health management, fire protection and emergency response, for a total of 163 auditing items. Vendors are required to perform

#### New Waste Vendors

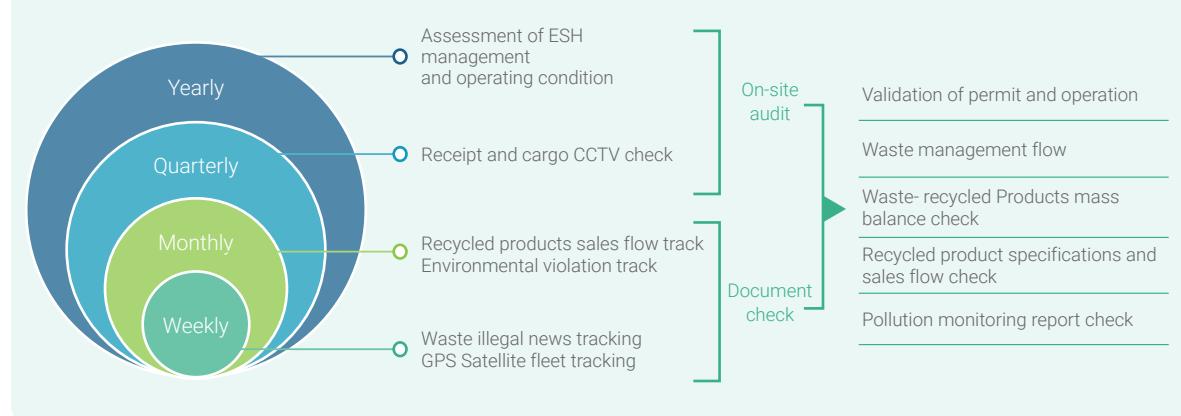


#### All Existing Waste Vendors<sup>Note 1</sup>



Note 1

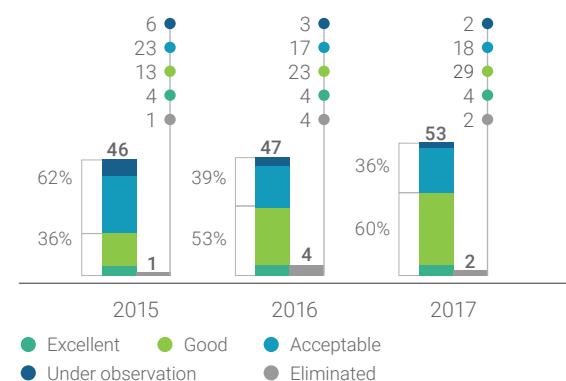
#### Vendor Audit<sup>Note 2</sup>



Corporate ESH Division  
Waste Management Section  
Procurement Division  
Legal Division  
Cease transactions with vendors scored as "under observation" and showing no improvement

#### Evaluation Result<sup>Note 3 & 4</sup>

Unit: Number





## 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

self-evaluation using those checklist items before auditing. This is to verify the documents with the actual on-site audits to ensure the proper outsourcing disposal of TSMC's waste. At the same time, TSMC reinforces the tracking of recycled products. All vendors producing the recycled or regenerated products are to report their production and sales records on a monthly basis. TSMC also periodically visits the vendors and verifies the disposals and recycling of their processing waste and compares that with the product sales records to ensure that recycled products are of legal use.

Qualified vendors are subject to an Annual Vendor Evaluation, with three dimensions: "company scale and reputation", "past operational records" and "control and management of waste". For vendors with poor scores, counseling, recommendations and improvement monitoring are provided during the annual audits. They are also required to obtain ISO/OHSAS certification to improve their environmental and safety management capabilities. Their coordination efforts and improvement becomes part of the assessment criteria on whether they can remain as a supplying vendors. In 2017, the proportion of waste disposal vendors with excellent and good ratings improved to 60% from the 36% performance in 2015.

### 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. TSMC 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

### TSMC 2020/2025 Goals

Achievements & Targets

#### Best Available Technology (BAT)

Using BAT to deal with operational pollution and reduce its environmental impact

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

#### Zero Failure of Control Equipment

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

Reportable incidents to governing authority <1 2020

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!

Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets

**96.4%****Reduction rate of volatile organic gases was 96.4%**

Target: &gt;90%

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

Note: Air pollutants include a total of 8 chemicals : total hydrocarbons, sulfuric acid, hydrochloric acid, nitric acid, hydrofluoric acid, phosphoric acid, chlorine and ammonia





Two-stage type scrubber

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

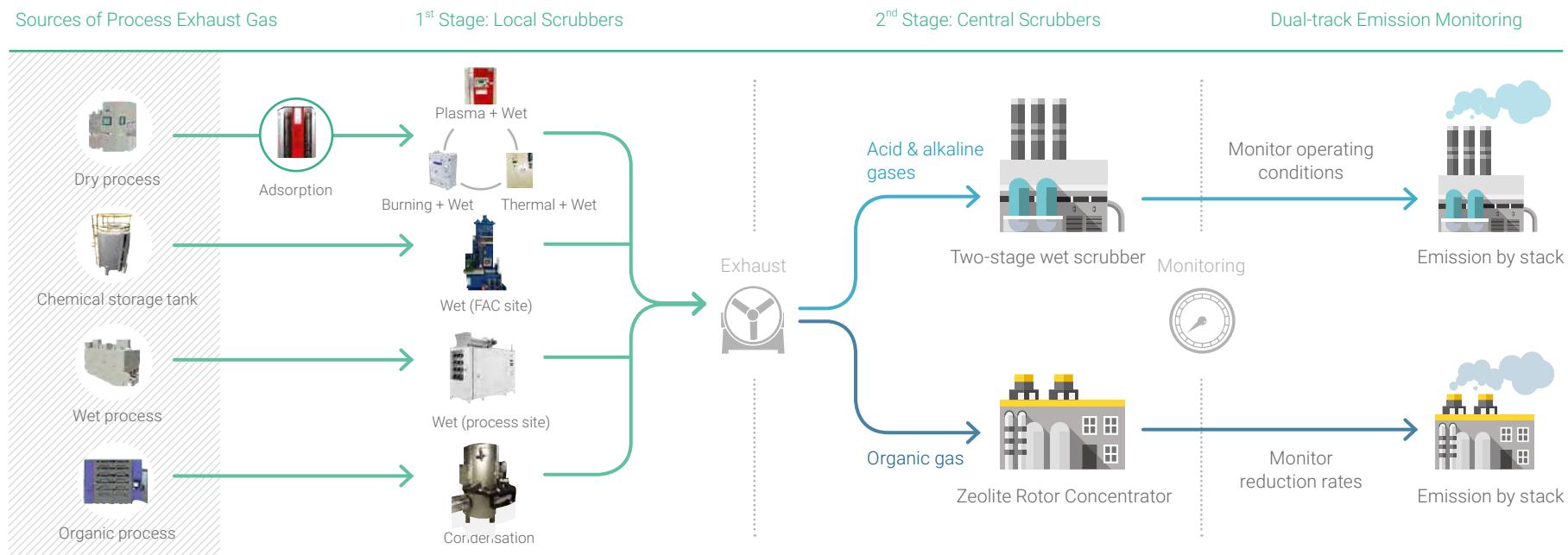
TSMC has spared no effort to reduce air pollution. In order to achieve the best available technology in the prevention and control process, TSMC has adopted the method of "effective reduction of exhaust sources and enhanced treatment of terminal control equipment". In the first stage, high-efficiency 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 alkalis, 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<sup>Note</sup> can reach above 99%.

Note: Calculation of total reduction rate after two-stage control equipment 1-[  
(1-Local scrubber reduction rate)×(1-Central scrubber reduction rate)]

## Air Pollution Control Process



# 96.4%

Reduction rate of volatile organic gases reached 96.4% in 2017

# 24%

Air pollutant emissions per unit product decreased 24% compared to 2015 level

## 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 it 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

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

## Zero Failure of Control Equipment

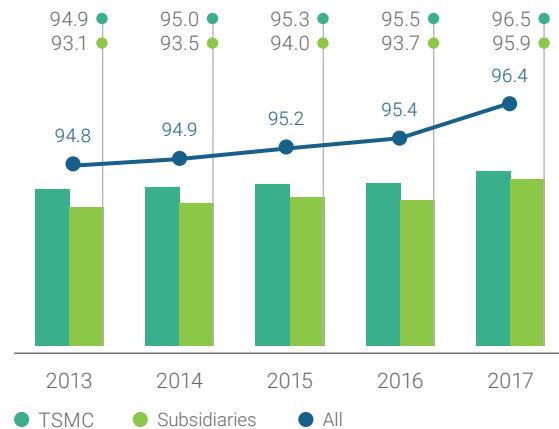
TSMC's air pollution control capability complies with Taiwan's "Air Pollution Control and Emission Standards for Semiconductor Manufacturing" and the "Air Pollutants Emission Standards for Fixed Pollutants", and overseas subsidiary companies also meet local regulatory standards. To ensure stable 24-hour 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

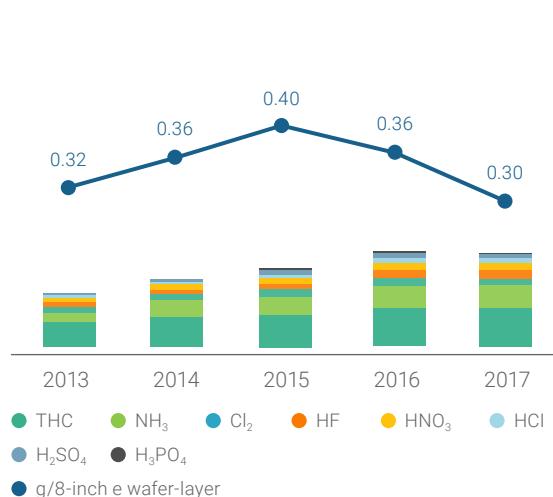
Unit: %



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 taken into account in 2017)

### Annual Emissions of Air Pollutants and Emissions Per Unit Product

Unit: metric tons



Note 1: 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 due to the different items declaration

Note 2: Total air pollutant emission includes total hydrocarbons (THC), sulfuric acid (H<sub>2</sub>SO<sub>4</sub>), hydrochloric acid (HCl), nitric acid (HNO<sub>3</sub>), hydrofluoric acid (HF), phosphoric acid (H<sub>3</sub>PO<sub>4</sub>), chlorine (Cl<sub>2</sub>) and ammonia (NH<sub>3</sub>), a total of 8 kinds

Note 3: Air pollutant emissions per unit product in TSMC excludes packaging and testing plants (because they do not have actual wafer output to calculate)



Industrial Safety Emergency Response Center

Facility Monitor Control Center



## 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



### Case Study

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

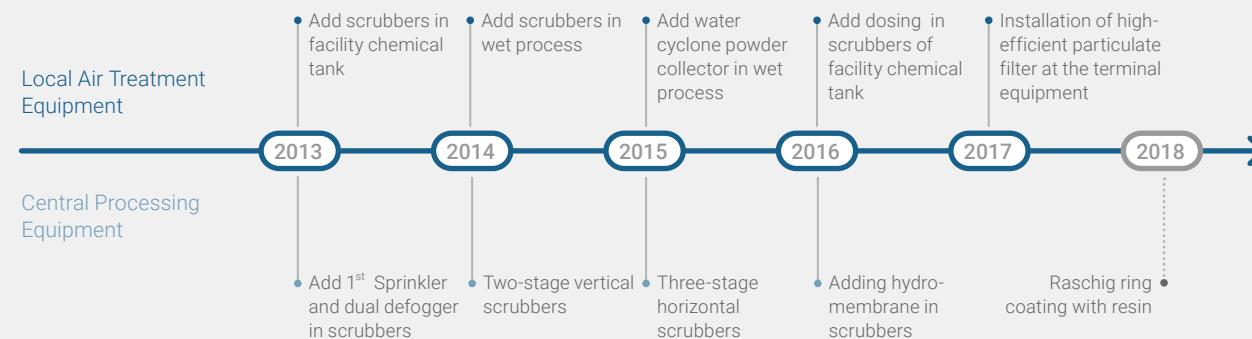
In order to improve the performance of air pollution control equipment, TSMC continues to cooperate with supplier partners to introduce the latest technologies. In 2016, "hydro-membrane<sup>Note\*</sup>" technology was installed in the scrubber of Fab 14, Phase 5 in Tainan Science Park. It was found 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 ( $H_2SO_4$ ) 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%.

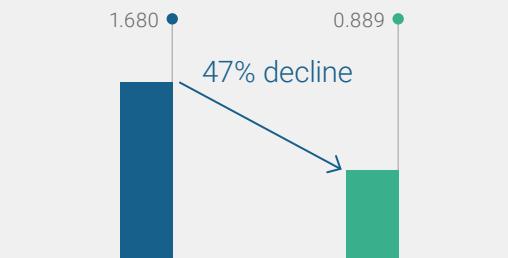
#### Improvement and Evolution of TSMC Air Pollution Control Equipment



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.

#### Reduction in scrubber sulfuric acid concentration

Unit: mg/Nm<sup>3</sup>



● Before adding hydro-membrane  
● After adding hydro-membrane

## Inclusive Workplace

# 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.

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**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)

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**0**

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

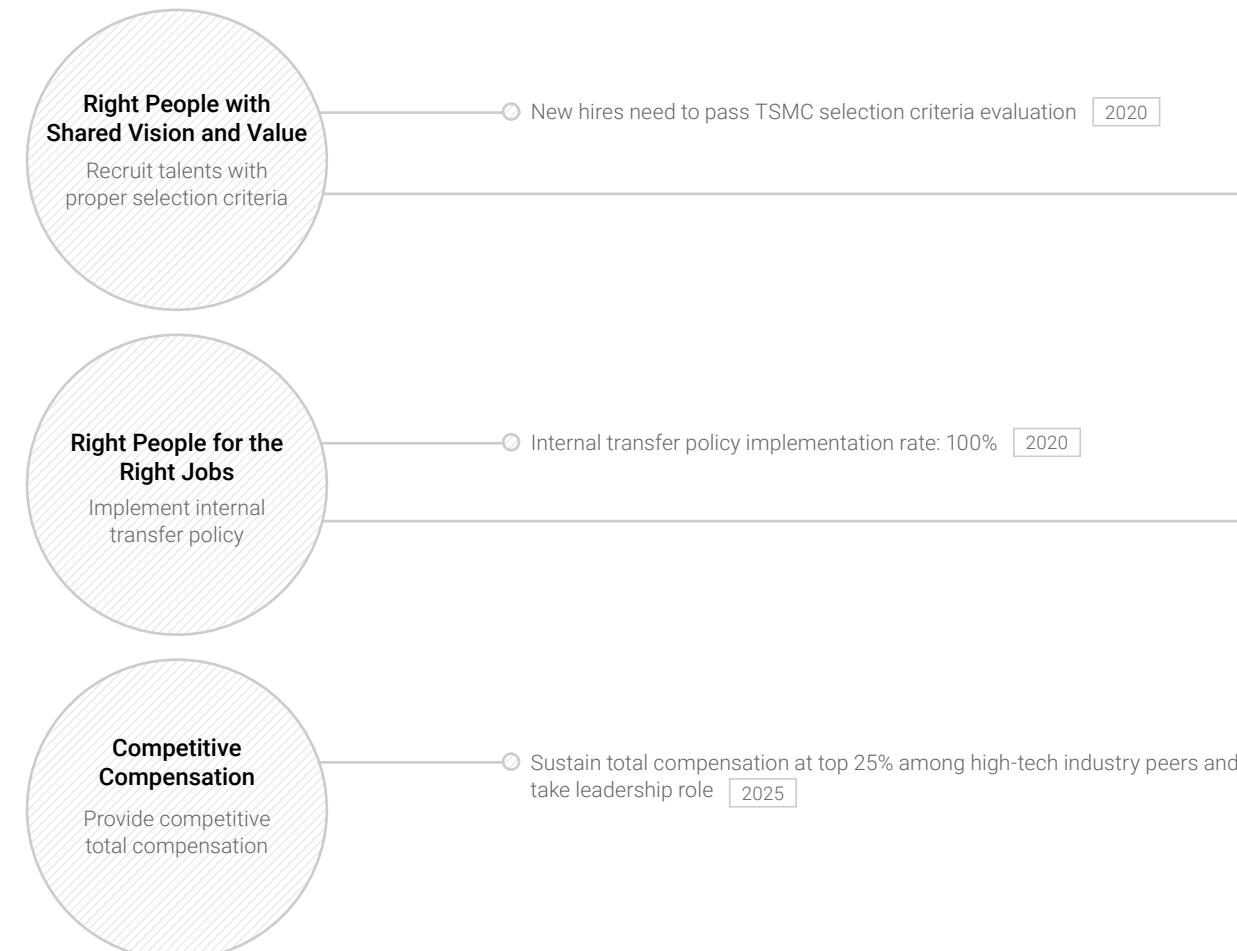


**Material Issue**

# Talent Attraction and Retention

**Strategies****TSMC 2020/2025 Goals**

Achievements &amp; Targets



Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets

**89%**  
Offer acceptance rate  
Target: 87%

**89%**  
External hiring fulfillment rate  
Target: 76%

- New hires need to pass questionnaire and interview evaluation to ensure the possessions of they are equip with TSMC's selection criteria

**>95%**  
Of the employees 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<sup>Note1</sup>  
Target: >95%

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



**4.2%**  
Turnover rate  
Target: Between 5~10%

- Internal transfer policy implementation rate: 100%<sup>Note2</sup>



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

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



Employees are an important force that sustains our competitive advantage. The Human Resource Organization's key mission is to recruit talent with high potential, create an energized organization and inclusive workplace, and to enable employees' continuous contribution and growth in the Company.



**Connie Ma**  
Vice President, Human Resources

## Right People with Shared Vision and Values

### Talents with Same Vision

"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.

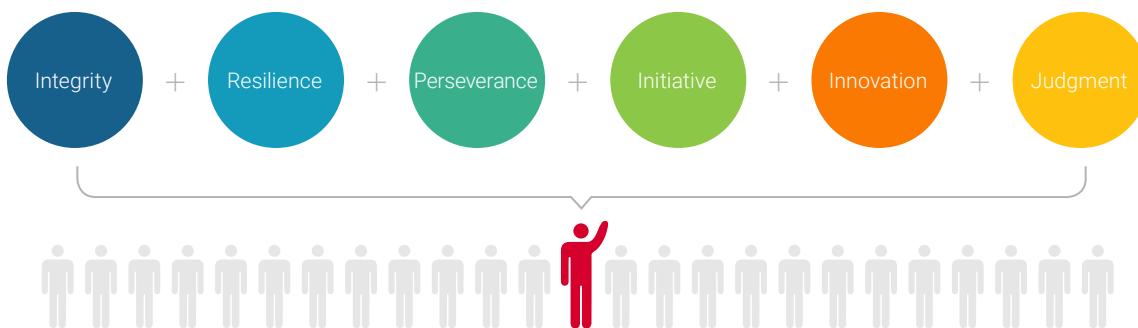
Character and qualifications are the most important criteria for talent selection at TSMC. In order to ensure the quality of recruitment, we developed a set of selection criteria, including integrity, resilience, perseverance, initiative, innovation, judgment and etc. Besides professional skills, all 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 9<sup>th</sup> in the world and was the only Asian company in the top 10, reaching US\$218,951.

### TSMC Talent Selection Criteria



### Workforce Structure

Categories	Groups	Male		Female		Subtotal and Percentage by Groups	
		Number	Percentage of Group	Number	Percentage of Group	Number	Percentage of Group
Employee Category	Managers	4,480	87.7%	627	12.3%	5,107	10.5%
	Professionals	18,046	82.4%	3,849	17.6%	21,895	45.0%
	Assistant Engineer/Clerical	3,297	80.8%	785	19.2%	4,082	8.4%
	Technician	3,675	21.0%	13,843	79.0%	17,518	36.0%
Location	Taiwan	26,400	60.8%	16,993	39.2%	43,393	89.3%
	Asia	2,010	55.3%	1,623	44.7%	3,633	7.5%
	North America	1,053	69.2%	469	30.8%	1,522	3.1%
	Europe	35	64.8%	19	35.2%	54	0.1%
Age	18~20	25	46.3%	29	53.7%	54	0.1%
	21~30	8,116	62.4%	4,880	37.6%	12,996	26.7%
	31~40	14,711	60.6%	9,549	39.4%	24,260	49.9%
	41~50	5,469	58.0%	3,960	42.0%	9,429	19.4%
	51~60	1,072	62.1%	653	37.9%	1,725	3.5%
	60+	105	76.1%	33	23.9%	138	0.3%
	Ph.D.	2,041	90.9%	205	9.1%	2,246	4.6%
Education	Master's	16,516	81.8%	3,671	18.2%	20,187	41.5%
	Bachelor's	7,839	61.4%	4,936	38.6%	12,775	26.3%
	Other Higher Education	1,610	29.1%	3,923	70.9%	5,533	11.4%
	High School	1,492	19.0%	6,369	81.0%	7,861	16.2%
	Employment Type	Regular	60.7%	19,103	39.3%	48,598	99.9%
		Temp	75.0%	1	25.0%	4	0.1%
		Subtotal by Genders		29,498	60.7%	19,104	39.3%
		Total				48,602	--

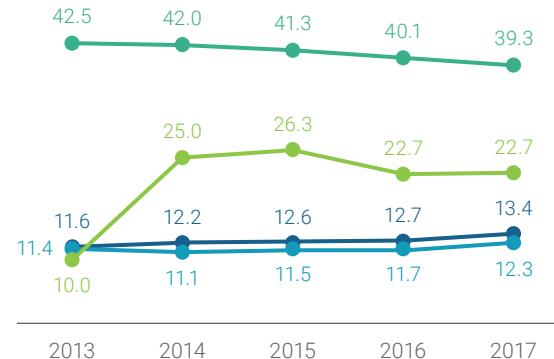
### Female Workers

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

Unit: %



● Female Share of Total Workforce

● Females in Management Positions

● Females in Top Management Positions

● Females in Junior Management Positions

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 exposure 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.

### New Hires in TSMC

Unit: numbers



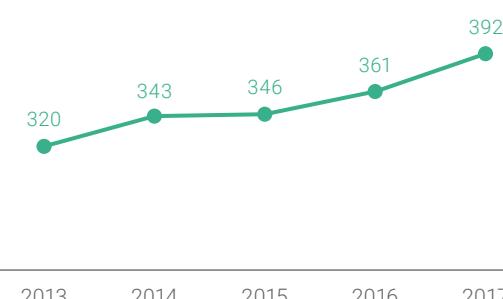
### Overseas New Hires in TSMC

Unit: numbers



### Disabled Workers Hired in TSMC

Unit: numbers



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

## 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.

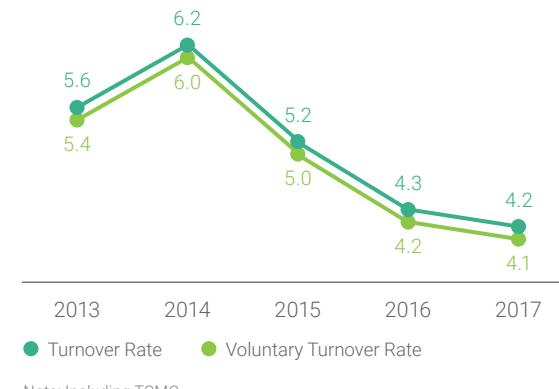
## Implement Internal Transfer Policy

### 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.

## 2013-2017 TSMC's Turnover Rate

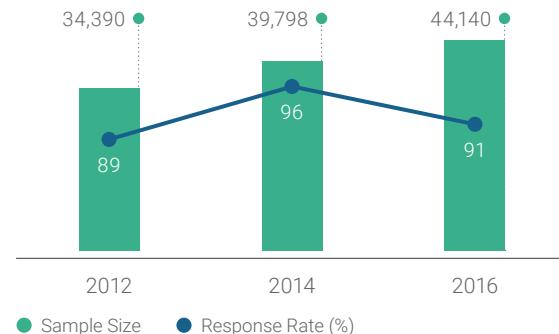
Unit: %



Note: Including TSMC

## TSMC Core Value Survey

### Core Value Survey Sample Size and Response Rate



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

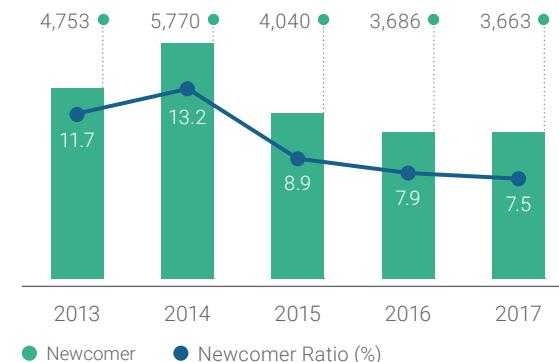
### Core Value Survey Scores<sup>Note</sup>

Unit: score



## 2013-2017 TSMC's Newcomer Ratio

Unit: number



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<sup>Note</sup> 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%.

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

### 2017 Salary Increase and Bonus

Salary Increase	Bonus
<ul style="list-style-type: none"> <li>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.</li> <li>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 for employees in TSMC's subsidiary VisEra was 3%. 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</li> </ul>	<ul style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>The profit sharing bonus of NT\$ 23,019,082,000 to be distributed in July 2018 to encourage our employees' continuous contribution.</li> <li>In 2017, TSMC employees' compensation and benefits which includes salary, allowance, cash bonus, profit sharing bonus, pension expenses and benefit programs was NT\$ 104,130,099,000</li> </ul>

## 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.

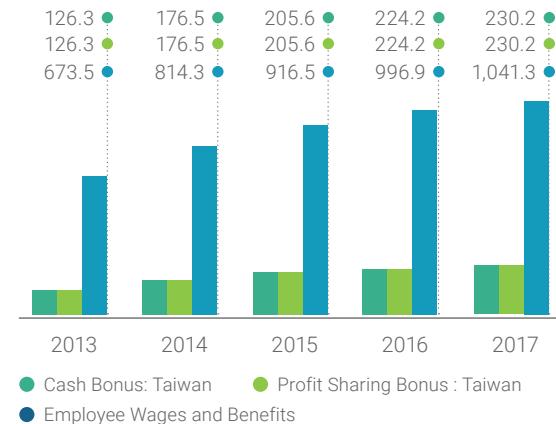
TSMC achieved record-high operational performance and profit in 2017. The total amount of employees' cash bonus

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 month's employees' cash bonus and profit sharing bonus which is above the average of industry peers.

### Employees' Compensation and Benefits

Unit: hundred million



Note: Employee wages and benefits mainly are salary, allowance, cash bonus, profit sharing bonus, pension expenses and benefit programs

# 1.4%

The number of newborns of TSMC employees was 2,664 in 2017, equal to 1.4% of the newborns in Taiwan

## 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

Item	Labor Law	Practices in TSMC fabs in Taiwan
Holiday	12 national holidays per year	<ul style="list-style-type: none"> <li>TSMC holidays include 12 national holidays in accordance with the Labor Standards Act and 7 additional memorial days</li> </ul>
Annual Leave	3 days for 6-month service in the first year	<ul style="list-style-type: none"> <li>1 day for each 2-month service in the first year to look after new hired employees' leave requirements</li> </ul>
Sick Leave	30 days of half-paid sick leave per year	<ul style="list-style-type: none"> <li>120 hours fully-paid and 120 hours half-paid sick leave per year</li> </ul>
Personal-affairs Leave	14 days of personal-affairs leave per year	<ul style="list-style-type: none"> <li>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</li> </ul>
Insurance Plan	Employee shall be insured by Labor and National Health Insurance eligible for their statutory benefits from the first day they come on board	<ul style="list-style-type: none"> <li>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.</li> <li>The coverage will be extended without charge to employees in leave of absence for the purpose identified by labor law.</li> <li>VisEra provides group insurance coverage to employee's 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</li> </ul>

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

## Newborns of TSMC Employees in Taiwan

Unit: numbers



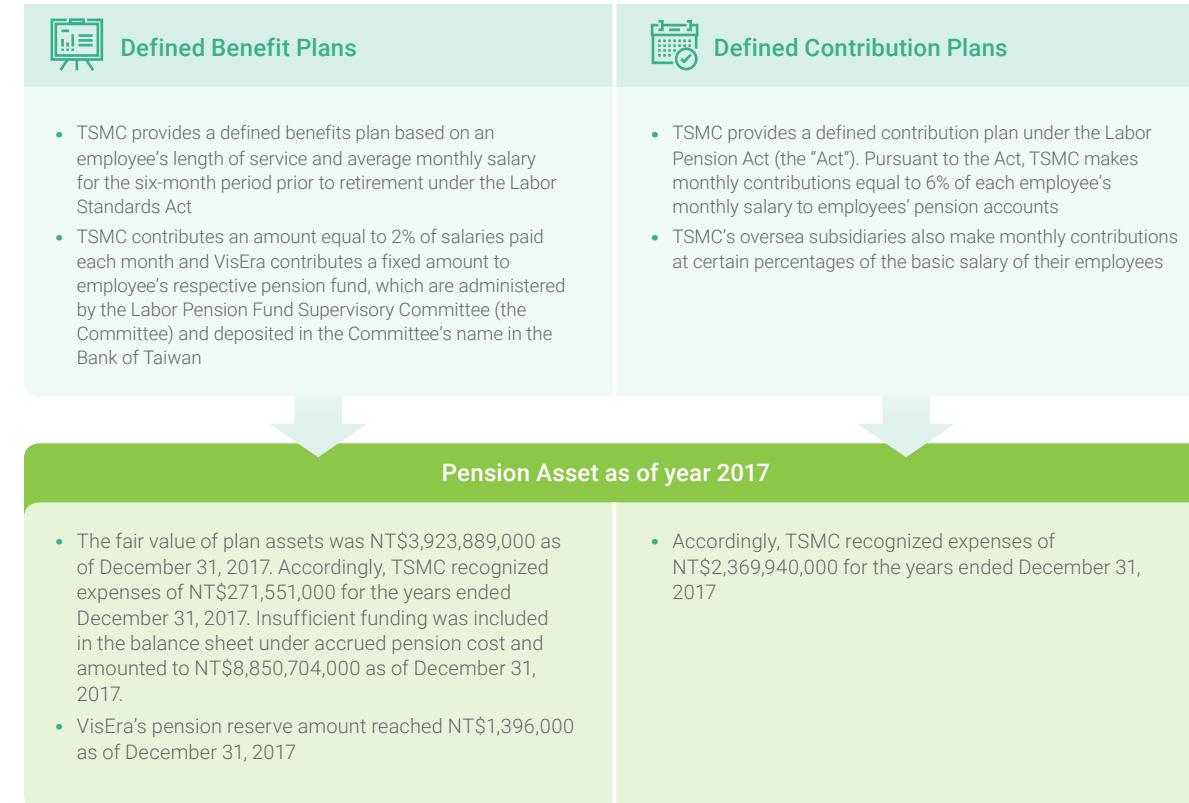
**2017 Number of Employees Who Took Parental Leave of Absence, Return to Work Rate and Retention Rate<sup>Note</sup>**



### 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





## Tasks of 2018

Make the best use and advance selection tool to ensure recruitment quality

Implement internal transfer policy to achieve internal transfer ratio 100%

Provide employees with the compensation and benefits which are better than industry peers and statutory requirements to encourage employee's performance and development along with the growth of company's performance

### 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**

Region	Position	Male	Female
Taiwan	Manager	1.08	1
	Professional	1.04	1
China <small>Note</small>	Assistant Engineer/Clerical	0.92	1
	Technician	0.85	1
China	Manager	1.04	1
	Professional	1.15	1
Japan	Assistant Engineer/Clerical	1.06	1
	Technician	1.00	1
North America	Manager	1.75	1
	Professional	1.21	1
Europe	Manager	1.22	1
	Professional	1.37	1

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

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

Company	Position	Male	Female
VisEra	Manager	1.28	1
	Professional	1.13	1
WaferTech	Assistant Engineer/Clerical	1.12	1
	Technician	0.95	1
WaferTech	Manager	1.25	1
	Professional	1.23	1
WaferTech	Assistant Engineer/Clerical	1.11	1
	Technician	0.93	1

### 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

**Strategies****TSMC 2020/2025 Goals**

Achievements &amp; Targets

**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

Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets

<b>5~10%</b> <b>CAGR in Revenue Per Headcount</b>	<b>10~15%</b> <b>CAGR in Profit Per Headcount</b>
 Target: Based on organizational needs, implement organizational and talent development projects to enhance working effectiveness	 Target: Based on organizational needs, implement organizational and talent development projects to enhance working effectiveness
<b>92%</b> <b>Completion rate of pre-training for Taiwan assignees</b>	 Increase the percentage of self-directed leaning mechanism to 50% in organizational learning or development programs
<b>63.4%</b> <b>Percentage of open positions filled by internal candidates</b>	 100% support the training for employees of the new sites to achieve the missions of plant set-up, machine installation, or mass production
 Target: 63%	 Increase the percentage of open positions filled by internal candidates via JOS or promotion to 64%



# 640,000 hours

In 2017, TSMC provided nearly 640,000 hours of training and a total of nearly 550,000 attendees participated. We spent over NT\$64 million on the learning and development for employees.

## 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

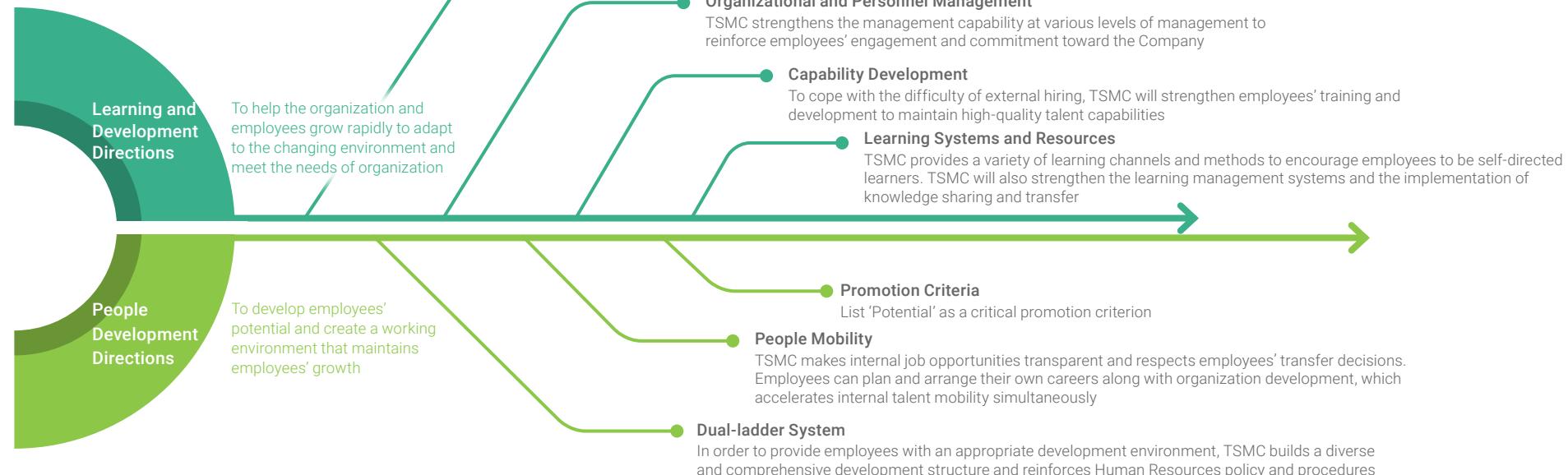
Employee's learning and development is an integral and critical factor for the growth of a company, and it should be 'goal-oriented, planned and disciplined'. TSMC is committed to cultivating a continuous and diverse learning environment, and established 'TSMC Employee Training and Education Procedure' 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<sup>Note</sup>, 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

## Direction of Talent Development







## 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 got ready in time and stated 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



##### Training Effectiveness

Completion rate: 92%  
ROI: 91 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



##### 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



## Tasks of 2018

People Management Capability Enhancement for First-line Manager

Enhance organizational and people effectiveness with Organizational and Talent Development Project

Execute training for employees located at Fab 18 in Tainan

### 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%.

### 2013-2017 Percentage of Open Positions Filled by Internal Candidates

Unit: %



### 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

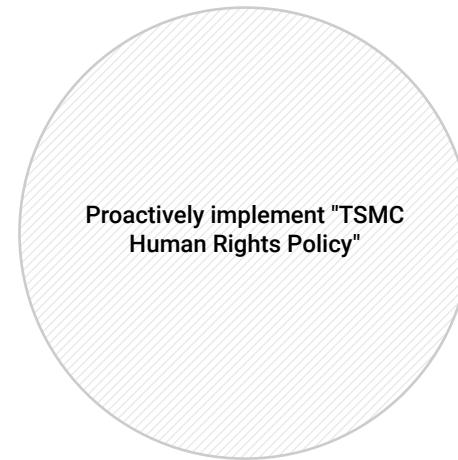
## Material Issue

## Human Rights

Strategies

TSMC 2020/2025 Goals

Achievements &amp; Targets



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



Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets

**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

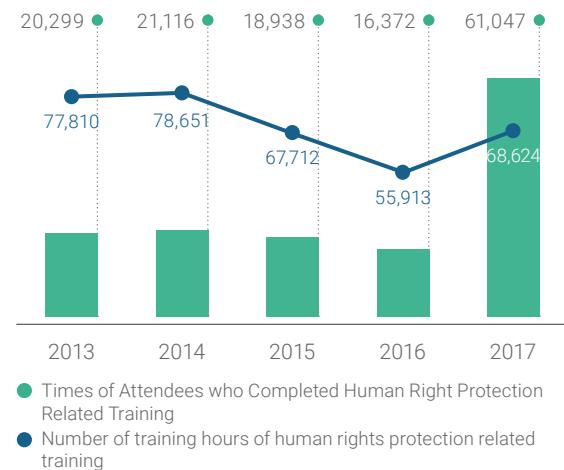
Provide a Safe and Healthy Work Environment	Eradicate Discrimination to Ensure Equal Employment Opportunity	Forbid Child Labor	Eliminate Forced Labor	Promote Employee Physical and Mental Health and Work-life Balance	
<p><b>Provide a Safe and Healthy Work Environment</b></p> <ul style="list-style-type: none"> <li>Set "zero accident" as safety and health goal</li> <li>Adopt strict safety and health management procedures, maintain stringent standards for facility and hardware operations</li> <li>Conduct individual and group management by analysis of health examinations and occupational factors to prevent potential health risks</li> <li>Provide health promotion activities and employee assistance programs based on employee's needs to help them implement a healthy life style</li> </ul>	<p><b>Eradicate Discrimination to Ensure Equal Employment Opportunity</b></p> <ul style="list-style-type: none"> <li>Follow local government labor act, international norms and "TSMC Human Rights Policy" to implement the rules and regulations.</li> <li>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</li> <li>To conduct imperative adjustments according to the findings from internal control</li> </ul>	<p><b>Forbid Child Labor</b></p> <ul style="list-style-type: none"> <li>Complying with "TSMC Human Rights Policy", the Company amended and implemented &lt;TSMC Candidate Interview Process Control Instruction&gt;. TSMC only accepts applicants over the age of 18 and exam employments to avoid any omissions</li> </ul>	<p><b>Eliminate Forced Labor</b></p> <ul style="list-style-type: none"> <li>Adhere firmly to local regulations, internationally-recognized protocols and "TSMC Human Rights Policy", the Company has never forced involuntary labor from any person with menace of any penalty</li> </ul>	<p><b>Promote Employee Physical and Mental Health and Work-life Balance</b></p> <ul style="list-style-type: none"> <li>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 "work-life balance"</li> <li>The Company owns on-site day-care center to assist employees in need and provide counselling services</li> </ul>	
Work-induced cerebral and cardiovascular disease  49	From the very beginning, all application processes are handled accordingly to the law to avoid discrimination  0	From the very beginning, all application processes are handled accordingly to the law to eradicate child labor  0	0  0	All employees  0	Employees in need  We draw a lottery to provide services, employees who are not able to join day-care center will be provided additional advice

## 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

Unit: Times of attendees



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

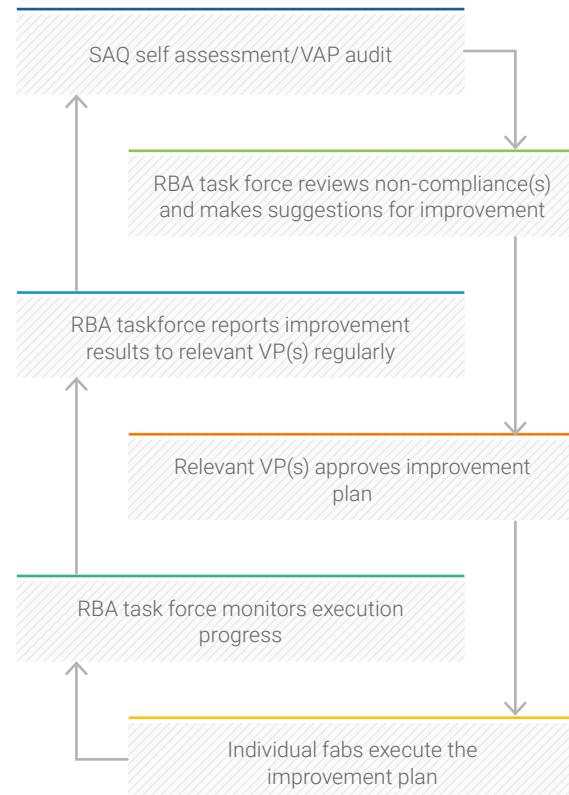
Help employees understand what is bullying in the workplace, and know how to avoid bullying behaviors, so as to jointly create a friendly working environment with zero bullying.



#### 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



### Risk Assessment in 2017

SAQ Full Score is 100

● Low Risk ≥85

● Medium Risk ≥65 &amp; &lt;85

● High Risk &lt;65

VAP Full Score is 200

#### VAP audit completed in 2017

Taiwan	Fab 2	SAQ <b>92.6</b>	VAP <b>200</b>
	Fab 5	SAQ <b>92.6</b>	VAP <b>200</b>
	Fab 12B	SAQ <b>92.6</b>	VAP <b>200</b>
	Fab 14B	SAQ <b>92.2</b>	VAP <b>200</b>
	Fab 15B	SAQ <b>91.8</b>	VAP <b>200</b>
China	TSMC (China)	SAQ <b>93.7</b>	VAP <b>200</b>
U.S.	WaferTech	SAQ <b>91.3</b>	VAP <b>200</b>

#### Advanced Backend Fab 1

SAQ  
**93.9**VAP  
**200**

#### Advanced Backend Fab 2

SAQ  
**93.7**VAP  
**200**

#### Advanced Backend Fab 3

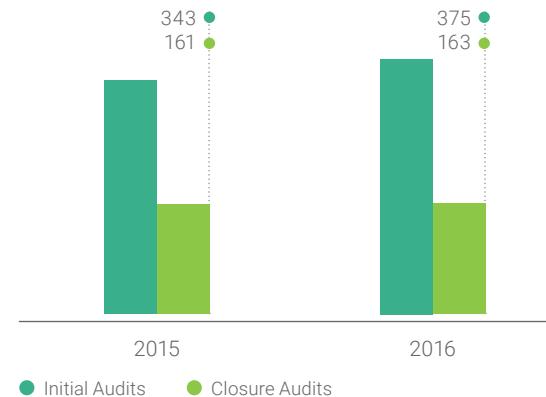
SAQ  
**93.8**VAP  
**200**

#### VAP audit completed in 2016

Corporate	SAQ <b>95.3</b>	VAP <b>200</b>
Fab 3	SAQ <b>92.9</b>	VAP <b>200</b>
Fab 6	SAQ <b>92.2</b>	VAP <b>200</b>
Fab 8	SAQ <b>92.5</b>	VAP <b>200</b>
Fab 12A	SAQ <b>92.6</b>	VAP <b>193.3</b>
Fab 14A	SAQ <b>92.2</b>	VAP <b>182.4</b>
Fab 15A	SAQ <b>92.6</b>	VAP <b>200</b>

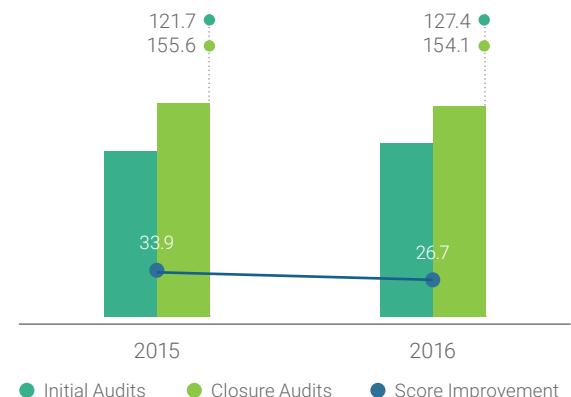
### RBA Worldwide VAP Audit Performed

Unit: number of audit



### RBA Worldwide Average VAP Audit Score

Unit: score





## Tasks of 2018

Continue to advocate sexual harassment prevention concept

Continue to promote e-Learning courses to reinforce the concept of ethics codes and create a friendly workplace

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 Meeting periodically<sup>Note</sup>, summarizes and publishes business updates, labor conditions, and employee welfare activities for employees.

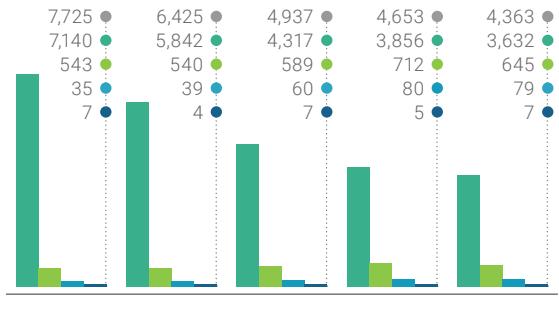
In 2017, there were 4,363 cases being raised through internal communication channels in Taiwan, including 7 sexual harassment cases from sexual harassment investigation committee, 79 cases via ombudsman system, 645 cases via employee opinion box, and 3,632 cases via fab caring circle. All these cases 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 new comers 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.

### 2013~2017 Number of Cases Raised through Internal Communication Channels

Unit: Number of cases



● Fab Caring Circle ● Employee Opinion Box ● Ombudsman System  
● Sexual Harassment Investigation Committee ● Total

### Employee Voice Channels



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

Note: Regulations for Implementing Labor-Management Meeting Article 3- The labor-management meeting shall be organized by equal number of representatives from both the labor and the management sides, each side shall have no less than 5 representatives as the business entity has more than 100 persons./ Article 18- The labor-management meeting shall be convened at least once every 3 months, if necessary an ad hoc meeting may be held

**Material Issue**

# Occupational Safety and Health

**Strategies****TSMC 2020/2025 Goals<sup>Note1</sup>**

Achievements &amp; Targets



- 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 <sup>Note2</sup> 2020
- Expect to reduce work-relative disabling severity rate to 2.39 <sup>Note2</sup> 2020



- Expect the Self-help participation rate of health programs to be equal to or greater than 54% <sup>Note3</sup> 2020



- Expected completion rate for coaching and conducting audits to high risk suppliers to 100% <sup>Note4</sup> 2020

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

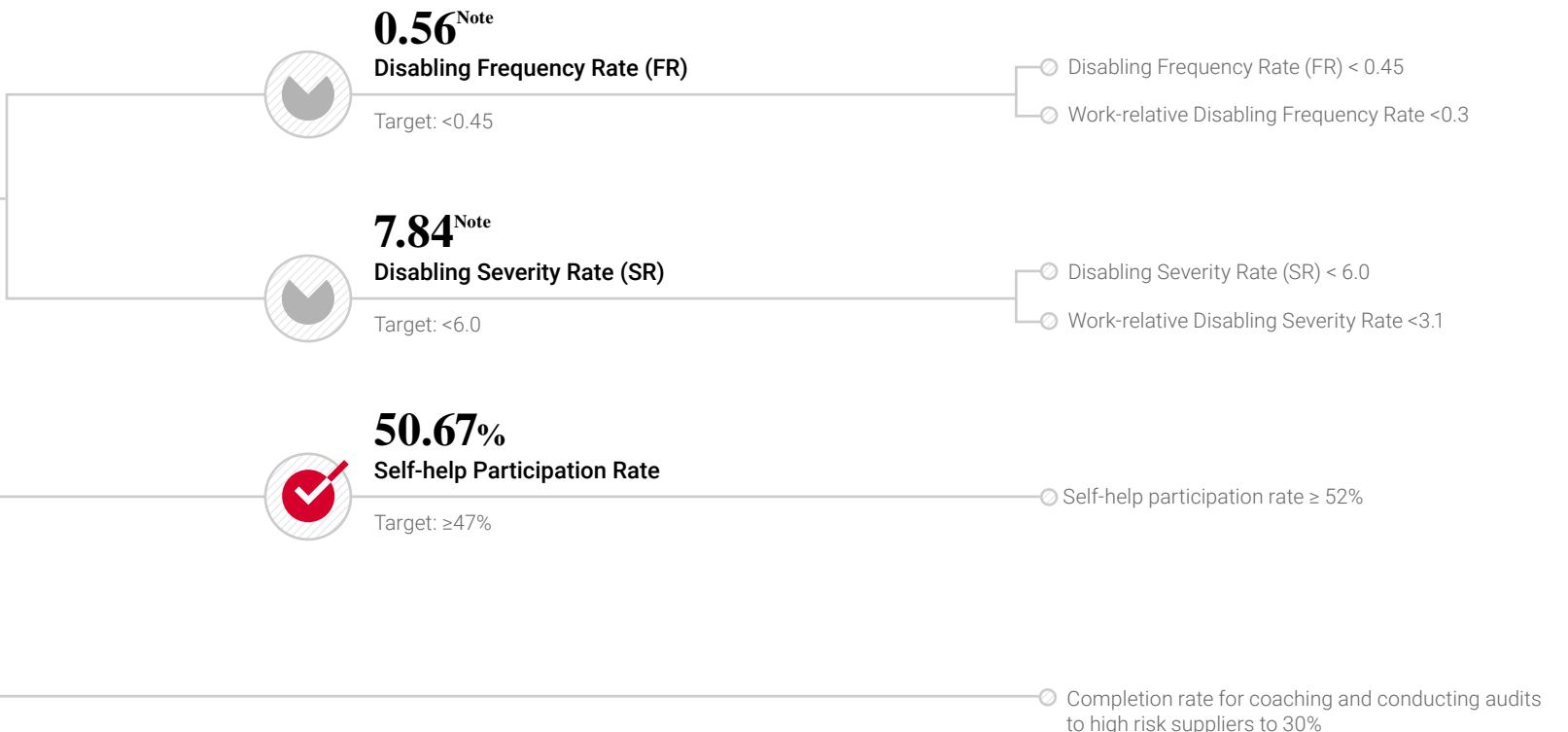
Note 3: Set the "Self-help participation rate of health programs" as a key performance index of participation and effectiveness from employee's attendance of non-mandatory health programs, which may include some overlaps in participation

Note 4: Renew target setting. Regarding safety and health management system of high-risk operation supplier, we will reduce the risk of workplace safety and health through counseling and auditing, and enhance the industrial safety working environment

Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets



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.



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

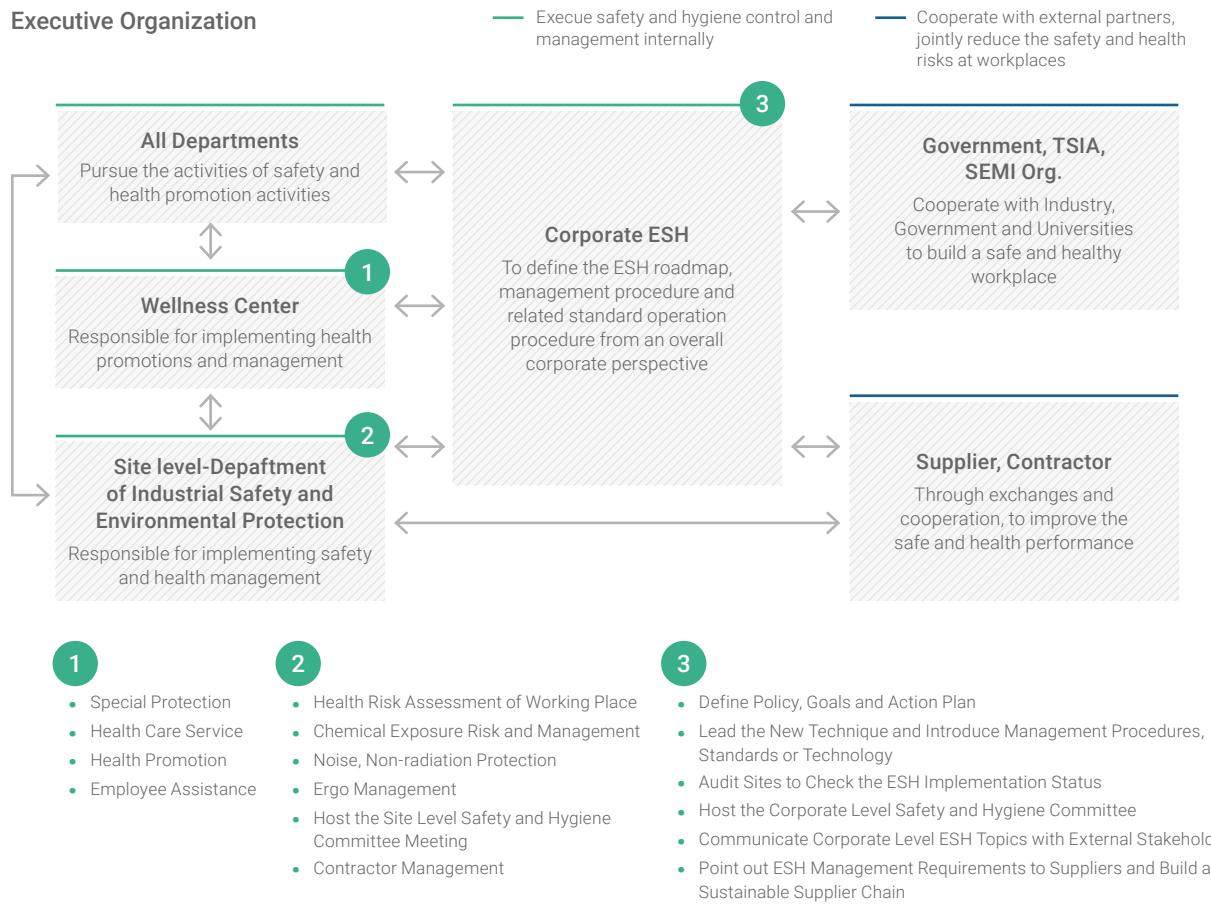
The standard procedures are established in accordance with the Occupational Safety and Health Act, as well as the requirements of the Occupational Health and Safety Assessment Series (OHSAS-18001), with reference to advanced domestic and international safety and health practices. The occurrence of errors 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 synchronically 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

Active Items	Passive Items
<ul style="list-style-type: none"> <li>• Numbers of safety management of change</li> <li>• Numbers of safety and health executing program</li> <li>• Numbers of safety and health licenses</li> <li>• Numbers of safety and health promotion activity</li> </ul>	<ul style="list-style-type: none"> <li>• Numbers of incident</li> <li>• Numbers of proactive audit defects</li> <li>• Completed rate of regulation identification</li> <li>• Internal and external defect rates of safety and health</li> <li>• Contractor management (Include the numbers of inspection audit defect, proactive audit defect, notify abnormal case to site ISEP proactively, proactive improvement)</li> </ul>

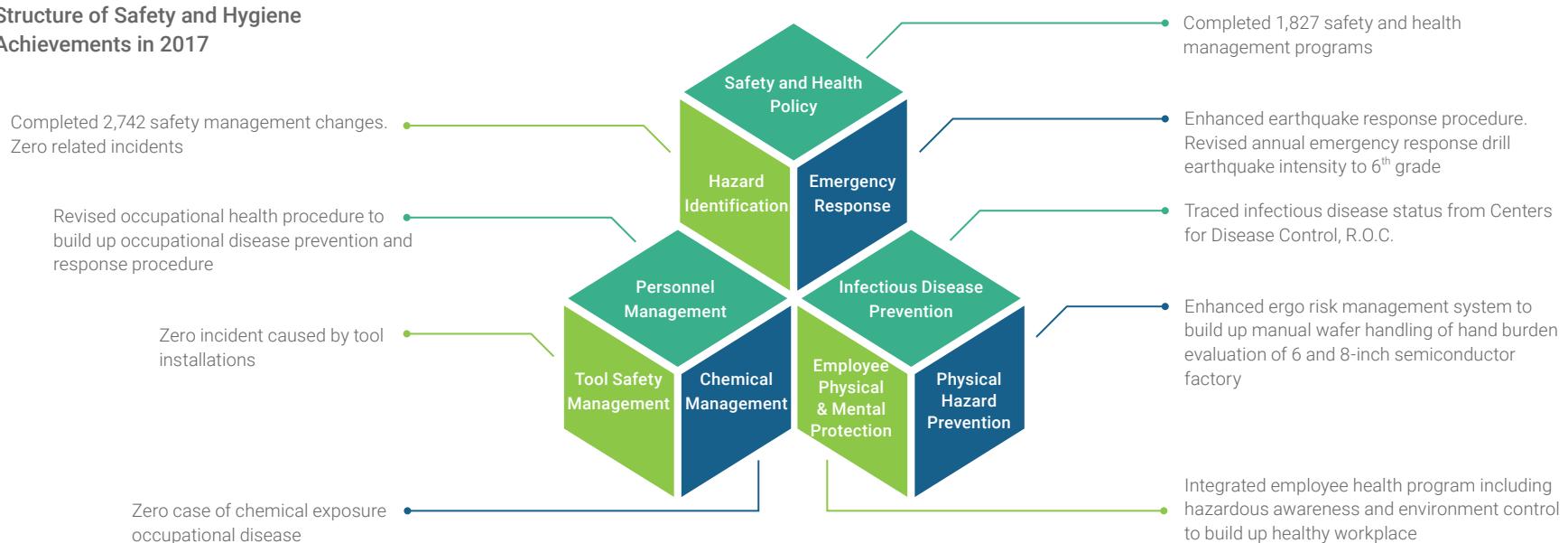
### Sample of Four-Level Lights

SPI	Performance	Color
$SPI \geq 95$	Excellent	●
$85 \leq SPI < 95$	Good	●
$70 \leq SPI < 85$	Warning	○
$SPI < 70$	Alarm	●

### SPI Four-Level Lights Ratio



### Structure of Safety and Hygiene Achievements in 2017



## 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-relative 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<sup>Note</sup>.

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)

Types of occupational injuries	Male		Female		Total	
	Total working hours yearly: 50,557,053 hours	Loss day	Total working hours yearly: 31,558,154 hours	Loss day	Total working hours yearly: 82,115,207 hours	Loss day
Work-relative	Musculoskeletal injury	12	1	140	1	152
	Injuries caused by falling objects	3	1	13	2	16
	Cut/incision/abrasion/puncture wounds	17	1	5	1	22
	Pinch point and entanglement injuries	23	4	0	0	23
	Injuries caused by a bump	2	1	10	6	12
	Injuries caused by a fall	0	0	48	9	48
	Others	0	0	12	2	12
Non-work-relative	Sports injuries	262	3	0	0	262
	Traffic accidents occurred inside plants	0	0	29	2	29
	Injuries caused by a fall	11	4	57	6	68
<b>Total</b>		330	15	314	29	644
						44

Types	Explanation on disabling injuries suffered by employees	Loss day
Work-relative	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	141
	Sprain of left ankle due to participation in a running race at a sporting event	165
Non-work-relative	A bone fracture due to a fall when running in a race at a sporting event	42
	A bone fracture due to a fall when participating in the Windy City Cup Basketball Tournament	55
	Falling off a scooter due to skidding when riding through a ditch cover inside a plant on a rainy day	28



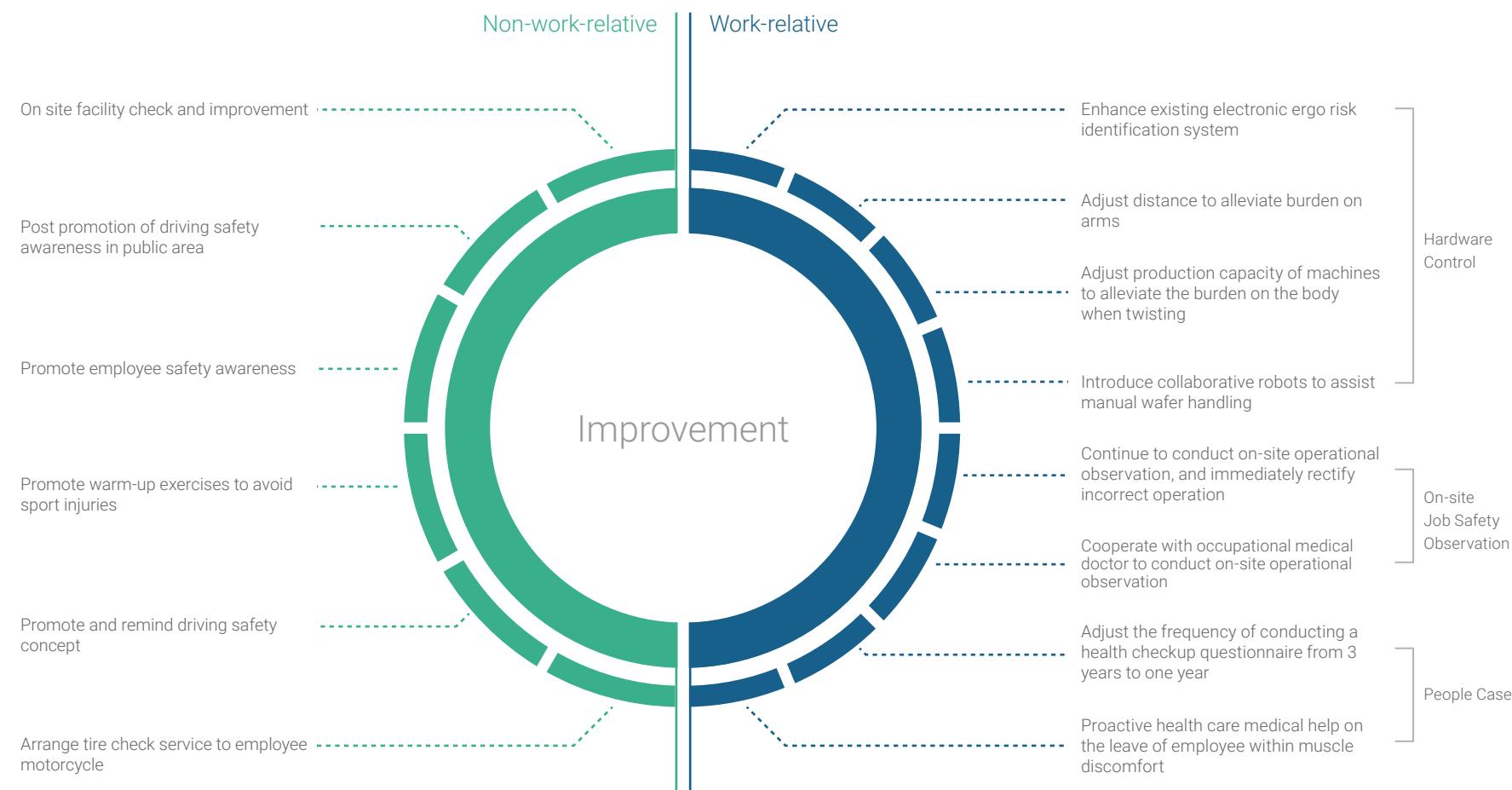
Arrange tire check service to employee motorcycle



Adjust production capacity of machines to alleviate the burden on the body when twisting

## 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.





Collaborative robot replaces wafer manual handling by employees



## Case Study

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

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 wafer. Due to limited space, our 6-inch and 8-Inch factories introduce collaborative robot instead of installing AMHS.

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

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

2016

2017

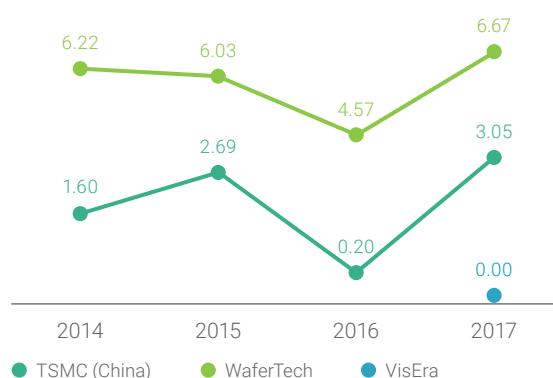
2018

Risks	TSMC Safety Practice
 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 1973 and UN 38.3 standards to prevent the occurrence of fire

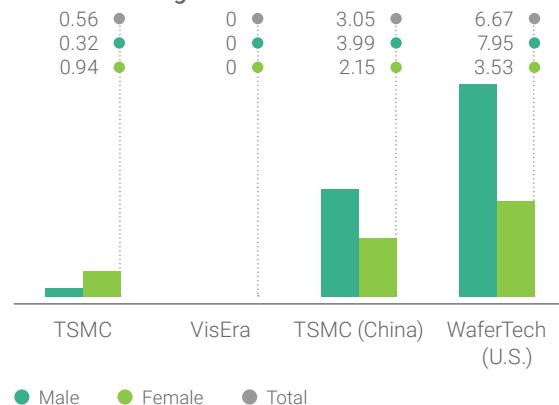
TSMC Taiwan Disabling Injury Data



TSMC Subsidiaries Disabling Injury Data



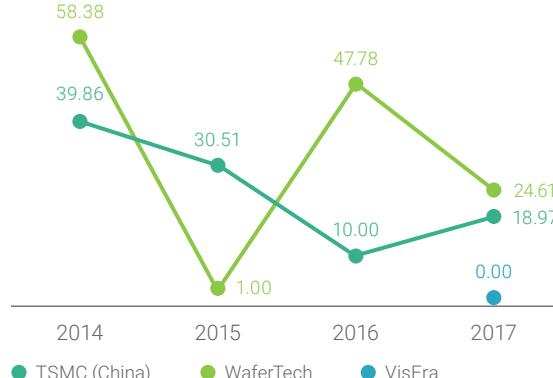
Disabling Frequency Rate (FR) of TSMCfabs by Gender and Region in 2017



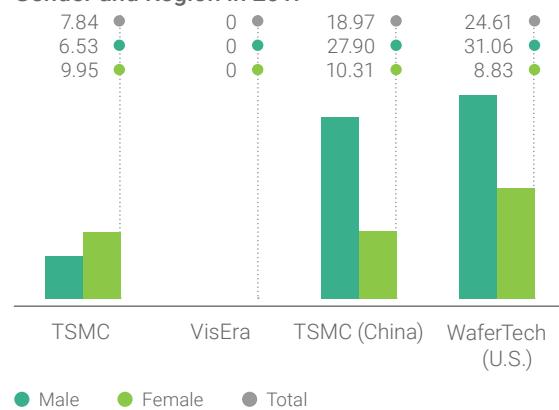
TSMC Taiwan Disabling Severity Rate



TSMC Subsidiaries Disabling Severity Rate



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



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



Annual Fire-Fighting Training: Wearing fire protection equipment to fight the fire accident



Annual Emergency Response Drill: Wearing Class A protective clothing to handle chemical leakage events

### 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.

Items	2017
Disabling Frequency Rate	0.026
Injury Severity Rate	1.576

### 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.

### Employee and Contractor Safety and Health Related Training

Note 1 & 2

✓ Meets regulatory requirements    ↗ Exceeds regulatory requirements

Identity	Training Course	Persons in 2015	Persons in 2016	Persons in 2017	Regulatory Item
On-duty	New Hired	General Safety and Health Training	3,430	3,361	3,023 <span style="color: green;">✓</span>
		Safety and Health Training for New Promoted Manager	310	197	207 <span style="color: green;">✓</span>
		Monthly Safety and Health Promotion	60,243	40,319	50,178 <span style="color: green;">↗</span>
		Annual Department/Division Safety and Health Training	12,651	9,086	10,028 <span style="color: green;">✓</span>
		Annual Fire-Fighting Training	18,529	14,130	20,929 <span style="color: green;">✓</span>
		Annual Evacuation Drill	22,916	25,624	27,549 <span style="color: green;">✓</span>
		Occupational Diseases Prevention and Response Procedure Training (2017 new created)	--	--	30 <span style="color: green;">↗</span>
Employees		Emergency Response Training	3,861	8,631	2,039 <span style="color: green;">↗</span>
		IC Commander Training	2,378	2,683	1,410 <span style="color: green;">↗</span>
		First-aid Personnel Training	4,461	4,478	4,338 <span style="color: green;">✓</span>
		External Fire-fighting Training	296	1,031	821 <span style="color: green;">↗</span>
		Quarterly Emergency Response Drill	8,202	9,230	13,462 <span style="color: green;">↗</span>
		Annual Emergency Response Drill	820	1,628	1,348 <span style="color: green;">↗</span>
		General Safety and Health Training	16,242	21,370	15,708 <span style="color: green;">✓</span>
Contractors	New	Personal protective Equipment Training for contractors whom located at TSMC and have chemical exposure risk	1,998	2,608	1,891 <span style="color: green;">↗</span>
		Annual Emergency Response Drill for contractors whom located at TSMC and have chemical exposure risk	124	205	778 <span style="color: green;">✓</span>

Note 1: The reason for the decline in the number of employee training courses in 2017 was that a large number of employees from Nanjing factory was back to Taiwan to receive training in safety and health before the launch of the Nanjing in 2016

Note 2: The reason for the decline in the number of contractor training course was that TSMC began to comprehensively promote the contractor training program, resulting in a higher number of participants in the training year



Kick-off Meeting of "Employee Health Management" Program

## 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"

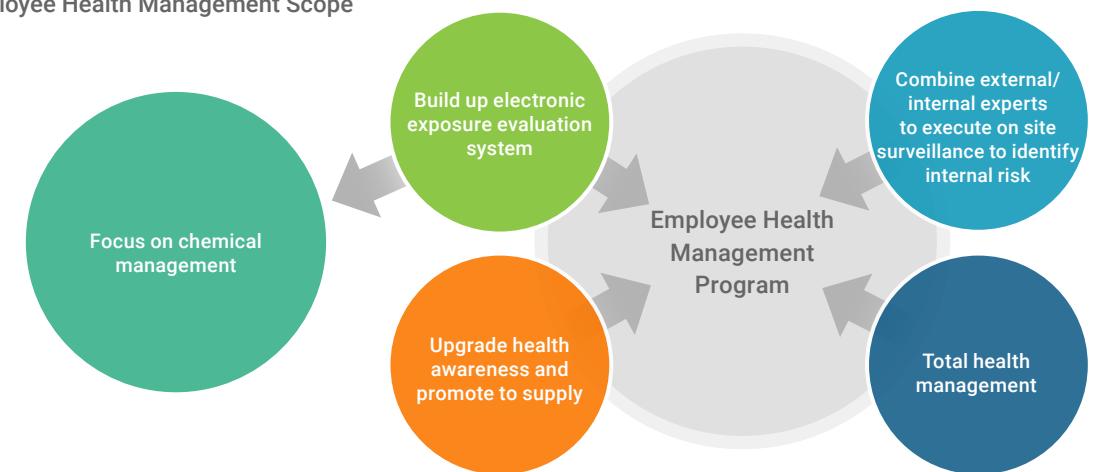
TSMC continues to improve its management of chemicals; it manages and controls all of its chemicals with standards that are superior to those specified in laws and regulations. Its objective is to maintain its excellent record of zero occupational diseases associated with exposure to chemical contaminants.

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.

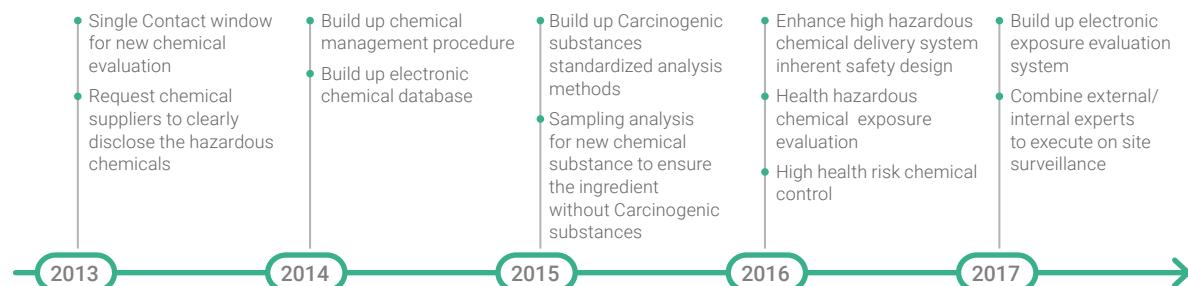
In 2017, TSMC integrated the electronic data bases including chemical, working environment measurements, and similar exposure group to build up the first Semiconductor Industrial "E-Exposure Assessment System". The E-Exposure Assessment System can streamline the hazardous chemicals and employees who 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

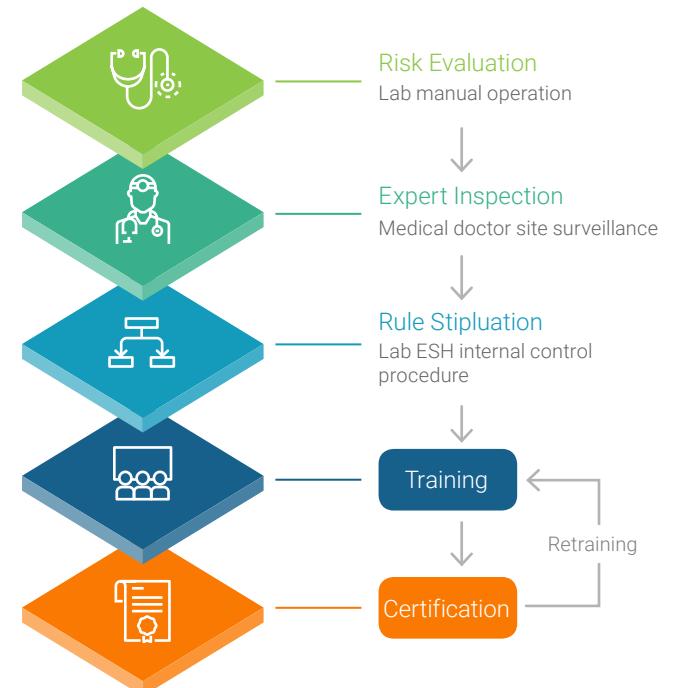


### Chemical Management Procedure



### 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.



## Occupational Diseases Prevention Training and Promotion

### Care First Training

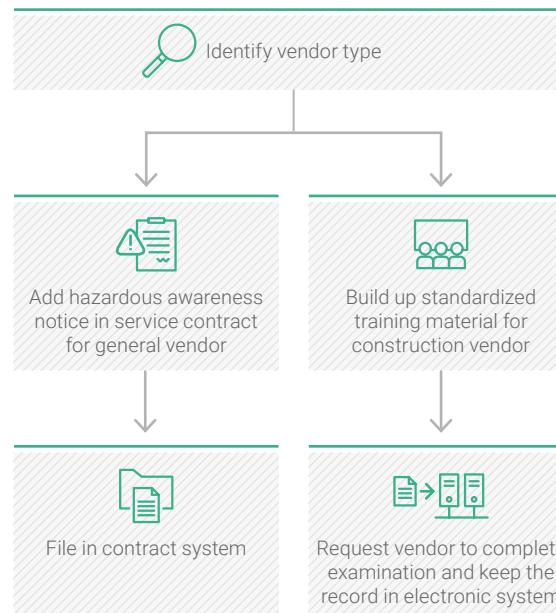
In the Health Management Project, reinforcing employees' concept of health risks is an important step in the improvement of internal risks. Enabling employees and managers to clearly understand the potential risks associated with the semiconductor manufacturing process environment and their effects on 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.

Target Training Audience	Training Content
 General and newly recruited employees	<ul style="list-style-type: none"> <li>A general concept of safety and health</li> <li>Introduction to work environment</li> <li>Timing for delivering emergency evacuation alerts</li> </ul>
 Employees who run the risk of being exposed to chemicals or radiation	<ul style="list-style-type: none"> <li>Potential exposure risks in the work environment</li> <li>Personal protection and environmental monitoring</li> <li>Potential injuries caused by exposure to chemicals or radiation</li> <li>Emergency response drills</li> </ul>
 Supervisors working in high risk areas	<ul style="list-style-type: none"> <li>Caring for employees</li> <li>Potential health risk factors of the semiconductor industry</li> <li>Prevention of occupational diseases</li> <li>Crisis response</li> </ul>



## 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.

# 100%

The completion rate of health examination for special task workers reached 100%

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.



For more details, please refer to our website "[TSMC and OSHA Cooperate to Improve Supply Chain Occupational Health](#)"

## 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,



## Special Protection Programs



### Special Health Examinations and Management

Special task workers



### 2017 Achievements

- 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%

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

## Work-induced Cerebral and Cardiovascular Disease Prevention and Management



The middle and high risk groups

- 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

## Maternal Health Protection and Management



Female workers who are pregnant or postpartum within one year

- 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



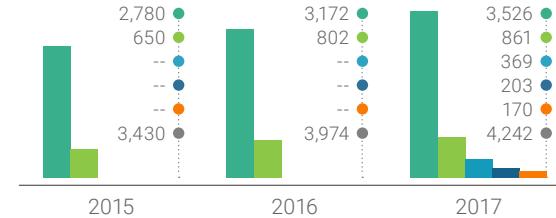
The high risk group who were suffered muscle pain and took more than 4 days off for it

- 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

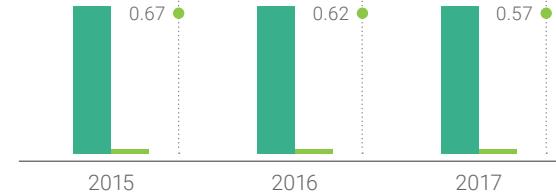
## Visits of Special Health Examination

Unit: number of visit



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

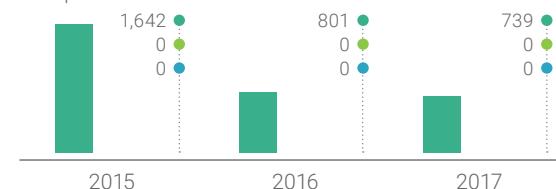
Unit: %



Note: 0.57% of 33,540 employees of TSMC Taiwan and VisEra were identified to be in the middle or high risk group

## Person-times of Maternal Health Protection and Management

Unit: person-times



Note: The data consists of TSMC Taiwan and VisEra in 2017

# 37,973 attendees

37,973 attendees received health care services 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



### 2017 Achievements

- ✓ 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

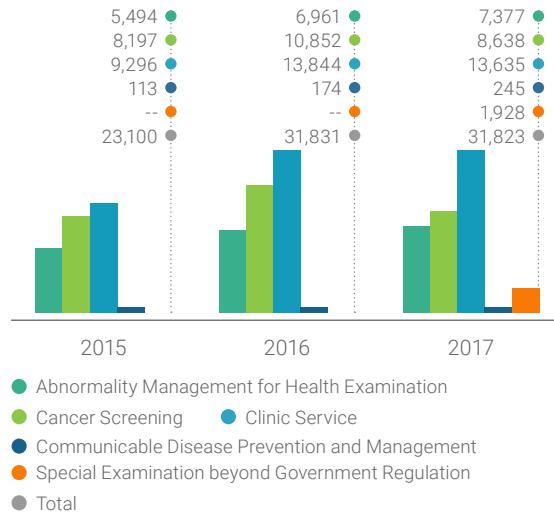
Special workplace

- 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

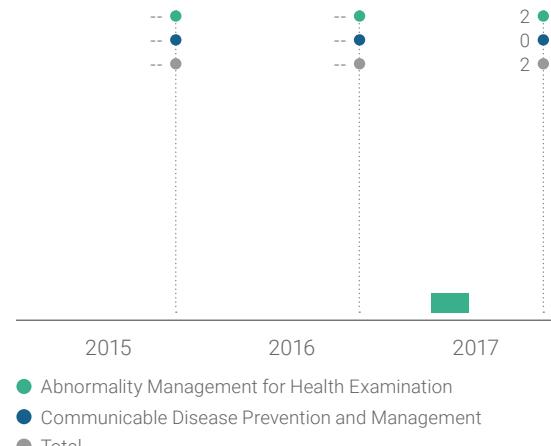
### Attendance of Health Care Service: Taiwan Sites

Unit: number of people



### Attendance of Health Care Service: TSMC (Nanjing)

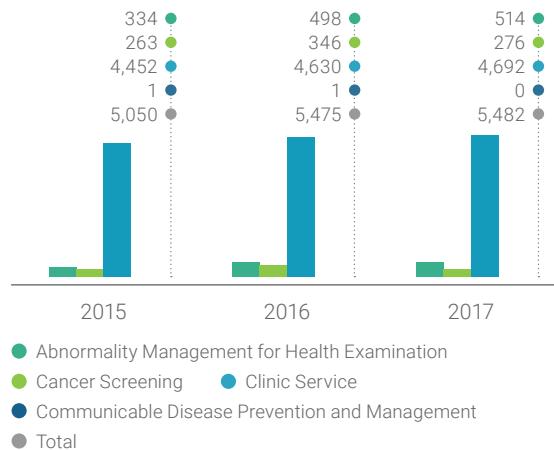
Unit: number of people



Note: The statistics for TSMC (Nanjing) starts from 2017

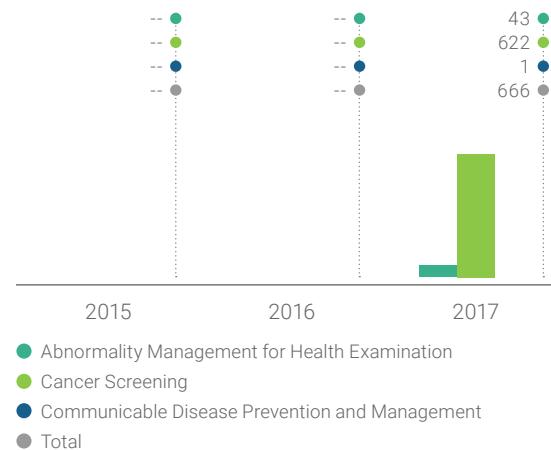
### Attendance of Health Care Service: TSMC (China)

Unit: number of people



### Attendance of Health Care Service: VisEra

Unit: number of people



Note: The statistics for VisEra starts from 2017

## 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  $\geq 24$  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<sup>Note</sup>

● Participate   ● Do Not Participate

#### Total Cholesterol

2016	2017
• 196.64	• 192.84
• 197.60	• 197.00

#### High-density Lipoprotein

2016	2017
• 47.74	• 48.15
• 47.85	• 47.88

#### Low-density Lipoprotein

2016	2017
• 128.36	• 126.68
• 127.26	• 129.13

#### Triglyceride

2016	2017
• 136.75	• 132.00
• 137.75	• 139.71

#### Fasting Blood Glucose

2016	2017
• 96.02	• 94.36
• 96.16	• 95.01

#### Liver Function

2016	2017
• 35.59	• 34.26
• 35.77	• 38.41

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

### Health Promotion Programs



#### Infuse Lohas into Your Life



Employees who were suffered sleep disorder, smoking, and BMI > 24

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



#### 2017 Achievements



3,397 participants

- (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



Common health problem of employees

- Topics included health examination, stress adjustment, communication, chronic diseases, etc.



3,049 attendees

Taiwan especially provided 11 sessions of "understand your health check result" for 181 employees before annual health examination



#### Chiropractor Service



All employees

- Taiwan site: additional charge for on-site chiropractor service
- Shanghai site: provide free massage program to direct labors



8,207 participants



#### Sport Center/Gym



Employees and their family members

- Providing energy lessons such as flywheel, boxing, pilates, yoga, and swimming, etc. at fitness center and swimming pool



106,274 participants

Lecture of Chinese medicine





## Tasks of 2018

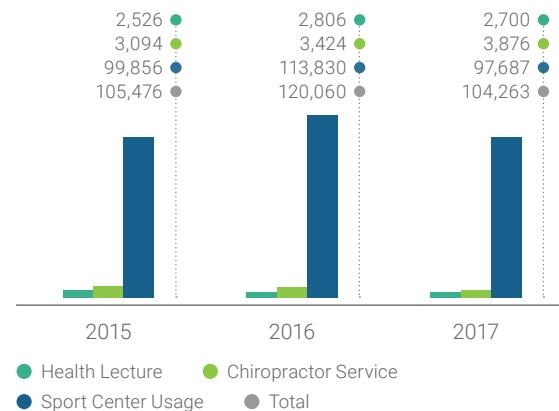
Identify risk and establish exposure assessment tool, arrange occupational medical experts to execute on site observation of 24 high risk areas, and occupational disease prevention training and promotion

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

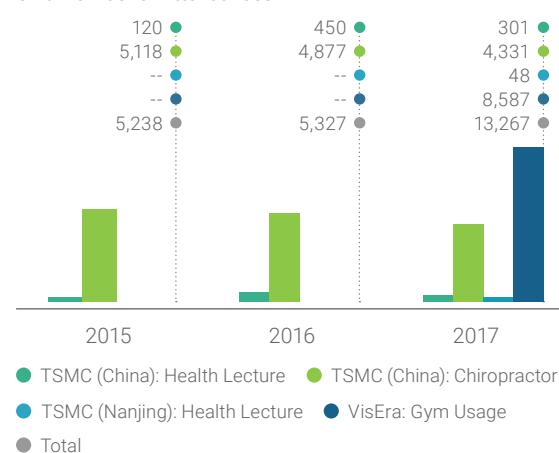
### Attendances of Health Promotion Service: Taiwan Sites

Unit: Number of Attendances



### Attendances of Health Promotion Service: TSMC (China), TSMC (Nanjing) and VisEra

Unit: Number of Attendances

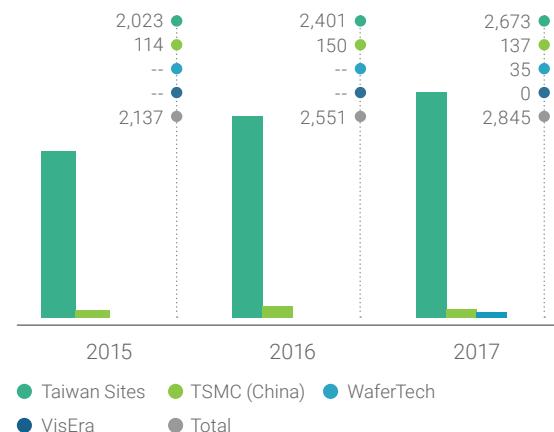


## Employee Assistance

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.

### Attendances of Employee Assistance

Unit: Number of Attendances



## Employee Assistance Programs



### External Counselling and Consultation Service

All employees

- On-site counselling and consultation provided by external professional institutes can be book through telephone or internet



### 2017 Achievements

- 1,869 participants, which has increased 249 person-times compared with 2016



### Internal Counselling and Consultation Service

Moderate to severe stress group

- 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

- 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



### How We Contributed (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.

# TSMC Education and Culture Foundation



## Strategies

## TSMC 2020/2025 Goals

Achievements & Targets

### Caring for the Educationally Disadvantaged

Narrowing the urban-rural gap in cooperation with in-system/out-system and different-sized educational institutions

- Continuously providing resources and cooperate with in-system and out-system educational institutions. Contribute not less than NT\$10 million per year 2020

### 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

- Continuously holding competitions of humanity and science with not less than 500 contestants in each 2020

### Promoting Arts and Culture

Continuously organizing grand arts festival at TSMC's site communities, Hsinchu, Taichung and Tainan, to cultivate young artists and to promote exquisite fine arts in the community

- Continuously organizing "Hsinchu Arts Festival" and sponsor at least five artists or teams in Taiwan per year 2020

Strategies &amp; 2020/2025 Goals

## 2017 Achievements

## 2018 Targets

**Collaborated with "Teach for Taiwan" to support young teachers going into rural areas**

Target: Add one more external educational partner

- Plan "mentor" program for the Rising Sun Scholarship. In addition to providing financial support, this program also gives guidance on learning and life activities

**452 (23.4% Growth)  
"TSMC Youth Calligraphy Contest" contestants**

Target: No less than 366 contestants (previous year)

**616<sup>Note</sup>  
"TSMC Youth Literature Award" articles**

Target: No less than 628 articles (previous year)

- The contestants of each contest are not less than those of the 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

- 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.



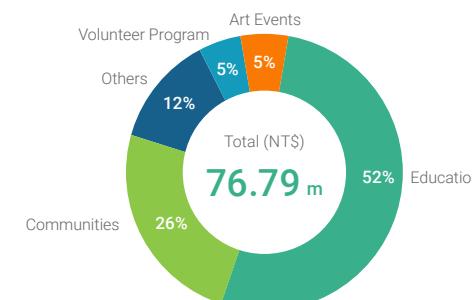
#### F.C. Tseng

Chairman, TSMC Education and Culture Foundation

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.

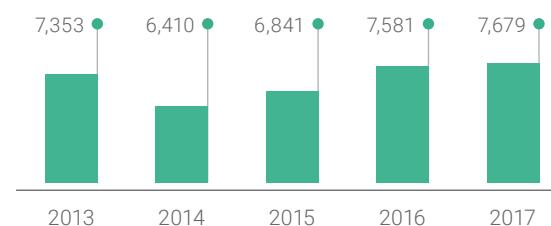
The TSMC Foundation established a website [www.tsmc-foundation.org](http://www.tsmc-foundation.org) to offer the public online lectures, activity information, and details of the Foundation's projects.

#### Sponsorship by the TSMC Education and Culture Foundation in 2017



#### Sponsorship by the TSMC Education and Culture Foundation in 2013~2017

Unit: NT\$ ten thousand



#### Caring for the Educationally Disadvantaged

#### Invest educational resources; eliminate urban-and-rural gap

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 firework.

**Cathy Ling** Secretary-general, CommonWealth Foundation



#### Supporting Youth with Multiple Educational Platforms

#### Build educational platforms; encourage the young to follow their dreams

It's the tenth year of "TSMC Youth Calligraphy and Seal-Carving Competition". Apart from offering a platform for young creators to exchange and learn from each other, we invite calligraphy and seal-carving masters all over Taiwan to participate in the event. Through feature reports in the newspapers, workshops and work exhibition, we bring the beauty of calligraphy to campus and everyday life.



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



#### Promoting Arts and Culture

#### Keep the traditional classical culture alive; improve spiritual life

Traditional theatres encompass profound humanistic foundation and historical contents and are the common cultural memories for a whole generation. Every year TSMC Hsinchu Arts Festival brings a series of exceptional arts and cultural performances and exhibitions to many audiences. The Arts Festival is dedicated to promoting traditional classical arts so that more people can experience the charms of the theatre.



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



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

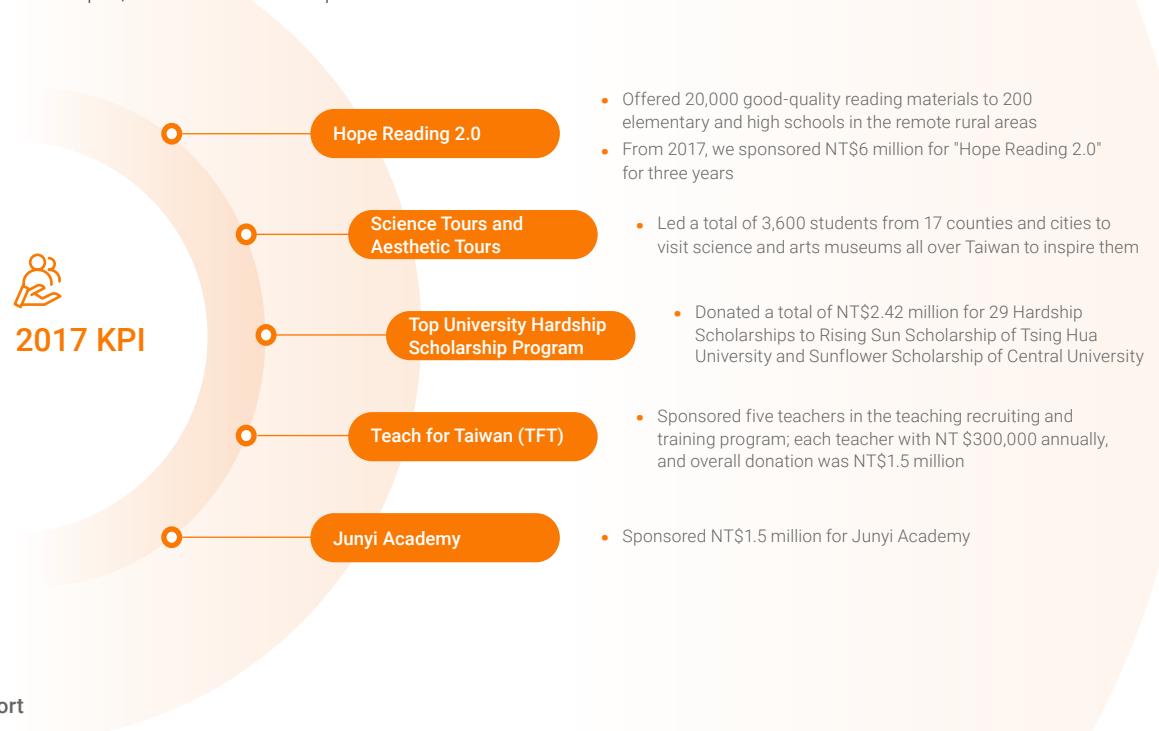
The 2012 Programme for International Student Assessment (PISA) report points out that Taiwan tops all economies and countries in the academic performance disparity between the top and lower bottom students, and the lower bottom students' performance are deeply affected by their socio-economic background. 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 reformative measures by the government, resources investing in the 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 "TSMC Aesthetic Tour" and "TSMC Science Tour" and financing the Boyo Social Welfare Foundation's after-school programs, Rising Sun Scholarship of Tsing Hua University and Sunflower Scholarship of Central University.

### 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 programming 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 knowledge is power. If the children learn to love reading and further to influence their family members, they can change the 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 enrollment 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

## Teach for Taiwan; Junyi Academy



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.

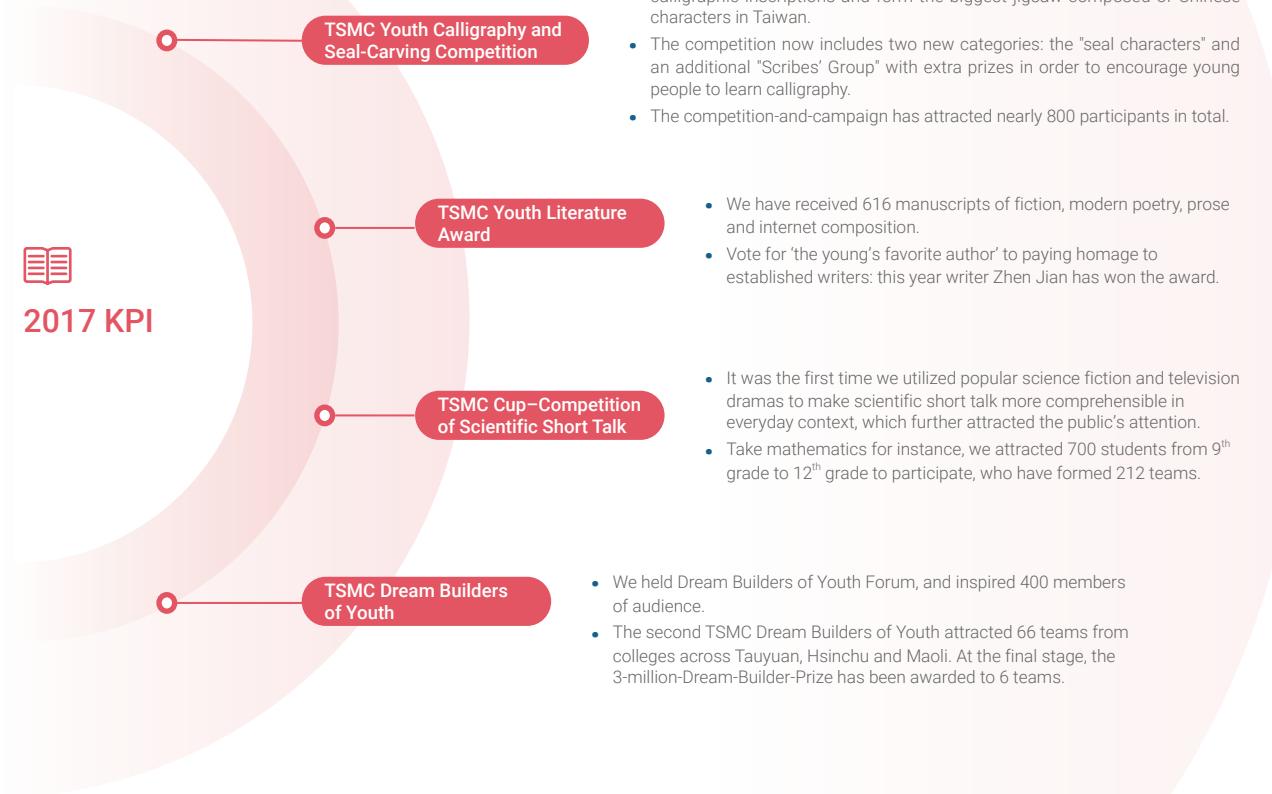
The TSMC Foundation supports the full-time teaching project proposed by "Teach for Taiwan". This project engages young people to devote themselves to teaching at elementary schools with teacher shortage in the remote rural areas and offers the recruits professional training and support system, channelling 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.



## 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



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.

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

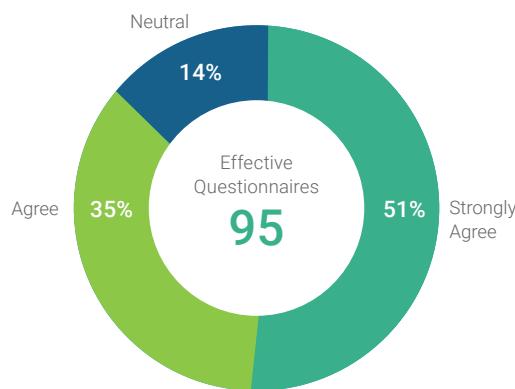
### "Arts and Culture Talents Cultivation Award" of Arts and Business Award of the Ministry of Culture: Achievements gleaned from TSMC Youth Calligraphy and Seal-Carving Competition and TSMC Youth Literature Award



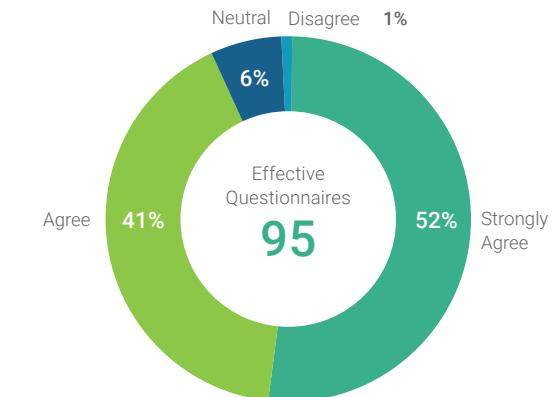
The TSMC Culture and Education Foundation is dedicated to the humanities education for the youth, and to keeping our traditional classical arts alive by running TSMC Youth Calligraphy and Seal-Carving Competition and TSMC Youth Literature Award for 10 and 14 years, respectively. The two awards provide young creators a platform and are decorated with the distinguished honor of 'Arts and Culture Talents Cultivation Award' of Arts and Business Award of the Ministry of Culture.

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?



### Does this lecture (topic, contents and inspiration) meet your expectation?



# TSMC Youth Calligraphy and Seal-Carving Competition

## The Tenth Anniversary of TSMC Youth Calligraphy and Seal-Carving Competition: Writing the Largest Chinese Character Together in Lukang

In 2017, the TSMC Youth Calligraphy and Seal-Carving Competition marked its tenth anniversary. This year we didn't follow the past's footprint: centring the competition and campaigns in Taipei and Kaohsiung 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.

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.





The Acceptance Speech from the 3rd Place Winner of the "Semi-Cursive Script Group" of the 10th TSMC Youth Calligraphy and Seal-Carving Competition

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, 12<sup>th</sup> Grader



I observe, I read and therefore I am

In early 2016, I happened to learn of the news of the 8<sup>th</sup> 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 excited me ... Here I enclose five photos which show that our military instructor at the 8<sup>th</sup> and the 9<sup>th</sup> 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**

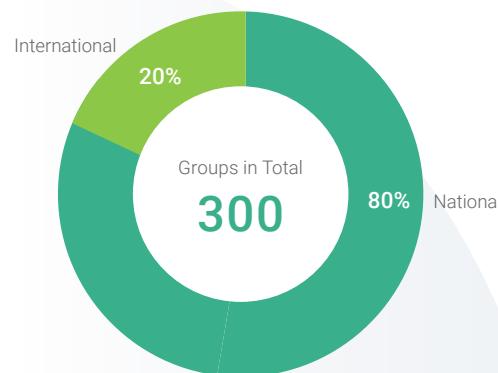
A Letter to F. C. Tseng, the chairman of TSMC Culture and Education Foundation (extract)

(The complete article is published in the National Defense Medical alumnus quarterly Long-running History (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.

### The Proportion of the TSMC Foundation's Sponsorship for National and International Arts and Culture Groups from 1998 to 2017



## 2017 KPI

### Sponsorship of Arts and Culture

- Sponsored 10 Taiwanese arts and culture groups

### Beautiful Performance of the Arts Festival

- This year's arts festival brought 35 beautiful performances to nearly 20,000 audiences

### Sponsoring Taiwan's Own Excellent Orchestra

- 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

### TSMC Lectures

- TSMC Lectures invited professor Thomas H. C. Lee to give the final talk on Western Civilization. A total of 630 people attended the talk

### Gathering Audience Feedback by Questionnaires

- Gathered questionnaire from the attending audience to evaluate if the arts and cultural events are tailored to meet the community's needs

## The 15<sup>th</sup> 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 15<sup>th</sup> 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

### Sparks on the Laurels: Nobel Prize in Literature



"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



"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.



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.



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.



## Tasks of 2018

Collaborate with educational institutions inside or out of the establishment; provide economic supports and academic guidance for underprivileged students

Continuously host diverse competitions, encourage the youth to pursue their dreams, and cultivate the scientific and aesthetic literacy in students

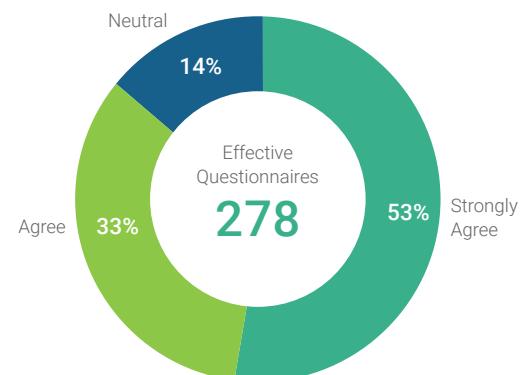
Host large-scale arts Festival in local community and provide platform for Taiwan's own excellent arts and culture groups

### TSMC Lectures: History of Western Civilization, the Final Chapter of the Trilogy

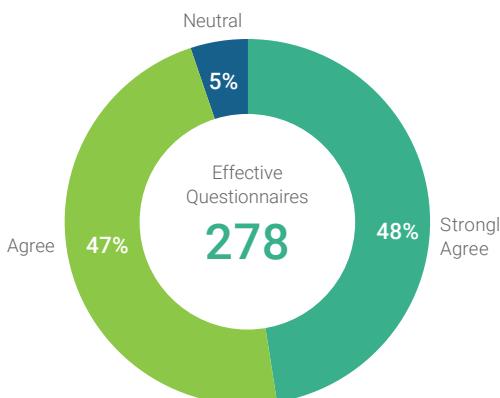
The TSMC Culture and Education Foundation has invited specialists in all fields to give various humanities talks in local communities. The topics of the talks encompass eastern and western music, history and philosophy. The "Western Civilisation Lectures", which started from 2004, invites retired Emeritus 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 18<sup>th</sup> century French salons where the local people can exchange thoughts at cafés.

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?

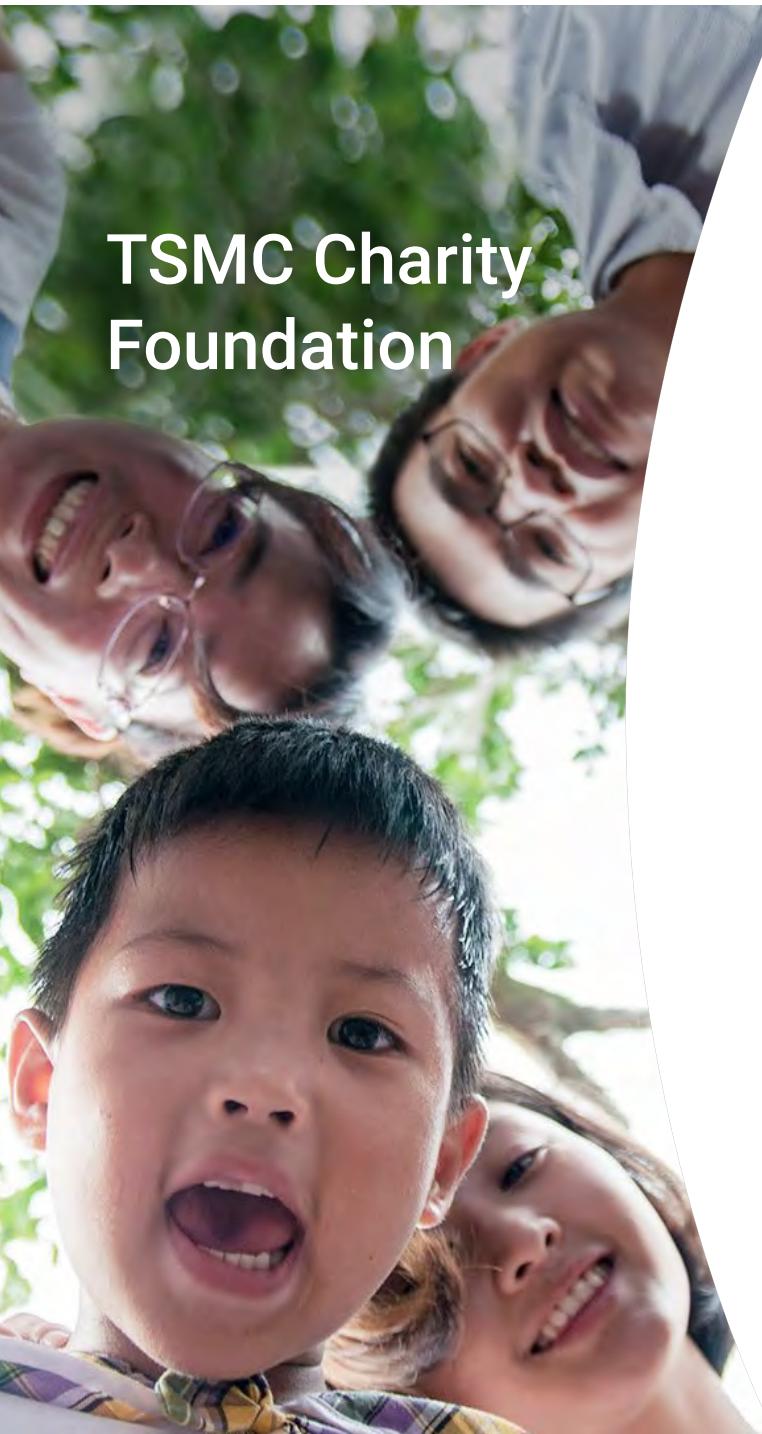


#### Does this lecture (topic, contents and inspiration) meet your expectation?



For more information, please visit our [website](#)

# TSMC Charity Foundation



## Strategies

## TSMC 2020/2025 Goals

Achievements & Targets

### 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 Disadvantaged

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]

## 2017 Achievements

## 2018 Targets

**7,200 person-time****Elder people who lived alone served through the Networking of Love**

Target: Serve 6,500 person-time



- Served 7,500 person-time elder people who live alone through the Networking of Love

**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



- Co-work with the Ministry of Education, media and other companies, and combine with TSMC's filial piety volunteers to implement filial piety education at no less than 20 elementary schools

**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.

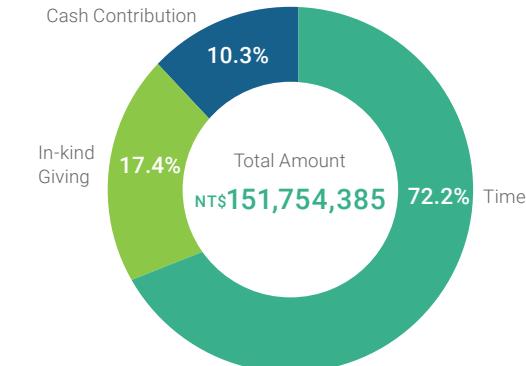
## TSMC Charity Foundation's Four Focuses



## TSMC Charity Foundation Contribution

### Type of Contribution<sup>Note 1</sup>

Unit: NT\$



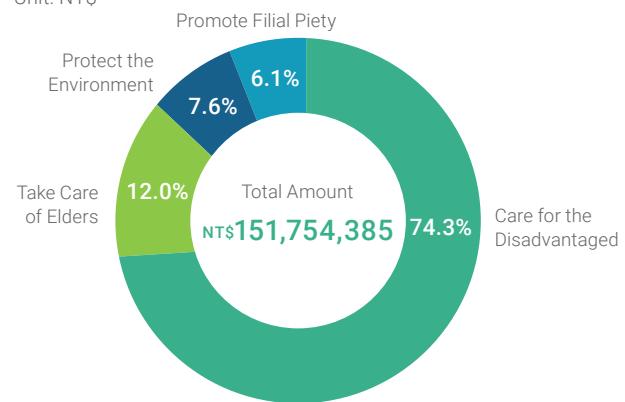
### Type of Philanthropic Activities<sup>Note2</sup>

Unit: NT\$



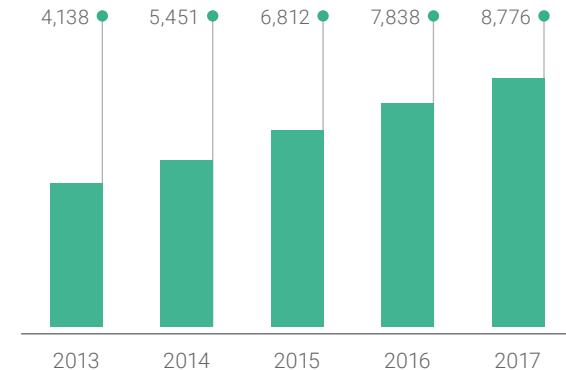
### Type of Philanthropic Focus

Unit: NT\$



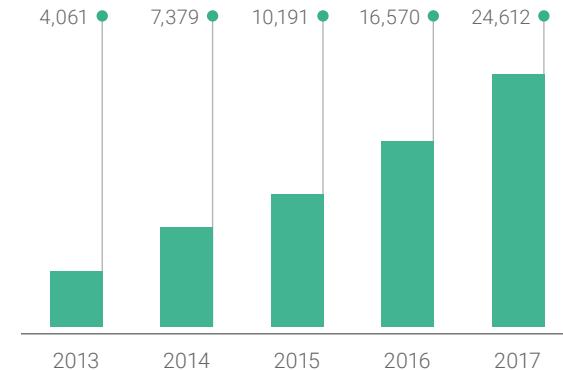
### Volunteer Head Count

Unit: numbers



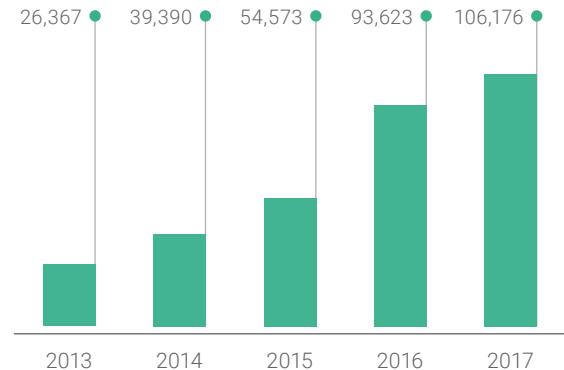
### Volunteer Person-time

Unit: person-time



### Volunteer Service Man-hour

Unit: man-hour

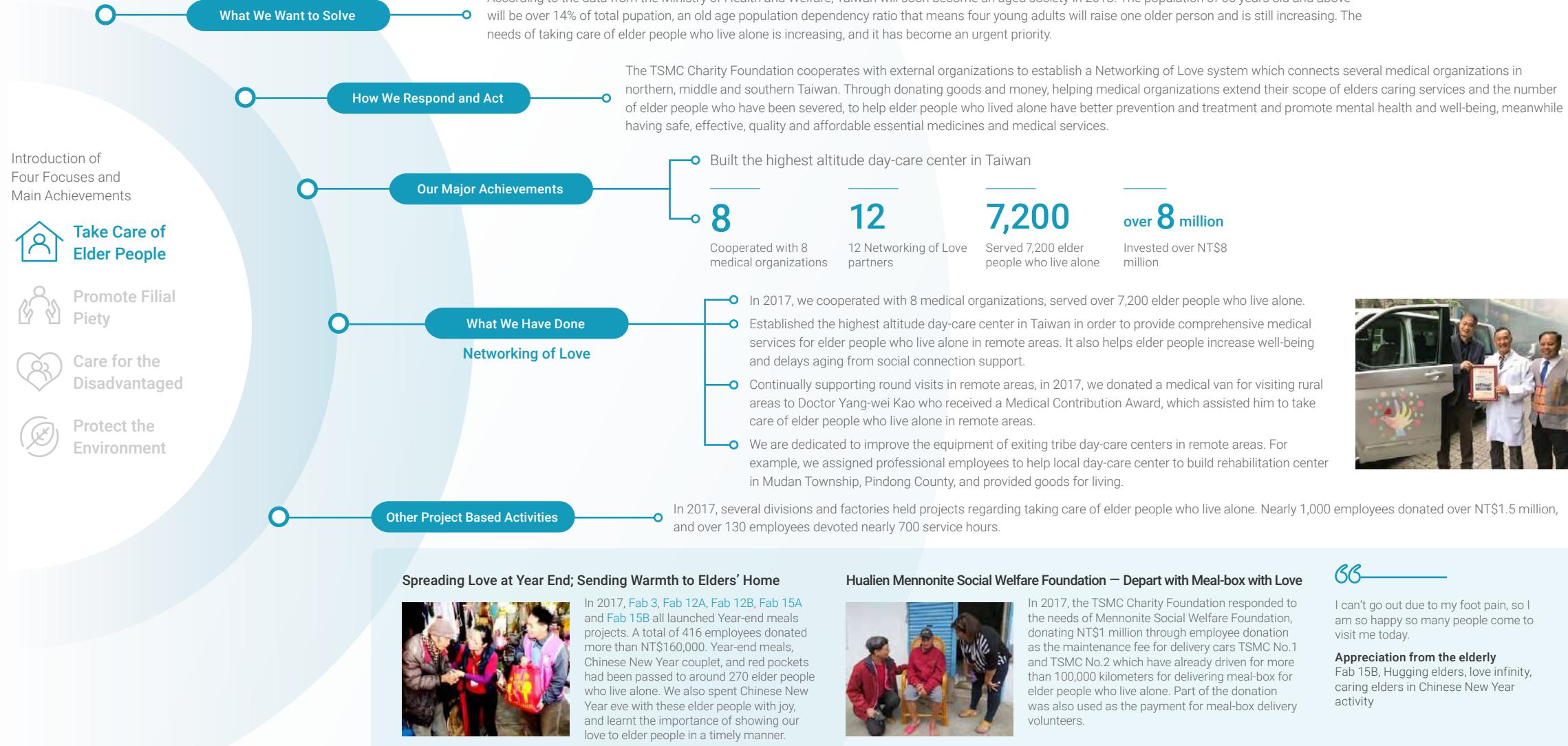


Note 1: Classify all activities into cash contribution, time, and in-kind giving according to DJSI's definition, and calculate the ratio of each category's investment by monetary value.

Time: volunteer service hours\*average hourly rate.

In-kind giving: the monetary value the company invest to provide the item or service

Note 2: Classify all activities into charitable donation, community Investment, and commercial Initiatives according to DJSI's definition, and calculate the ratio of each type's investment by monetary value



Introduction of  
Four Focuses and  
Main Achievements



Take Care of  
Elder People



Promote Filial  
Piety



Care for the  
Disadvantaged



Protect the  
Environment

**What We Want to Solve**

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.

**How We Respond and Act**

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.

**Our Major Achievements**

Filial piety was formally included in education outline of the Ministry of Education of Taiwan, and completed demonstration teaching.

**What We Have Done**

**Published Filial Piety Education Outline**

In July 2017, Chairwoman Sophie Chang gave a speech "the trigger of revival of filial piety" at the Division head conference of the Ministry of Education of Taiwan. We started co-working with the K-12 Education Administration under the Ministry of Education, added the education outline of filial piety in the education outline of the Ministry of Education, and completed demonstration teaching on December 21<sup>th</sup> at the Wufeng Feng Gu Elementary School.

In 2018, we plan to push the filial piety education outline to all the elementary schools in Taiwan, and combine the strength of TSMC filial piety volunteers and at least 8 companies to implement filial piety education at 20 elementary schools together, and build the foundation of the spirit of filial piety from the childhood.



**Other Project Based Activities**

The TSMC Charity Foundation proactively co-works with the government, media and schools to push filial piety education outline, and our employees also actively support it. In 2017, there were 191 volunteer person-times devoted 844 hours to promote filial piety.

**Ecology Tour and Filial Piety Activity – Thank You for Loving Me**



In October 2017, **ecology volunteers** and **Fab 12B** held an "Ecology tour and filial piety activity". Around 50 employees and their family members enjoyed the activity, where we hope to let the children understand their parents' working environment through ecology education and appreciation activity, and also let them understand the importance of filial piety through planting activity.

**Filial Piety Story Reading**



**Fab 15B** co-worked with the Taichung Liren Elementary School and the Daming Elementary School. There were around 25 volunteers read a series of filial piety stories for around 450 students to promote filial piety, and letting the students to cherish the time spending with elder family members better through writing the appreciation cards .

**Fab 14 Open Day-Parents Visiting**



On the **Fab 14** opening day, our employees invited their parents to visit the factories and offices to understand their daily working environment. Meanwhile, our employees had a chance to experience elderly's inconvenience of walking by using the experiencing tools provided by the Old Five Old Foundation, so our employees would better understand the needs from the elderly.

Introduction of  
Four Focuses and  
Main Achievements

Take Care of  
Elder People

Promote Filial  
Piety

Care for the  
Disadvantaged

Protect the  
Environment

**What We Want to Solve**

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.

**How We Respond and Act**

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.

**Our Major Achievements**

**22,128**

Volunteer person-time

**92,206**

volunteer service hours

**nearly 30 million**

Invested nearly NT\$30 million

**over 24,000**

Over 24,000 people benefited

**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 8,000 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.



66

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

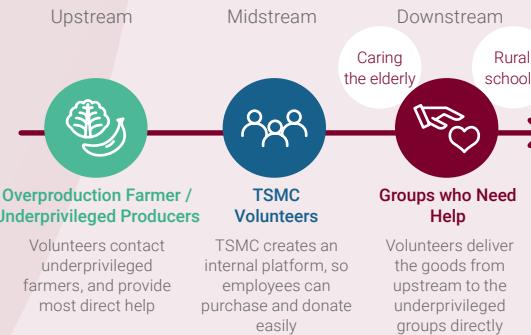
## Care for the Disadvantaged

Other Project Based Activities

TSMC continues to care about underprivileged groups' living and education, provides economic support and living goods, and provides children with a safe learning environment, helping education organizations which lack of resources to re-build the classroom, and ensure students' learning quality. In 2017, 22,128 volunteers devoted 92,206 hours to activities of taking care of underprivileged groups. We invested nearly NT\$30 million, and more than 24,000 people were benefited.

**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.


**Chiayi Shuishang Chuanai Afterschool Reconstruction – Turning the Hope of Future**


Miss. Que-Dai Shu-wei established the Chiayi Shuishang Chuanai afterschool 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.

BB

The new classrooms are so beautiful, and the toilet can be flushed now. We are so happy there are new classrooms for us to study and learn!

**Student of the Chiayi Shuishang Chuanai afterschool**

**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 Jin-hu elementary school, and renovated the hardware and school building which were eroded by the sea wind.



## Care for the Disadvantaged

**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.



**300mm 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.



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.



**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.



**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.



**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!





## 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



### Protect the Environment

#### 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 Xinfeng Mangrove and the Tainan Anping Beach. The awareness of protecting environment was also been awoken when protecting the earth.

##### 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.

##### 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.

##### 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

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[Listening to Stakeholders](#)

[Participation in Industry Associations  
and Non-Profit Organizations](#)

[CSR Performance Summary](#)

[Contact Information](#)

## About This Report

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



Website <http://www.tsmc.com.tw/csr/en/index.html>



E-mail [cse@tsmc.com](mailto:cse@tsmc.com)



Phone +886-3-5636688

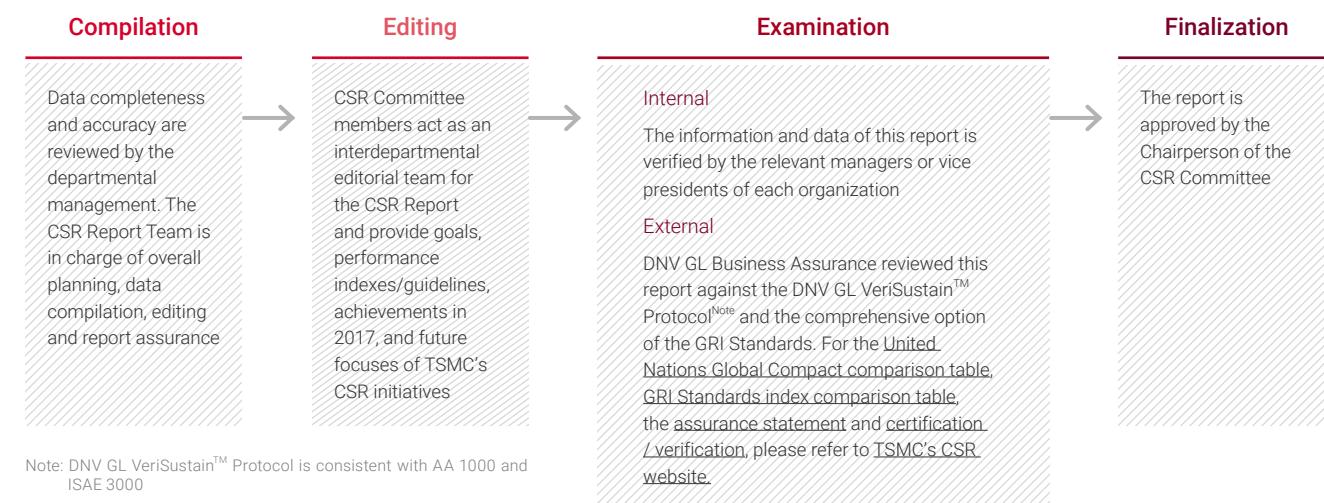


Address 8, Li-Hsin Rd. 6, Hsinchu Science Park, Hsinchu 30078

### Reporting Guidelines and Principles

Sustainability	Financial	Environmental
<b>Standard</b> <ul style="list-style-type: none"> <li>✓ GRI Standards: Comprehensive Option</li> <li>✓ AA 1000 Accountability Principle</li> </ul> <b>Certification Organization</b>	<b>Standard</b> <ul style="list-style-type: none"> <li>✓ Taiwan-IFRSs 2013 version</li> <li>✓ Guidelines Governing the Preparation of Financial Reports by Securities Issuers</li> </ul> <b>Certification Organization</b>	<b>Standard</b> <ul style="list-style-type: none"> <li>✓ ISO 14001 Environmental Management System</li> <li>✓ ISO 14064 Greenhouse Gas Inventory</li> </ul> <b>Certification Organization</b>

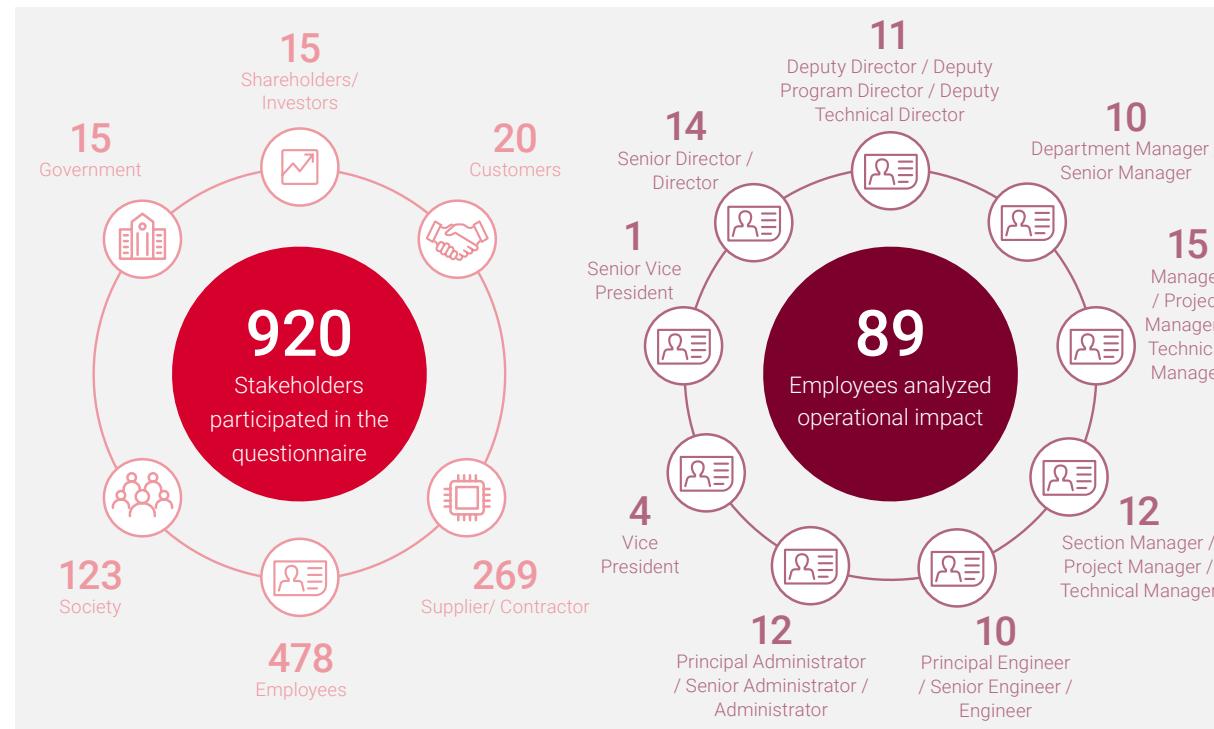
### Reporting Quality Management Process





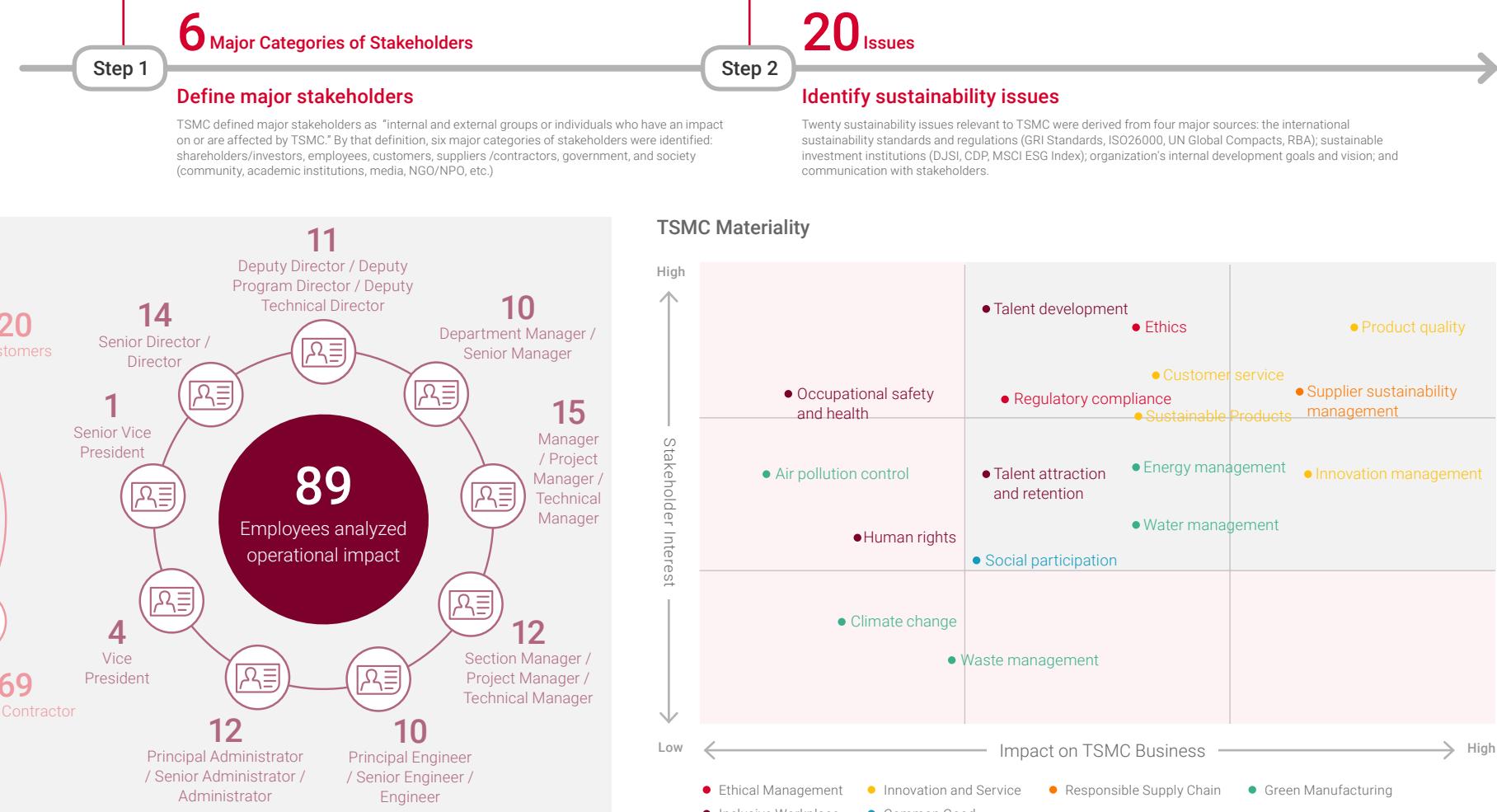
## Materiality Analysis

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.



## Phase 1 Identification

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 to 20 for the 2017 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 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 issues' impact on TSMC's operations. We started from conducting a questionnaire survey among key stakeholders identified and defined by internal business units to obtain substantive feedback from the stakeholders about TSMC's CSR. After the survey samples were collected, Senior Vice President Lora Ho, who chaired the TSMC CSR Committee, led a total of 89 colleagues, including vice presidents, senior plant managers, and vice plant managers, to measure the importance of each sustainability issue against six internal and external factors — innovation and R&D, cost, revenue, customer satisfaction, brand/reputation, and risk — before they moved on to decide the priority of the issues and map them on the TSMC materiality matrix.

## Phase 3 Validation

After reviewing the materiality matrix, TSMC's CSR Committee decided to incorporate "labor 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.



### Material Issues in TSMC Value Chain

Focuses	Material Issues	Operational Impact					GRI Standards Topics	Upstream <sup>Note1</sup>	TSMC Operations <sup>Note2</sup>		Downstream <sup>Note3</sup>
		Innovation/R&D	Revenue	Cost	Customer Satisfaction	Brand/Reputation			Procurement	Wafer fabrication	
Ethical Management	Ethics				✓	✓	✓	Anti-corruption, anti-competitive behavior	✓	✓	✓
	Regulatory compliance					✓	✓	Environmental compliance, socioeconomic compliance	✓	✓	✓
Innovation and Service	Innovation management	✓	✓		✓			Energy		✓	✓
	Sustainable products	✓	✓				✓	Customer health and safety	✓	✓	✓
	Product quality	✓	✓		✓		✓	Customer health and safety	✓	✓	✓
	Customer service		✓		✓			Customer privacy	✓	✓	✓
Responsible Supply Chain	Supplier sustainability management		✓	✓			✓	Procurement practices, supplier environmental assessment, supplier social assessment	✓		
Green Manufacturing	Energy management			✓			✓	Energy	✓	✓	✓
	Climate change						✓	Emissions, economic performance	✓	✓	✓
	Water management						✓	Water, effluents, and waste	✓	✓	
	Air pollution control						✓	Emissions	✓	✓	
	Waste management						✓	Effluents and waste	✓	✓	
Inclusive Workplace	Talent attraction and retention	✓	✓					Economic performance, employment, diversity and equal opportunity, market status	✓	✓	✓
	Talent development	✓	✓					Training and education	✓	✓	✓
	Human rights			✓		✓		Labor management relations, non-discrimination, freedom of association and collective bargaining, child labor, forced or compulsory labor, human rights assessment	✓	✓	✓
	Occupational safety and health					✓		Occupational safety and health	✓	✓	✓
Common Good	Social participation				✓			Economic performance, indirect economic impacts, local communities	✓	✓	

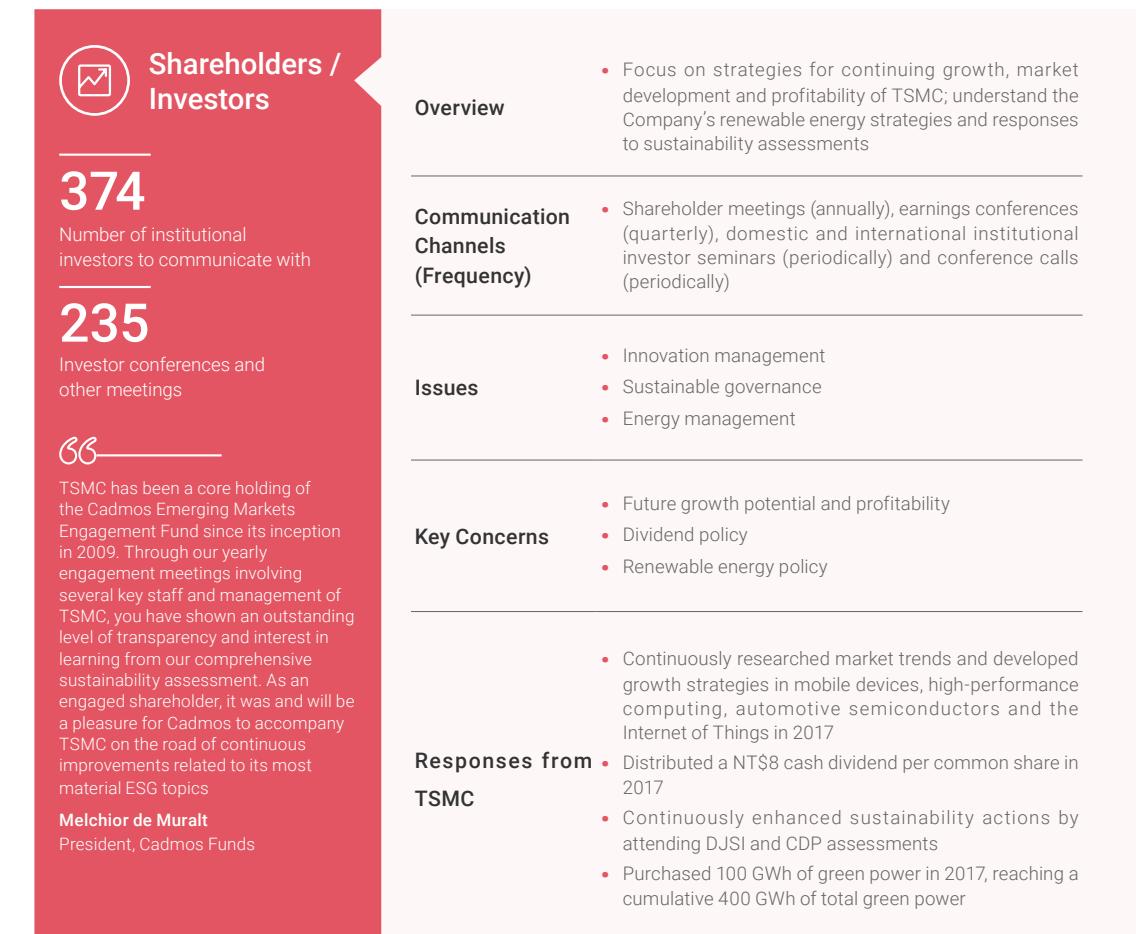
## Listening to Stakeholders

**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.



<b>Overview</b>	<ul style="list-style-type: none"> <li>Encourage a healthy work-life balance, uphold employees' human rights, and enhance employees' skills</li> </ul>
<b>Communication Channels (Frequency)</b>	<ul style="list-style-type: none"> <li>Meetings (periodically), questionnaires (annually) and employee opinion box (periodically)</li> </ul>
<b>Issues</b>	<ul style="list-style-type: none"> <li>Talent attraction and retention</li> <li>Talent development</li> <li>Human rights</li> </ul>
<b>Key Concerns</b>	<ul style="list-style-type: none"> <li>Limiting maximum workweek to 50 hours</li> <li>Establishing on-site childcare facilities at other fabs</li> <li>Multiple and varied corporate entertainment events</li> <li>Sufficient training for managers and engineers</li> </ul>
<b>Responses from TSMC</b>	<ul style="list-style-type: none"> <li>Implemented automated overtime system in 2017 to reduce employees' time spent on tracking and claiming overtime pay</li> <li>Established kindergarten at Taichung site in 2017</li> <li>Completed post-event satisfaction survey in 2017 and developed corporate entertainment functions more aligned with employee needs</li> <li>Implemented annual training program to prevent workplace bullying and increase personnel sensitivity of first-line managers in Operations; adjusted training structure for technicians</li> </ul>





## Customers

**33**

Number of customers holding quarterly reviews

**111**

Number of quarterly meetings

**66**

TSMC customer service is outstanding and has continued to improve over time.

**Sailesh Chittipeddi**  
Executive Vice President, Global Operations and Chief Technology Officer, IDT

### Overview

- Continue to develop new technologies, enhance product quality, and implement measures to minimize risk

### Communication Channels (Frequency)

- Customer quarterly business reviews (quarterly), audits (annually)

### Issues

- Innovation management
- Product quality
- Proprietary information protection
- Occupational safety and health

### Key Concerns

- Earthquake protection, risk management, and business continuity program
- Leaks of confidential information of key chips or manufacturing processes
- New process technology development
- Continuous product quality improvements

### Responses from TSMC

- Completed 111 drills, 38 improvements and revisions of 11 crisis management standard operating procedures in 2017 for all major crisis events
- Passed customer audits on security and obtained ISO 15408 site certification in 2017
- 7nm process technology in risk production in 2017
- Introduced machine learning into advanced spectral analysis and established automatic defect classification system for 12-inch wafers outgoing visual inspection in 2017



## Suppliers/Contractors

**>600**

Number of suppliers that attended the Supply Chain Management Forum

**102**

Supplier communication meetings

**66**

As one of TSMC's supply chain partners focused on advanced materials, we continue to improve local R&D capability and invest in local manufacturing to work closely together with TSMC and win together.

**Keiji Miyayashi**  
President, FUJIFILM Electronic Materials Co., Ltd.

**66**

Thanks to TSMC for its assistance and guidance in environment, safety, and health. Through self-evaluation and support from their auditing personnel, we will continue to improve our green management capabilities.

**Kelly Hou**  
Sales Division Vice General Manager, The Beaming Co., Ltd.

### Overview

- 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

### Communication Channels (Frequency)

- Supplier meetings / forums (annually), supplier onsite audits (periodically)

### Issues

- Ethics
- Product quality
- Waste management
- Occupational safety and health

### Key Concerns

- Requirements related to quality improvement and new technology development
- Compliance with supplier ethics and code of conduct
- Enhancement of suppliers' capabilities in environmental, safety and health issues
- Supplier auditing and counselling

### Responses from TSMC

- 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
- 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
- Hosted supplier code of conduct training in 2017, with 2018 attendance rate expected to exceed 95%
- 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



## Government

**16**

Number of government meetings attended

**50**

Industry association meetings

**66**

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

### Overview

- Collaborate with TSMC on subjects of environment and occupational safety, and have the Company set nationwide industry standards

### Communication Channels (Frequency)

- 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

**169**

Number of cooperating charity groups

**330,677**

Beneficiaries

**66**

TSMC's perseverant execution and investments in talent development are rare and commendable.

**Gerard Hei**  
Chief Executive Officer of Greater China, Dale Carnegie Training

**66**

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**

### Overview

- Provide support and resources for social charities, expand scope and depth of the Company's engagement, and bring about meaningful social impacts

### Communication Channels (Frequency)

- 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

## Participation in Industry Associations and Non-Profit Organizations<sup>Note1</sup>

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<sup>Note2</sup>. In 2017, TSMC participated in more than 30 industry associations and non-profit organizations, with expenditures of over NT\$21.2 million<sup>Note3</sup>.

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

TSMC strives for the development of the global and domestic semiconductor industry. In addition to participating in the main industry associations in the field of semiconductors, the Company also makes policy suggestions to the government in areas including land, water, electricity, talent, intellectual property protection and other areas related to the competitiveness of the industry. Industry associations that TSMC participates in in the area of industry development include:

- The Semiconductor Industry Association (SIA)
- The Taiwan Semiconductor Association (TSIA)
- Semiconductor Equipment and Materials International (SEMI)
- The Allied Association for Science Park Industries

TSMC Co-CEO C.C. Wei has served as Chairman of The TSIA since 2017, and Vice President J.K. Lin currently serves as standing Board member of The Allied Association for Science Park Industries.

### 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 Protection (TTSP)
- The MEMS And Sensors Industry Group
- The Peripheral Component Interconnect Special Interest Group (PCI SIG)

TSMC Vice President and General Counsel Sylvia Fang has served as the President of the TTSP, 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 received 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 Taiwan Corporate Governance Association (TSGA)

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, and 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 committee members and committee chairman in the TSIA and the Allied Association for Science Park Industries to set standards in energy, water, environmental protection, and occupational health, and meet these standards together. The industry associations and non-profit organizations 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 Hu currently serves as member of the Taiwan Center for Corporate Sustainability board of directors.

### 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 commit 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.

Note 3: The five largest membership fees paid or donations made by TSMC, in descending order, are:

(1) Semiconductor Industry Association/NT\$6,120,800

The United States is one of TSMC's primary markets. TSMC participates in the SIA to communicate with the U.S. government along with other industry members and highlight the importance of the semiconductor industry to U.S. economic development, national security, and global competitiveness.

(2) Taiwan Semiconductor Industry Association/NT\$5,367,385

TSMC participates in the TSIA to support Taiwan's semiconductor

industry and develop consensus on the development of the industry through the association's activities and promote healthy growth for the sector through cooperation amid competition.

(3) The Allied Association for Science Park Industries/NT\$1,980,000

TSMC participates in the Allied Association for Science Park Industries, which serves as a conduit between government and business for promulgation of policies and communication of views. It serves the common interests of companies in Taiwan's science parks and facilitates cooperation for the stable development of science park businesses.

(4) Responsible Business Alliance (formerly Electronics Industry Citizenship Coalition)/NT\$1,323,225

TSMC is a member of the RBA, and follows the guidelines set by the alliance for the supply chain to ensure a safe working environment, respect and dignity for workers, environmentally sustainable business operations, and compliance with business ethics

(5) Epoch Foundation/NT\$1,306,467

TSMC firmly believes that the Asia-Pacific Region and the Chinese economic sphere will play a key role in global economic development, and has joined the Epoch Foundation to help domestic industries in promoting regional economic prosperity. This foundation has also established long-term collaboration in management and technology innovation with the U.S. Massachusetts Institute of Technology.

## CSR Performance Summary

Key Indicators		2013	2014	2015	2016	2017
Economic	Net Revenue (NT\$ billion)	597	763	843	948	977
	Net Income Attributable to Shareholders of the Parent (NT\$ billion)	188	264	307	334	343
	Income Tax Expense (NT\$ billion)	27	38	44	52	53
	R&D Expenses (NT\$ billion)	48	57	66	71	81
	Capital Expenditures (NT\$ billion)	288	289	258	328	331
Environmental	Greenhouse Gas Emission (Metric Ton - CO2 equivalent) (Scope 1 and Scope 2)	5,222,778	6,356,130	6,670,291	7,413,953	8,153,658
	Scope 1	1,715,808	2,113,858	2,027,645	2,035,510	2,073,447
	Taiwan Sites	1,443,218	1,655,498	1,566,662	1,648,268	1,638,051
	Overseas Sites	272,590	458,360	460,983	387,242	435,396
	Scope 2	3,506,970	4,242,272	4,642,646	5,378,443	6,080,211
	Taiwan Sites	3,211,022	3,939,172	4,315,766	5,030,647	5,702,511
	Overseas Sites	295,948	303,100	326,880	347,796	377,700
	Scope 3	-	-	3,446,447	3,767,411	4,242,521
	Energy Consumption (GWh) (Including electricity, nature gas and diesel)	6,604	7,968	8,925	9,848	12,016
	Direct Energy Consumption (GWh) (Including electricity, nature gas and diesel)	375	423	455	489	628.2
	Indirect Energy Consumption (GWh) (Electricity)	6,229	7,545	8,470	9,358	11,388
	Water Consumption (Million Metric Tons)	33.2	38.2	37.5	42.0	49.0
	Taiwan Sites	29.7	34.9	34.0	38.6	45.2
	Overseas Sites	3.5	3.3	3.5	3.4	3.8
	Process Water Recycling Rate (%) (Taiwan Sites)	86.9	87.6	87.3	87.4	87.5
	Total Water Saving (Million Metric Tons) (Taiwan Sites)	66.9	81.0	85.6	94.3	103.4

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	Key Indicators	2013	2014	2015	2016	2017
Environmental	Waste Generated (Metric Tons)	149,951	208,213	273,096	298,761	369,745
	General Waste Generated (Metric Tons)	47,336	66,462	137,524	163,584	201,114
	Taiwan Sites	42,180	61,026	132,427	158,899	196,077
	Overseas Sites	5,156	5,436	5,097	4,685	5,037
	Hazardous Waste Generated <sup>Note1</sup> (Metric Tons)	102,615	141,751	135,572	135,177	168,631
	Taiwan Sites	101,100	140,024	133,360	133,085	165,891
	Overseas Sites	1,515	1,727	2,212	2,092	2,740
	Waste Recycling Rate (%)	91	93	95	95	95
	Taiwan Sites	92	93	95	95	95
	Overseas Sites	79	79	79	79	80
Social	Numbers of Employee	40,483	43,591	45,272	46,968	48,602
	Employee Training Hours	889,184	884,174	780,546	623,711	639,852
	Safety - Injury Frequency Rate <sup>Note2</sup> (Taiwan Sites)	0.25	0.36	0.47	0.54	0.56
	Safety - Injury Severity Rate <sup>Note3</sup> (Taiwan Sites)	1.34	3.48	5.12	7.62	7.84
	Cash Donation (NT\$ million)	95.2	99	64.8	89.1	301.2 <sup>Note4</sup>

Note 1: Difference in previously disclosed 2015 and 2016 hazardous waste is due to subtraction of waste recycled in-house

Note 2: Safety - Injury Frequency Rate=Injury NumberX1,000,000 /Total hours worked

Note 3: Safety - Injury Severity Rate= Lost Work DaysX1,000,000/Total hours worked

Note 4: Amounts donated by TSMC, TSMC Education and Culture Foundation, TSMC Charity Foundation and TSMC employees

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