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 demostrating 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

343.11bn (NT$)
Reached record high net income in 2017

23.6%
2017 ROE

1
The world's largest semiconductor foundry

19%
Continued to invest in research and development in 2017, with total R&D expenditures of US$ 2,651 million, up about 19% from the previous year

7nm
Led the industry in manufacturing of 7nm technology in 2017

Environmental

13%
2017 unit product GHG emission reduced 13% below 2010 level

55%
2017 unit product Perfluorinated Compounds (PFC) emission reduced 55% below 2010 level

10.4%
2017 unit product power consumption reduced 10.4% below 2010 level

24.7%
2017 unit product water consumption reduced 24.7% below 2010 level

4
In 2017, the Company amended its Articles of Incorporation to add four more categories to its scope of business for the realization of circular economy

Social

218,951(US$)
In 2017, profit per employee reached US$218,951 for TSMC employees in Taiwan; the only Asian company in Expert Market survey's Top 10 list

32
In 2017, annual compensation of a newly-graduated engineer in Taiwan with a Master's degree was equal to 32 months' salary, outperforming our industry peers

24,612
2017 volunteer person-time

106,176
2017 volunteer service hours

747,726,172(NT$)
Total input for social participation in 2017

Awards and Recognitions

MEMBER OF Dow Jones Sustainability Indices In Collaboration with RobecoSAM

Membership in the Dow Jones Sustainability World Index for the 17th consecutive year

ROBECOSAM Sustainability Award Gold Class 2018

RobecoSAM Sustainability Award - Gold Class

MSCI 2017 Constituent MSCI ESG Leaders Indexes

Selected as component of MSCI ESG Leaders Indexes

MSCI 2017 Constituent MSCI SRI Indexes

Selected as component of MSCI SRI Indexes

FORTUNE ★THE WORLD'S MOST ADMIRED COMPANIES

Selected as one of The World's Most Admired Companies

Forbes2017 GLOBAL TOP REGARDED COMPANIES 2000

Selected as one of the Top Regarded Companies

IR magazine

Listed in the Global Top 50 ranking

FTSE4Good

Selected as FTSE4Good Emerging Index component

Selected as FTSE4Good TIP Taiwan ESG Index component

CDP DRIVING SUSTAINABLE ECONOMIES

Climate Change Scoring Level: Leadership

The Magazine for Clean Capitalism Corporate Knights

Selected as one of the Global 100 Most Sustainable Corporations

Corporate Responsibility Prime rated by oekom research

Rated "Prime" by oekom Corporate Rating

Institutional Investor

Most Honored Company (Technology/Semiconductor) - All Asia

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

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

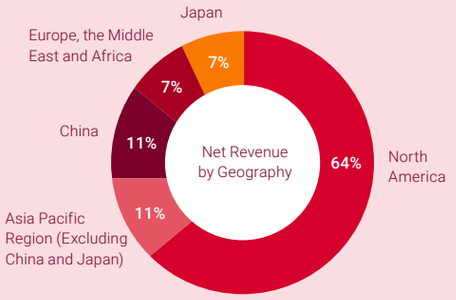
1
The world's largest semiconductor foundry

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

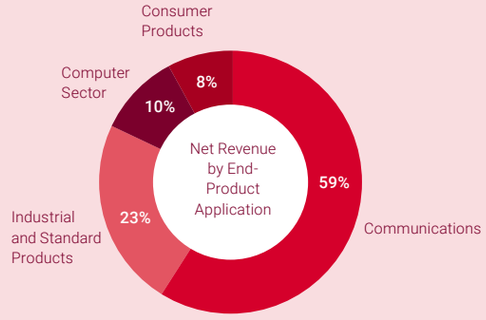
48,602 employees
Employed about 48,000 people worldwide at the end of 2017, and recruited 3,663 new employees

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



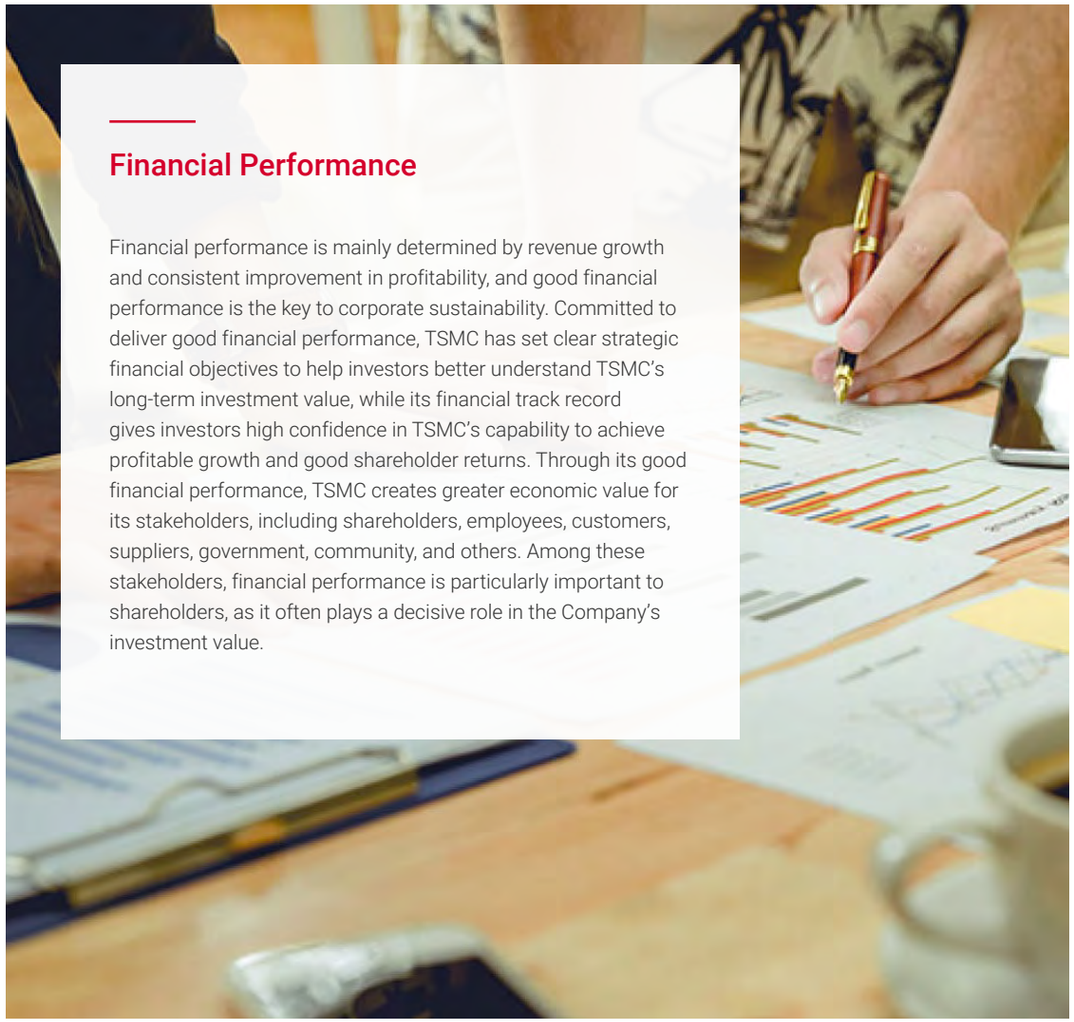
Net Revenue by End-Product Application



>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

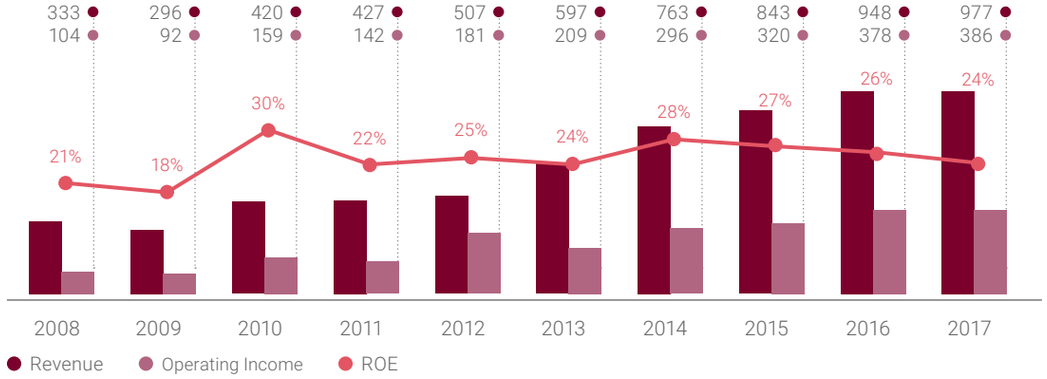


Financial Performance

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".

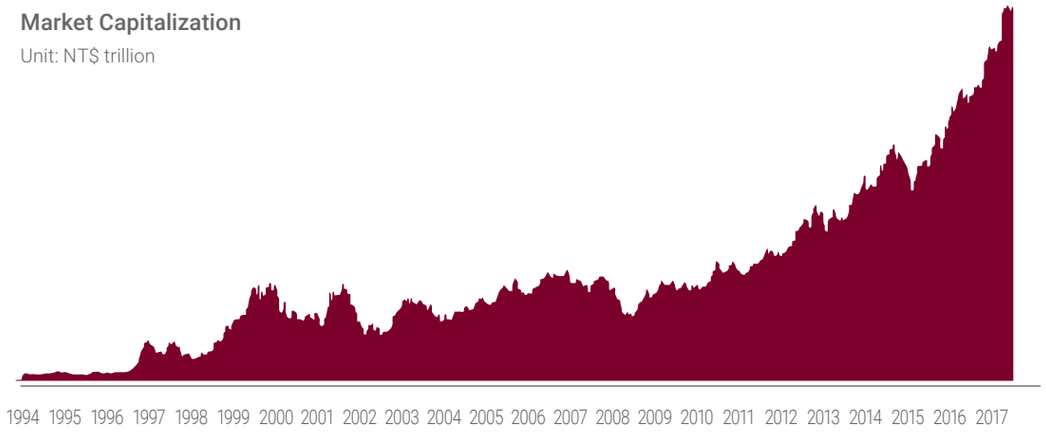
A+
Standard & Poor's (S&P) Ratings

Aa3
Moody's Ratings

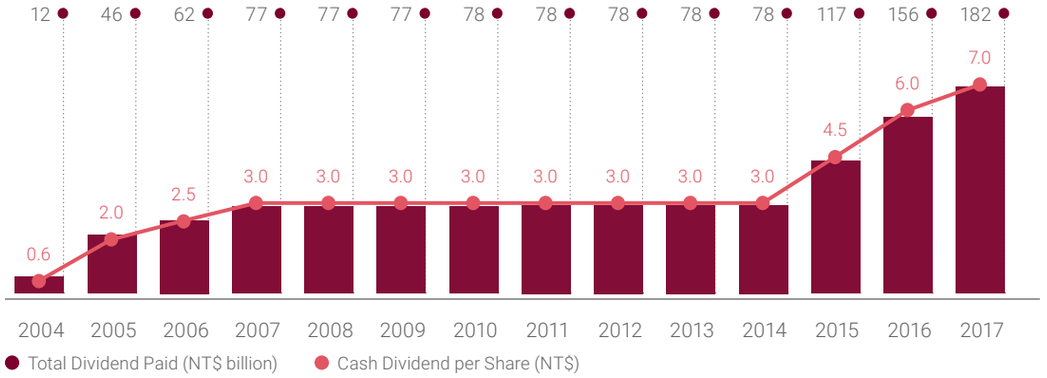
twAAA
Taiwan Ratings

Market Capitalization

Unit: NT$ trillion



Cash Dividend



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.

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.

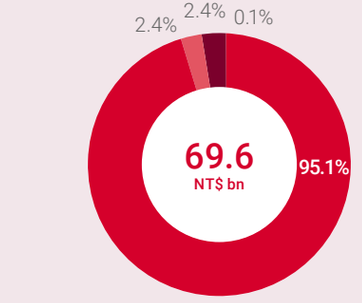
Our Commitments

- 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.

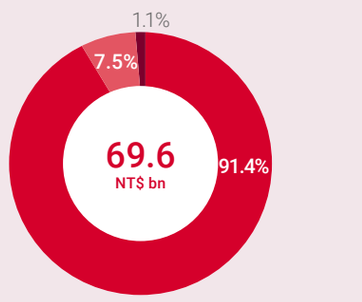
Tax Risk

- 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[Note]



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

1

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

>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.

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

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.

> 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

Vision To Uplift Society

Mission

Acting with Integrity

Guiding Principles

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

Strengthening Environmental Protection

Guiding Principles

TSMC strives to achieve environmental sustainability and continues to promote green fabs, green manufacturing, and green supply chains. The Company seeks the most efficient use of energy and resources and is committed to reducing waste and preventing pollution. TSMC is eager to share its environmental experience and expertise and aims to collaborate with government, academia, and all of society to address the challenges of climate change.

Caring for the Disadvantaged

Guiding Principles

TSMC believes in equality, justice, and a safe and prosperous society. The Company combines its resources with employee volunteer service to commit money, material and labor to the two main areas of "education" and "living." TSMC hopes to provide underprivileged students in rural regions with diverse learning opportunities and to offer disadvantaged groups necessary aid and emergency relief for the common good of society.

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.

TSMC \ Society	Morality	Business Ethics	Economy	Rule of Law	Sustainability	Work/Life Balance Happiness	Philanthropy
Integrity	●	●					
Law Compliance				●			
Anti-Corruption Anti-Bribery Anti-Cronyism	●	●		●			
Environmental Protection Climate Control Energy Conservation				●	●		
Corporate Governance		●	●	●			
Provide Well-paying Jobs			●			●	
Good Shareholder Return			●				
Employees' Work-Life Balance						●	
Encourage Innovation		●	●				
Good Work Environment						●	
TSMC Charity Foundation					●	●	●
TSMC Education and Culture Foundation							●

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.

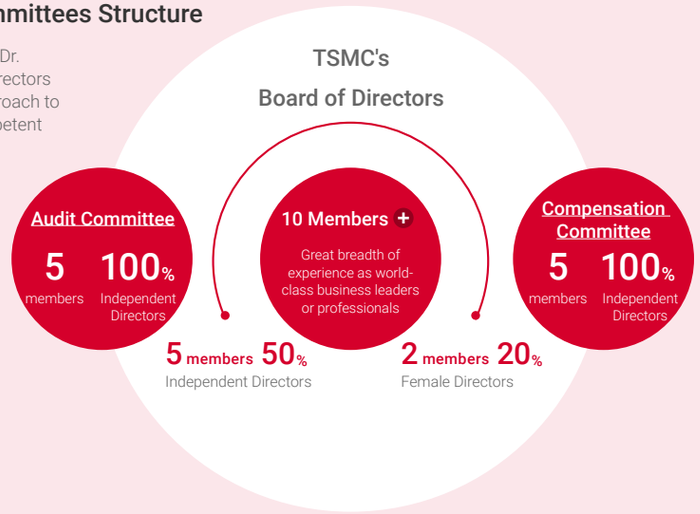
Governance Structure

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 independant 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



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.

For details of the Company's corporate governance, please refer to the "Corporate Governance" section of TSMC's 2017 annual report. Starting from 2016 Annual Report, TSMC voluntary discloses the compensation of its Directors, President & Co-CEOs and Chief Financial Officer on an individualized basis. For details, please refer to "Board Members" and "Management Team" of TSMC's 2017 Annual Report. In addition, in 2017, the median total compensation of all TSMC global employees is about NT$1,570,000, and the ratio between the total annual compensation of President & Co-CEO and the median employee compensation is about 134:1.

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

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.

> 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

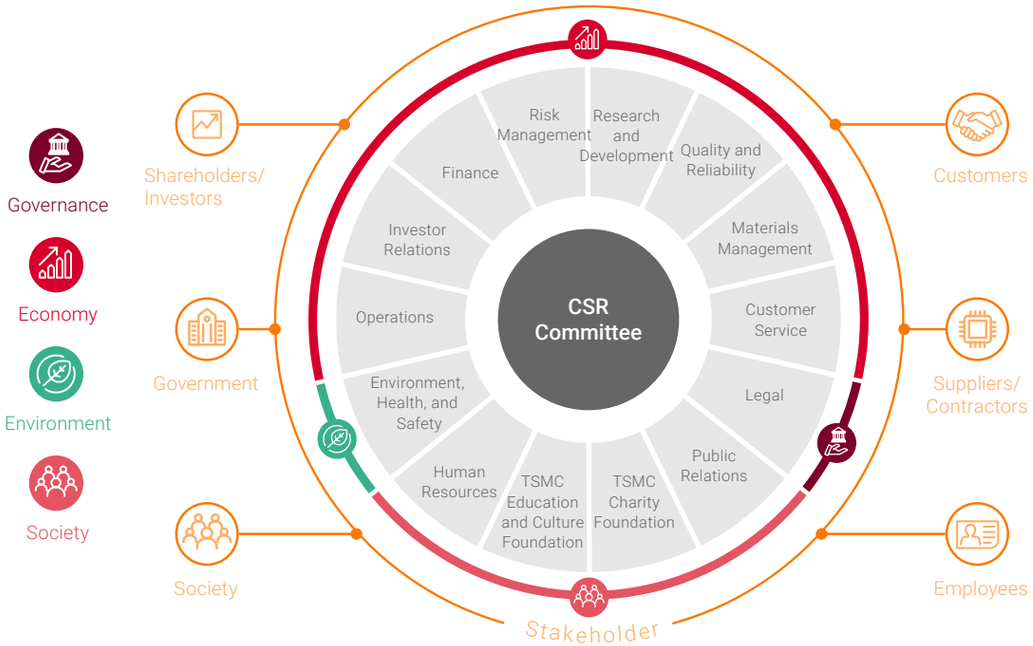
The highest-level corporate social responsibility organization within TSMC

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

Implementation Results for the Year

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

Work Plan for the Following Year

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

Corporate Social Responsibility Committee Achievements in 2017

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

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

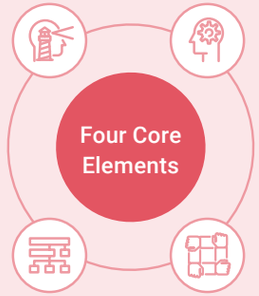
Society
Give back to society and obtain its trust through community participation

Process and Methods

TSMC's sustainable management, with value chain and operational model as its core, generates corresponding value for respective stakeholders by devoting Six Main Capitals: Finance, Manufacturing, Intelligence, Human Resource, Environment, and Society. We are deeply aware of the accompanying negative impact of the TSMC's value chain (including procurement, production and customer usage) on our environment and society. Therefore, TSMC creates its own sustainable-value management model as the framework for advocating sustainable entrepreneurial management internally, and actively pursues sustainable performance through maximizing positive impacts and minimizing negative impacts. This is achieved by constantly improving the organization's seven Sustainable-Management Competencies (Corporate Ethics Management, Innovation Research Management, Customer Relationship Management, Supply Chain Management, Environmental Management, Human Resource Management, and Stakeholder Engagement) through Four Core Elements: Senior Management Support, Junior Management Involvement, Committee of Corporate Social Responsibility, and Organization Culture.

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

Seven Sustainable-Management Competencies

- **Corporate Ethics Management**
  - Ethics Code
  - Regulatory Compliance
- **Innovation Research Management**
  - Innovation Management
  - Sustainable Products
  - Product Quality
- **Customer Relationship Management**
  - Customer Service
- **Supply Chain Management**
  - Supply Chain Sustainability Management
- **Environmental Management**
  - Energy Management
  - Climate Change
  - Water Management
  - Waste Management
  - Air Pollution Control
- **Human Resource Management**
  - Talent Attraction and Retention
  - Talent Development
  - Human Rights
  - Occupational Safety and Health
- **Stakeholder Engagement**
  - Social Participation

Value Chain: Procurement | TSMC Operations | Customer Usage

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

Shareholders/ Investors | Customer | Supplier/Contractor | Government | Community | 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*".

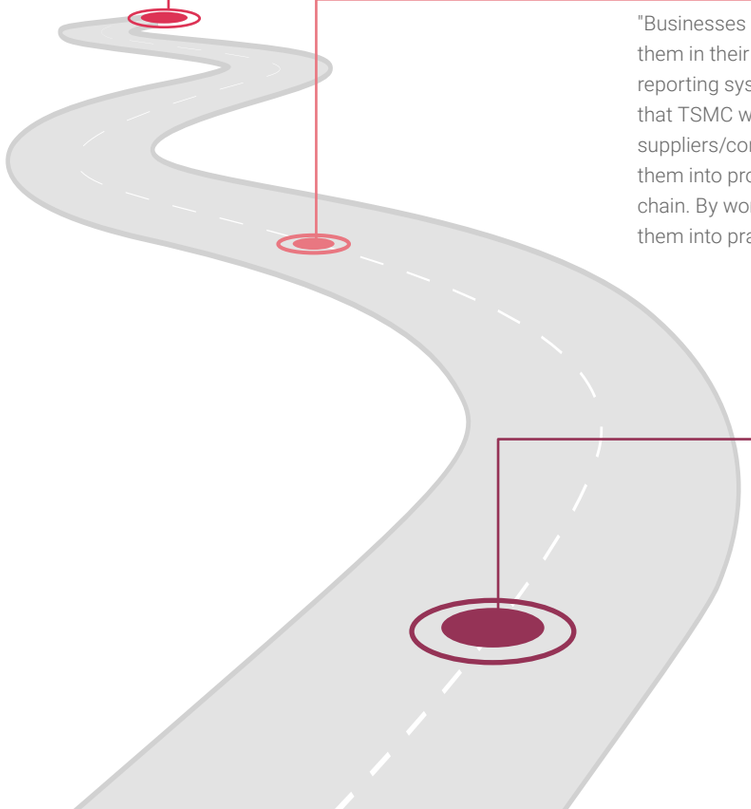
Note 5: Talent and Community Development covers TSMC University Collaboration Programs in Taiwan, environmental initiatives, and education sponsorships. For relevant value assessment, please refer to "*TSMC 2016-2017 Social Impact Valuation Report*".

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: Procurement	Value Chain: TSMC Operations	Value Chain: Customer Usage	SDGs
Ethical Management Implement the core value of "integrity," fully aware that corruption and bribery will fundamentally undermine the foundation of corporate sustainability. Our open reporting system allows the code of conduct to be deeply rooted in the daily work of employees and suppliers	✓	✓		16
Innovation and Service Respond to rapid technological changes and global sustainability trends. TSMC introduces new technological applications through innovation, as well as resolves climate change issues faced by humankind through product and process innovation	✓	✓	✓	4, 7
Responsible Supply Chain Leverage local purchasing volume. As an industrial leader in the semiconductor industry, we should increase our utilization of local service providers as well as incorporate a corporate sustainability mindset and requirements into our supply chain management in order to drive the responsible behavior across the entire supply chain	✓			7, 8, 12, 13
Green Manufacturing Building cleaner production plants is a basic requirement of corporate sustainability. Our spirit of responsibility drives us to construct green manufacturing plants that emphasize dematerialization, decarbonization and detoxification across all aspects of our products, processes, and supply chain	✓	✓	✓	6, 7, 12, 13
Inclusive Workplace Embrace our original vision of seeking out people who subscribe to our values. We are committed to establishing a safe and inclusive workplace, ensuring every employee enjoys basic human rights and can develop their skills in a safe work environment, and making our workplace an asset worth protecting.	✓	✓		8
Common Good Society and Company are interdependent. Through its two major charitable foundations, TSMC has been deeply involved in issues such as education, helping the less privileged, assisting the elderly who live alone, and other cultural assets. We aim to support and encourage the power of love and positive social influence		✓		1, 3, 4

Linking SDGs to TSMC 2020/2025 Goals

TSMC Approaches	TSMC 2020/2025 Goals
Replace PFOA-related substances	100% compliance for product hazardous substance free legal and customer requirements
Improve effluent water and ammonia nitrogen treatment	Reduce ammonia nitrogen concentration in wastewater discharge to <25mg/L
Increase urban reclaimed water usage	Replace tap water with reclaimed water for up to 28,000 tons/day
Research, develop and manufacture more energy-efficient products	Reduce power consumption per unit wafer (kWh/8-inch wafer equivalent - mask layer) by 12% relative to that in 2010
Cooperate with suppliers to develop energy-efficient equipment	Accumulated 2,800 GWh of electricity savings for new measures of energy saving
Use renewable energy	Continue to purchase renewable energy [Note]
Ban child labor	More than 240 suppliers completed the audit by RBA
Promote a safe work environment	Frequency of disability <0.37; severity of disability <4.55
Support local suppliers	Counsel 38 local suppliers for improving process and yield rate
Enhance suppliers' quality culture	90% local suppliers participate in the National United Circle Competition
Promote reduction of industrial waste output	Reduce waste volume of major local waste-producing suppliers by 24% relative to that in 2014
Promote fab site economy	Reduce outsourced waste treatment per unit wafer to 0.32 kg / 8-inch wafer equivalent - mask layer
Promote adaptation strategies for climate risk	Reduce GHG emission per unit product by 18% relative to that in 2010
Strengthen resilience of supply chain climate risk	Organize supplier emergency response observation for 160 suppliers

TSMC Approaches	TSMC 2020/2025 Goals
Provide various resources for disadvantaged groups	Donate a minimum of NT$10 million to disadvantaged groups per year
Improve medical care for elderly people living alone	Serve 8,300 elderly people who live alone
Promote filial piety among younger generations	Promote filial piety education in 50 elementary schools together with the other Science Park enterprises
Caring for the educationally disadvantaged	Cooperate with institutions to invest no less than NT$10 million per year
Reading volunteers for children in remote regions	More than 8,000 hours of reading volunteers
Mitigate corruption and bribery	95% training rate for ethics code and anti-corruption education

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 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*.

Steps to Calculating SROI

Establishing Scope and Identifying Stakeholders

- Selected two areas of focus, Energy Conservation and Quality Education
- Identify key stakeholders

↓

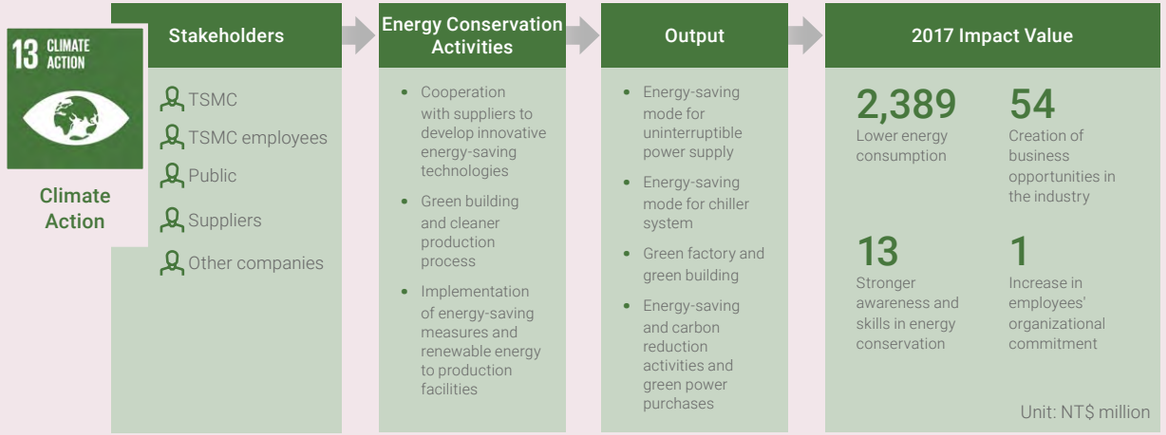
Evidencing and Valuing Outcomes

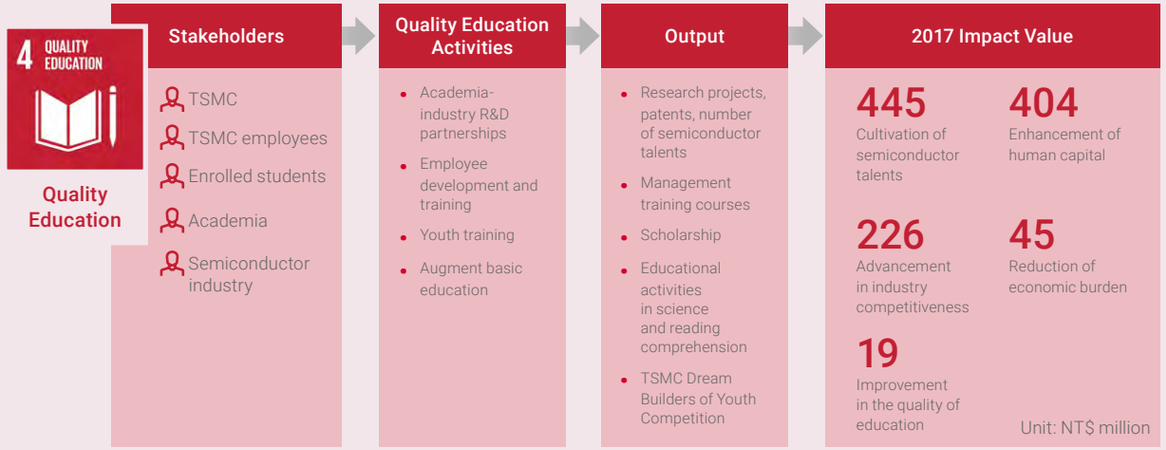
- Understand what changes and describe outcomes by engaging stakeholders
- Identify financial proxies to value outcomes

↓

Calculating Social Impact

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





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 though green manufacturing, and strive to be the most attractive employer centered around our talent. This is how we drive change in society.

Ethical Management

A Trusted Company

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

29,000

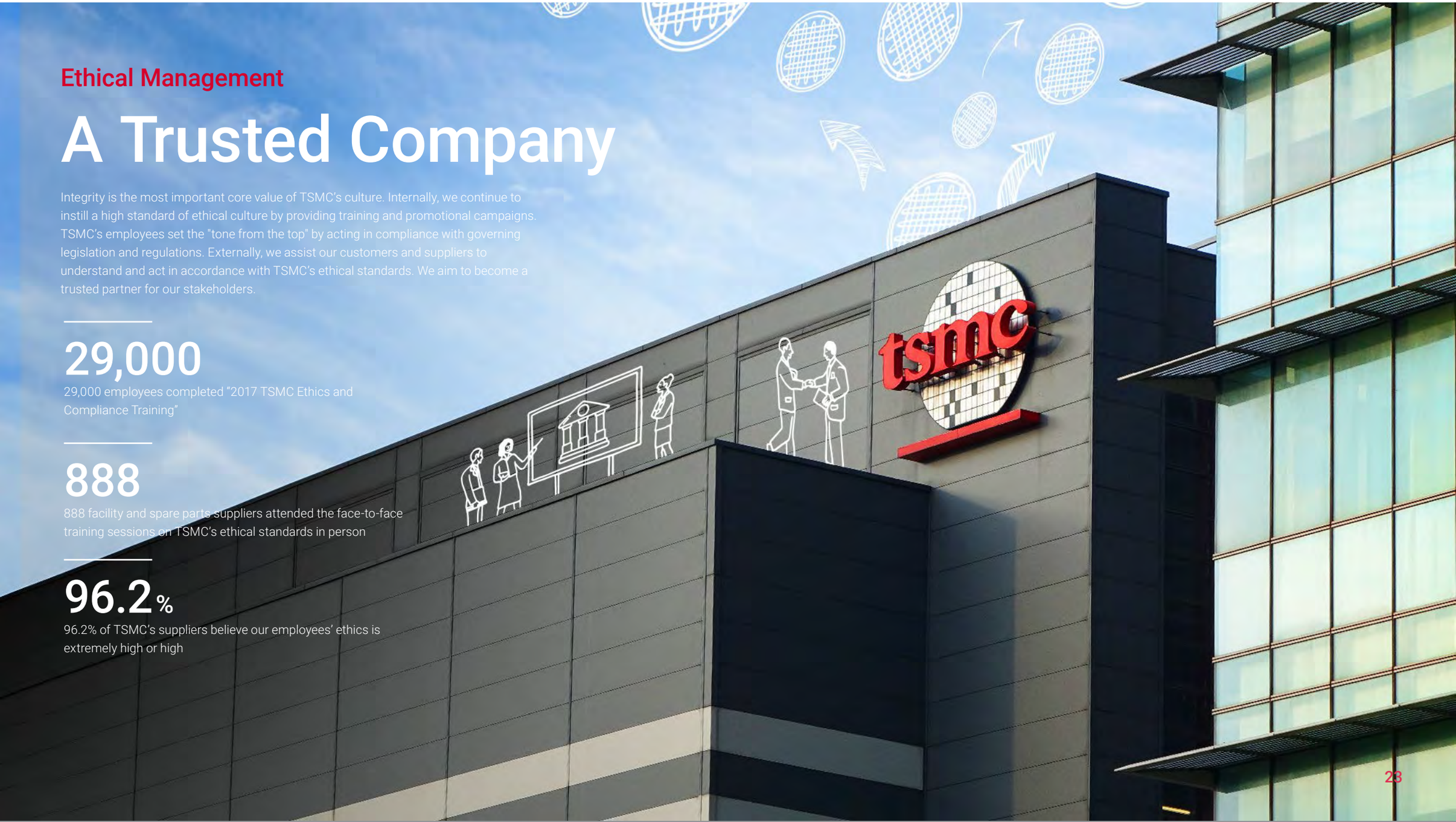
29,000 employees completed "2017 TSMC Ethics and Compliance Training"

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 & 2020/2025 Goals	2017 Achievements	2018 Targets
	97% **Completion rate for employee annual training of ethics and regulatory compliance** Target: 95%	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%
	98% **Participation rate for communicating with major suppliers in person** Note Target: 95%	Develop a suppliers ethics guidelines manual - Develop an ethics guidelines manual to facilitate suppliers' internal promotion activities
	0 **Material violation** Target: No material regulatory violation (where the fine exceeds NT$1 million)	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

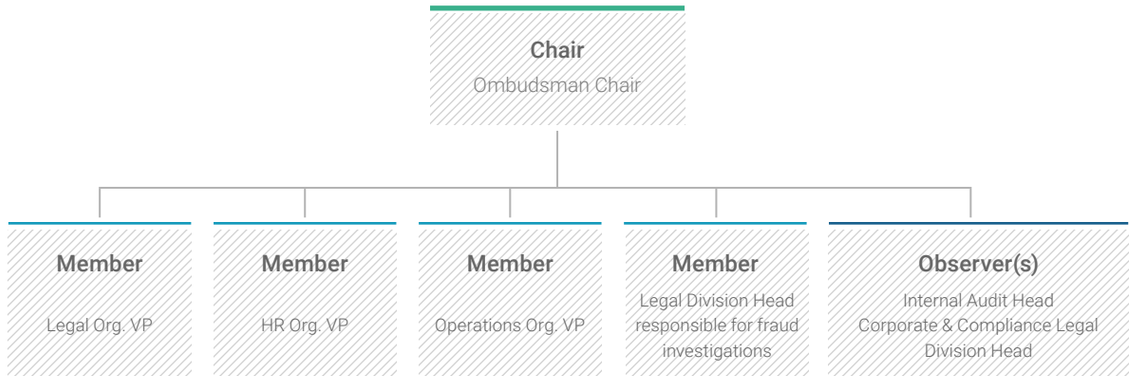
TSMC ensures compliance with TSMC's Code of Ethics and Business Conduct (the "Ethics Code") and relevant laws and regulations in a systematically way by implementing the following methodologies in six dimensions.

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.

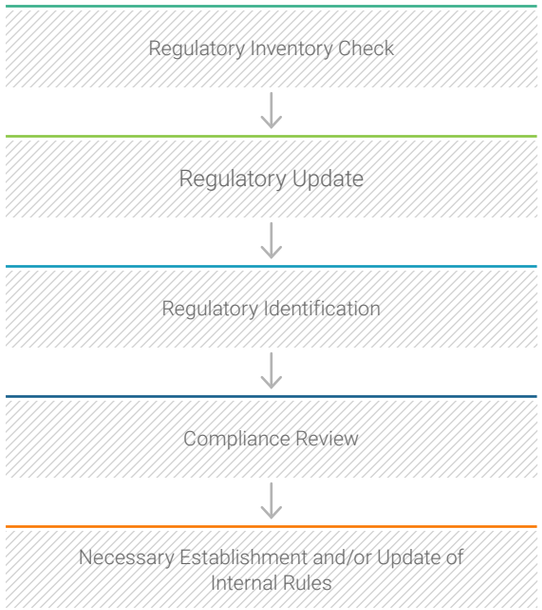
Ethics Committee



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	around **36,000** employees	• Includes anti-corruption, avoidance of conflict of interests, reporting channels and whistleblower protection • Includes both face-to-face training and electronic training Note: The Legal department provided face-to-face training to select group of overseas assignees and departments for enhancement of awareness
Ethical Standards (to suppliers)	719 suppliers	**888** suppliers	• Includes anti-corruption, avoidance of conflict of interests, reporting channels and whistleblower protection • Face-to-face training only
Regulatory Compliance	around 26,000 employees	around **29,000** employees	• Includes export control, personal data protection, insider trading and record retention and disposal • Includes both face-to-face training and electronic training

Annual Self-assessment and Declaration of Conflict of Interest

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

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

Supplier Management

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

Promotion Focus

"Integrity" is TSMC's core value

+

TSMC does not tolerate corruption of any kind

+

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

+

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

+

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

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

98%
Up to 98% participation rate

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

97%
Up to 97% positive feedback

Tasks of 2018

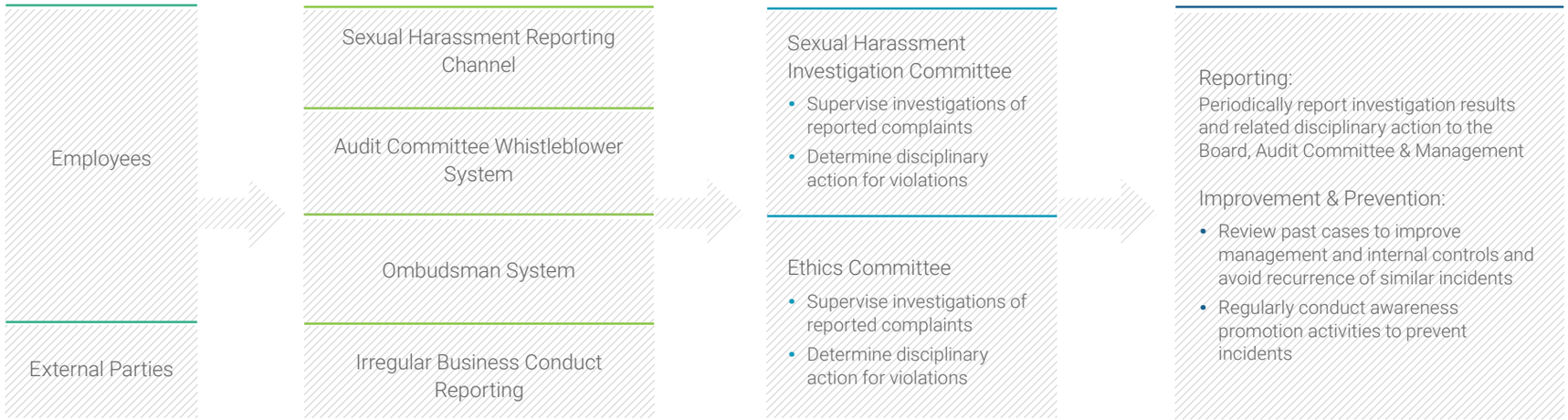
Update course materials for annual ethics and regulatory compliance training

Develop a suppliers ethics guidelines manual

Reporting Channels and Whistleblower Protection

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

Reporting Channels and Investigation Management

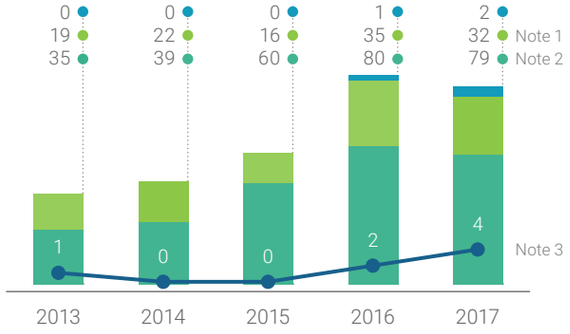


TSMC's legal department participated in a panel to share views on the trends, and importance of whistleblower protection in a 2017 APEC (Asia-Pacific Economic Cooperation) Workshop with delegates from 13 APEC member economies, such as Chile, Japan, South Korea and the U.S.. The workshop provided the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



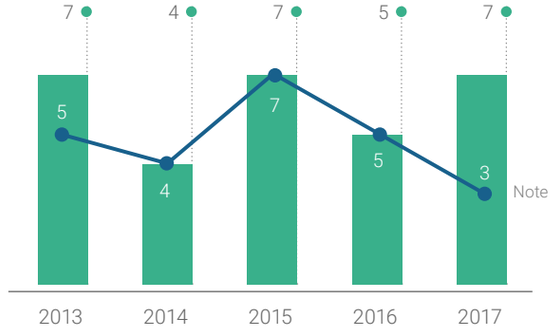
Note 1 Among the 32 cases, 18 cases related to ethics matters

Note 2 Among the 79 cases, no incidents related to ethics matters

Note 3 After investigation of the 4 cases, 9 employees confirmed their violation of the Ethics Code. All 9 employees were severely disciplined by the Company and 3 were dismissed.

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

Unit: numbers



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

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

Innovation and Service

An Innovation Pioneer

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

5,000 / 8,000

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

10.1bn (NT$)

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

93.3%

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

Material Issue

Innovation Management

Strategies	TSMC 2020/2025 Goals	Achievements & 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 & 2020/2025 Goals	2017 Achievements	2018 Targets
	Production ramp-up of industry leading 7nm technology, the 4th 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

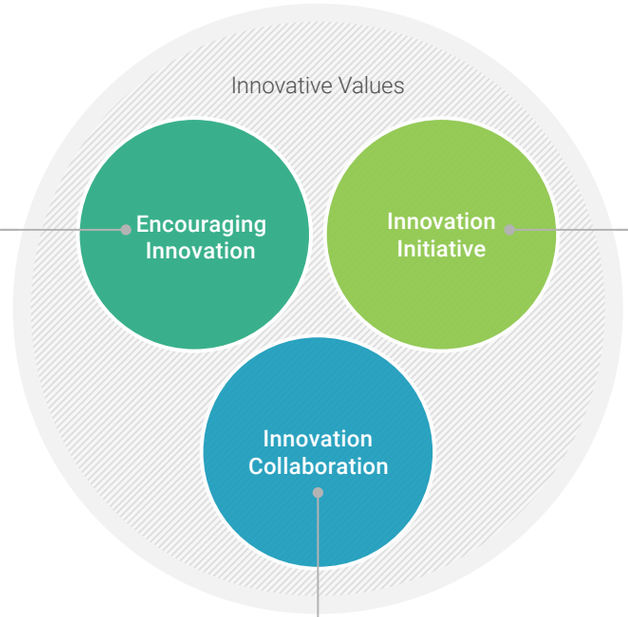
"Being everyone's foundry" is the core of TSMC's strategy. Through the expansion of our technology and services, we built an open platform that welcomes all innovators in the semiconductor industry to realize their innovations and to quickly introduce their products to market in volume.

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.

Technology Leadership

Green Product

Intellectual Property Protection

Intelligent Precision Manufacturing

Green Innovation Cases

- Develop Intelligent Chilled Water System
- New Water Conservation Measures for Production Tools
- Project Big Green
- Refinement and Enrichment of Ammonium Sulfate Dewatering Technology
- Application of Hydro-membrane

Open Innovation Platform®

Cooperation with World-class R&D institute[Note]

TSMC University Collaboration Programs

- TSMC University Research Centers Program
- TSMC University Shuttle Program

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

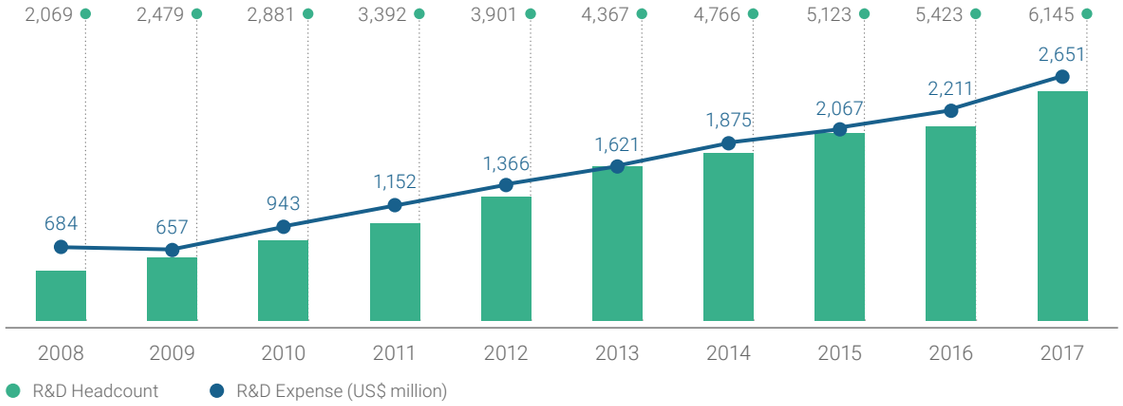
In 2017, TSMC continued to invest in research and development, with total R&D expenditures amounting to US$2,651 million, up about 19% from the previous year, accounting for 8% of total revenue. R&D headcount increased to 6,145, up about 13%, a level that equals or exceeds the R&D investment of many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

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

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

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

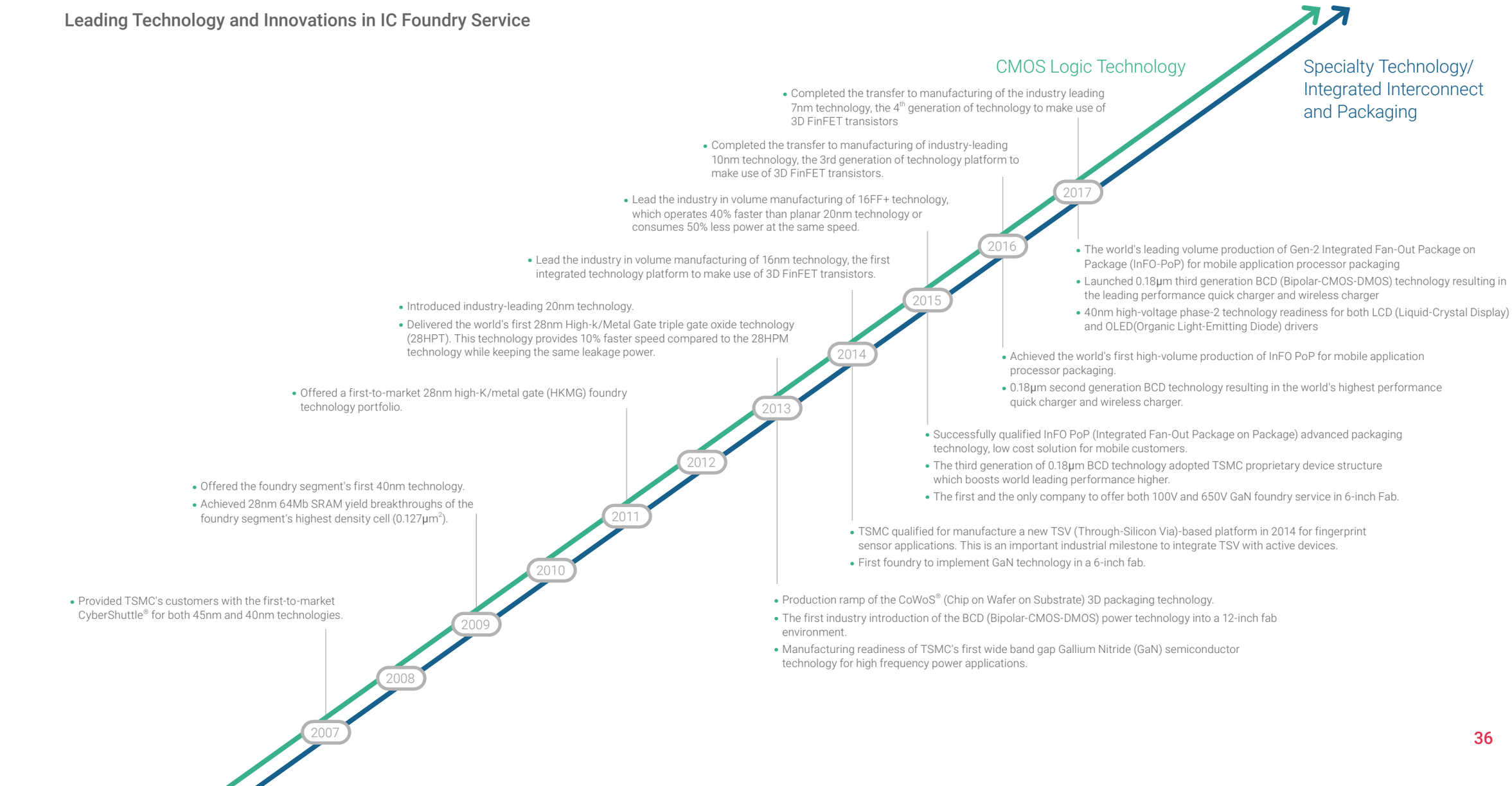
TSMC is Committed to Investment in Technology Advancement



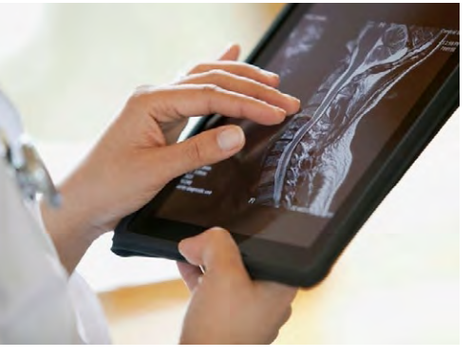
Specialty Technology / Integrated Interconnect & Packaging

Advanced Fan-Out Packaging	Power IC/BCD Technology	Embedded Flash Technology	GaN Technology	Panel Drivers
• The world's leading volume production of Gen-2 Integrated Fan-Out Package on Package (InFO-PoP) for mobile application processor packaging • Successful qualification of Gen-3 InFO-PoP advanced packaging technology for mobile applications • Started risk production of Integrated Fan-Out on Substrate (InFO-oS) for die-partition and HPC applications	Launched 0.18μm third generation BCD (Bipolar-CMOS-DMOS) technology resulting in the leading performance quick charger and wireless charger	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	Successful development and manufacturing qualification of 650V, 100V E-HEMT, and RF 30V D-MISFET GaN devices	Completed 40nm high-voltage phase-2 technology readiness for both LCD (Liquid-Crystal Display) and OLED (Organic Light-Emitting Diode) drivers

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

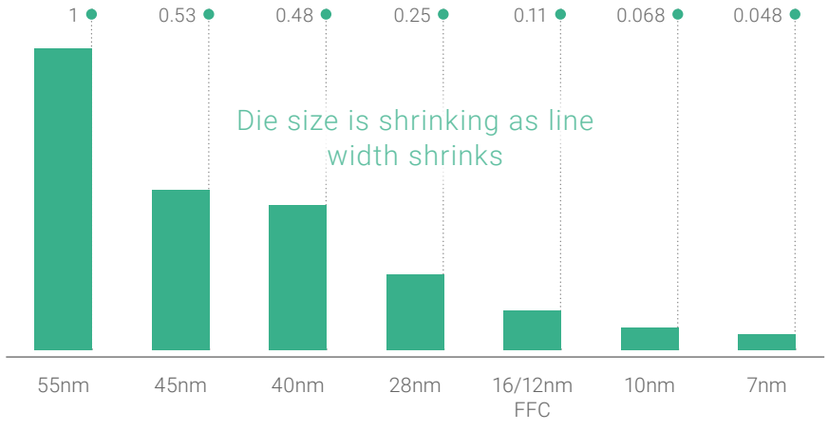
Green Products

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

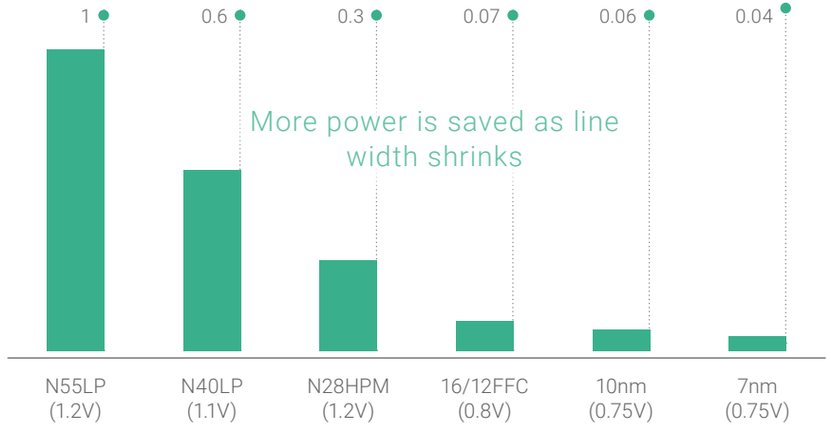
TSMC is consistently first among dedicated foundries to provide next-generation, leading-edge technologies. The Company also provides comprehensive specialty technologies and excellent frontend and backend integration capabilities. These help customers produce more advanced, energy-saving and environmentally 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



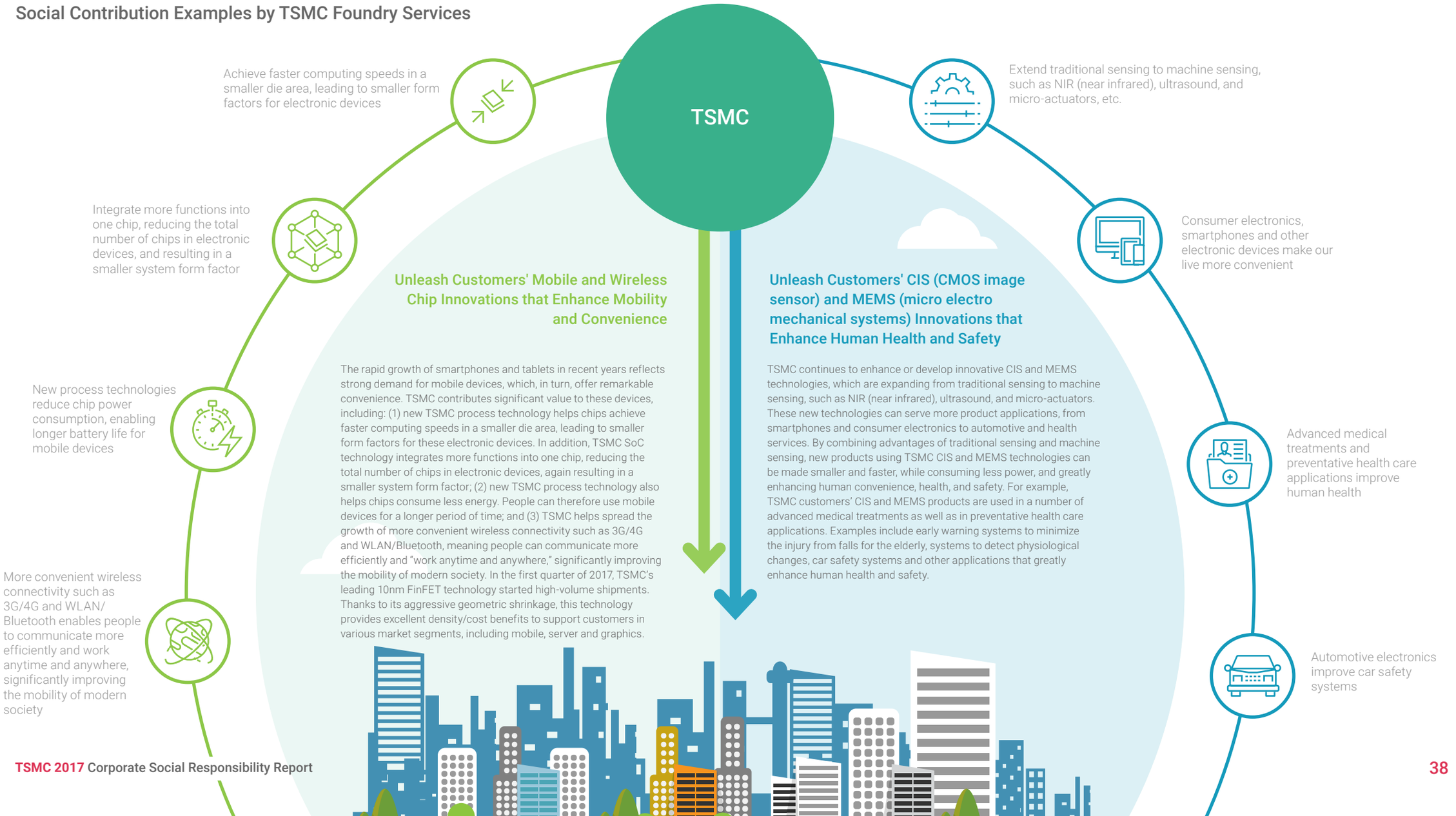
Data source: TSMC

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 2nd consecutive year

1

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

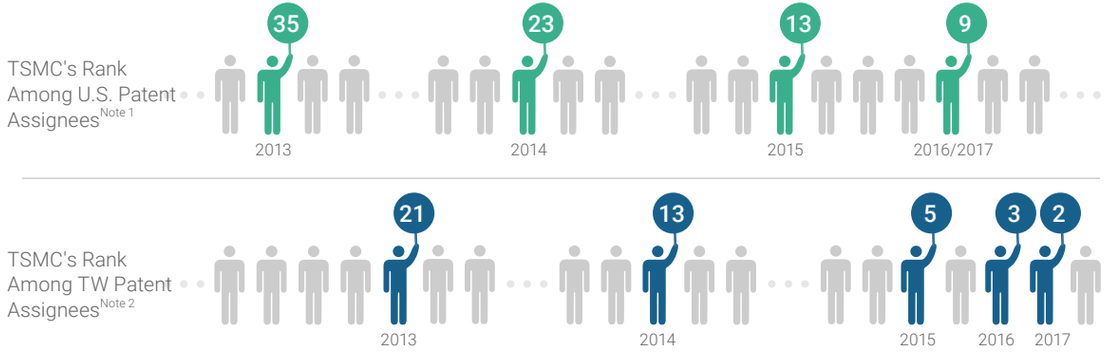
Intellectual Property Protection

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

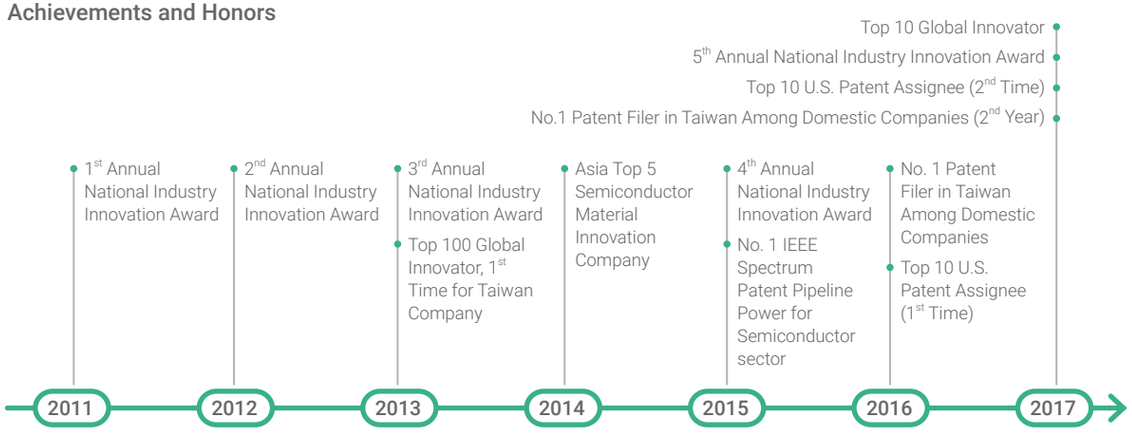
TSMC actively develops its patent holdings and strategically sets patent-filing goals in close alignment with the Company's R&D resource allocations and investment plans to construct an ever-expanding global patent portfolio. Primary measures to achieve these goals include: patent filing within patent 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 2nd consecutive year. In addition, TSMC was ranked No. 1 in 2017 with respect to the number of patent filings in Taiwan. In terms of patent quality, the allowance rate of TSMC's U.S. patent applications was the highest among the top 10 U.S. patent assignees in 2017. These achievements not only strengthen TSMC's technological leadership, but have also established a solid reputation for its intellectual property while protecting the Company's ability to conduct business worldwide.

TSMC Worldwide Patent Rankings



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.

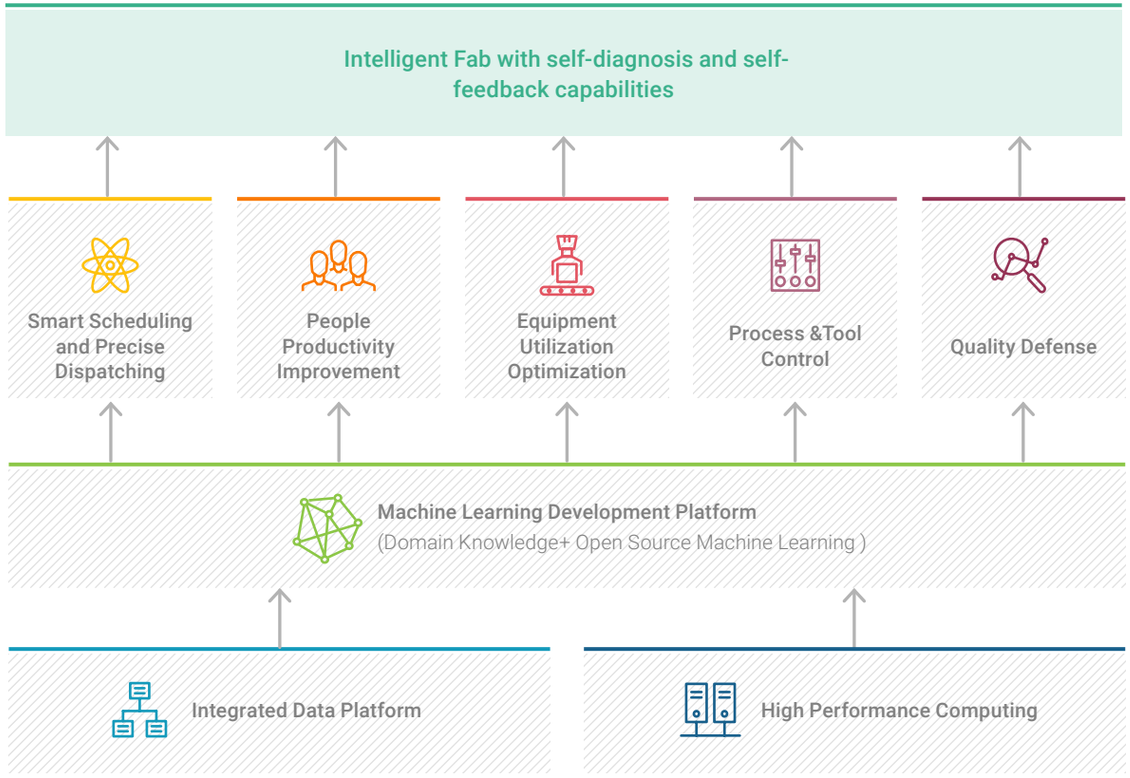
The trade secret registration and management system is located in an "ultra high security" area, with control by a dedicated organization to ensure secrecy. To enhance the operational effectiveness of the company, TSMC has integrated this system with other Company systems to perform joint applications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

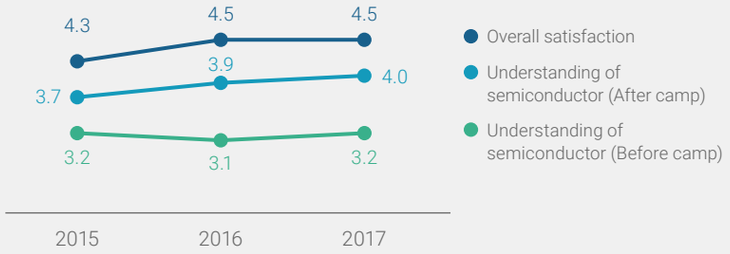
Case Study

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

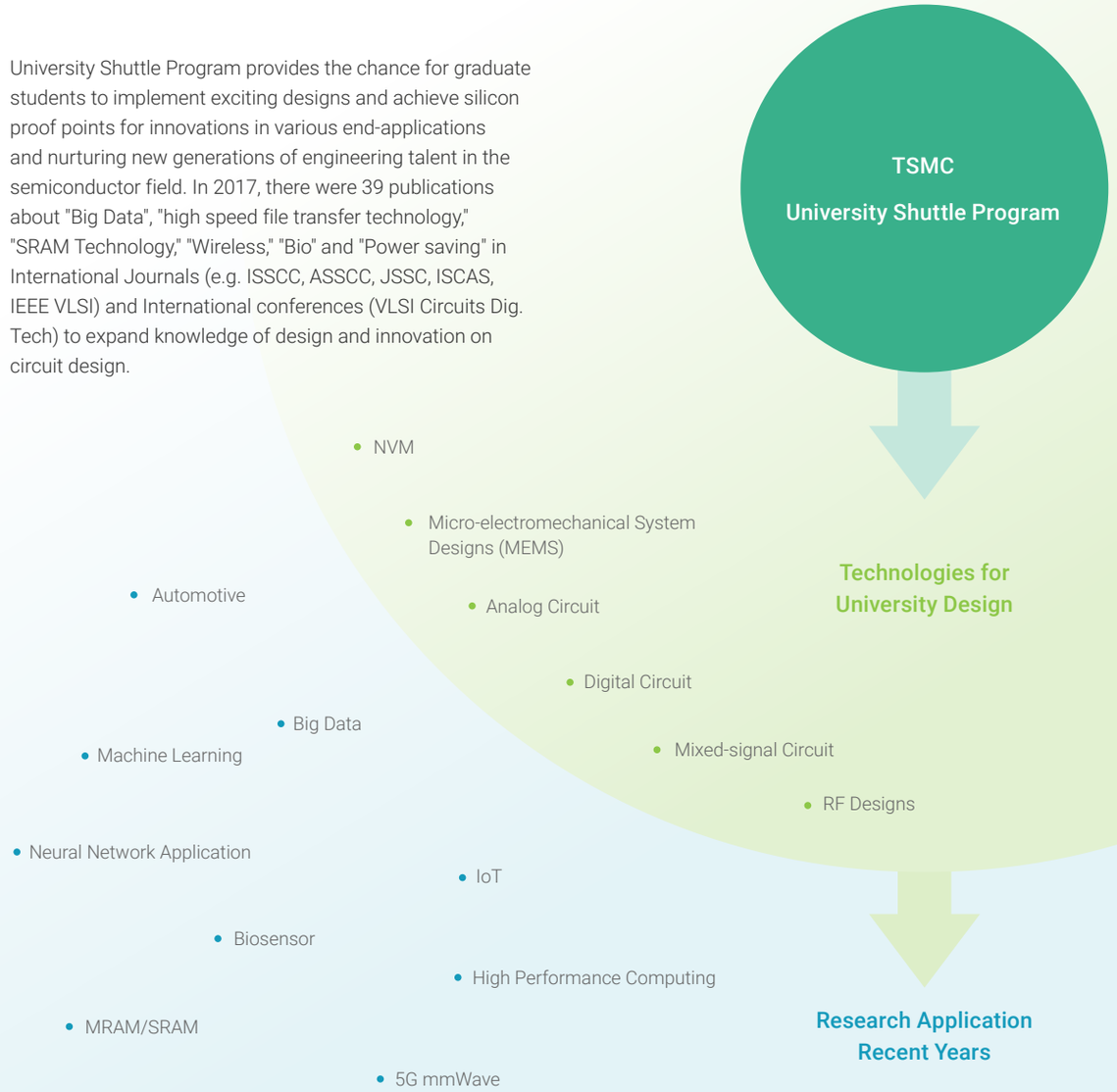
University Research Center

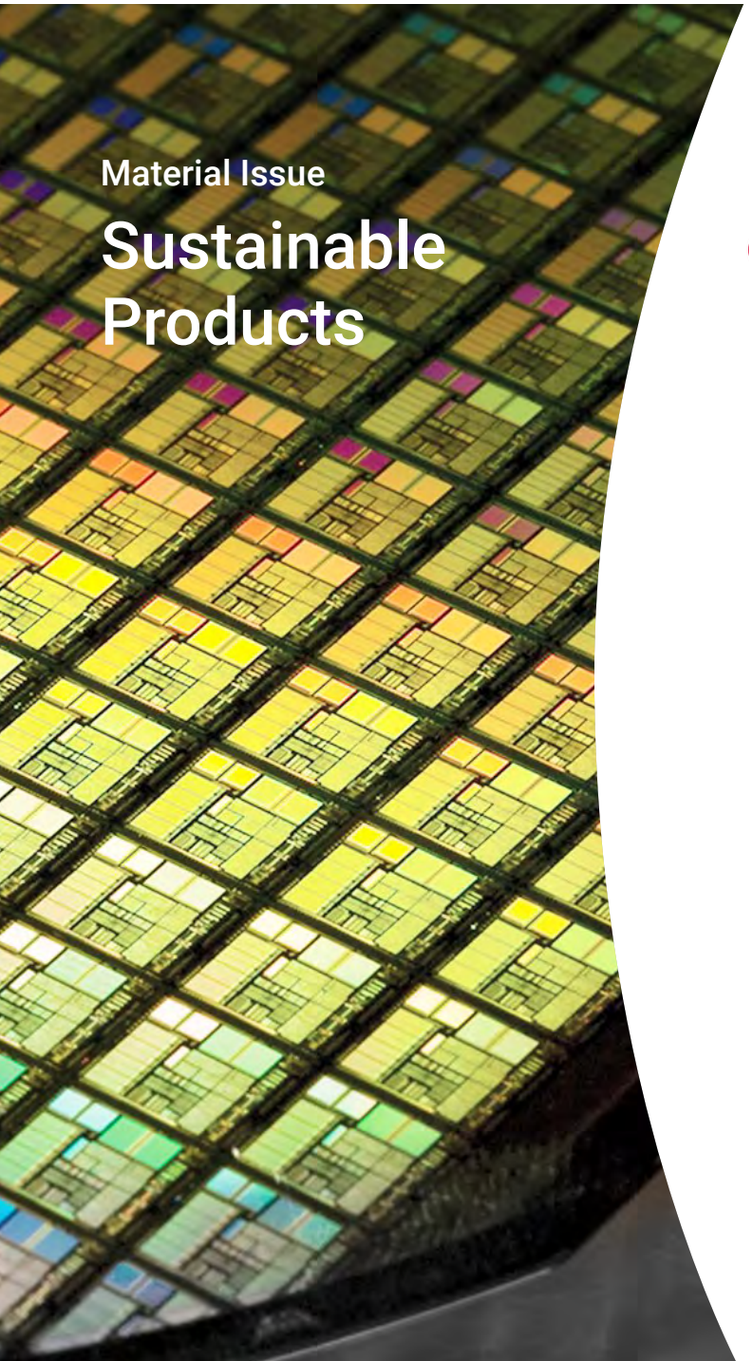
TSMC is committed to talent development in the semiconductor industry. Starting from 2013, four research centers have been established at National Chiao Tung University, National Taiwan University, National Cheng Kung University, and National Tsing Hua University, with 1,840 students participating. Through 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.

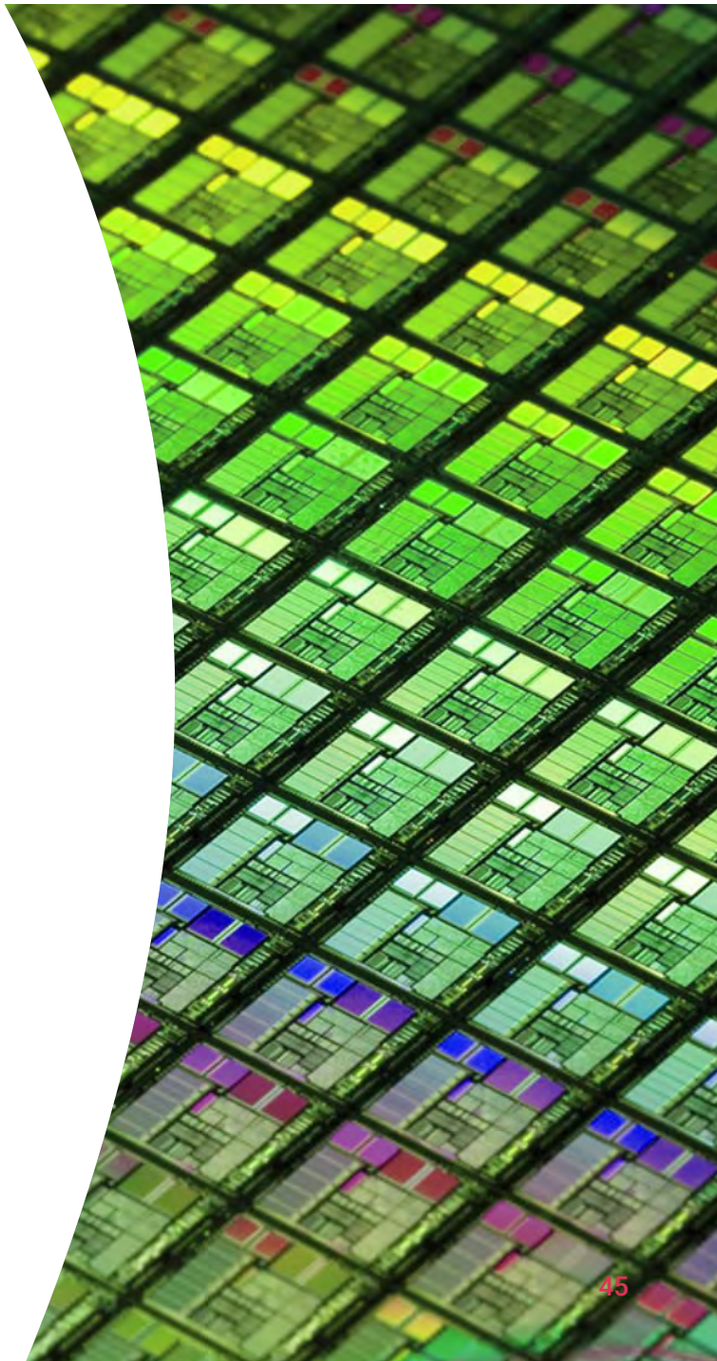




Material Issue

Sustainable Products

Strategies	TSMC 2020/2025 Goals	Achievements & 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 & 2020/2025 Goals	2017 Achievements	2018 Targets
		Complete establishment and renew of product life cycle assessment of all fabs
	100% Compliance for product hazardous substance free legal and customer requirements Target: 100%	100% compliance for product hazardous substance free legal and customer requirements
	82%[Note] Verification of PFOA related substances replacement Target: 100%	100% completion of verification of replacement for all chemicals containing perfluorooctanoic acid (PFOA) related substances
		Complete process used NMP (N-Methylpyrrolidinone) phase-down project

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.

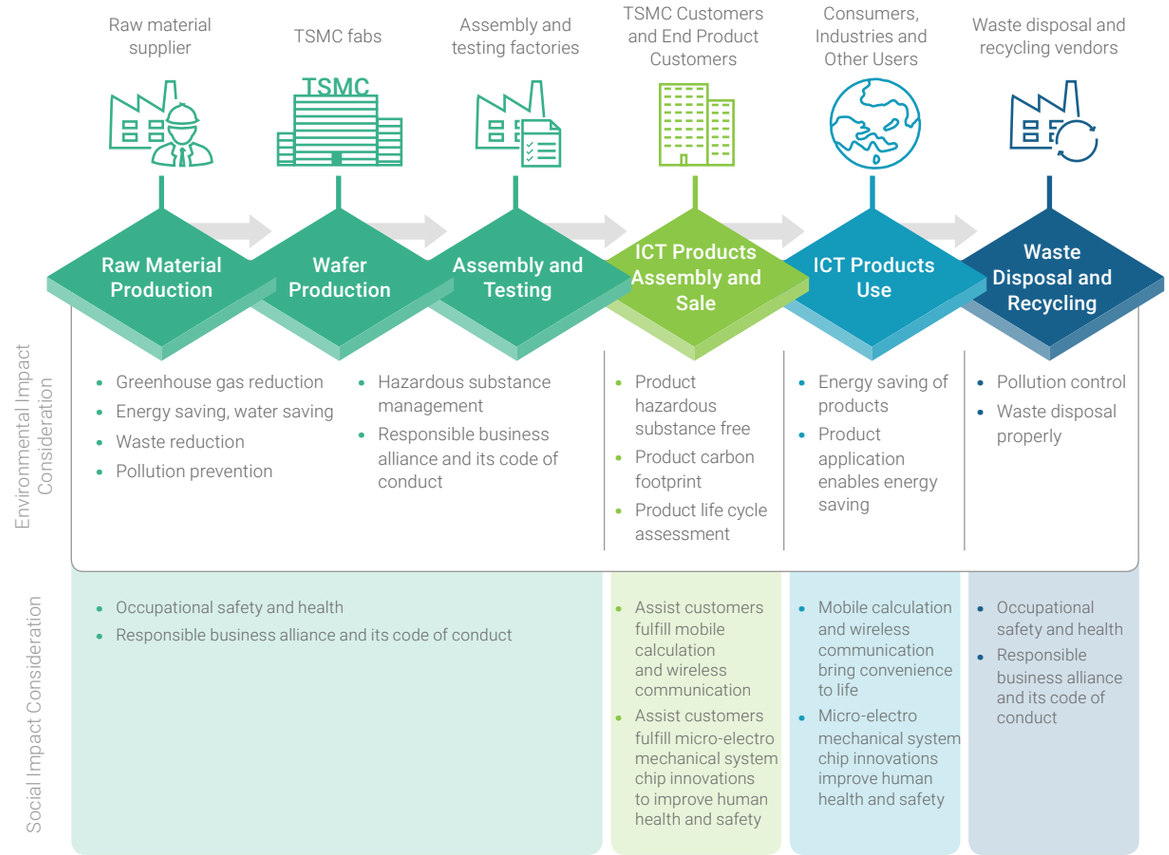
Product Life Cycle Thinking

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



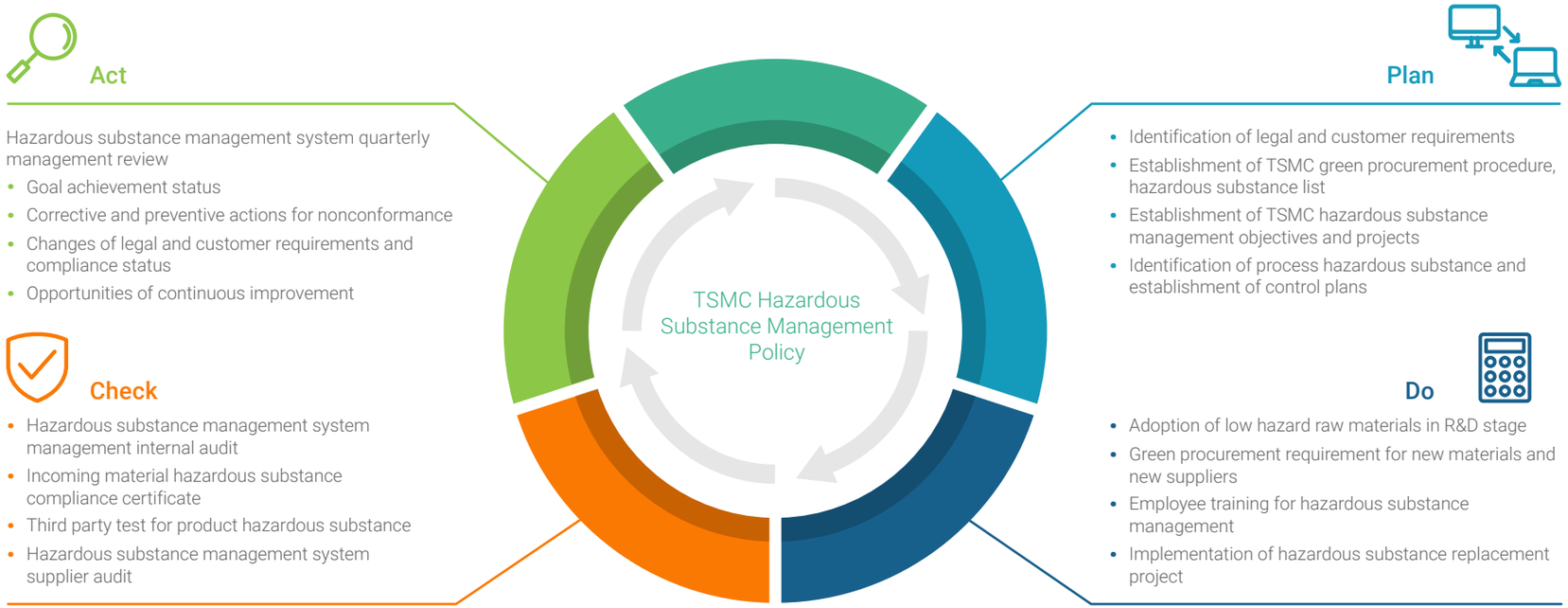
According to TSMC wafer product carbon footprint and water footprint inventory results, the wafer manufacturing stage and raw material mining, production and transportation account for about 70% and 30%, respectively. TSMC continues to improve carbon reduction, water saving and waste reduction. TSMC 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 perfluorooctanoic acid (PFOA) and its related substances may harm human body and the environment, the international legislation has gradually led to regulation. TSMC led the global semiconductor industry and has completely stopped using raw materials containing PFOS and PFOA in year 2010 and 2015 respectively, and all products do not contain these substances. Although PFOA related substances include its precursors and derivatives have not yet been restricted to be used in semiconductor manufacturing processes in the world, TSMC has initiated chemical replacement projects in 2016. As of 2017, we have completed 82% of the verification process for alternative substances. It is expected to be 100% completed in 2018.

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

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)	• TSMC provides lead free bumps to customers. A few customers still need trace lead contained bump which is exempted by EU RoHS • Other EU RoHS restricted substances are not used in TSMC process
Product Halogen Free Requirements	• All TSMC products are compliant
Perfluorooctanesulfonic Acid (PFOS), Perfluorooctanoic Acid (PFOA) Restriction in Process	• TSMC has totally phased out using PFOS and PFOA, and all products also do not contain these two substances
EU Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) (REACH) Annex XVII	• All TSMC products are compliant
EU REACH Substances of Very High Concern (SVHC)	• All TSMC products are compliant
EU Waste Electrical and Electronic Equipment (WEEE) Directive	• TSMC's products are not final products and this law is not directly applicable

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

Prohibited or Restricted Substances

25 categories of prohibited or restricted substances including legal, customer requirements and TSMC voluntary.

- Prohibit or restrict containing in process raw materials or products

Controlled Substances

Carcinogenic, mutagenic or toxic for reproduction (CMR) substances.

- "Not use" as the principle, but to be used following environmental, safety and health requirements and approval of R&D, Operation Vice Presidents and Corporate ESH unit if no available alternatives.

Reportable Substances

Required to report by regulations

- Use after conforming related information

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.

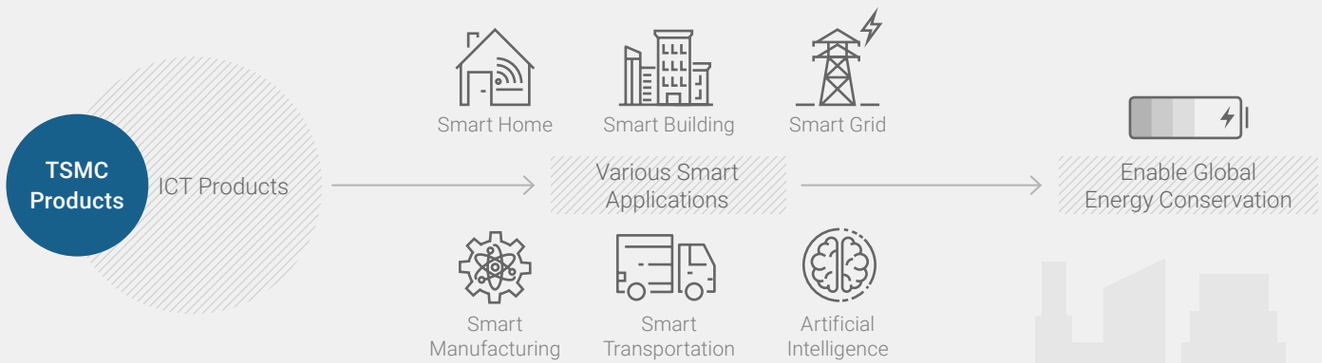
Continue to collaborate with ITRI Industrial Economics and Knowledge Center and MIT to further study the energy conservation contribution of global information and communications technology and semiconductor products to other industries and smart households.

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"



Material Issue

Product Quality

Strategies	TSMC 2020/2025 Goals	Achievements & 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	

Strategies & 2020/2025 Goals	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	Targrt: 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	Target: Complete reliability qualification for 7nm technology and specialty technologies
		Complete reliability qualification for leading technology and specialty technologies according to R&D's goal

> 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.

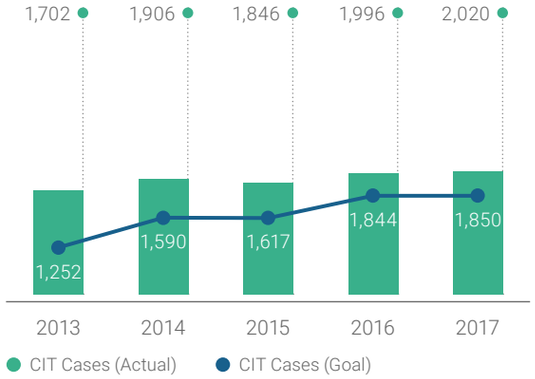
To enhance corporate quality culture with continual improvements on product quality, production efficiency, cost reduction and customer satisfaction, TSMC fully promoted the "Suggestion[Note 1]" in basic levels and the activities of "Continual Improvement Team (CIT) [Note 2]". TSMC also held a corporate-level "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.

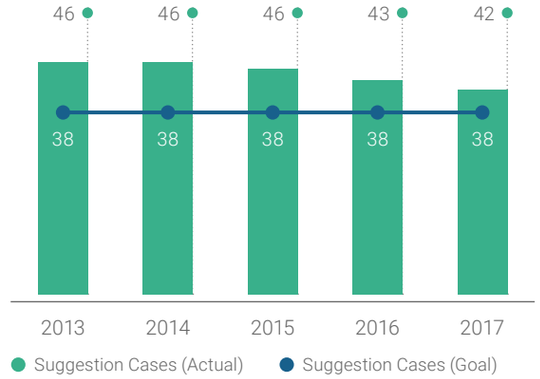
Continual Improvement Team (CIT) Program

Unit: case



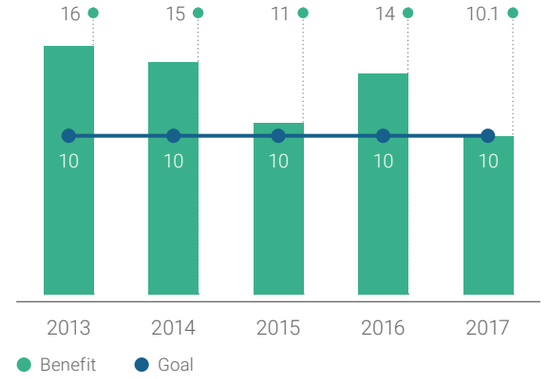
Suggestion Program

Unit: thousand cases



Benefit from Suggestion Program and CIT

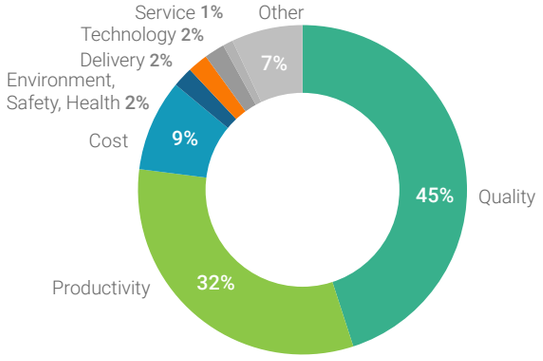
Unit: NT$ billion



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"[Note 1] 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[Note 2] 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

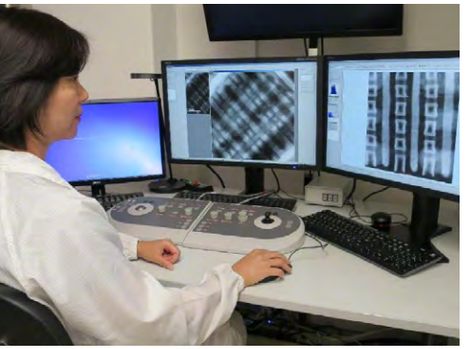
Group	Cases	Benefit
Quality Enhancement	To improve the methods in Lithography processes	**99.7%** Enhanced product yield to 99.7%
	To improve the methods in Integrated Fan-Out (InFO) clean process	**88%** Improved test reject rate 88%
	To improve the methods in Furnace process	**75%** Reduced specific product defect rate 75%
	To improve the methods in 3D image sensor Etching process	**50%** Enhanced image resolution 50%
Customer Satisfaction	To develop 40nm Ultra Low Power technology	**80%** Improved customer product standby power performance 80%
	To establish innovative design service platform for stacked CMOS image sensors	**70%** Shortened customer product development schedule for image analysis and test 70%
Environment, Safety, Health	To reduce 8-inch Fab carbon emissions and save energy	**63,500 metric tons** **60,290,000 kWh** Reduced CO_2 emission 63,500 metric tons and saved the use of electricity 60,290,000 kWh annually

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 competiveness.

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.

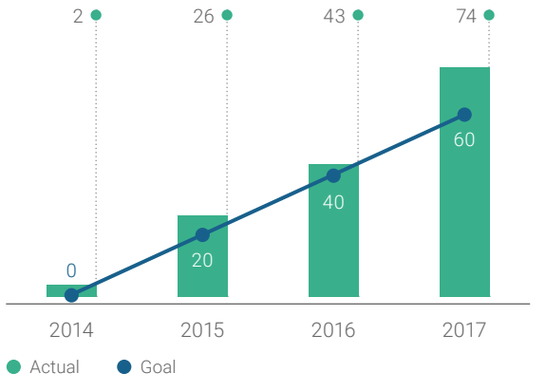
Quality Capability Enhancement

The failure analysis capability plays an important role to support advanced and specialty technology development, reliability qualification and mass production timing. To help customers meet their time-to-market requirements, the Quality and Reliability organization collaborates with academics, suppliers and customers to develop failure analysis techniques, enrich advanced material and chemical analysis capabilities and enhance fault isolation methods.

TSMC continually enhances its manufacturing capabilities. To reduce product defects, enhance process controls, detect abnormalities early and prevent quality events affecting customers, the Quality and Reliability organization and Operation organization collaborate to establish real-time defense systems by applying advanced statistical methods and quality tools. In 2017, the deep machine learning methodology had successfully been applied for advanced spectral analysis to detect differences among processes and equipment, and triggered improvement actions. With machine learning methodology, an automatic defect classification system for 12-inch wafers outgoing visual inspection was also established to enhance the consistency of visual inspection and enrich a visual inspector's monthly productivity to 4,747 pieces.

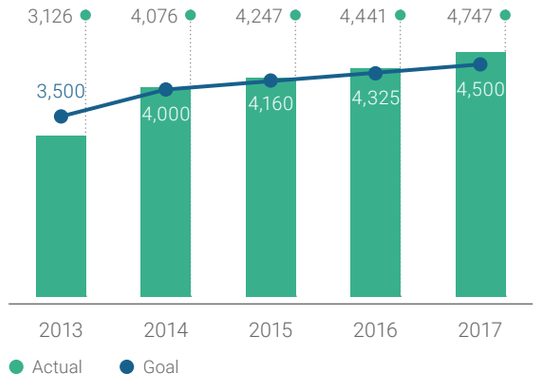
Suppliers' National QCC Participation Rate

Unit: %



12-inch Wafer Outgoing Visual Inspector Productivity

Unit: wafer (piece)



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

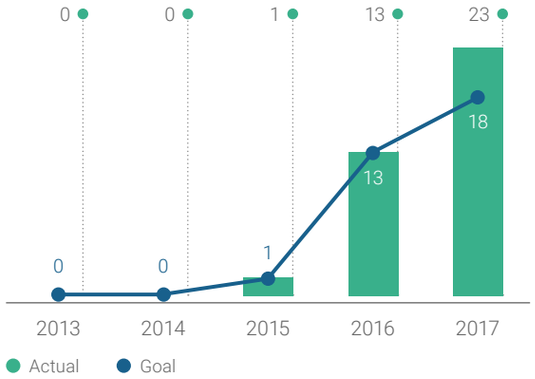
Enhance outgoing visual inspection defect automatic classification system and chemical laboratory's capability for material analysis

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 (Perfluorooctanoic acid) derivatives for replacement of existing materials with PFOA derivatives. Additionally, a third-party audit verified the effectiveness of TSMC's hazardous substance process management system and quality management systems in compliance with IECQ QC 080000 and IATF 16949. Equally important, the products made by TSMC complied with European Union regulations and customer requirements with the sampling validation by a third-party external laboratory.

Quality Application Realization

To provide excellent and reliable product quality for customers' requiring timely delivery, ensuring users' safety and product applications, and preventing post-productionrecalls, 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 & Targets
Customer's Virtual Fab Provide complete and timely information to facilitate production success; enhance process and security mechanism to ensure customer information protection	Align with TSMC technology development roadmap, available technologies through TSMC-Online to reach 370 2025 Pass customer product information audit without major defect 2025	
Listen and Respond to Customer Needs Closely collaborate with customer and conduct meeting/questionnaire to understand and answer customer's questions, so that we can provide the best customer service	"Customer Service" score in Quarterly Business Reviews to reach 75% with satisfactory feedback 2025	

Strategies & 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

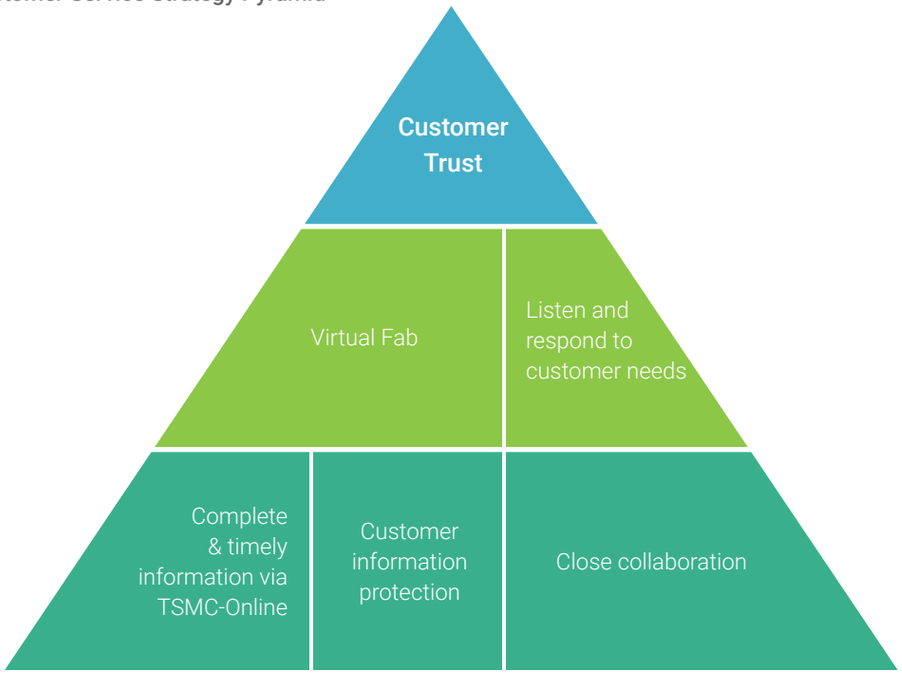
Surpassed Achieved Unachieved

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

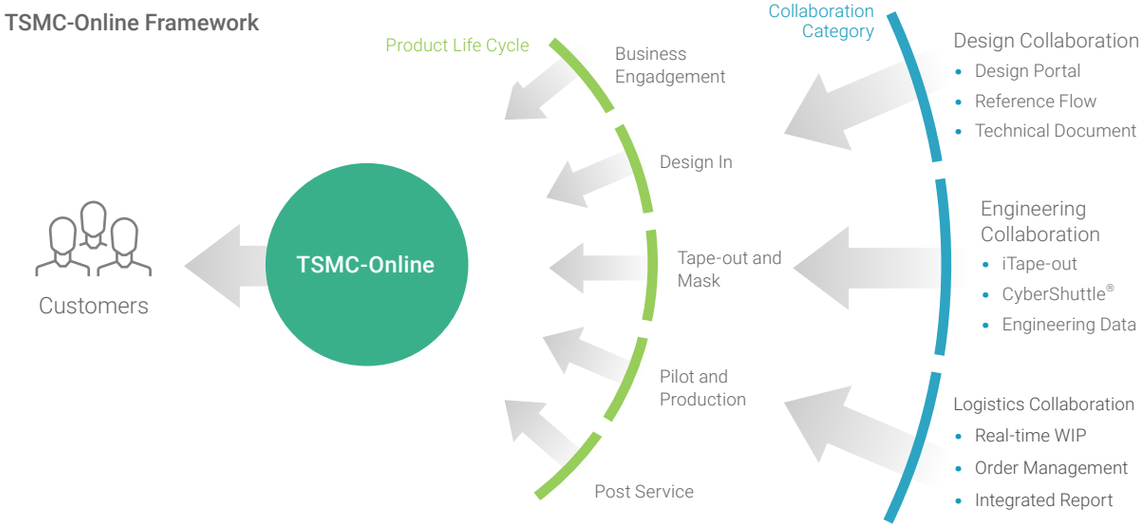
Customer trust has always been a very important core value in TSMC, and it is also the reason why customers entrust their manufacturing service to TSMC. Real-time interactive information exchange and secure customer information protection are the key factors to win customer trust.

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

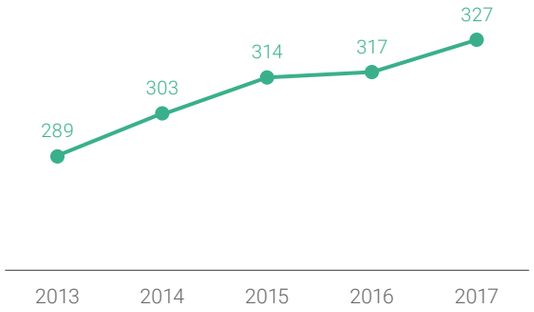
Regarding customer information security, TSMC is committed to protect all customers' proprietary information. With the Virtual Fab architecture, TSMC has implemented special security controls throughout the customer's product lifecycle that are examined and refined every year. In 2017, TSMC enhanced 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.

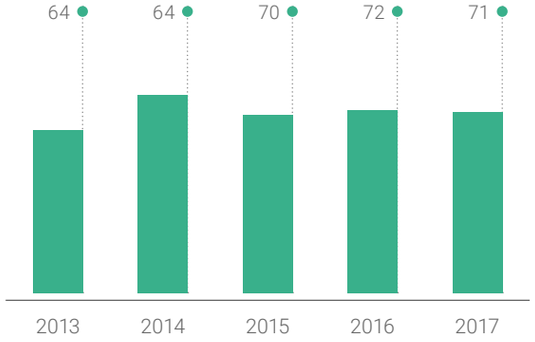
In 2017, "Customer Service" score in Quarterly Business Reviews with satisfactory feedback is 71%, with 1% loss as compared to 2016. The major reason for this minor decrease is due to the length of time it took for technology collaboration discussion and decision. In the future, TSMC will improve the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



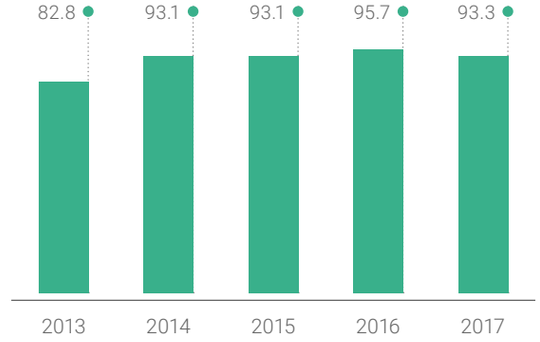
Quarterly Business Review Customer Service Score

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

PIP Guidelines Revision

12 PIP guidelines were revised or created, including top secret information management and physical security area definition

Employee Access Control

Employee information access is secured by automated system control

Information Control

Categorized proprietary information by security levels. Strictly controlled information access, delivery, and retrieval

Incorporated PIP protection into the design of new fabs

Security control systems were established in the initial stages of Nanjing Fab such as portable storage device control

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

5 Customer Security Audits

Passed 5 customer security audits and certifications, ensured product information protection during manufacturing

100%

Over 3,000 newcomers completed Proprietary Information Protection training course

100%

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

8 Promotion Micro Films

8 PIP micro films to deliver PIP major concepts

12 Regulations

Newly created or revised 12 Proprietary Information Protection regulations

24 Promotion Posters

24 PIP promotion posters to raise PIP awareness

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.

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

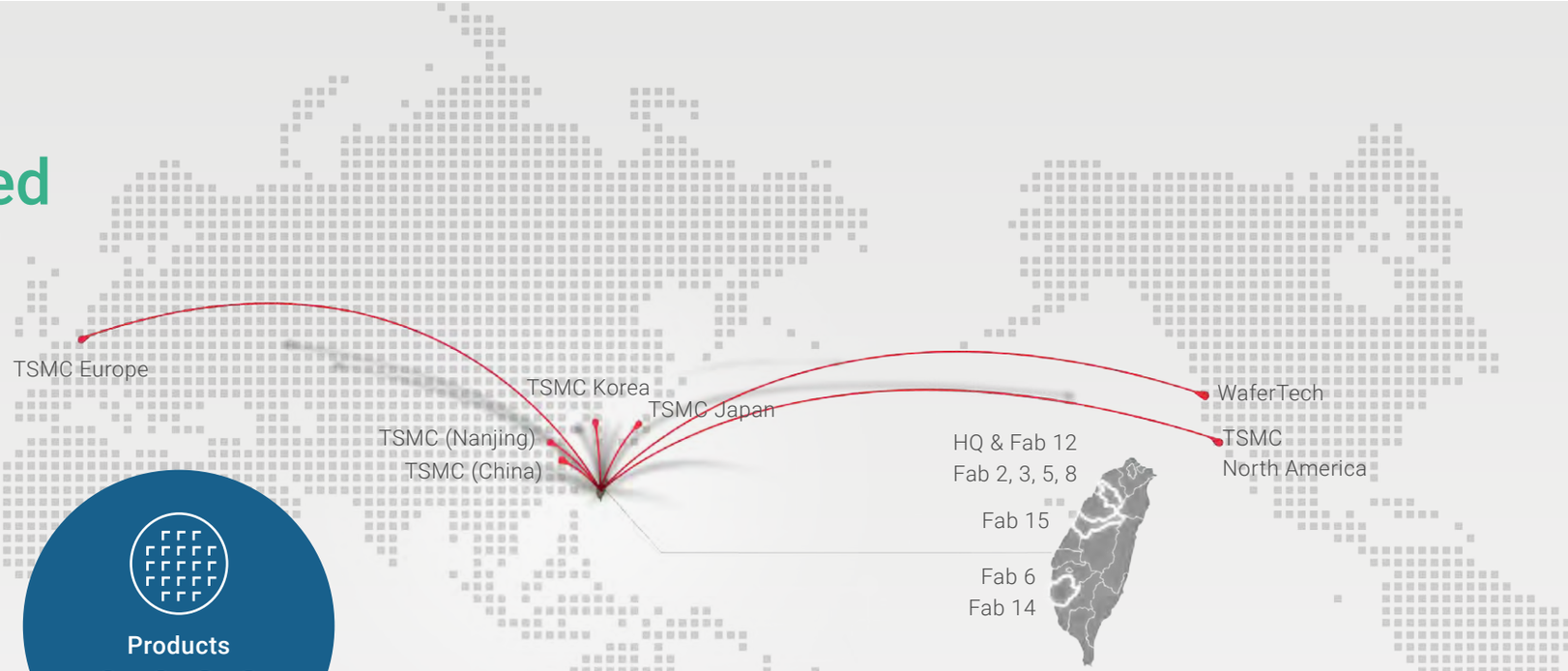
3M Checks

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.



Technologies 258

Customers 465

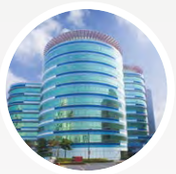
Products 9,920

Fab 2
- 32
- 82
- 1,203

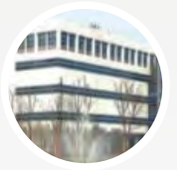
Fab 3
- 67
- 162
- 1,377

Fab 5
- 21
- 38
- 260

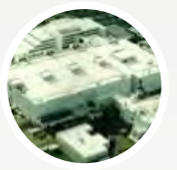
Fab 6
- 54
- 134
- 702



Fab 8
- 49
- 166
- 1,687

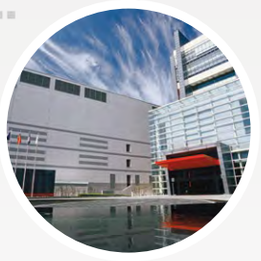


TSMC (China)
- 44
- 133
- 813



WaferTech
- 23
- 39
- 478

GIGAFAB®



HQ & Fab 12
- 68
- 123
- 1,053

GIGAFAB®

Fab 14
- 65
- 168
- 1,657

GIGAFAB®

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.

100%

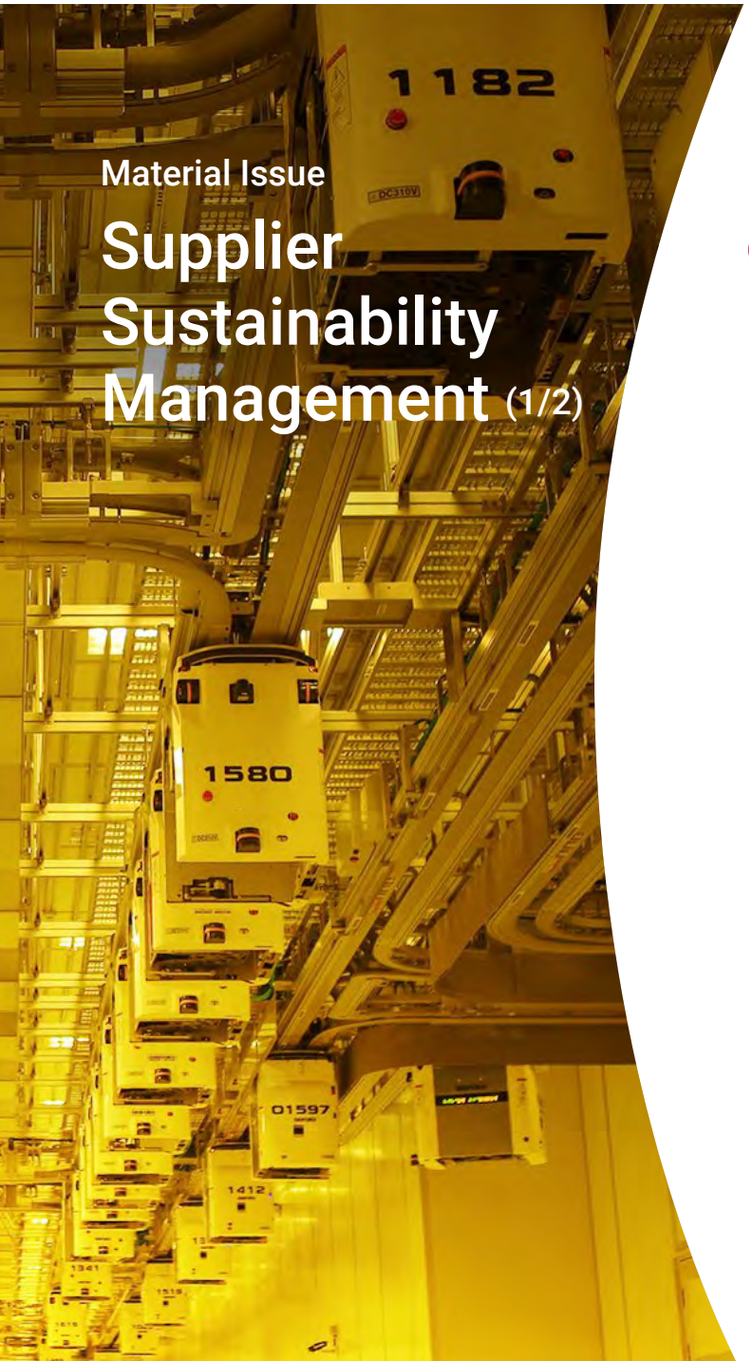
100% of the new suppliers signed the Supplier Code of Conduct

100%

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

20.5%

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



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[Note 1]

- 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[Note 2] 2020
  - 100% of first-tier suppliers sign the Letter of Assurance 2025
  - 80% of the critical second-tier suppliers sign the Letter of Assurance[Note 3] 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 & 2020/2025 Goals | 2017 Achievements | 2018 Targets

86.5%
Existing Suppliers Signed

Target: 80% of the existing suppliers are to sign Supplier Code of Conduct

100%
New Suppliers Signed

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

- 90% of all suppliers are to sign the Code of Conduct (new supplier must be 100% compliant and sign the Letter of Assurance before doing business with TSMC)
- 30% of the major second-tier suppliers sign the Code of Conduct
- Organize responsible supply chain forum and jointly establish the long-term goals against ESG issues
- Intensify supplier man-hour management to ensure the compliance of laws and regulations of supplier employees working at TSMC sites [Note 1]

84[Note 2]
Supplier Site Audits

Target: Conduct 90 supplier audits to ensure the compliance of RBA standards

- Require 30 suppliers to cooperate with third-party audit firm and to accept professional audits with RBA standards
- The achievement rate for prority issues improvement[Note 3] must be higher than 80%[Note 4]

100%
Materials Source from RMAP Conformant Smelter

Target: 100%

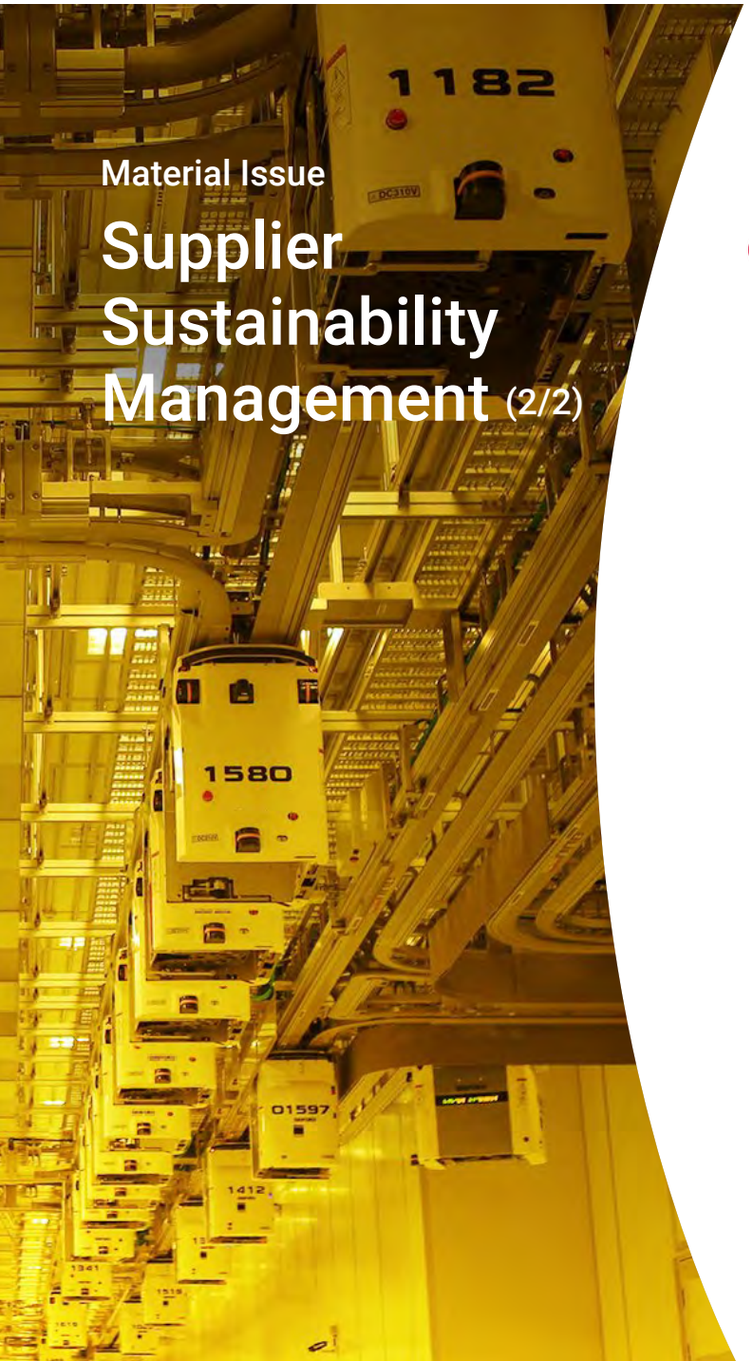
- Conduct documentation audit on at least 3 suppliers to verify its due diligence efforts in ensuring 100% conflict-free sourcing

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

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

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

Note 4: The priority issues identified in the fourth quarter of the year would take at least 30 days to improve, making the goal of achievement to be set at more than 80% instead of 100%



Material Issue

Supplier Sustainability Management (2/2)

Strategies	TSMC 2020/2025 Goals	Achievements & Targets

Improve Supply Chain Resilience

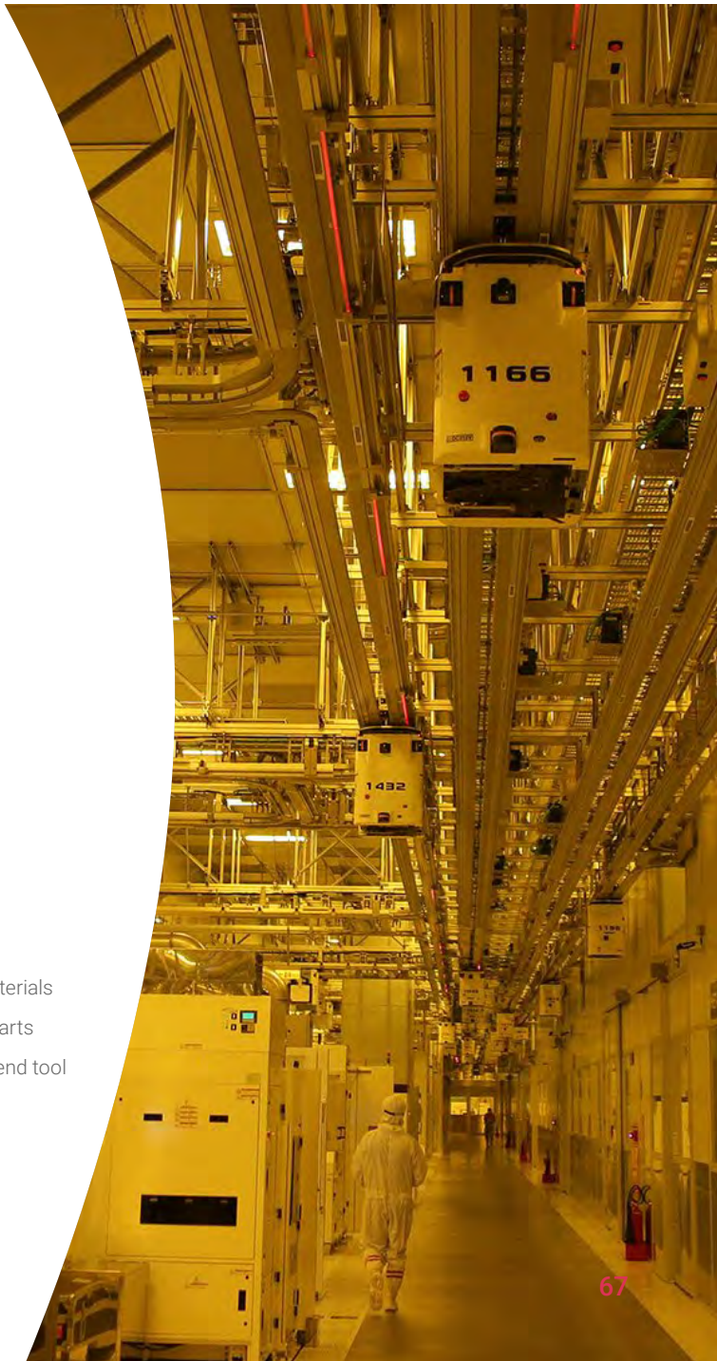
Assist supplier to strengthen capability of emergency response, implement occupational safety and hygiene, improve process and quality

- 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 & 2020/2025 Goals	2017 Achievements	2018 Targets
	154 Elevated ESH score by counselling Target: 150 or more (full score is 200)	
	9 Local material suppliers were counselled for process and quality improvement Target: 9 (accumulated to 20 suppliers)	Publish TSMC ESH Guidance, and provide suppliers the new ESH standards for reference[Note 1] 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[Note 2] 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
	20.5% Reduced unit waste production of major local waste-producing suppliers (compared with 2014) Target: 20%	The waste output of major local waste-producing suppliers will be reduced by 21.5% (compared with 2014)
	34 (from 5 suppliers) Power-efficient tool models assessed Target: 20	
	114 (for 34 models) Energy saving activities launched Target: Deliver 2025 power-efficient equipment development plan	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
	44%[Note 3] Localization for raw materials Target: 46%	
	66% Localization for spare parts Target: 66%	
	33% Localization for backend tool Target: 33%	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

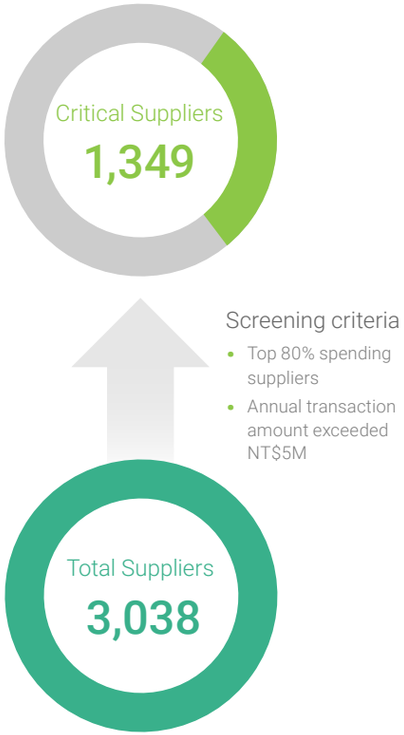
Vice President, Operations / Mainstream Fabs and Manufacturing Technology, and Materials Management & Risk Management

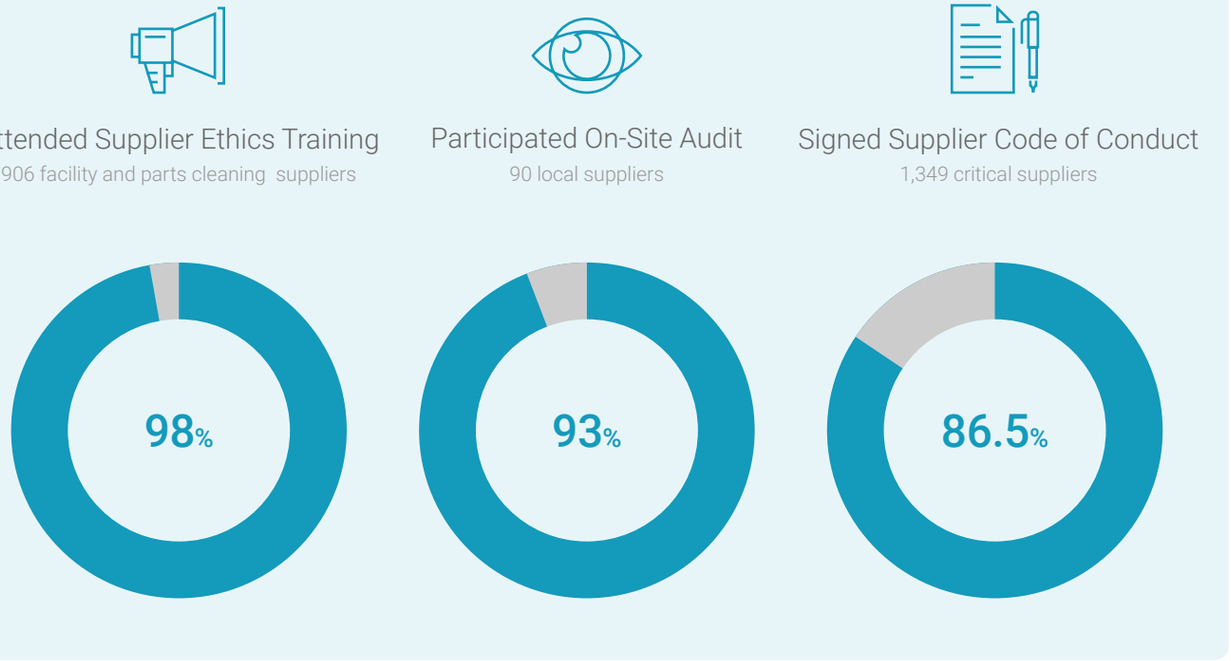
Implement Responsible Supply Chain Management

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.

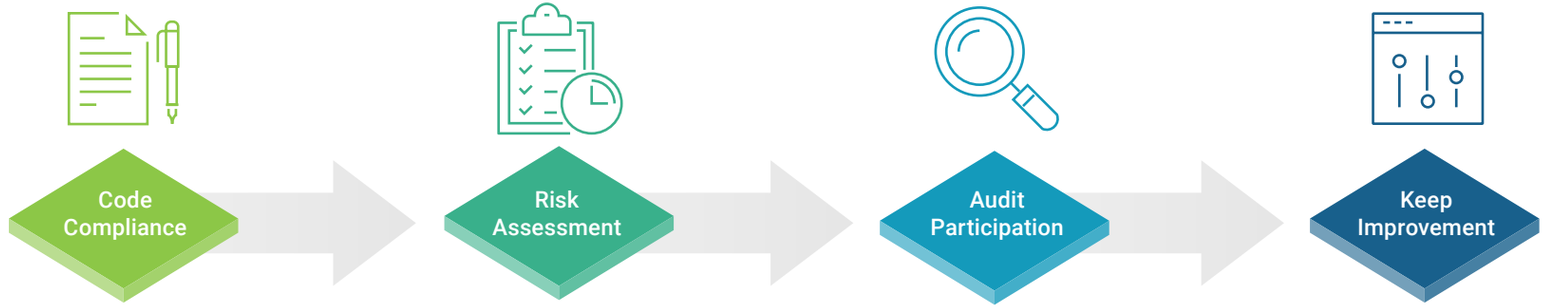
In 2017, 86.5% of TSMC's 1,349 critical suppliers completed the supplier Code of Conduct sign-off. Through strengthening the advocacy and management mechanism, it was expected that not only critical suppliers, but all suppliers, must complete the code compliance by 2025.

Supplier Code Compliance and Management Progress





Four Major Executional Guidelines



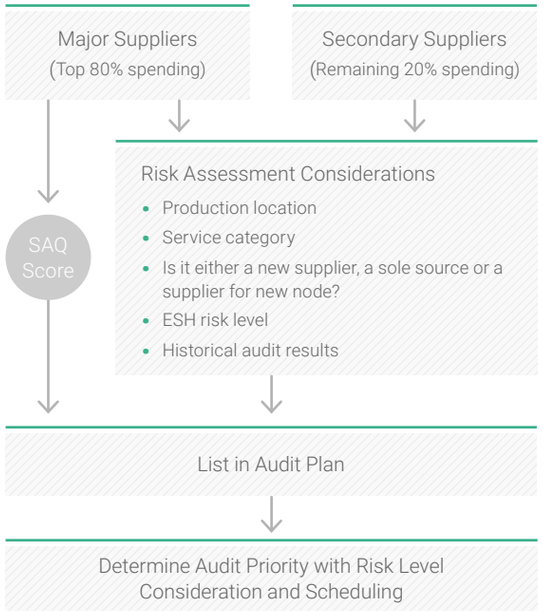
	Code Compliance	Risk Assessment	Audit Participation	Keep Improvement
Standard	• Comply with TSMC Supplier Code of Conduct	• Measure supply chain risk with Code of Conduct	• Participate professional audit by third-party audit firm [Note]	• All weaknesses are classified as priority, major and minor issues. The priority issues must be corrected immediately
Management Guidance	• All suppliers must comply and sign Code of Conduct • Ask critical second-tier suppliers to comply and sign Code of Conduct	• Identify supply chain high risks and take action for priority issues • Confirm supplier adopting same standard for its supply chain management	• Encourage suppliers to engage third-party audit • TSMC monitors and assists auditors in the role of observers	• Provide necessary counselling or assistance, arrange re-audit to ensure fulfilment • Reduce transaction or discontinue business relationship for supplier who failed on Code Compliance

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

Supplier Risk Assessment

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

Risk Assessment Flow



Risk Assessment Result

Major Suppliers

		2016		2017	
		Headquarters	Supplying Facilities	Headquarters	Supplying Facilities
Supplier Assessed	Japan, USA, and Western Europe	25	83	26 ↑	92 ↑
Assessment Method		Based on SAQ score + supplier risk assessment considerations			
Assessment Results		High risk: 0 Medium risk: 1 headquarter and 1 supplying facility, listed in priority audit plan Low risk: 24 headquarters and 82 supplying facilities, continue to monitor supplier's risks by SAQ		High risk: 0 Medium risk: 2 headquarters and 1 supplying facility, listed in priority audit plan Low risk: 24 headquarters and 91 supplying facilities, continue to monitor supplier's risks by SAQ	

Secondary Suppliers

Supplier Assessed	China, Malaysia, and Taiwan	207	210 ↑
Assessment Method		Based on supplier risk assessment considerations	
Assessment Results		106 suppliers are classified with potential risk, and listed in audit supplier pool [Note]	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.

RBA Standard Audit Results

	2016	2017
Audit Count	107	84
Oversea VAP Audit Count /Average Score[Note 1]		
China	3 / 71	8 / 115 ↑
Malaysia	2 / 76	2 / 138 ↑
Domestic Non-VAP Audit Count / Average Score[Note 1]	102 / 148	74 / 160 ↑
Priority Non-Compliances / Progress[Note 2]	**Working hours and employment fees / Improved**	**Working hours and employment fees / Improved**
Common Non-compliances / Progress	**Improved** • Earthquake protection **On-going** • Labor health regulations • Fire protection • Climate change response • Wages and benefits • Occupational safety • Hazardous substance management • Industrial hygiene	**On-going** • Labor health regulations • Fire protection • Climate change response • Wages and benefits • Occupational safety • Hazardous substance management • Industrial hygiene

Note 1: Full score 200

Note 2: All suppliers' weaknesses were traced by CAR (Corrective Action Request) System, and manage the improvement progress accordingly

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
Strengthen the supply chain management	• Protect labor and human right • Implement occupational safety and hygiene • Promote environmental protection
Enhance supply chain resilience	• Strengthen supplier's resilience • Advanced process and quality improvement

Action Plan of Responsible Supply Chain

2016

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

2017

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

2018

- Publish new Supplier Code of Conduct
- The second-tier suppliers are also included in the scope of the responsible supply chain action plan
- Working with third-party audit firms to perform audits with RBA standards
- Hold responsible supply chain forum to set long-term environmental goals
- Intensify due diligence audit for conflict mineral suppliers
- Intensify man-hour management for the supplier employees working at TSMC sites
- 30% of major second-tier suppliers are to sign TSMC Supplier Code of Conduct

2019

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

2020

- Over 90 suppliers completed RBA standard audit
- The waste output of major local waste-producing suppliers will be reduced by 24%
- Increase local purchasing amount by 47% for raw materials, 70% for spare parts and 38% for back-end tool

2025

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

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.

Action Plan	Problem and Challenge	Counselling and Action	Effects
Protect Labor and Human Right 113 suppliers (84 on-site audits) (29 conflict mineral suppliers)	Problems of supply chain labor and human rights. • Charging recruiting fees to foreign workers • Employers' custody of foreign labor documents • Consecutively working for 7 days • Work rules incompleteness • Ensuring conflict-free sourcing	• Intensify communication for Supplier Code of Conduct • Request supplier to return documents to foreign workers • Request suppliers to establish complete working rules • Continuous due diligence efforts to ensure 100% conflict-free sourcing of 3TG • Hold supplier communication meeting and request supplier to responsibly source cobalt materials and disclose the smelters from which they sourced cobalt materials	• Employers returned NT$5.5 million recruiting fees to 360 foreign workers • Employer's custody of foreign workers' documents has been 100% improved • The working rules established for 30% audit suppliers(+objects are labor intensified categories like facility, general affairs and parts cleaning) • Supplier consecutive-days worked is no longer an issue since increasing the manpower • Eight cobalt material suppliers have disclosed the smelters they sourced from • 100% of our 3TG suppliers implemented due diligence measures to ensure conflict-free sourcing
Implement Occupational Safety and Hygiene 69 suppliers (69 ESH audits)	Have room to improve the importance and performance of local suppliers' occupational safety and hygiene	• Introduce external consultants to provide on-site counseling for suppliers performance elevation [Note 1] • Continue to hold Suppliers' Environmental Safety and Health Forum • Continue to request suppliers to improve ESH major issues and pay for re-audit • Take the environmental assessment into the consideration of new supplier evaluation for spare parts, raw materials and waste treatment	• Supplier's average ESH score was improved from 148 in 2016 to 154 in 2017 (full score is 200) • TSMC held 11 ESH forums from 2007 to 2017, where more than 360 suppliers participated in all. • In 2017 supplier ESH assessment, 3 suppliers failed to pass the evaluation of doing business with TSMC. In addition, the originally reduced purchase volume has gradually increased after the supplier improved its ESH performance.
Promote Environmental Protection 15 suppliers (10 top waste-producing suppliers) (5 energy-saving tool suppliers)	Reduce the environmental impact, energy and materials consumption on the heels of localization	• Continue to request top 10 suppliers implement continuous waste reduction and update the progress every year [Note 2] • Stimulate 5 major tool suppliers to propose energy saving activities, and periodically review feasibility and benefits	• Unit waste reduction has been reduced by 20.5% in 2017 • 5 tool suppliers proposed 114 power-efficient activities for 34 tool models

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.

Action Plan	Problem and Challenge	Counselling and Action	Effects
Strengthen Supplier's Resilience 69 suppliers (69 ESH audits)	The supply chain is concentrated in the Pacific Rim with frequent earthquakes. The lack of emergency response capacity will lead to a higher risk of supply disruptions caused by disasters	• Each year, suppliers are invited to observe TSMC's annual emergency response drill • Communicate with the supplier executives directly to request immediate improvement	• A total of 21 suppliers were invited to observe TSMC emergency response drill in 2017 and a total of 48 suppliers have been participated
Advanced Process and Quality Improvement 38 suppliers (38 advanced node material suppliers)	The challenges of advanced process in metrology technology improvement, quality requirements, and capacity expansion	• Hold material technology forum and deliver three key requirements of Integrated Material Supply Ecosystem to suppliers • Establish production capacity that meets quality requirement of advanced materials	• Completed quality improvement for 42 advanced materials • 20 suppliers completed capacity build-up and 100% fulfilled the requirements on 10nm mass production of the advanced node

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

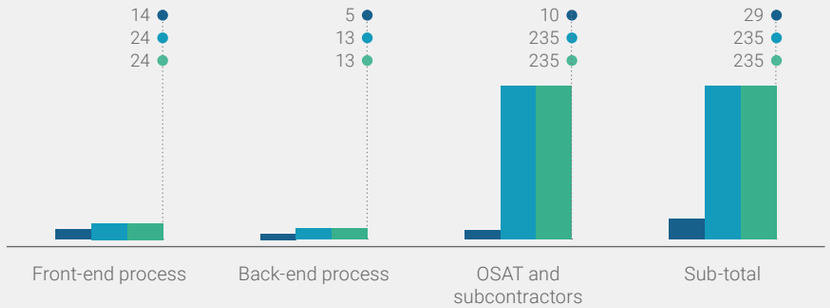
Case Study

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

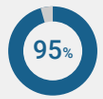


29
First-tier suppliers

235
3TG smelters

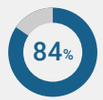
100%
Sourced conflict-free materials

Suppliers implemented due diligence measures for conflict-free sourcing



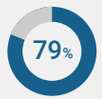
Suppliers review due diligence information received from upper-tier suppliers against the Company's expectations

Suppliers conducted conflict mineral surveys of TSMC's relevant suppliers



Suppliers' review process includes corrective action management

Suppliers have established a conflict minerals sourcing policy



Conflict minerals sourcing policy is available on suppliers' website

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
Note2: The smelters of front-end and back-end suppliers 100% overlapped with the smelters of OSAT suppliers

Case Study

Continue Driving Local Supply Chain Upgrade

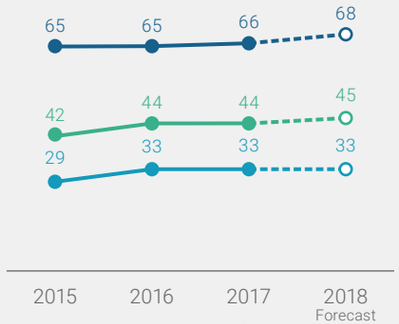
TSMC procurement categories are broadly divided into six categories: equipment, spare parts, raw materials, facility, IT and general affairs. In Taiwan, procurement in each plant is unified by headquarters in Hsinchu. TSMC (China), WaferTech and other subsidiaries have their own independent procurement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

In order to strengthen cooperation with suppliers, TSMC has been promoting the localization of procurement[Note1] 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.

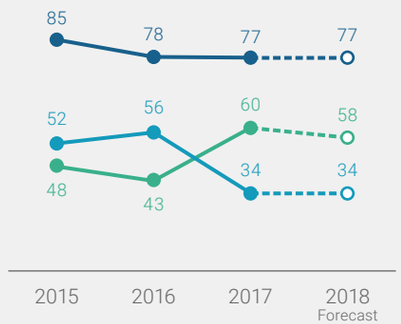
Taiwan

Unit: %



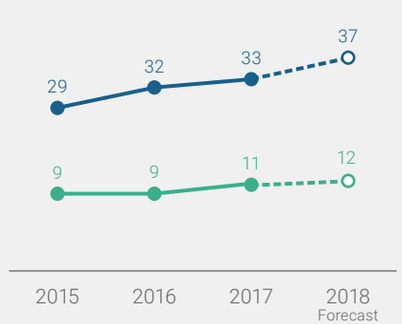
United States

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	• Capacity failed to meet the requirement of the advanced node • Product impurity is too high	• Product line expansion • Raw material purification	✓ Capacity increased by 2 to 3 times ✓ Impurity reduced by 30%
			• Product line expansion • Connecter automation upgrade and filling station isolation	✓ Capacity increased by 5 times ✓ Impurity reduced by 50%
			• Product line expansion • Tank materials upgrade	✓ Capacity increased by 3 times ✓ Impurity reduced by 30%
	Chemicals / 1 Photo Resists / 1	• Capacity failed to meet the requirement of the advanced node	• Product line expansion	✓ Capacity increased by 3 times ✓ Capacity increased by 2 times
Advanced Metrology Technology	Gases / 2 Chemicals / 1	• Insufficient metrology tools • The technology of metrology failed to meet the requirements of the advanced nodes	• Set up new lab • Invest in metrology instruments	✓ Build up chip material analytical capability ✓ Increase detection limit of impurity by 50%
ESH Performance Improvement	Parts Cleaning / 2	• Inadequate safety protection of chemical operations • Partial exhaust capacity may be insufficient	• Top local executives directly participate in the ESH management and projects	✓ ESH score improved by 38%
			• Actively collaborate with TSMC and consultants to formulate safety protection and exhaust improvement plans	✓ ESH score improved by 27%
	Furnace Quartz / 1	• The facility department serves as the environmental safety management • Untracked audit improvement	• Formed dedicated ESH organization for independent safety inspection and management, and directed the environmental protection project progress and management performance by the regional head in Taiwan	✓ ESH score improved by 33%
	Chemicals / 1	• The maintenance of firefighting facilities is careless • Insufficient seismic protection	• The group conducts internal organizational learning. Headquarters lead the factory to set targets for fire protection and seismic improvement, and track progress	✓ ESH score improved by 32%

Green Manufacturing

A Green Power Practitioner

In addition to pursuing business growth and breakthroughs, TSMC aims to become a practiitioner of green power to raise environmental and social value. We assimilate green management into business and implement continuous improvement projects in the areas of 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 & Targets
Promoting Low-Carbon Manufacturing Continue adopting best practice approaches to mitigate emissions with the goal of being the industry's Low-Carbon Manufacturing leader	Reduce unit wafer GHG emission (Metric tons of CO_2 equivalent /8-inch wafer e mask-layer) to 18% below the year 2010 level	2020
	Reduce unit wafer PFC emission (Metric tons of CO_2 equivalent /8-inch wafer e mask-layer) to 60% below the year 2010 ; Reduce total PFC emission (Metric tons of CO_2 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 [Note]	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

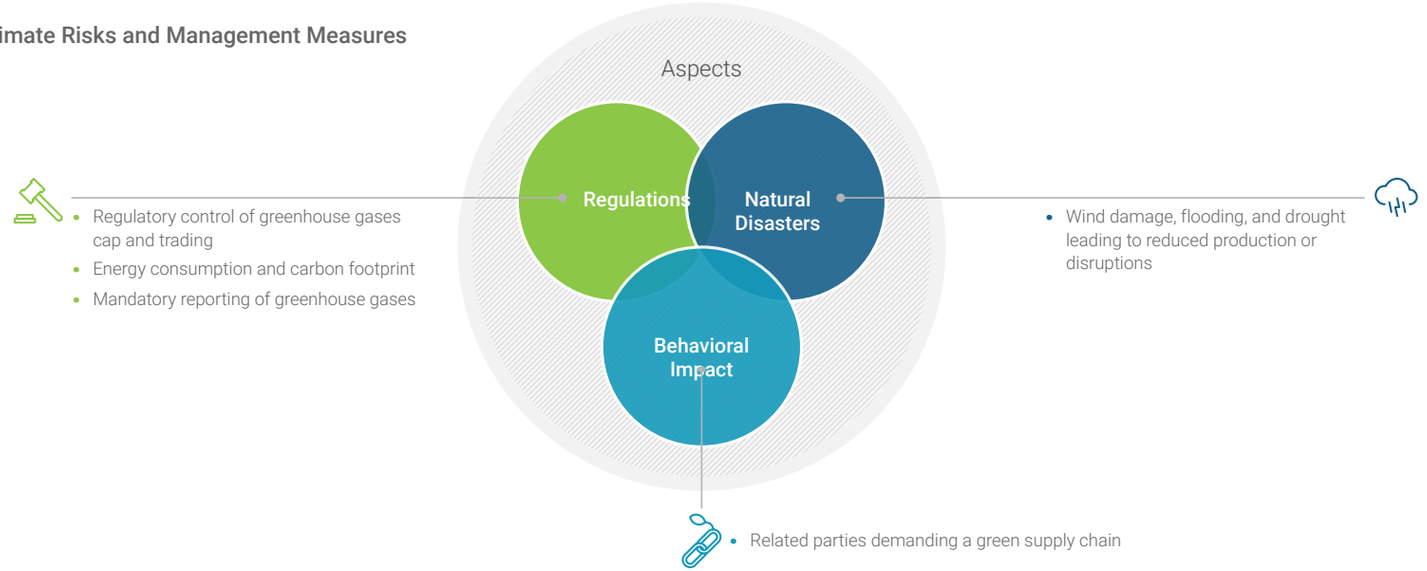
Strategies & 2020/2025 Goals	2017 Achievements	2018 Targets
	13% Unit wafer layer GHG emissions were 13% less than 2010 Target: 13%	Reduce unit wafer layer GHG emission to 15% below the year 2010 level
	55% Unit wafer layer PFC emissions were 55% less than 2010 Target: 50%	Reduce unit wafer layer PFC 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

Surpassed Achieved Unachieved

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



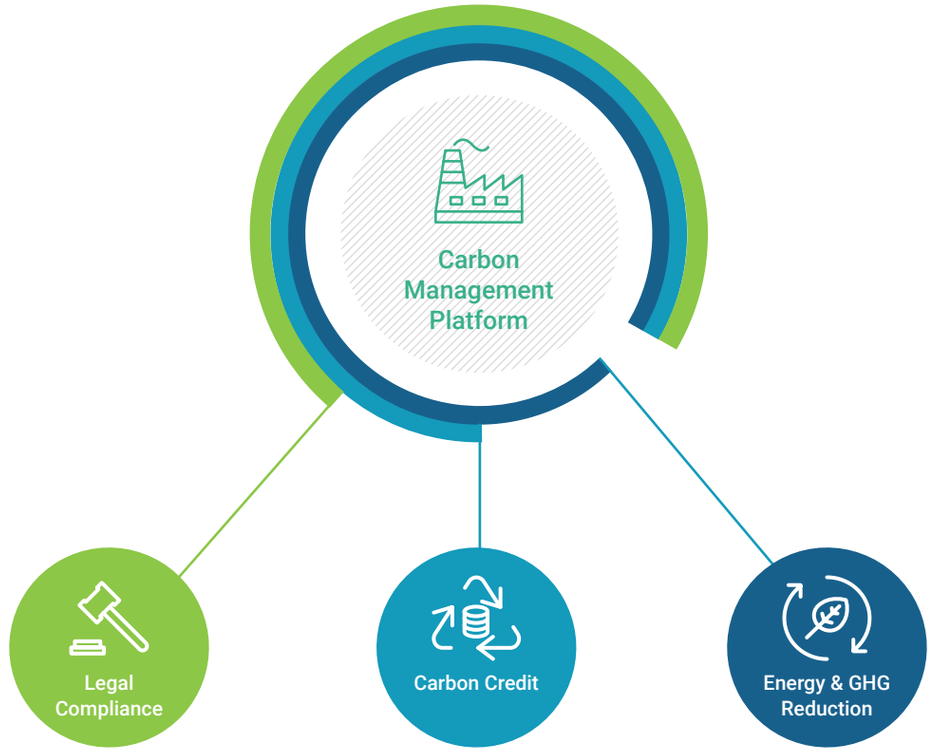
Aspects	Consideration	Measures	Achievements in 2017
Regulations	Mandatory reporting of greenhouse gases	Implement data inventory: investigate greenhouse gas emissions and energy usage	Greenhouse gas inventory 100% completed
	Regulatory control of greenhouse gases cap and trading	Implement carbon management: 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
Natural Disasters	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)
Behavioral Impact	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.



- GHG inventory (ISO 14064)
- Phased Regulatory Goals
- Product emission standard
- Cap and allocation principle

- Taiwan Renewable Energy Certificates (T-REC)
- Carbon credit & trade flow
- Early project
- Offset project
- TCFD

- ISO 50001
- Science Based Target
- Facility energy saving
- Process tool energy saving
- F-GHG abatement
- Green building

Three Aspects of Carbon Management			Achievements in 2017
Regulatory compliance	Adhere to greenhouse gas regulations	Participate in public hearings for regulations	Participated in establishing regulations for Phased Regulatory Goals and greenhouse gas emission rewards
		Member of the Industrial Development Bureau response team	Participated in the analysis of industry emission controls and quota for the Phased Regulatory Goals and Greenhouse Gas Emissions Rules.
	Support the carbon management commitments of the global semiconductor industry	Member of the World Semiconductor Council greenhouse gas response team and convener of the energy conservation team	Continued participation and followed the WSC PFC reduction best practice.
Energy Saving & Carbon Reduction	Establish greenhouse gas database (ISO14064/ ISO14067)	Acquire greenhouse gas inventory certification -ISO14064-1	All fabs completed third-party greenhouse gas inventory verification
		Acquire carbon & water footprint certification -ISO14067	Not required in 2017 (every 3-5 years)
		Establish e-platform	Energy Conservation & Carbon Reduction e-platform Enhancement Project
	Directly reduce greenhouse gas	Use low greenhouse warming potential gasses	C_2F_6 & $C3F_8$ (cleaning process) replaced by C_4F_8
	Establish and implement best available practice for greenhouse gas abatement	Install best available greenhouse abatement equipment	Fully installed new equipment in Fab 15B and replaced 62 tools in other fabs
		Develop and implement new greenhouse gas abatement technologies	Installed nitrous oxide abatement equipment in Fab 15B
	Implement energy management system (ISO 50001)	Acquire energy management system certification –ISO 50001	Fab 12 phase 7 received certification
	Initiate equipment energy-saving projects	Identify the energy saving potential of production tools, propose energy-saving measures, and include energy-saving features in tool purchasing decisions	Included energy-saving features in new equipment purchase guidelines
	Construct green fabs	Raise performance of fab systems	Enhanced chiller unit performance by 9%
		Acquire green building certification	Fab 12 phase 7 received U.S. LEED certification All 12-inch fabs received green building certification
Carbon Assets and Credits	ow carbon investments	Study Renewable Energy Certificate, REC	Fab 6 solar-powered system is the first semiconductor foundry in Taiwan to receive T-REC (received 275 RECs)
	Carbon trading platforms	Study carbon credits and trading systems	TSMC (China) purchased 280 thousand metric tons of carbon credits with carbon emissions in 2016
	Energy saving and carbon reduction incentives	Programmatic CDM - Clean Development Mechanism for certified emission reduction credits	Fab 2/5, Fab 5, Fab3, Fab 14B, and Fab 15A applied for Clean Dry Air system (CDA) CDM
		Greenhouse gas emission reduction rewards	Applied for greenhouse gas emission reduction rewards in 2018
		Continue to work on voluntary carbon reduction	Joined Industrial Development Bureau voluntary reduction project
	Renewable energy usage	Study the Electricity Act	Formed a corresponding task force
		Continue to purchase renewable energy	Purchased 100 GWh of green electricity from Taiwan Power Company

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[Note]) 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.

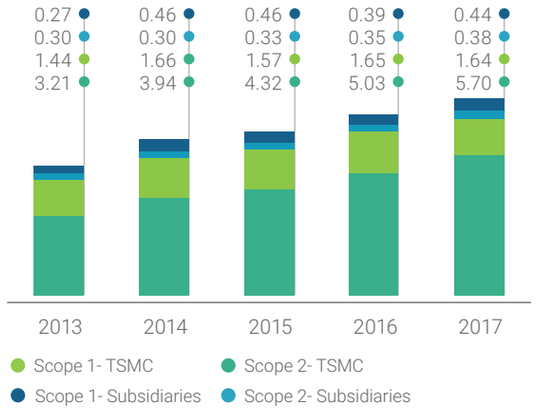
Note: Established in 2003, the Carbon Disclosure Project (CDP) is an independent, London-based, non-profit organization which supports companies to disclose environmental impact through the collection of carbon emission surveys.

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

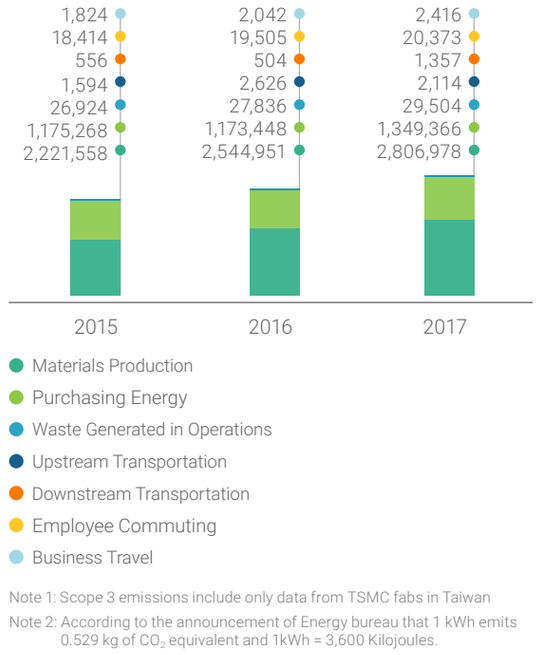
Unit: Million metric ton CO_2e



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_2e

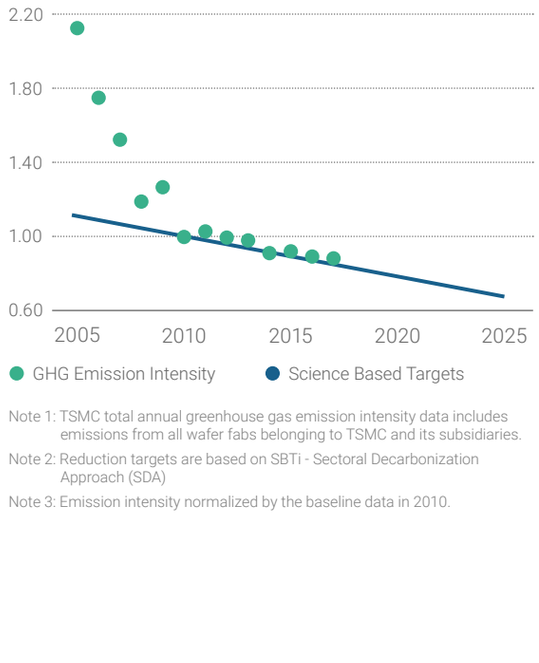


Note 1: Scope 3 emissions include only data from TSMC fabs in Taiwan

Note 2: According to the announcement of Energy bureau that 1 kWh emits 0.529 kg of CO_2 equivalent and 1kWh = 3,600 Kilojoules.

Greenhouse Gas Emission Intensity

Unit: Metric ton CO_2e/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	Includes all annual inventory and third-party verification for TSMC fabs and subsidiaries
	Gas usage optimization	New fabs must adhere to best practices outlined in technical committee guidelines
	Replace high greenhouse warming potential (GWP gases (current best available technology: remote plasma NF_3 / NF_3 / C_4F_8)	All 12-inch fabs use remote plasma NF_3; 6-inch and 8-inch fabs use C_4F_8 / NF_3 Subsidiaries to gradually replace C_4F_8 / NF_3
	Install point of use (POU) abatement equipment for F-GHG processes	New and existing fabs (including subsidiaries) must install POU abatement during new tools move-in Existing fabs abatement installation rate is up to 88% ; subsidiaries to gradually replace abatement equipment Existing fabs replaced 62 tools in 2017; 95 tools will be replaced in 2018 Lowest F-GHG emission per product unit in the world for semiconductor foundries
	Other greenhouse gases abatement technologies	Continue to develop on-site nitrous oxide abatement technologies Completed nitrous oxide abatement equipment verification on combustive treatment equipment and listed it as standard equipment (first in the world for semiconductor foundries)
Scope 2 Greenhouse Gas Indirect Emissions	ISO 50001 Energy management 3rd-party verification	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
	Top-level management	Vice Presidents of Operations lead the Energy Conservation & Carbon Reduction Committee as well as set and regularly review company targets
	New generation process tool development with energy-saving design	Initiated energy conservation projects for new generation process tools (first in the global semiconductor industry)
	Utilize renewable energy	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
	Energy efficiency enhancement	Highest energy efficiency in the industry 10-year target of 2,800 GWh of electricity saved; 510 GWh of electricity saved with 452 energy-saving measures in 2017

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.

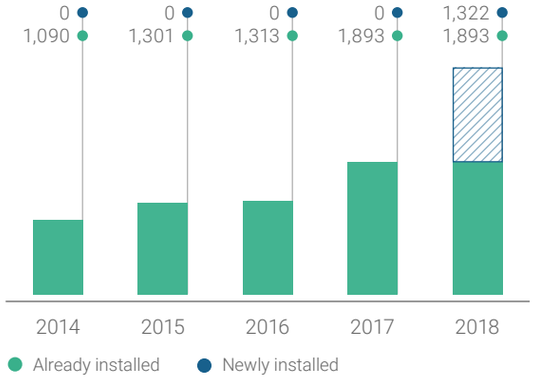
Installing Renewable Energy Power Generation Equipment

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 on impact on the mitigation of climate change.

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)

Improving Energy Efficiency

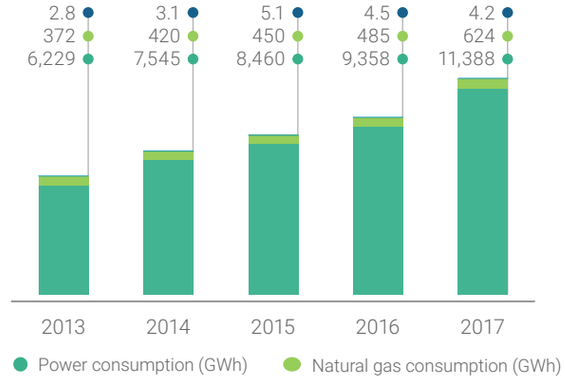
Comprehensive energy inventory

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

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

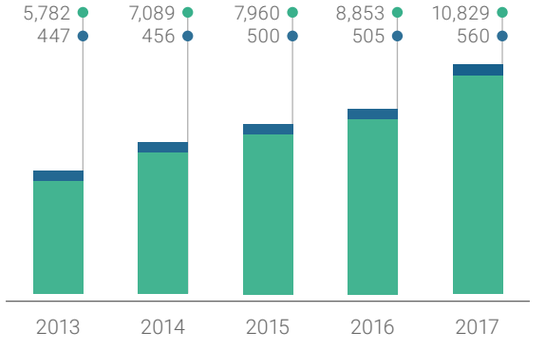
maximum efficiency from each kWh consumed. TSMC's unit power consumption was 9.5 (kWh/8-inch e wafer-layer) in 2017, 10.4% lower than 10.6 (kWh/8-inch e wafer-layer) in 2010. Additionally, this was 1.4% lower than the Company's optimum performance of 9% in 2017. Natural gas is mainly used for boilers, 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

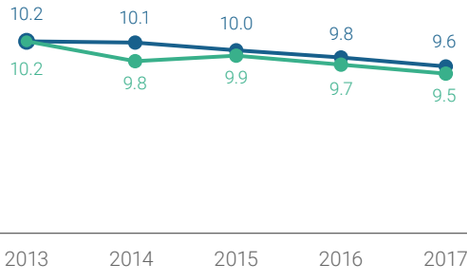
Unit: GWh



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

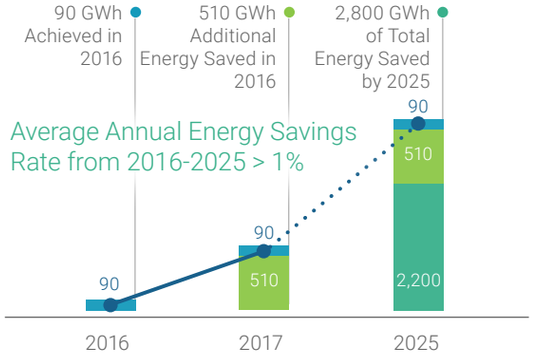


Note 1: The indicator for power consumption per wafer-layer includes all wafer fabs of TSMC and subsidiaries.

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

TSMC 10-year Energy-Saving Targets

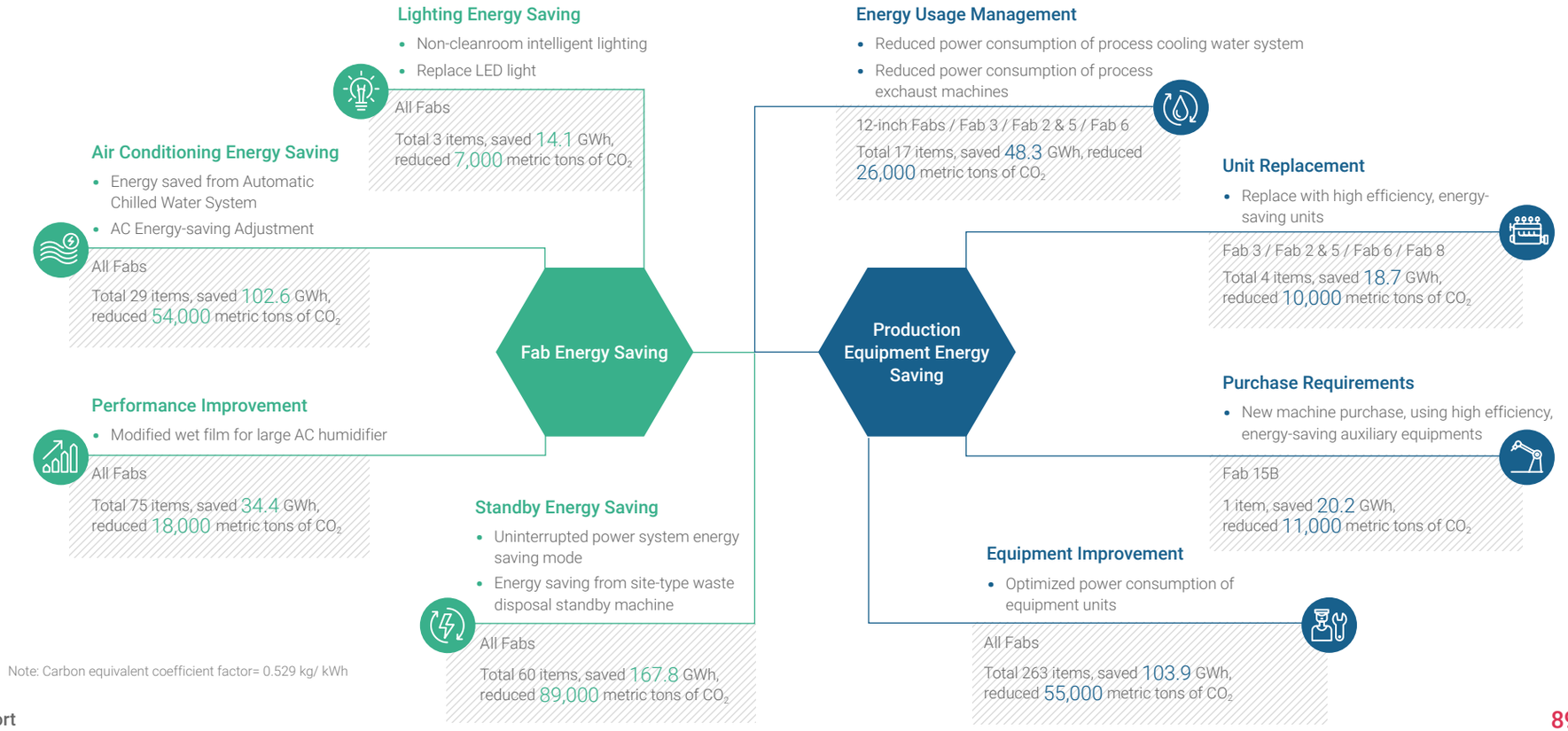
Unit: GWh



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 thechilled 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[Note]. 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



Note: Carbon equivalent coefficient factor= 0.529 kg/ kWh

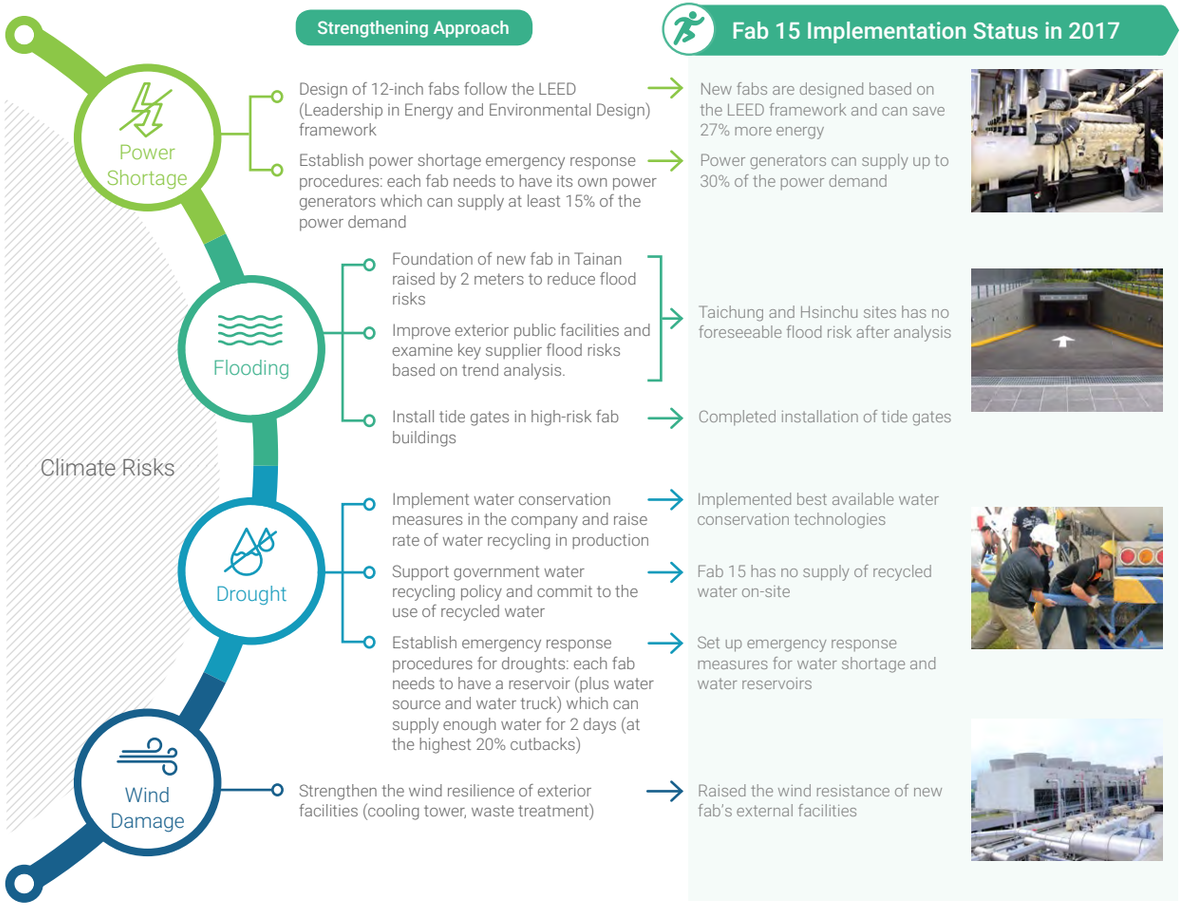
TSMC promotes industry benchmarking by inviting government agencies and academia to attend Energy and Carbon Reduction Committee meetings

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_2O 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

"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

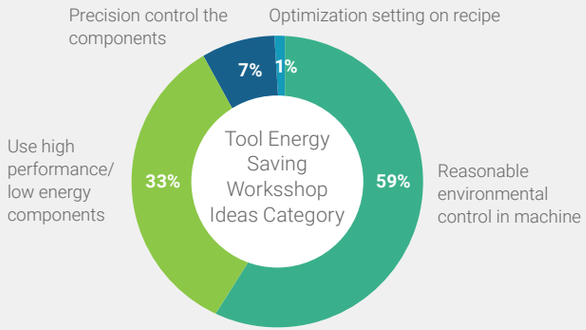
Green innovation is the responsibility of every TSMC employee. Through full implementation of energy reduction activities, hosts of cross-organizational energy-saving ideas competitions encourage their colleagues to continue to identify energy saving opportunities from daily operations and put them into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

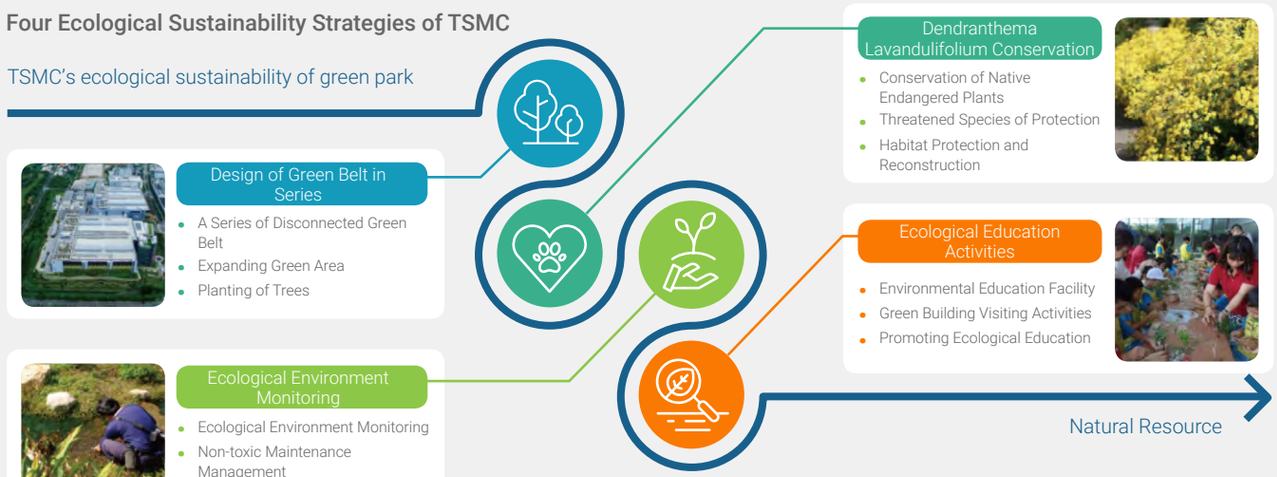
In 2017, TSMC's aggressive response to the United Nation's Sustainable Development Goals (SGDs), (UN Sustainable Development Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems...and halt biodiversity loss.) and the Aichi Biodiversity Target, conducting the first independent 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 Lavandulaeleaf dendranthema (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



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 & 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: < 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: < 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: < 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

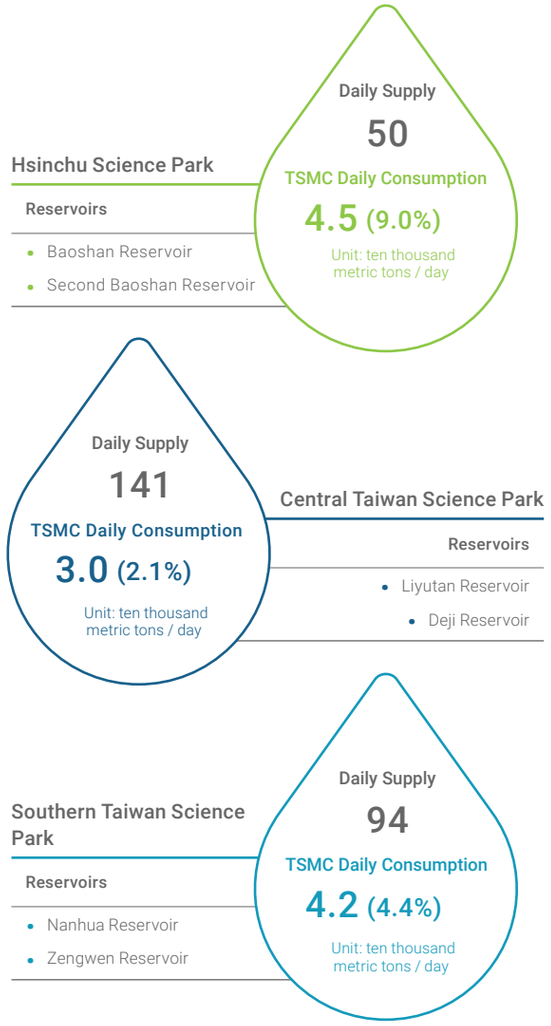
TSMC believes water resources management plays an important role in the risk management of climate change and the adaption to natural disasters. The Company uses a water reporting system to monitor the volume of each water reservoir and the water usage rate of every plant, and water training drills are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

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

TSMC Water Shortage Contingency Measures

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	• Regularly checked the status of all water reservoirs reported by the Water Resources Agency and held practice drills
Green Adequate	Farms advised to leave fields fallow	Establish a contingency team Assess the demand for water tankers/water reserve	• Established a contingency team to take inventory of water resources and water tanker capacity
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	• Reduced landscape watering by 50% • Lowered pressure of water supply to achieve 3% voluntary water conservation
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	• Did not occur
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	• Did not occur

Water Usage Ratio of TSMC in Three Science Parks

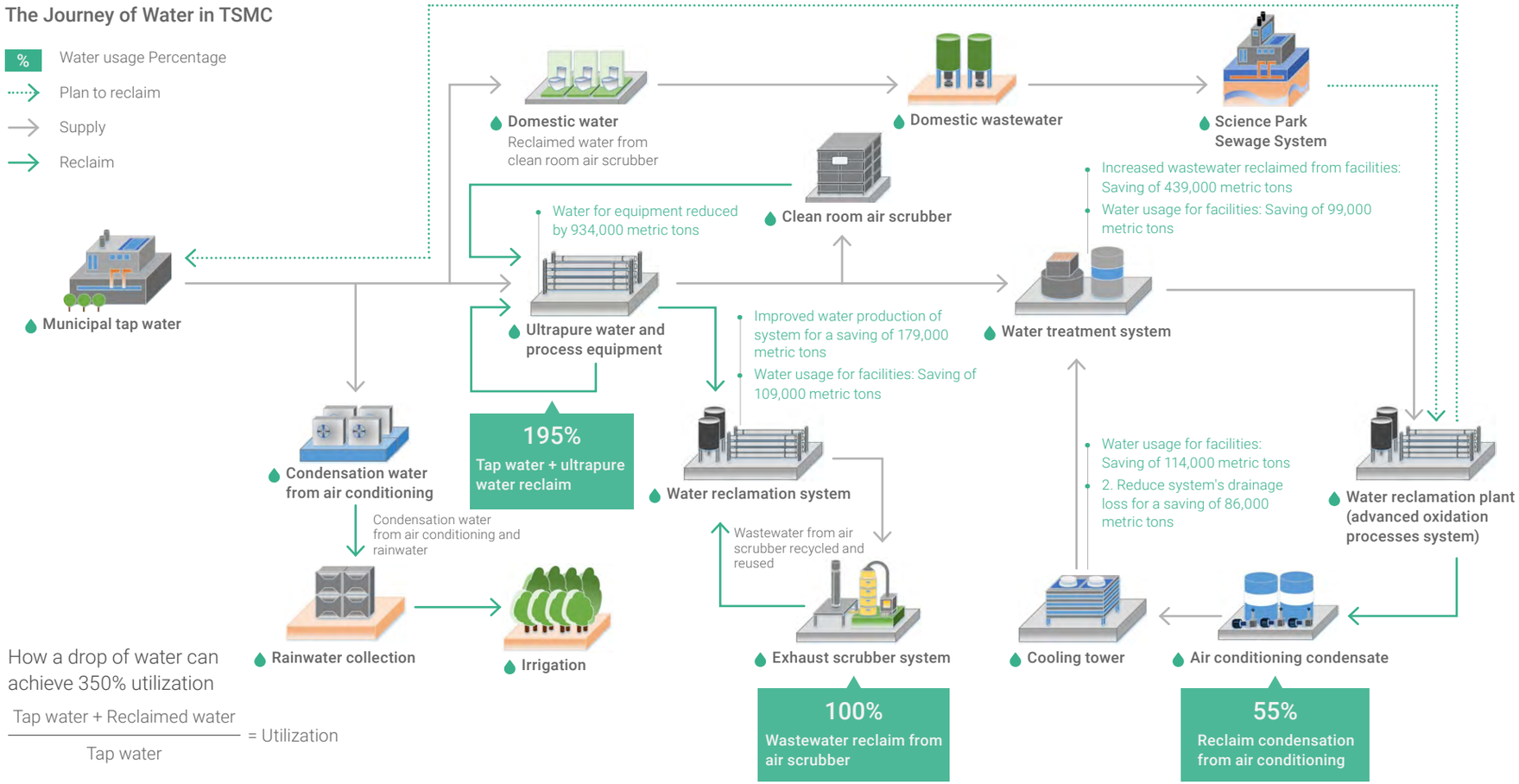


Note: Daily supply of reservoirs was based on Water Resource Agency data. Reservoirs for Taichung Science Park also supply Taichung and Miaoli area

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



How a drop of water can achieve 350% utilization

$$\frac{\text{Tap water + Reclaimed water}}{\text{Tap water}} = \text{Utilization}$$

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 (%) Note 1	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 Note 2	2.12	2.57	2.72	3.00	3.29
Equivalent number of standard swimming pools Note 3	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

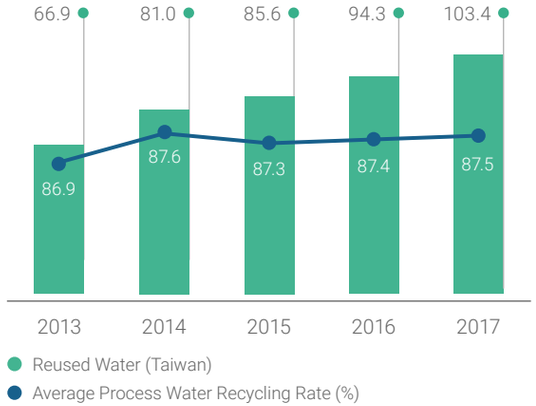
Note 1: Average process water recycling rate is defined by the Science Park Administration

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



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.[Note]

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

2017 New Measure

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

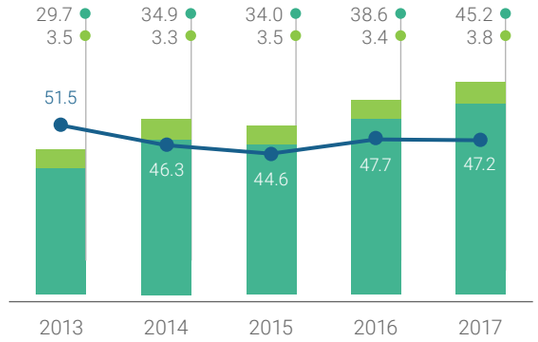
Reduce Loss from System Discharge

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



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.

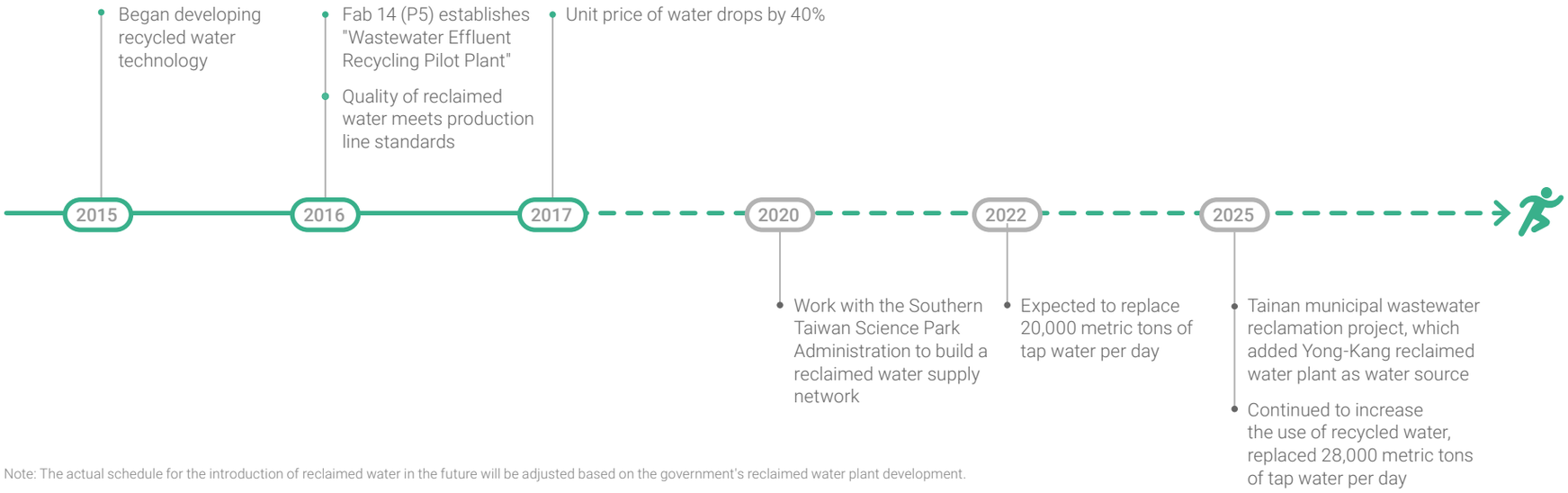
40%

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



Note: The actual schedule for the introduction of reclaimed water in the future will be adjusted based on the government's reclaimed water plant development.

Development of Preventive Measures

Classification of sources is the key to pollution prevention. Only a robust classification of sources at the beginning can result in effective prevention of pollution afterward.

Wastewater Classification and Recycling

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

Note 1: wastewater containing fluorine

Note 2: containing normal acid, alkali, ammonia nitrogen and tetramethylammonium hydroxide(TMAH)

36

The Industry's Strictest Wastewater Classification Management Systems

	Classification	Reclaim System	Wastewater Treatment	Product
Hydrofluoric Acid Drain	• HFD: Hydrofluoric acid drain(2 types) • HFD(O_3): Hydrofluoric acid drain with O_3 • Local scrubber drain	• Hydrofluoric acid drain • Local Scrubber drain reclaim	• Hydrofluoric chemical treatment	• Calcium fluoride • Fluorite
Acid and Caustic Wastewater	• DIR: Deionized water reclaim • DIR(O_3): Deionized water Reclaim with O_3 • AWD: Acid wastewater drain (2 types) • AWD(O_3): Acid wastewater drain • CWD: Caustic wastewater drain • CWD(O_3): Caustic wastewater drain with O_3 • Tetra-methyl ammonium hydroxide • Advance organic reclaim (2 types)	• Acid wastewater drain with reclaim • Acid wastewater drain with O_3 reclaim • Caustic wastewater drain reclaim • Advanced caustic wastewater drain reclaim • Advance organic reclaim	• Acid and caustic wastewater system • Ammonia nitrogen wastewater drain reclaim • TMAH reclaim	• Ammonium sulfate • Ammonia • Plaster • TMAH
Chemical Mechanical Grinding	• ECP: Electroplating • CMP: Chemical Mechanical Polishing • CUCMP: Chemical mechanical polishing with copper	• CMP drain coagulation sedimentation • Advanced CuCMP drain reclaim	• CMP drain coagulation sedimentation • CuCMP drain coagulation sedimentation	
High Concentration Wastewater	High concentration wastewater (18 types) • Waste-H_2SO_4 • Waste-$CuSO_4$		• Waste-H_2SO_4 reclaim • Electroplating with Cu	• H_2SO_4 • Electronic grade copper

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.

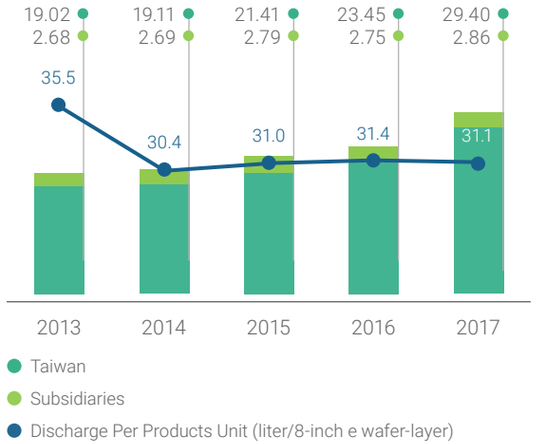
Wastewater Discharge Quality

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

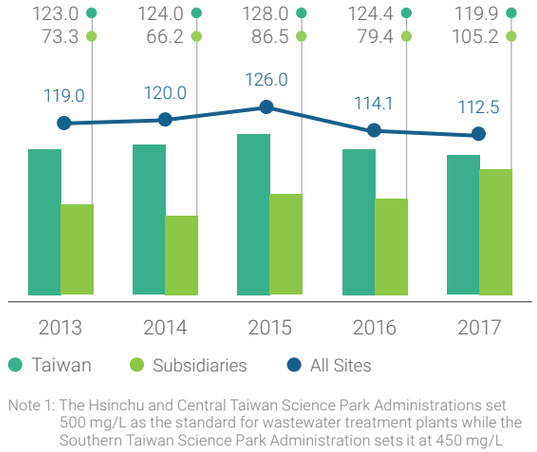
Unit: mg/L

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

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



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

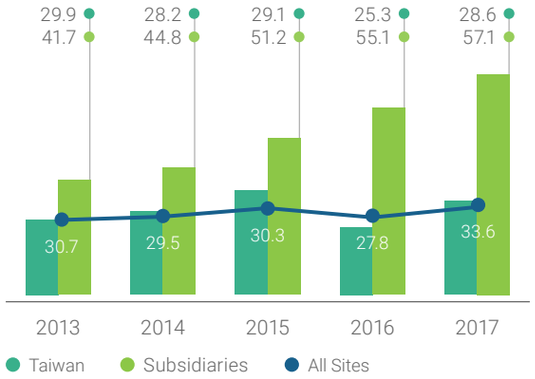
Reduction of Ammonia Nitrogen in Wastewater

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[Note1]" 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

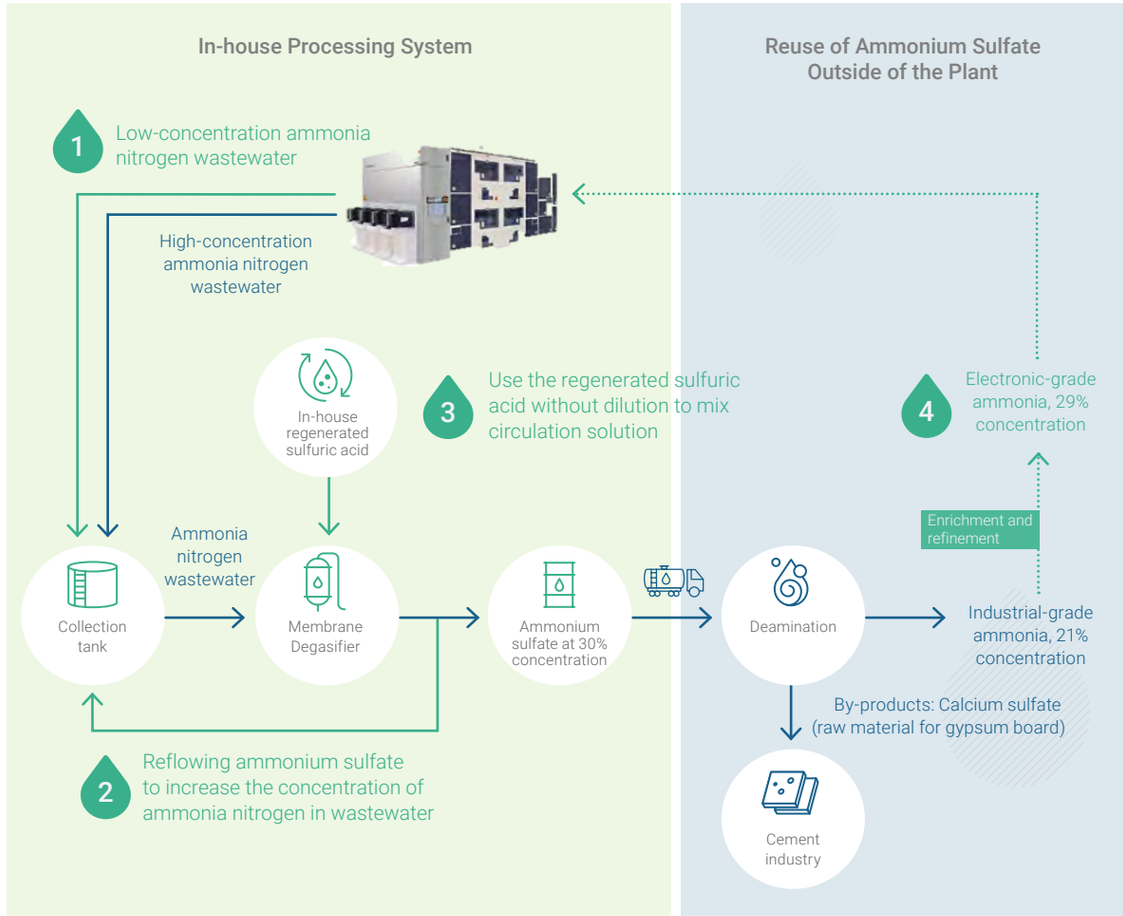
Unit: mg/L



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.

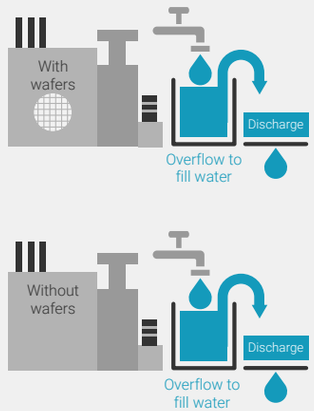
Discharge Recycling During Production Tool Standby

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

Before improvement

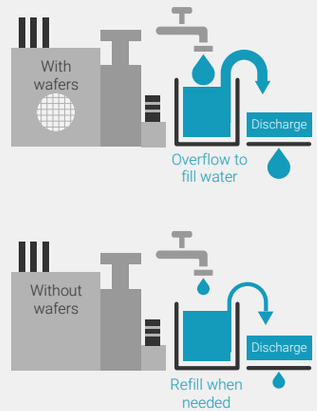
Overflow to refill water with/without wafers



After improvement

With wafers → Overflow to refill water

Without wafers → Refill when needed

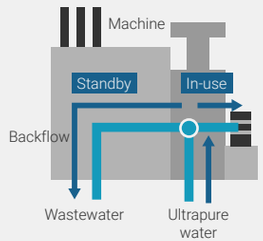


Schematic showing the recycling of water during tool standby

Before improvement

During standby → Backflow is discharged to wastewater

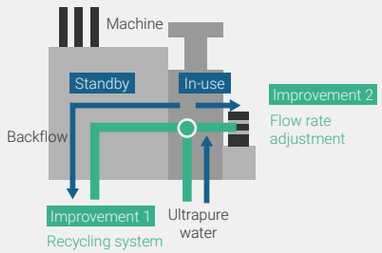
In use → Use large flow



After improvement

During standby → Backflow is recycled to the system

In use → Use small flow



Material Issue

Waste Management

Strategies	TSMC 2020/2025 Goals	Achievements & 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

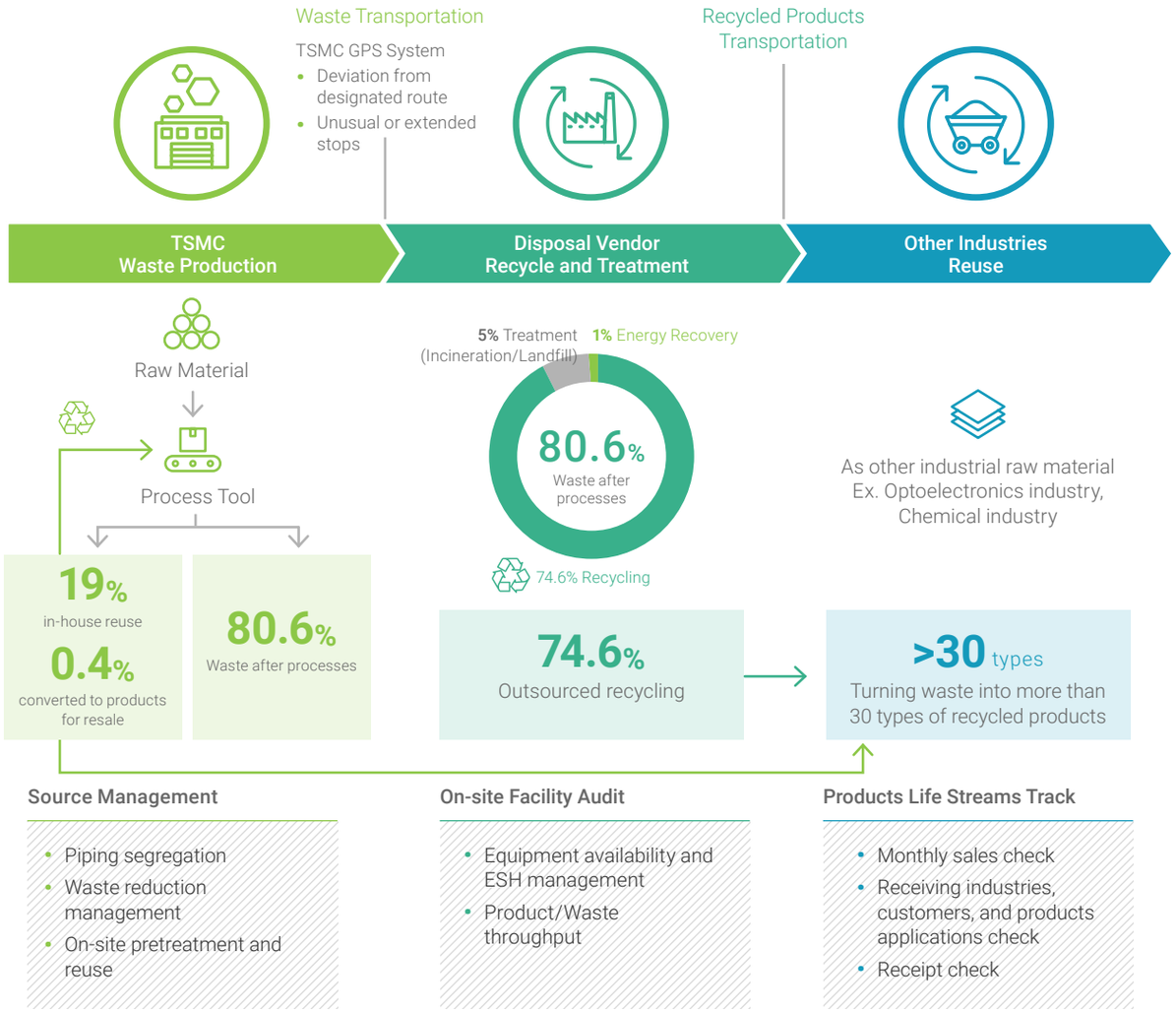
Strategies & 2020/2025 Goals	2017 Achievements	2018 Targets
Target: Outsourced unit waste output (8-inch e wafer-layer) < 0.36 kg	**0.36kg** Outsourced unit waste output reduced **212,904 metric tons** Annual waste reduced **814 NT$ million** Saved in waste disposal cost **404,195 metric tons** Waste recycled **250 NT$ million** Waste recycled and resold	Outsourced unit waste output (8-inch e wafer-layer) < 0.35 kg
Target: >95% Target: <1%	**95%** Recycling rate **0.08%** Waste landfill rate	Recycling rate > 95%, Waste landfill rate < 1%, In-house regeneration and recycling of resources > 30%
2017 new item	**Completed the amendment of the Company's Articles of Incorporation and added four scopes of business for chemicals. By working together with material suppliers, recycled copper tubes which regenerated from waste copper sulfate are successfully converted into electronic-grade electroplating materials and reused in TSMC's production processes**	Further expand in-house regeneration equipment to convert process chemicals into reclaimed products for reuse - Introduce additional copper sulfate regeneration equipment - Introduce additional ammonium sulfate regeneration equipment
		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.

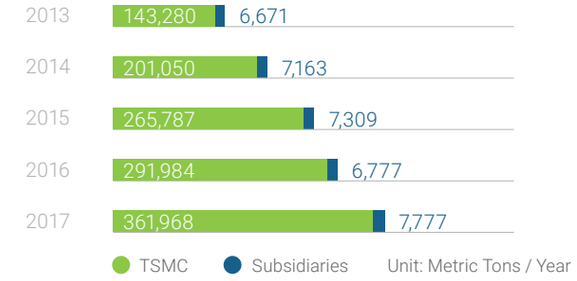
To achieve sustainable use of resources, TSMC is shifting our management strategy from conventional "waste management" to "sustainable materials and resources management", with the goal of reducing environmental impact and preserving natural resources. TSMC continues to assess the minimization of resources 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

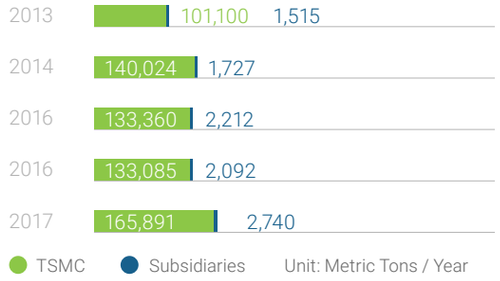


Waste Quantity and Treatment Status Statistics

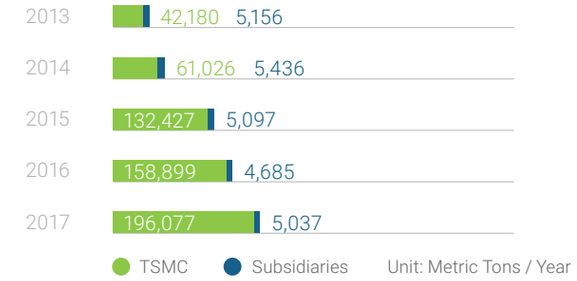
Outsourcing Disposal Waste



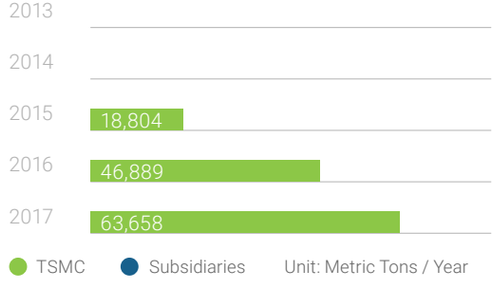
Hazardous Waste



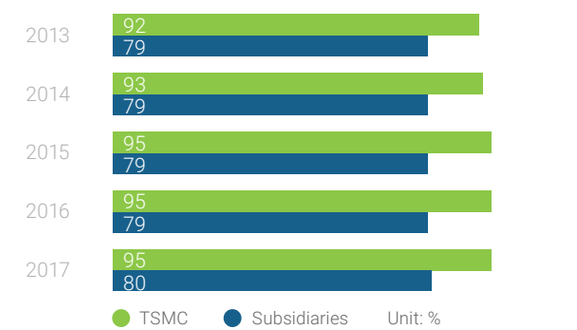
General Waste



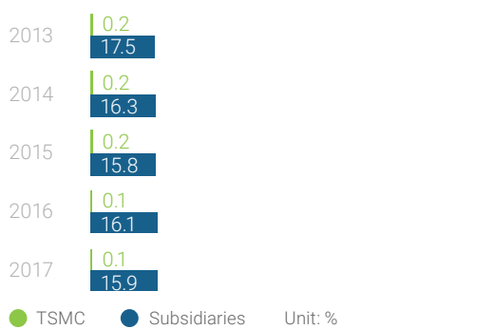
In-house Recycling Waste

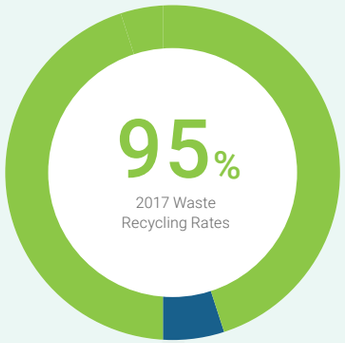


Waste Recycling Rate



Waste Landfill Rate





Recycled Waste

404,195 Metric Tons

425,626 Metric Tons

Total Waste

95% Recycled Waste

(404,195 Metric Tons)

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

5% Non-recycled Waste

(21,431 Metric Tons)

- 4.9% Incineration/Treatment
- 0.08% Landfill

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

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

Note 3: Hazardous wastes are defined by local governments

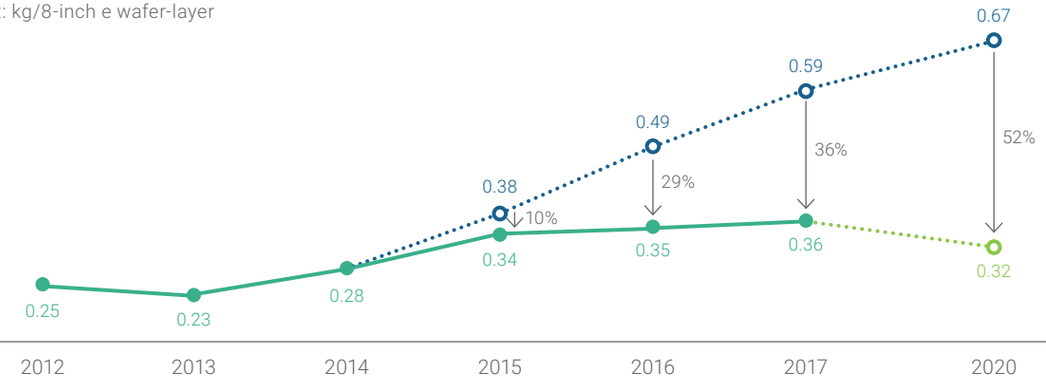
Note 4: Difference in previously disclosed 2015 and 2016 hazardous waste is due to subtraction of waste recycled in-house

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_3-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_2SO_4, H_2O_2, $(NH_4)OH$, $CuSO_4$, Photoresiswt 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.

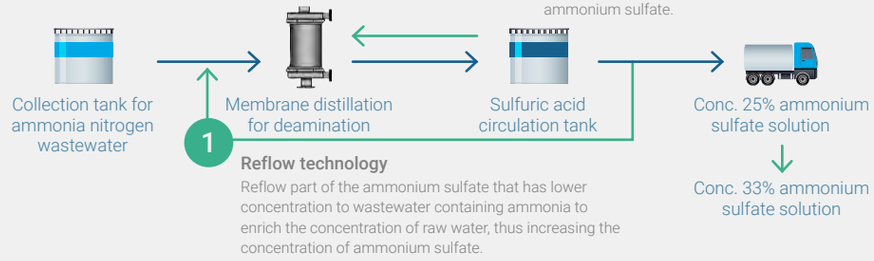
In 2017, various source reduction measures taken by TSMC enabled reduction of unit waste output by 0.1 kg, equivalent to annual waste reduction of 59,139 metric tons and additional savings of NT$240 million in waste disposal for the year.

Source Reduction of Process Chemicals

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

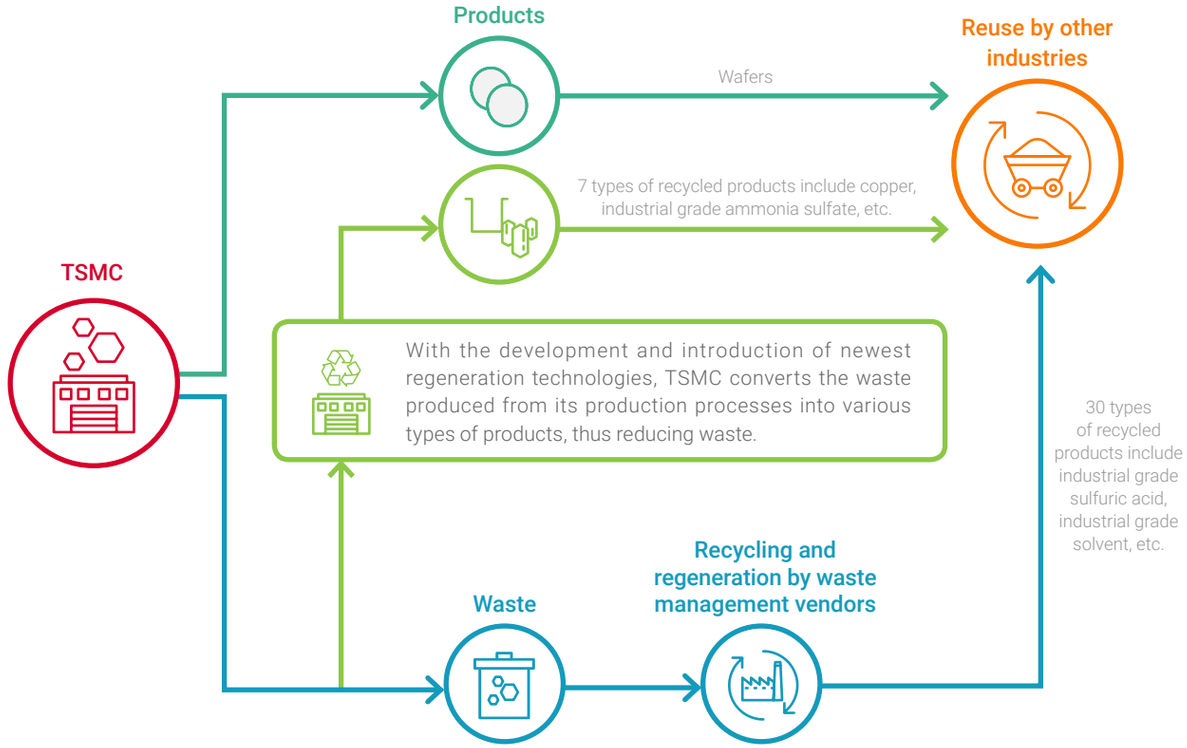
Circular Economy

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[Note] 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

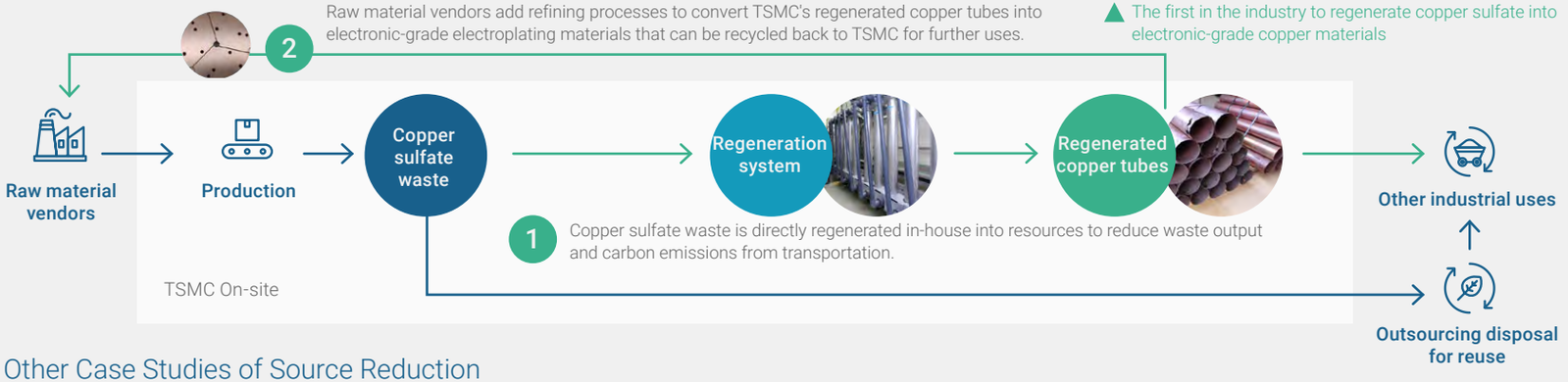
TSMC Committed to Becoming a Participant in the Circular Economy



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

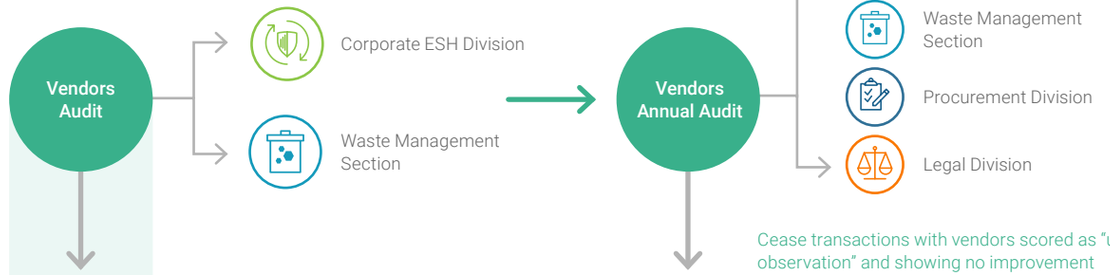
Waste Cleanup and Disposal Vendor Management Process

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.

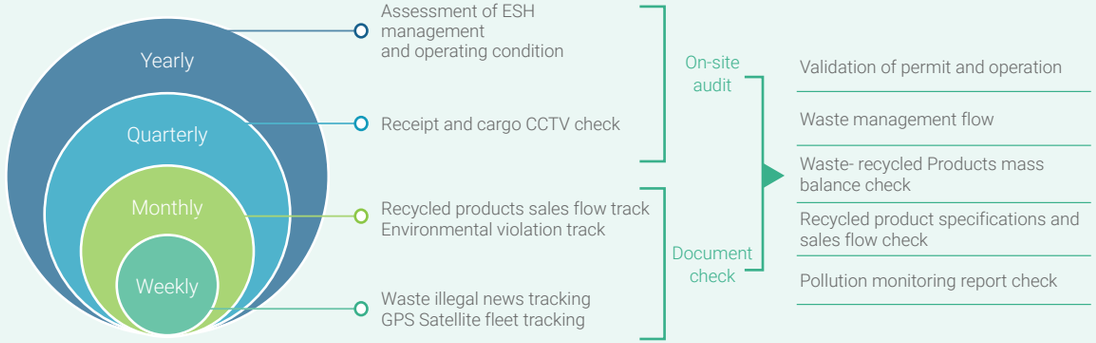
2017 amendments to the auditing articles cover eight major aspects. They are: operations management, waste management, wastewater management, air pollution control, equipment maintenance records, safety and health management, fire protection and emergency response, for a total of 163 auditing items.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

New Waste Vendors

All Existing Waste Vendors Note 1

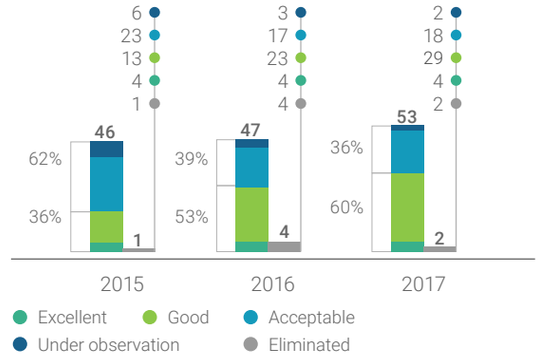


Vendor Audit Note 2



Evaluation Result Note 3 & 4

Unit: Number



Note 1: Public or municipal waste treatment facility were not included in audit process

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

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

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

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. TMSC also shares its experience in waste management with other industry players. In 2017, the Company participated in various seminars and forums related to circular economy organized by the Science Park Administration, SEMICON Taiwan, the Association for Taiwan Science Park Industries, and CTCI Foundation, in hopes of collaborating with the industry, government and academia sectors to improve the overall standard of waste disposal and the sustainable development of Taiwan.

Material Issue

Air Pollution Control

Strategies	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 & 2020/2025 Goals	2017 Achievements	2018 Targets
To decrease air pollutant emissions per unit product by 25%, compared to 2015 level[Note]	**96.4%** **Reduction rate of volatile organic gases was 96.4%** Targrt: >90%	

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.

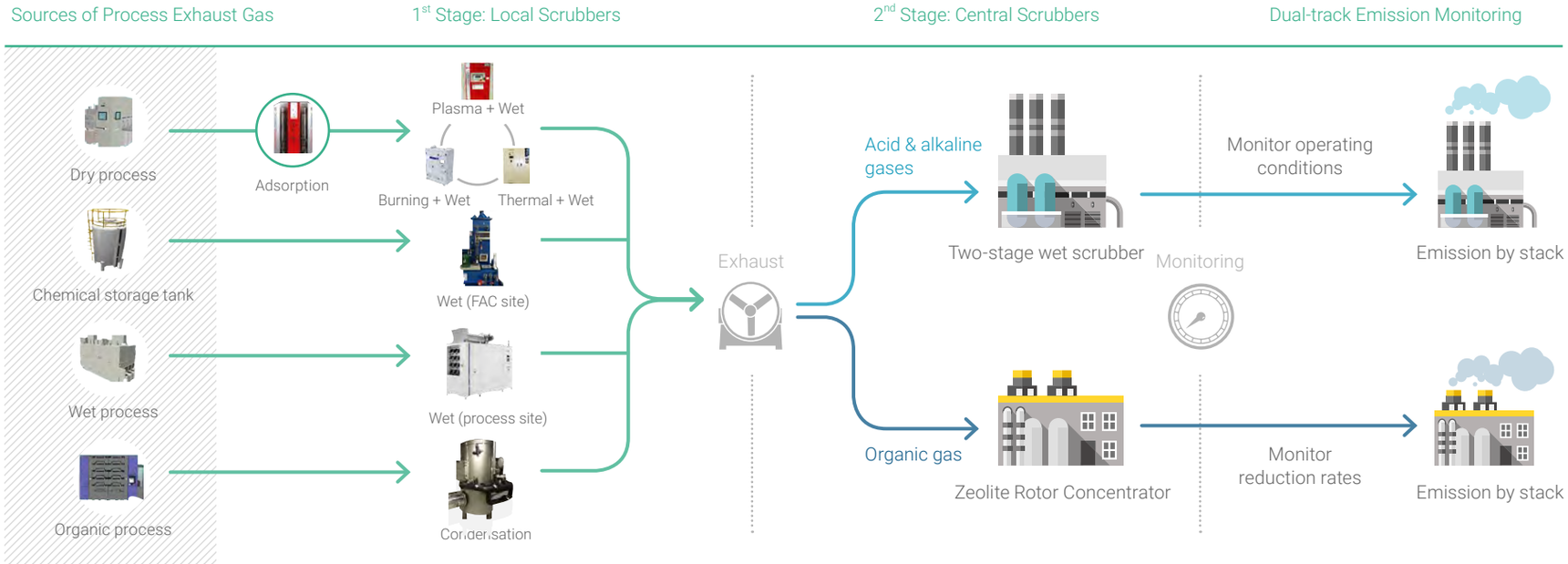
Best Available Technology

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[Note] 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 Eequipment 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

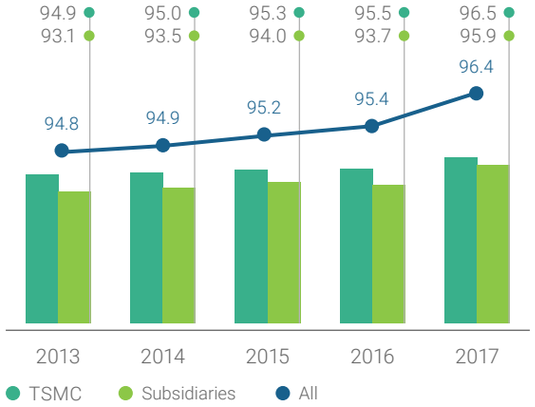
Process exhaust gas sources	Target pollutants	Control technology	Equipment pictures	Reduction rates	Instant monitoring parameters
Dry Process	Toxic gases	Adsorption		> 95% or Outlet less than 50 ppb	Scrubber pressure difference Inlet Pressure
	Corrosive gases, perfluorocarbons	Plasma + Wet		> 99%	Current 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

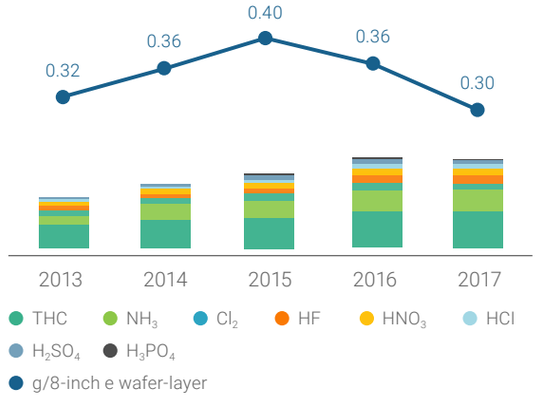
Unit: %



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 taked into account in 2017)

Annual Eemissions 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_2SO_4), hydrochloric acid (HCl), nitric acid (HNO_3), hydrofluoric acid (HF), phosphoric acid (H_3PO_4), chlorine (Cl_2) and ammonia (NH_3), 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

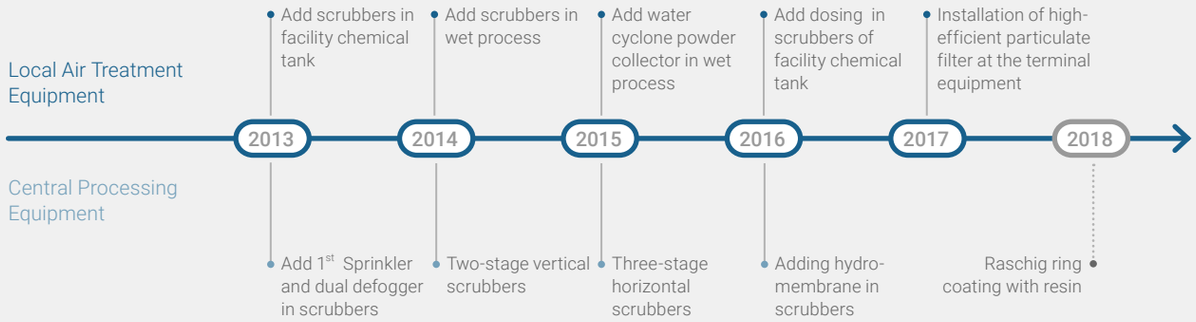
Case Study

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[Note]" 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.

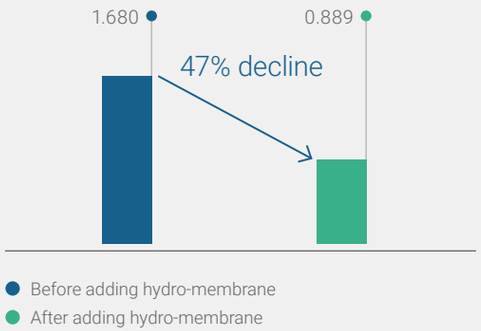
After modularizing the installation mode of the hydro-membrane and changing the membrane material, results from Fab 14 Phases 5, 6, and 7 showed that the sulfuric acid (H_2SO_4) concentration of the scrubber was reduced up to 47%. The removal efficiency of other acid and alkaline pollutants can also by improved up to about 5~38%.

Improvement and Evolution of TSMC Air Pollution Control Equipment



Reduction in scrubber sulfuric acid concentration

Unit: mg/Nm^3



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

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.

3,663

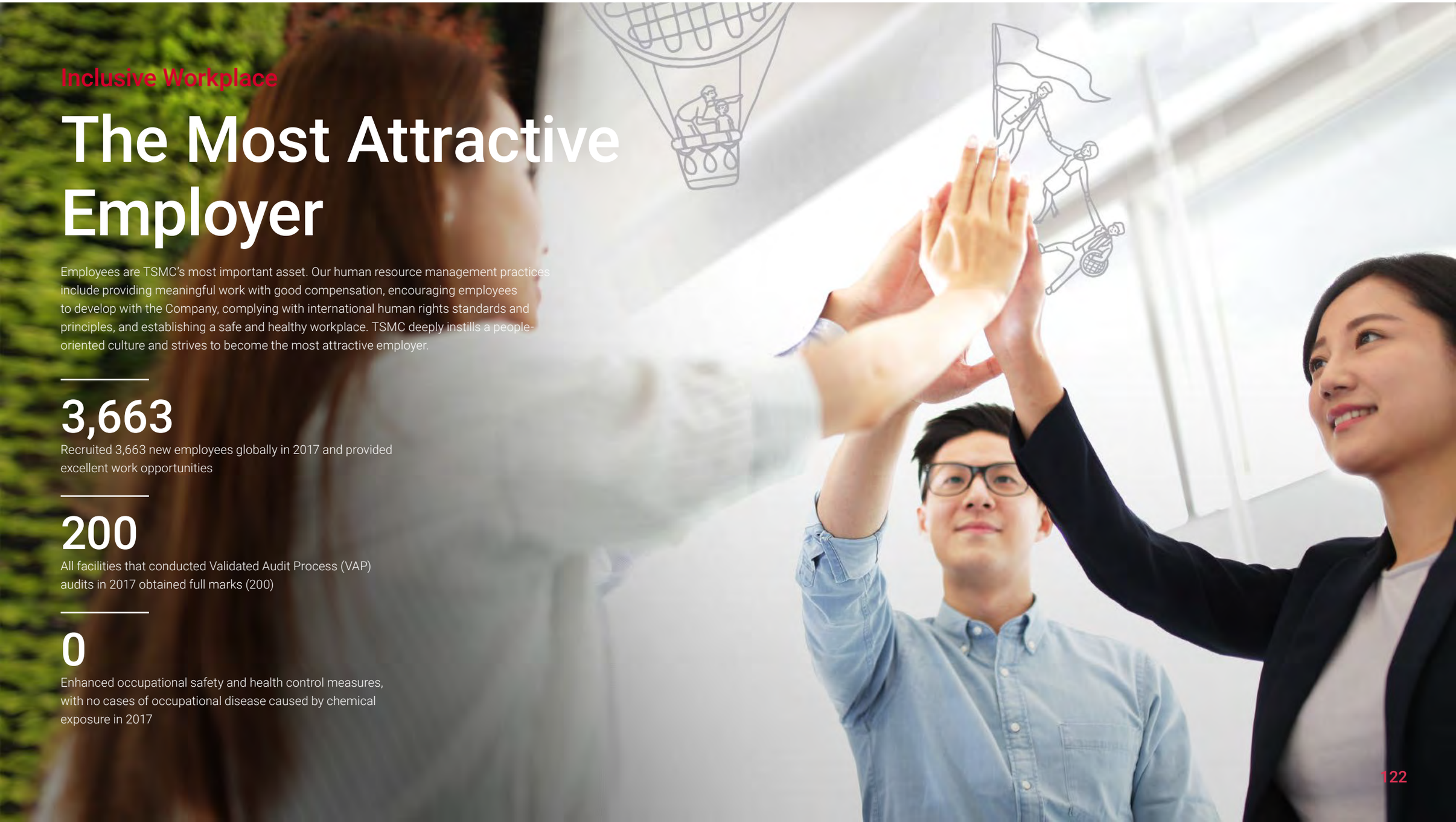
Recruited 3,663 new employees globally in 2017 and provided excellent work opportunities

200

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

0

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



Material Issue

Talent Attraction and Retention

Strategies	TSMC 2020/2025 Goals	Achievements & Targets
Right People with Shared Vision and Value Recruit talents with proper selection criteria	New hires need to pass TSMC selection criteria evaluation 2020	
Right People for the Right Jobs Implement internal transfer policy	Internal transfer policy implementation rate: 100% 2020	
Competitive Compensation Provide competitive total compensation	Sustain total compensation at top 25% among high-tech industry peers and take leadership role 2025	

Strategies & 2020/2025 Goals	2017 Achievements	2018 Targets
	89% Offer acceptance rate Target: 87%	New hires need to pass questionnaire and interview evaluation to ensure the possessions of they are equip with TSMC's selection criteria
	89% External hiring fulfillment rate Target: 76%	
	>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[Note1] 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%[Note 2]

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.

TSMC Talent Selection Criteria

Workforce Structure

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

In addition to recruiting right people with shared vision and value, TSMC's fabs in Taiwan create great value obviously. The Expert Market published a survey, which used "Fortune Global 500 List 2017" to analyze those companies' profit per headcount. The profit per headcount at TSMC's fabs in Taiwan ranked 9th in the world and was the only Asian company in the top 10, reaching US$218,951.

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%
Education	Ph.D.	2,041	90.9%	205	9.1%	2,246	4.6%
	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	29,495	60.7%	19,103	39.3%	48,598	99.9%
	Temp	3	75.0%	1	25.0%	4	0.1%
Subtotal by Genders		29,498	60.7%	19,104	39.3%	--	--
Total							48,602

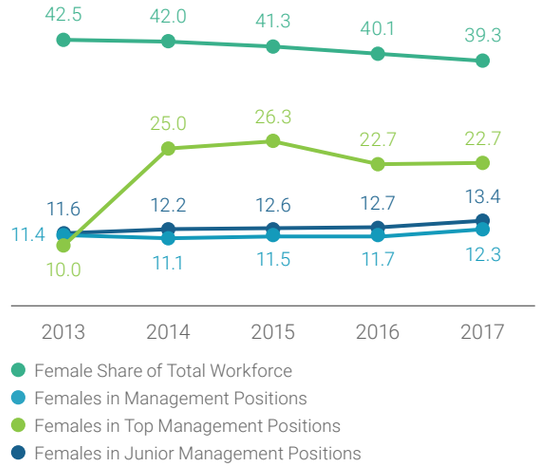
Female Workers

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: %



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.

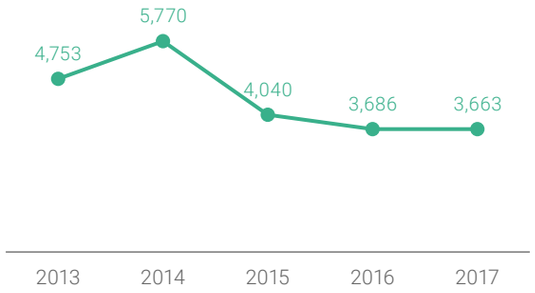
Besides overseas students, we also recruit experienced talents. Thus, TSMC visits selective universities and cities periodically every year to look for semiconductor talents. The search regions for semiconductor talents expanded to Europe (UK, Germany, Belgium and Netherland), Canada and Japan. Meanwhile, 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.

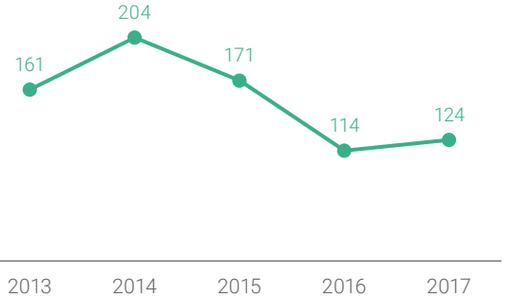
New Hires in TSMC

Unit: numbers



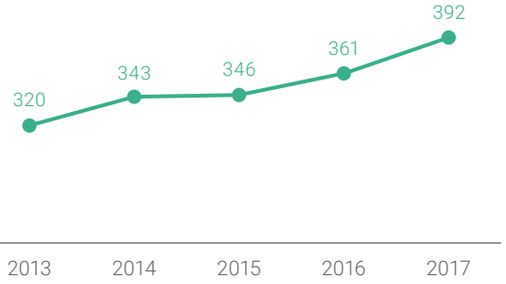
Overseas New Hires in TSMC

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.

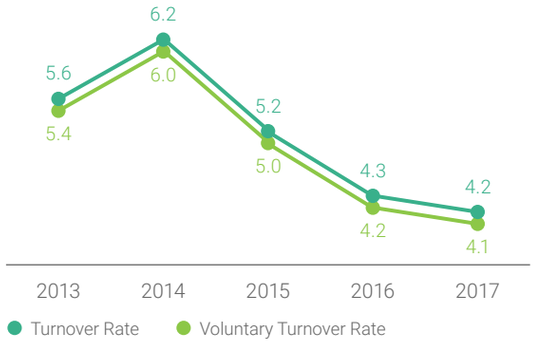
Implement Internal Transfer Policy

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

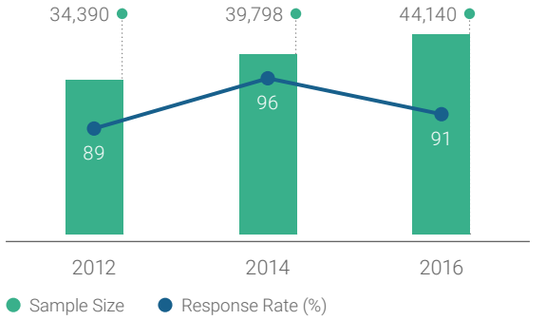
Unit: %



Note: Including TSMC

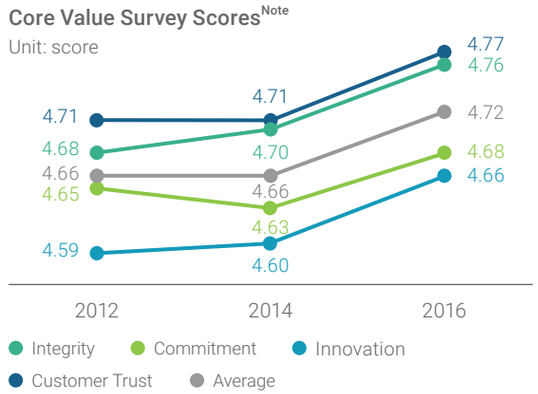
TSMC Core Value Survey

Core Value Survey Sample Size and Response Rate



Core Value Survey Scores[Note]

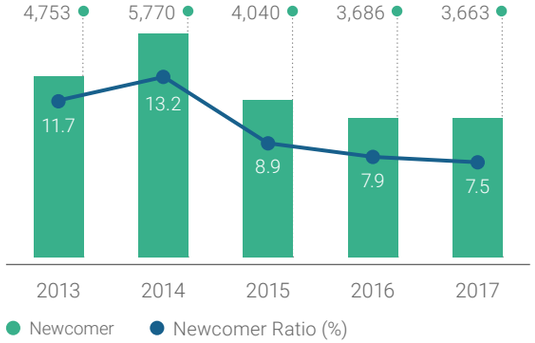
Unit: score



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

2013-2017 TSMC's 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[Note] 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

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.

2017 Salary Increase and Bonus

Salary Increase

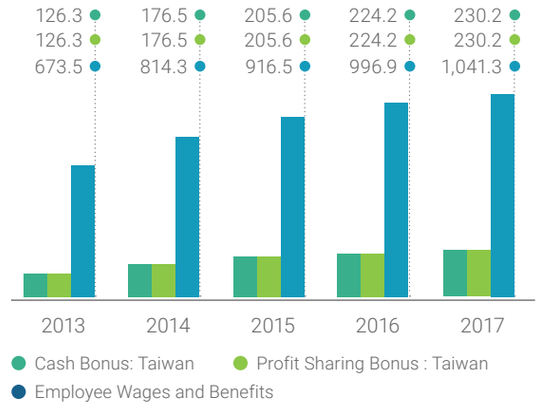
- In order to maintain the competitiveness of our total compensation, we appropriately adjust employees' salaries annually, taking into consideration of the results of global salary surveys, market salary scales, and economic indices.
- In April 2017, TSMC completed salary increase for employees in Taiwan 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

Bonus

- 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.
- 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.
- The profit sharing bonus of NT$ 23,019,082,000 to be distributed in July 2018 to encourage our employees' continuous contribution.
- 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

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.

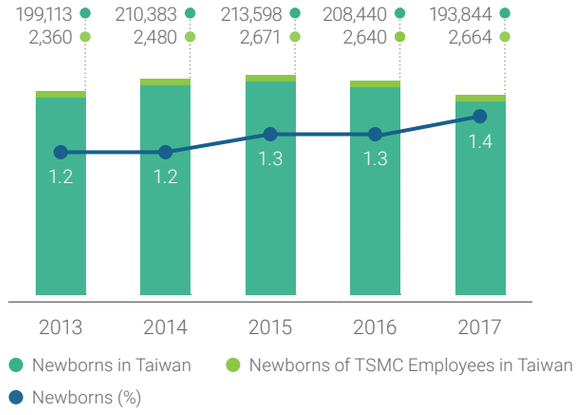
Benefit Practices which Exceed the Statutory Requirement

Item	Labor Law	Practices in TSMC fabs in Taiwan
Holiday	12 national holidays per year	• TSMC holidays include 12 national holidays in accordance with the Labor Standards Act and 7 additional memorial days
Annual Leave	3 days for 6-month service in the first year	• 1 day for each 2-month service in the first year to look after new hired employees' leave requirements
Sick Leave	30 days of half-paid sick leave per year	• 120 hours fully-paid and 120 hours half-paid sick leave per year
Personal-affairs Leave	14 days of personal-affairs leave per year	• 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
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	• In addition to the Labor Insurance and National Health Insurance, we provide comprehensive group insurance plans to employees without charge. Coverage includes life insurance, accident insurance, hospital insurance, cancer insurance, and business travel insurance. Besides, employees also have the flexibility to participate in self-pay insurance plans for their family with lower prices. • The coverage will be extended without charge to employees in leave of absence for the purpose identified by labor law. • 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

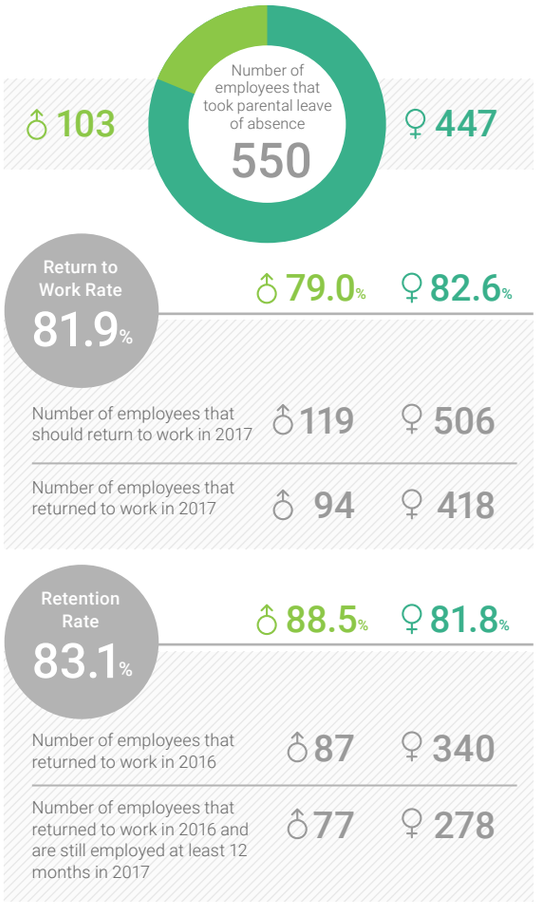
Note: TSMC provides localized leave and insurance programs to employees in overseas regions. We grant additional days of annual leave to employees in China, North America and Europe. As for insurance program, the comprehensive life and medical insurance program are also designed in consideration of the 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[Note]



Note: Number of employees that took parental leave of absence, return to Work and retention status include TSMC Fabs in Taiwan and VisEra

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

Defined Benefit Plans

- TSMC provides a defined benefits plan based on an employee's length of service and average monthly salary for the six-month period prior to retirement under the Labor Standards Act
- TSMC contributes an amount equal to 2% of salaries paid each month and VisEra contributes a fixed amount to employee's respective pension fund, which are administered by the Labor Pension Fund Supervisory Committee (the Committee) and deposited in the Committee's name in the Bank of Taiwan

Defined Contribution Plans

- TSMC provides a defined contribution plan under the Labor Pension Act (the "Act"). Pursuant to the Act, TSMC makes monthly contributions equal to 6% of each employee's monthly salary to employees' pension accounts
- TSMC's oversea subsidiaries also make monthly contributions at certain percentages of the basic salary of their employees

Pension Asset as of year 2017

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

- Accordingly, TSMC recognized expenses of NT$2,369,940,000 for the years ended December 31, 2017

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
	Assistant Engineer/ Clerical	0.92	1
	Technician	0.85	1
China Note	Manager	1.04	1
	Professional	1.15	1
	Assistant Engineer/ Clerical	1.06	1
	Technician	1.00	1
Japan	Manager	1.75	1
	Professional	1.21	1
North America	Manager	1.22	1
	Professional	1.37	1
Europe	Manager	0.50	1
	Professional	1.11	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
	Assistant Engineer/ Clerical	1.12	1
	Technician	0.95	1
WaferTech	Manager	1.25	1
	Professional	1.23	1
	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 & 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 & 2020/2025 Goals	2017 Achievements	2018 Targets
	5~10% CAGR in Revenue Per Headcount Target: Based on organizational needs, implement organizational and talent development projects to enhance working effectiveness	**10~15%** CAGR in Profit Per Headcount Target: Based on organizational needs, implement organizational and talent development projects to enhance working effectiveness	Increase the percentage of self-directed leaning mechanism to 50% in organizational learning or development programs
	92% Completion rate of pre-training for Taiwan assignees Target: Continuously support employees in Nanjing site to accomplish the missions	**100%** Completion rate of orientation for Nanjing newly recruited employees Target: Continuously support employees in Nanjing site to accomplish the missions	100% support the training for employees of the new sites to achieve the missions of plant set-up, machine installation, or mass production
	63.4% Percentage of open positions filled by internal candidates Target: 63%		Increase the percentage of open positions filled by internal candidates via JOS or promotion to 64%

Surpassed Achieved Unachieved

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.

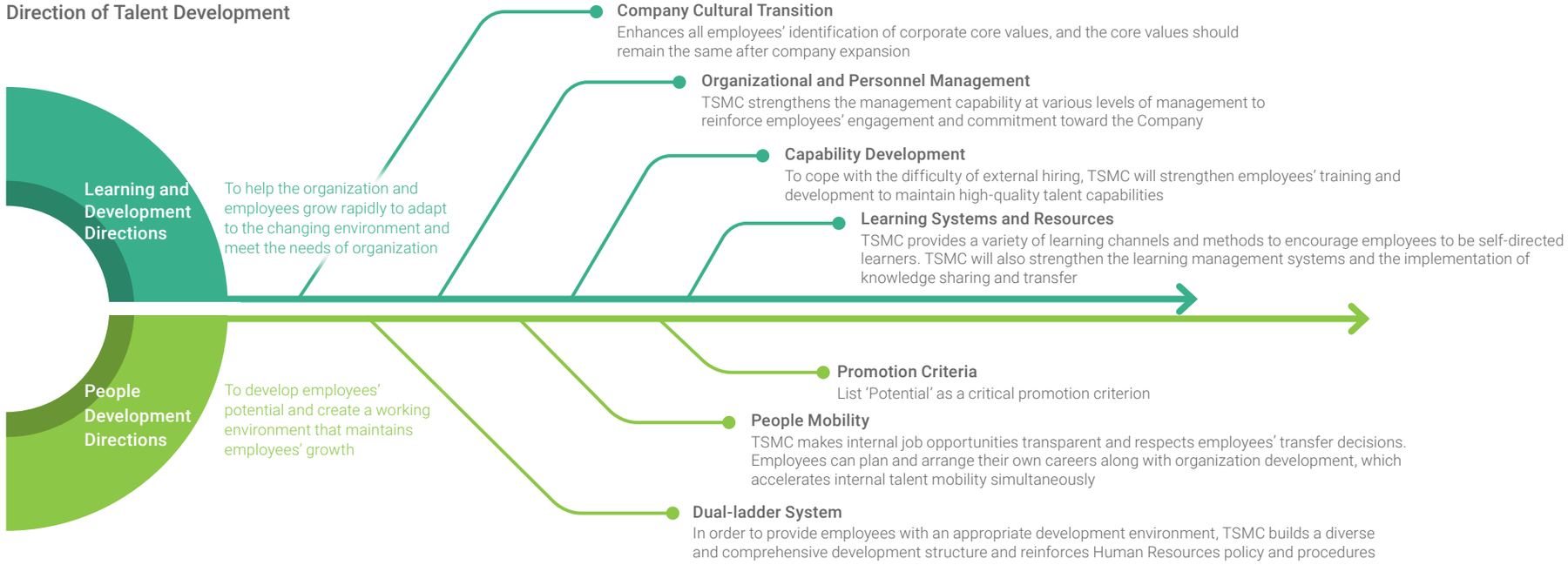
Learning and Development

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[Note], 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 wok 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

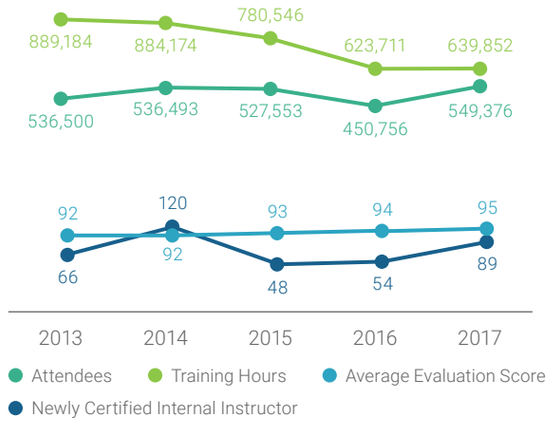
Direction of Talent Development



To ensure the quality of the courses, we measure the training effectiveness through questionnaires and pre- and post-assessment mechanisms to continuously improve the quality. As the quality of the course improved year by year, the average score of trainees' evaluation (course content, instructor, administration and effectiveness) increased to 95 points in 2017.

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

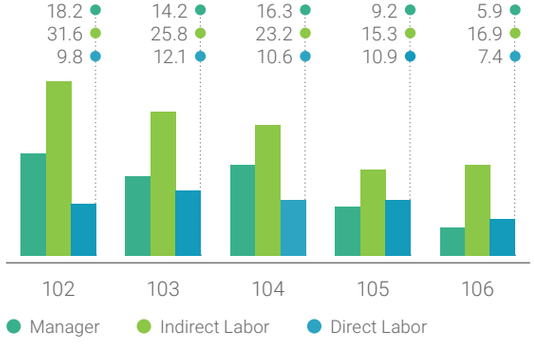
2013-2017 Training Index



Note: The data scope of attendees, training hours, and the newly certified internal instructors came from Taiwan, China, Japan, Korea, Europe and North America. Due to the difference of training systems, the average evaluation score does not include North America

Average Trainng Hours of Manager, Indirect Labor and Direct Labor

Unit: hour



2017 Key Focuses of Learning and Development

	Ratio of attendees over full-time employees	Achievements
People Management Capability Enhancement for First-line Managers Streamline the people management capabilities required for first-line managers to perform their management responsibilities	11.0%	• Enhance the personnel sensitivity of first-line managers in Operations, so as to reduce the risk of people and issue management. There was 89% completion and the ROI of the training reached 96 points
Organization and Talent Development Timely resolve organizational issues and enhance employees' working effectiveness	2.9%	• Completed a total of 32 programs which provided substantial benefits to organizations and employees in meeting performance, decision making, communication, and project management, and so forth • Organizational development programs received positive feedbacks from the users. For example, vice president of Quality and Reliability said that he clearly felt in various meetings that his staff made great strides in communication skills that showed in 'Stating clearly with full picture and attractive content' after the implementation of the 'Storytelling Capability Enhancement Project'. The increased management capabilities also reduced the time to handle customer issues by 10%
New Site Training Implement training for employees located in Nanjing to enable the organization and personnel to complete tasks in the new sites	1.6%	• Carried out the pre-training for Taiwan assignees, the orientation and the core value in-depth training for Nanjing newly recruited employees to accelerate their adaptation to the new jobs • The complete training of personnel enabled employees in Nanjing site to get ready in time and started to install machines in September of 2017 • The timeline of mass production in Nanjing will be ahead of schedule by more than one quarter

Case Study

The Nanjing Site Transplanted Taiwan's Experiences

The Progress of Mass Production will be Substantially Ahead of Schedule by More Than One Quarter

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

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

The solid training enabled employees in the Nanjing site 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

			Training Effectiveness
Pre-training for Taiwan Assignees	Taiwan assignees to Nanjing	• Strengthen assignees' awareness of TSMC Code of Conduct and Proprietary Information Protection • Accelerate assignees' adaptation to the environment	Completion rate: 92% ROI: 91 points
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

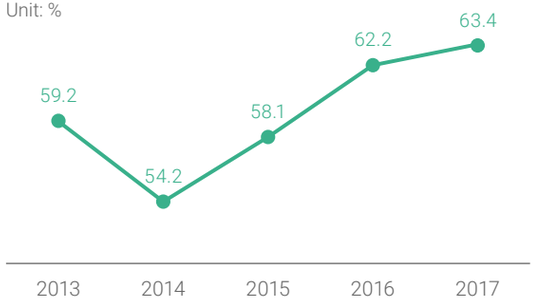
In order to retain internal talents, TSMC provides a diverse and comprehensive people development structure for employees, and strengthens the 'Dual Ladder System' so that employees can get appropriate development based on their attributes and expertise in managerial, technical or professional fields. 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

	Achievements
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	• 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
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	• 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
Promotion Criteria - Potential Emphasize the importance of employee's potential in the promotion system to enhance the quality of promotion decision-making	• 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 & 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 & 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

Counterpart | Employee number who's under high-risk conditions

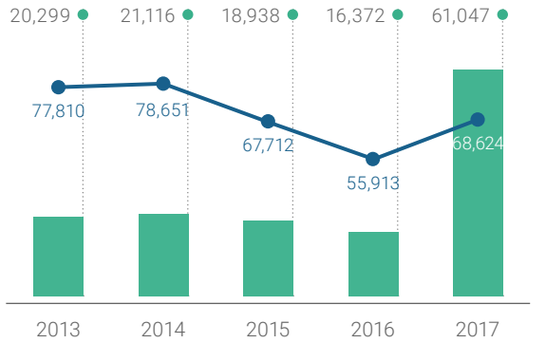
Provide a Safe and Healthy Work Environment	Eradicate Discrimination to Ensure Equal Employment Opportunity	Forbid Child Labor	Eliminate Forced Labor	Promote Employee Physical and Mental Health and Work-life Balance	
• Set "zero accident" as safety and health goal • Adopt strict safety and health management procedures, maintain stringent standards for facility and hardware operations • Conduct individual and group management by analysis of health examinations and occupational factors to prevent potential health risks • Provide health promotion activities and employee assistance programs based on employee's needs to help them implement a healthy life style	• Follow local government labor act, international norms and "TSMC Human Rights Policy" to implement the rules and regulations. • 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 • To conduct imperative adjustments according to the findings from internal control	• Complying with "TSMC Human Rights Policy", the Company amended and implemented <TSMC Candidate Interview Process Control Instruction>. TSMC only accepts applicants over the age of 18 and exam employments to avoid any omissions	• 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	• 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"	• The Company owns on-site day-care center to assist employees in need and provide counselling services
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



- Times of Attendees who Completed Human Right Protection Related Training
- Number of training hours of human rights protection related training

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.

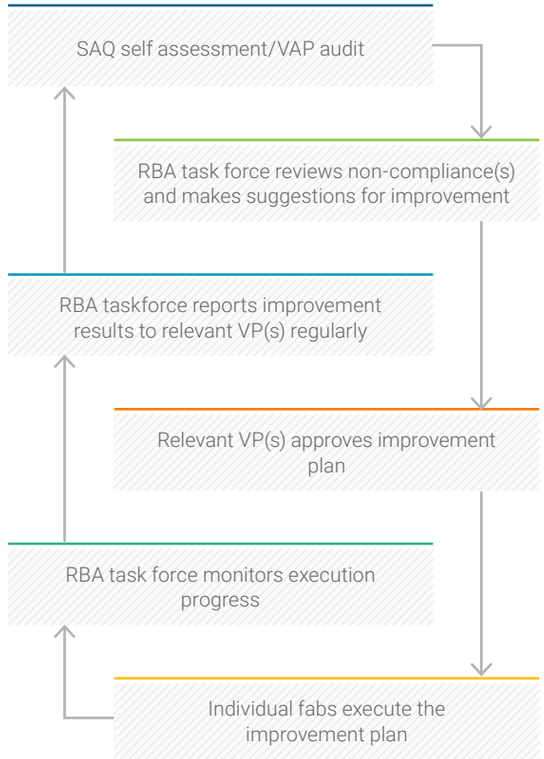
Implement Serial Propagandas Regarding the Prevention of Workplace Bullying

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 Pccupational 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 & <85 ● High Risk <65

VAP Full Score is 200

VAP audit completed in 2017

Taiwan

	SAQ	VAP
Fab 2	92.6	200
Fab 5	92.6	200
Fab 12B	92.6	200
Fab 14B	92.2	200
Fab 15B	91.8	200
Advanced Backend Fab 1	93.9	200
Advanced Backend Fab 2	93.7	200
Advanced Backend Fab 3	93.8	200

China

	SAQ	VAP
TSMC (China)	93.7	200

U.S.

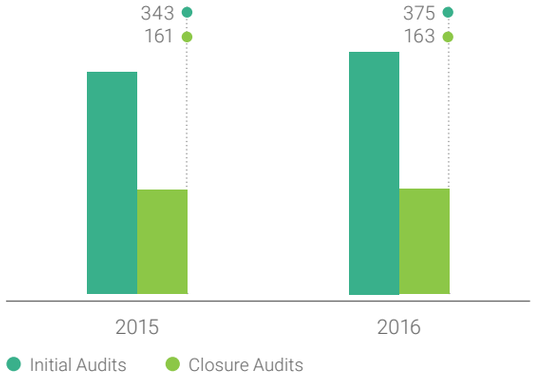
	SAQ	VAP
WaferTech	91.3	200

VAP audit completed in 2016

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

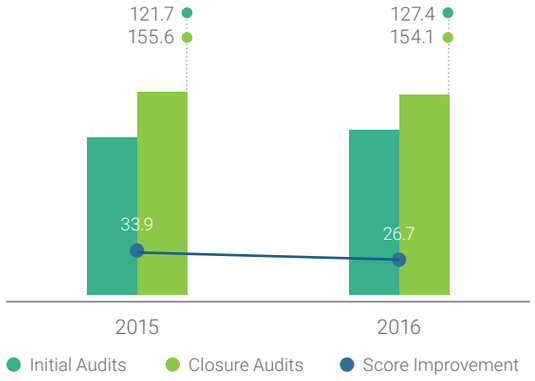
RBA Worldwide VAP Audit Performed

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

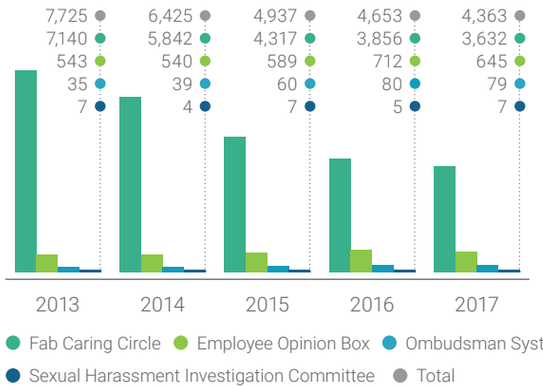
TSMC strives to create harmonious employee relations, values two-way communication and fosters open communication channels for management levels, subordinates and peers. The Company provides a number of voice channels with handling the cases in a fast and confidential manner. Among them, people in charge 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[Note], 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.

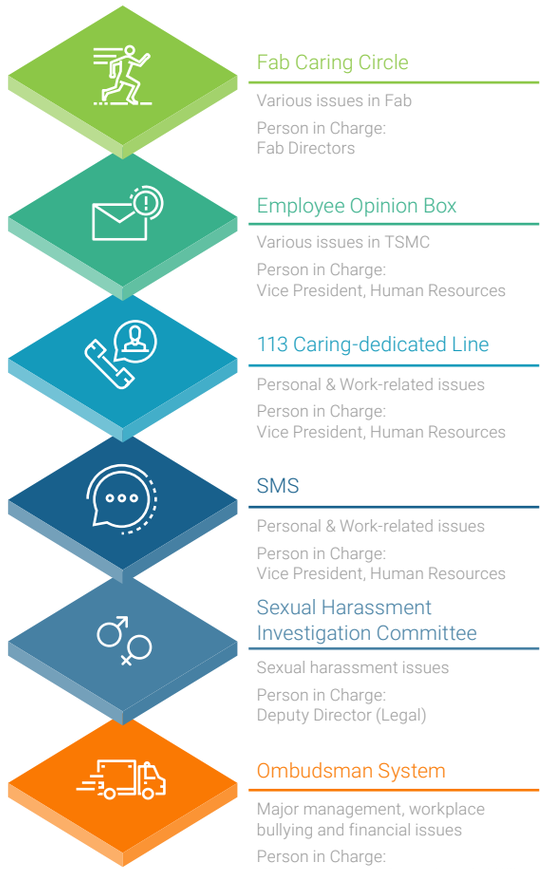
The relationship between our management level and employees has been harmonious over the years due to our effective communication channels. TSMC respects the right to form a labor union of employees, but no employees have pursued it so far, underlying the achievement of the Company's dedication. In 2016,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

2013~2017 Number of Cases Raised through Internal Communication Channels

Unit: Number of cases



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 [Note1]	Achievements & Targets
Advocate Safety Culture Deeply instill a people-oriented safety culture and establish an intrinsically safe working environment	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 [Note 2] — 2020 Expect to reduce work-relative disabling severity rate to 2.39 [Note 2] — 2020	
Establish an Optimal Healthy Workplace Promote employee health and achieve work/life balance	Expect the Self-help participation rate of health programs to be equal to or greater than 54% [Note 3] — 2020	
Upgrade Industry Safe Workplace Environment Collaborating with external parties to reduce safety and health risks	Expected completion rate for coaching and conducting audits to high risk suppliers to 100% [Note4] — 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 & 2020/2025 Goals	2017 Achievements	2018 Targets
	0.56[Note] Disabling Frequency Rate (FR)	Disabling Frequency Rate (FR) < 0.45
	Target: <0.45	Work-relative Disabling Frequency Rate <0.3
	7.84[Note] Disabling Severity Rate (SR)	Disabling Severity Rate (SR) < 6.0
	Target: <6.0	Work-relative Disabling Severity Rate <3.1
	50.67% Self-help Participation Rate	Self-help participation rate ≥ 52%
	Target: ≥47%	
		Completion rate for coaching and conducting audits to high risk suppliers to 30%

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.

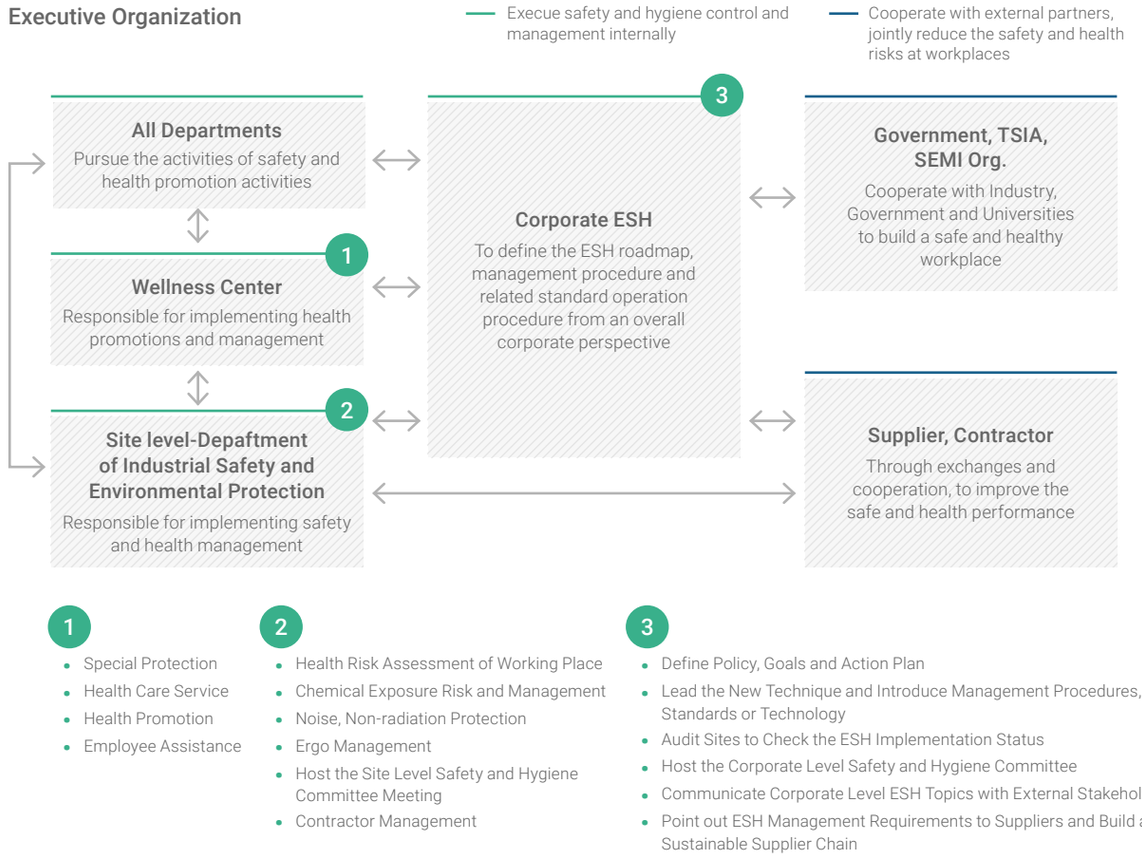
Promoting Safety Culture

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.



Safety Performance Index

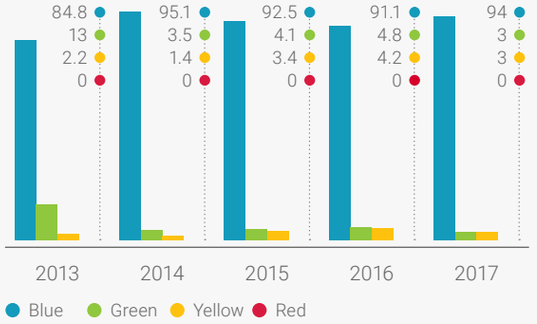
Active Items	Passive Items
• Numbers of safety management of change • Numbers of safety and health executing program • Numbers of safety and health licenses • Numbers of safety and health promotion activity	• Numbers of incident • Numbers of proactive audit defects • Completed rate of regulation identification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

Sample of Four-Level Lights

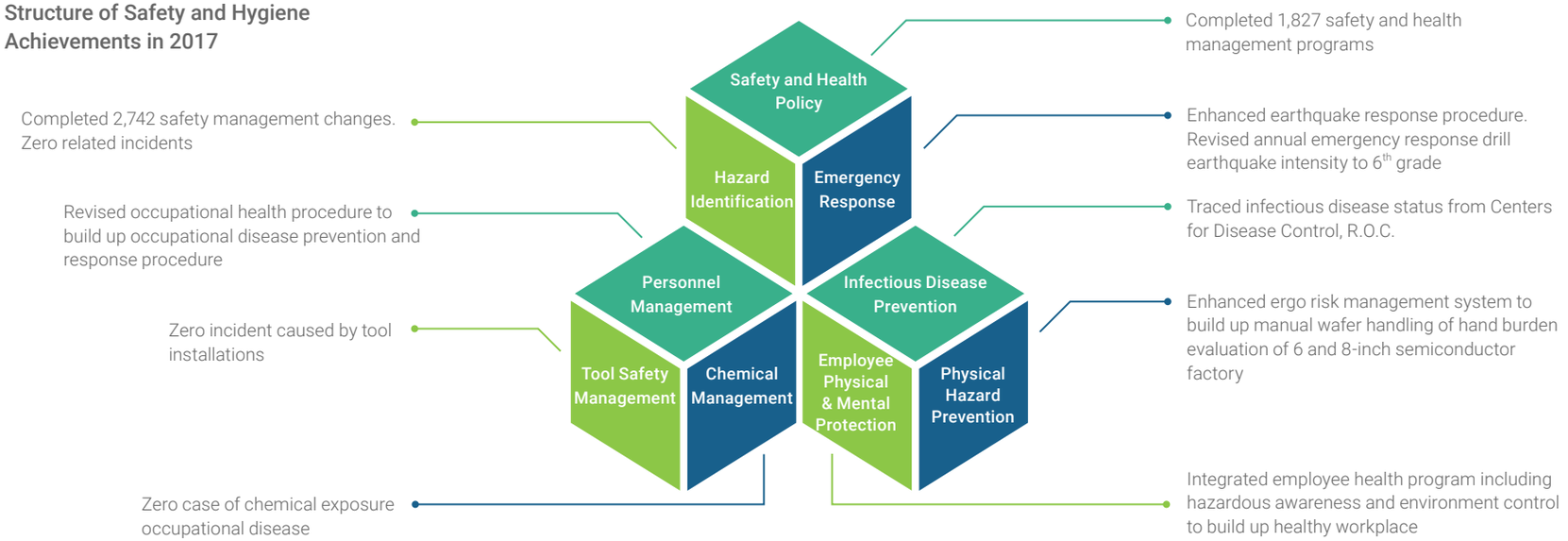
SPI	Performance	Color
SPI ≥ 95	Excellent	
85 ≤ SPI < 95	Good	
70 ≤ SPI < 85	Warning	
SPI < 70	Alarm	

SPI Four-Level Lights Ratio

Unit: %



Structure of Safety and Hygiene Achievements in 2017



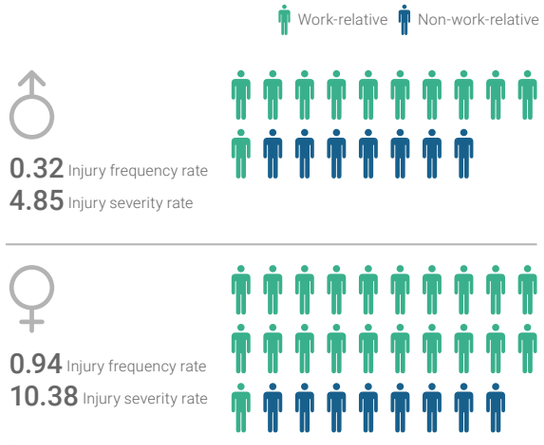
Disabling Injury Statistics

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[Note].

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



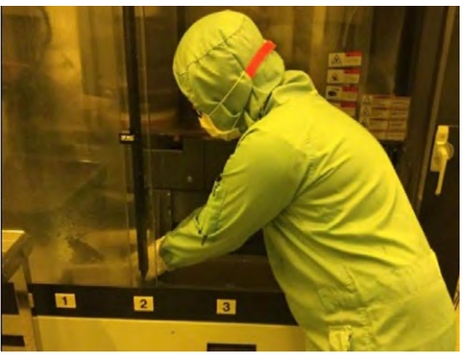
Through analyzing the pattern of injury, falls that were caused by improper movement accounted for 43% of the total disabling injury cases and 18% of the total number of cumulative work disability days. In addition to falls case, an analysis of the number of cumulative work disability days for the top 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 Total working hours yearly: 50,557,053 hours		Female Total working hours yearly: 31,558,154 hours		Total Total working hours yearly: 82,115,207 hours	
		Loss day	Case	Loss day	Case	Loss day	Case
Work-relative	Musculoskeletal injury	12	1	140	1	152	2
	Injuries caused by falling objects	3	1	13	2	16	3
	Cut/incision/abrasion/puncture wounds	17	1	5	1	22	2
	Pinch point and entanglement injuries	23	4	0	0	23	4
	Injuries caused by a bump	2	1	10	6	12	7
	Injuries caused by a fall	0	0	48	9	48	9
	Others	0	0	12	2	12	2
Non-work-relative	Sports injuries	262	3	0	0	262	3
	Traffic accidents occurred inside plants	0	0	29	2	29	2
	Injuries caused by a fall	11	4	57	6	68	10
Total		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
Non-work-relative	Sprain of left ankle due to participation in a running race at a sporting event	165
	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

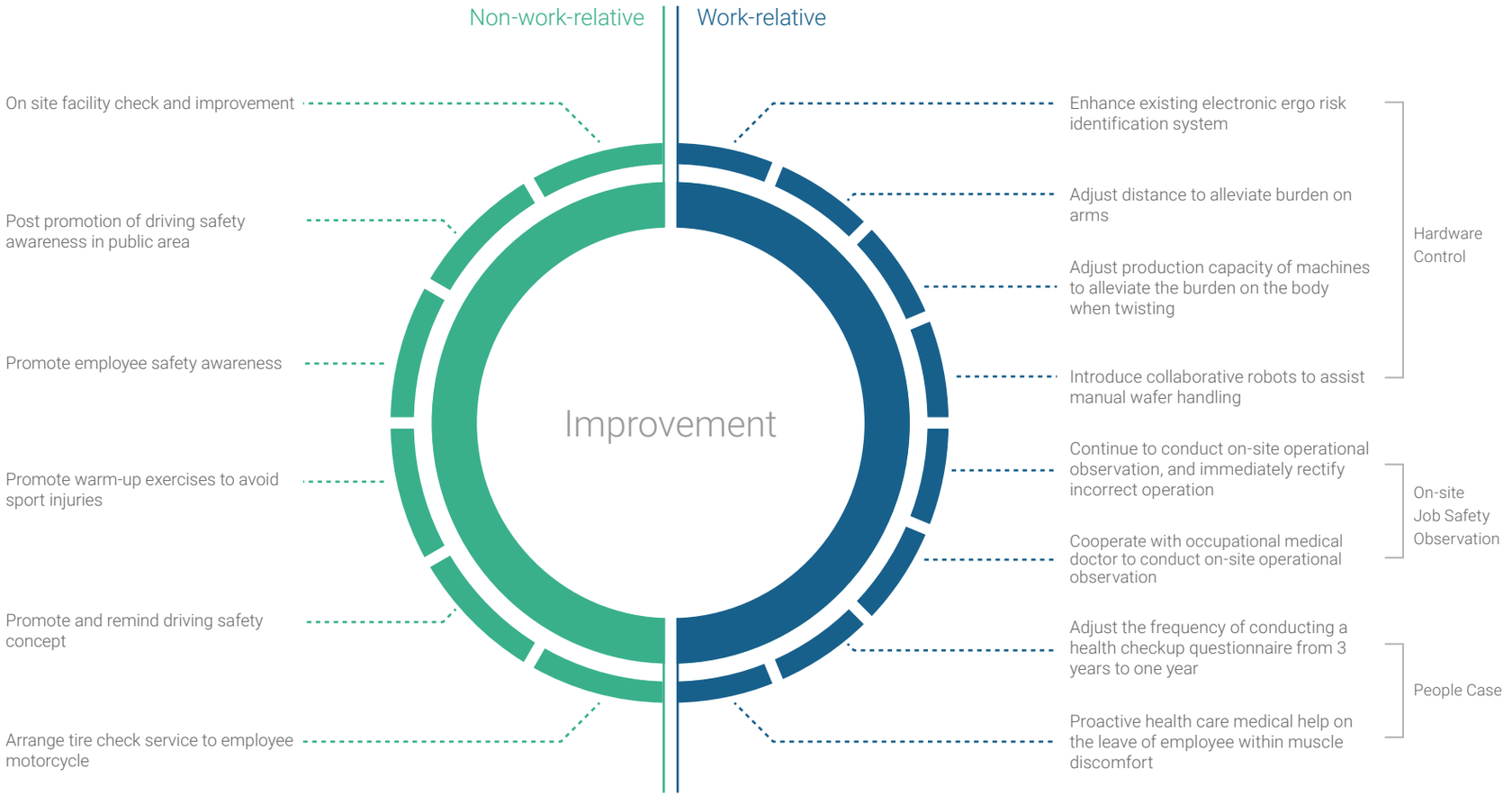
Arrange tire check service to employee motorcycle



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

Improvements

Operations at TSMC's 6inc and 8inch factories mostly reply 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.

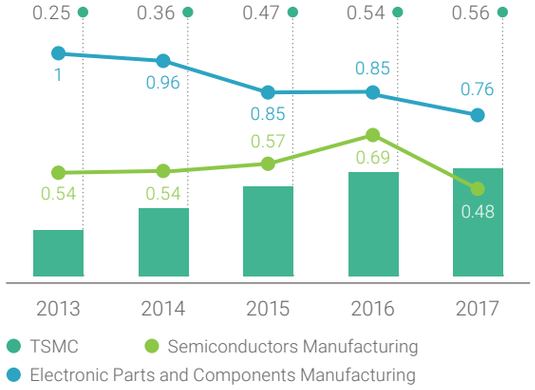
In order to meet intrinsically safe design requirements and provide safer work for collaborative robots, TSMC has not only complied with the new revised regulations, but also has stipulated the safety requirements.

Milestone of Collaborative Robot Planning and Introducing

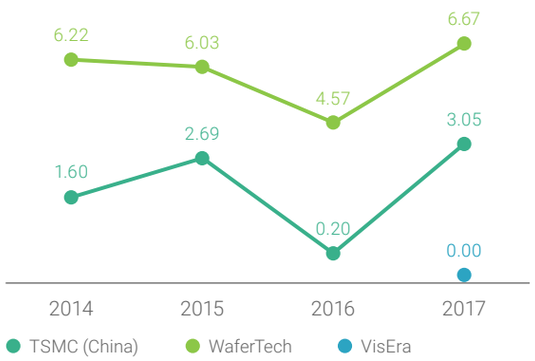
- **2016** — Started planning the introduction of collaborative robots into 6- and 8-inch wafer plants to reduce injuries caused by human factors due to repetitive handling of wafers
- **2017** — Collaborative robots were introduced to demonstrative production lines of wafer plants to be tested on site for a long period of time, in order to verify that they can safely and effectively engage in product manufacturing after relevant production requirements and safety and protection measures complied with the requirements of TSMC regulations. On-site testing and verification were conducted for more than 6 months
- **2018** — Mass production officially starts. Collaborative robots are successively introduced to production lines to engage in the handling of wafers

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

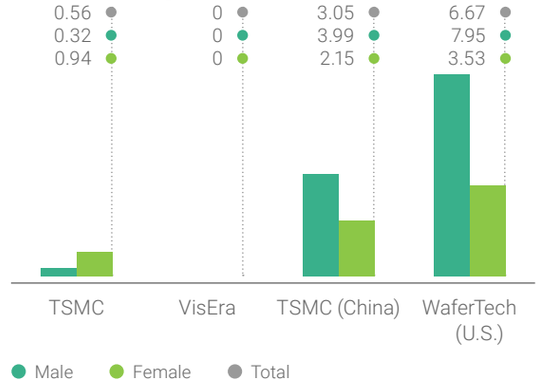
TSMC Taiwan Disabling Injury Data



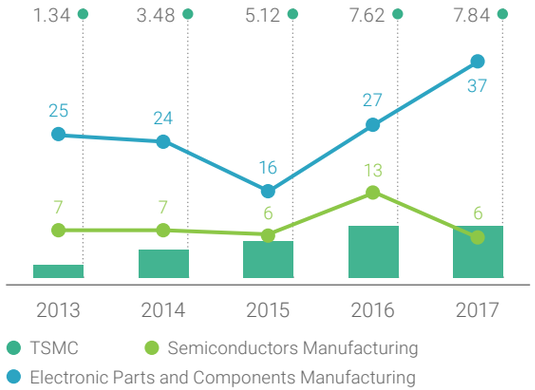
TSMC Subsidiaries Disabling Injury Data



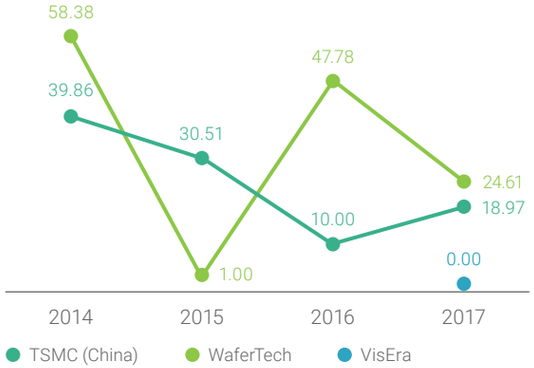
Disabling Frequency Rate (FR) of TSMC Fabs by Gender and Region in 2017



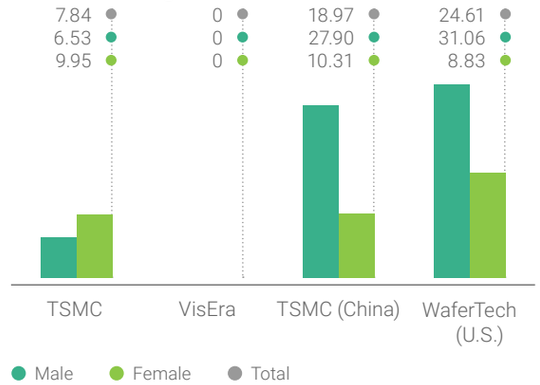
TSMC Taiwan Disabling Severity Rate



TSMC Subsidiaries Disabling Severity Rate



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

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 Opertion 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

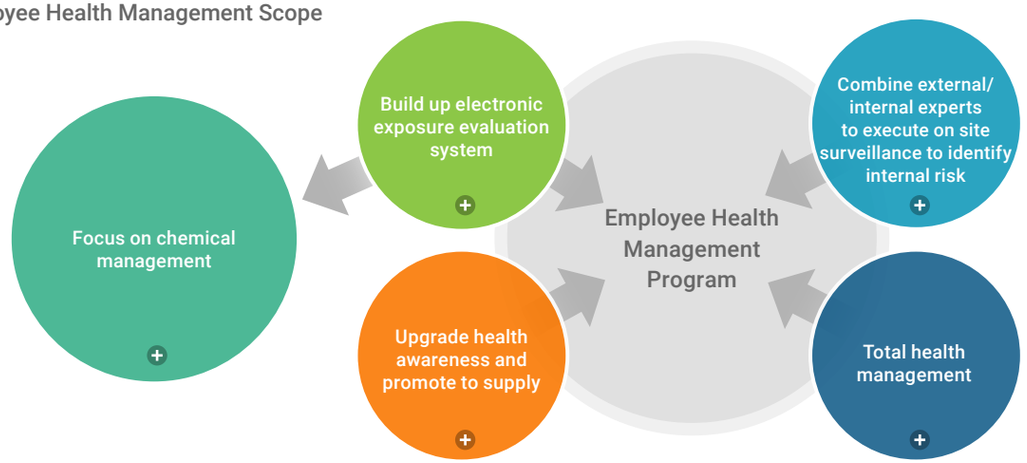
Integrate chemical data to build up the first Semiconductor Industrial "E-Exposure Assessment System"

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.

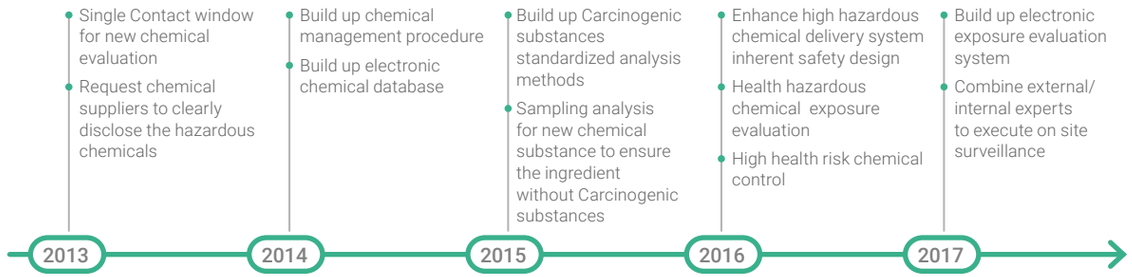
In 2016, TSMC established the principle of managing highly hazardous chemicals following that don't use highly hazardous chemicals when it is not necessary; Necessity use, use less; built effective abatement avoiding highly hazardous chemicals contaminate environment.

In 2017, TSMC integrated the electronic data bases including chemical, working environment measurements, and simliar 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.

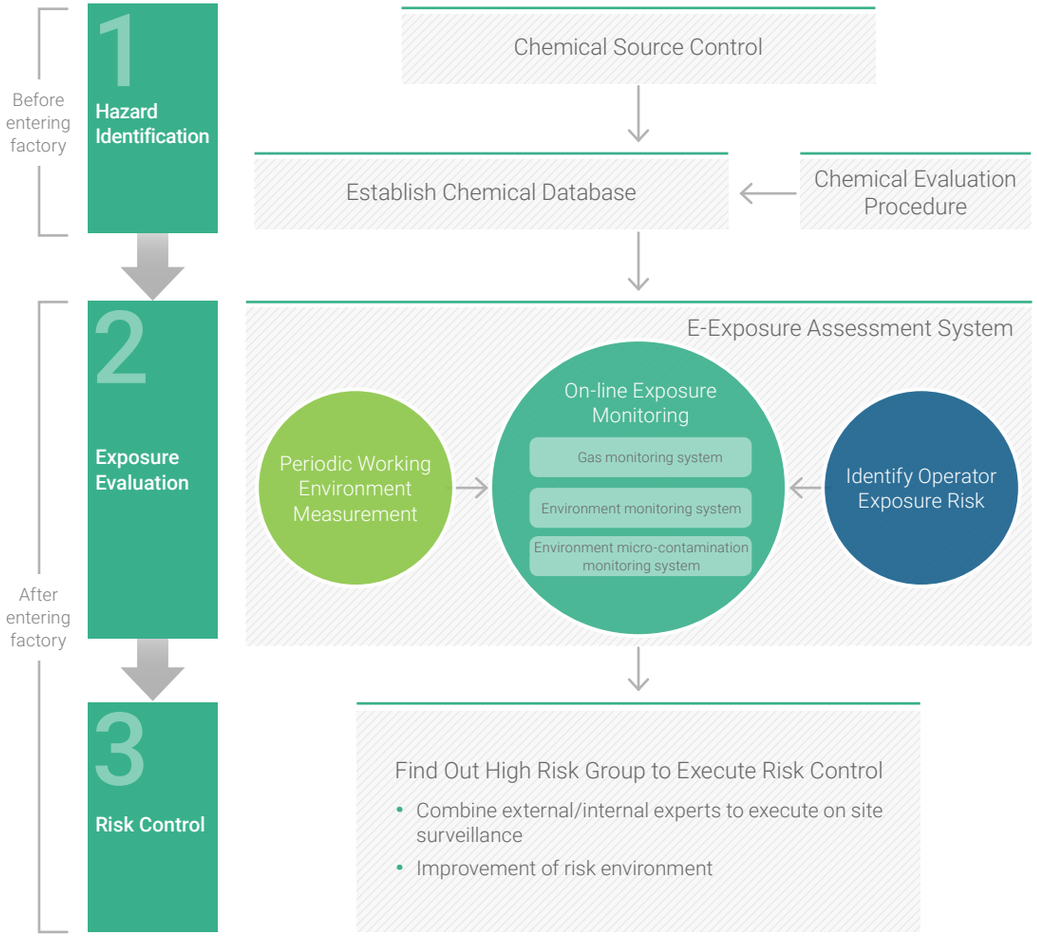
Employee Health Management Scope



Chemical Management Milestone

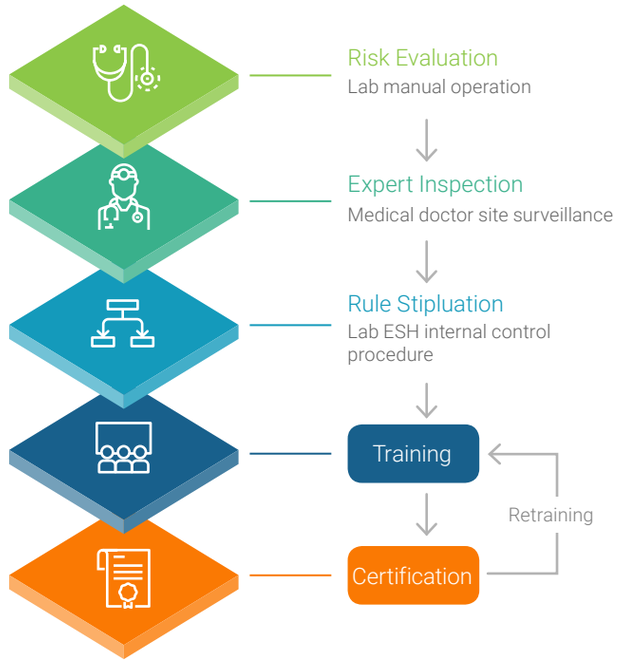


Chemical Management Procedure



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 operaters handling procedure. Based on the on-site survey result, we estanblish the "Laboratoty Safety, Health and Environment standard operation procedure". We install the ventaliation device to improve the laboratory working environment preventing dust and volatile organic compounds exposure risks dramaticly to achieve zero exposure of employees.



Occupational Diseases Prevention Training and Promotion

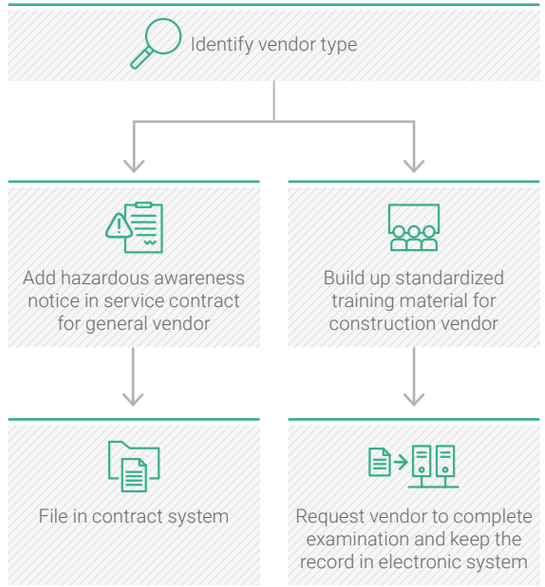
Care First Training

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.

Target Training Audience	Training Content
General and newly recruited employees	• A general concept of safety and health • Introduction to work environment • Timing for delivering emergency evacuation alerts
Employees who run the risk of being exposed to chemicals or radiation	• Potential exposure risks in the work environment • Personal protection and environmental monitoring • Potential injuries caused by exposure to chemicals or radiation • Emergency response drills
Supervisors working in high risk areas	• Caring for employees • Potential health risk factors of the semiconductor industry • Prevention of occupational diseases • Crisis response

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

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



Upgrade Industry Safe Workplace Environment

Collaborating with External Parties to Reduce Safety and Health Risks

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

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

Establishing a Two-way Communication Platform between TSMC and Contractors

For on-site personnel of these contractors, TSMC has begun to standardize safety and health training courses and increased their frequency to enhance training effectiveness and safety awareness. At the same time, depending on risk priority, the retraining frequency has been increased to quarterly or annually from once over a year previously to upgrade on-site facility employee safety awareness and secure workplace safety.

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.

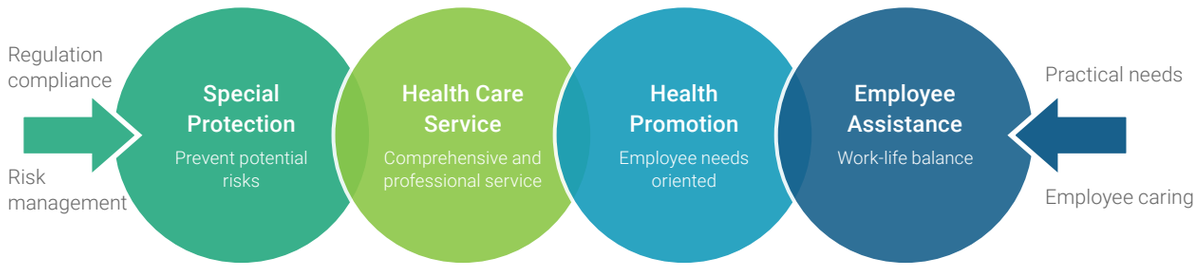
For more details, please refer to our website "TSMC Continues to Enhance Contractor Management"

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, health care services, health promotion, and employee assistance program, to prevent occupational injuries and diseases as well as promoting employee's physical and mental health.

Special Protetction

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



Special Protection Programs

Special Health Examinations and Management

2017 Achievements

Special task workers	• 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

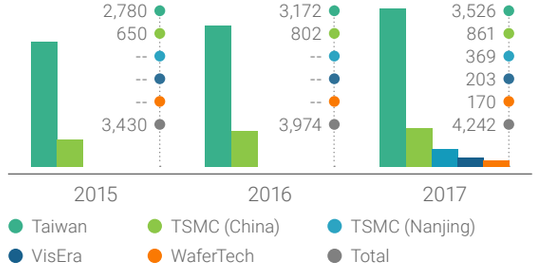
Female workers who are pregnant or postpartum within one year	• HR provides name list of leave for routine prenatal visit • Attractions: special gift and parking spaces for pregnant employees	739 female employees received individual assessment and management of Taiwan site and VisEra. 710 of them also 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

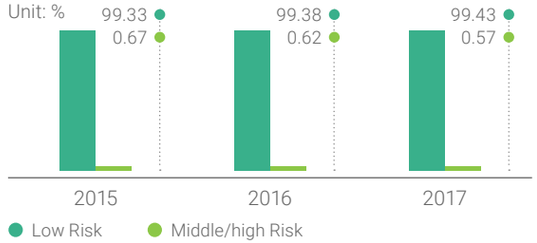
Visits of Special Health Examination

Unit: number of visit



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

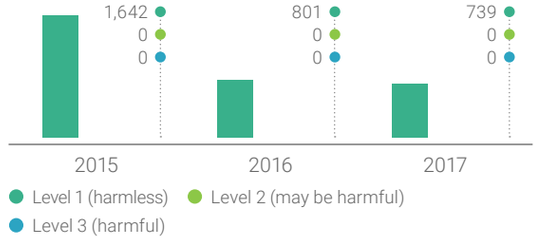
Unit: %



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

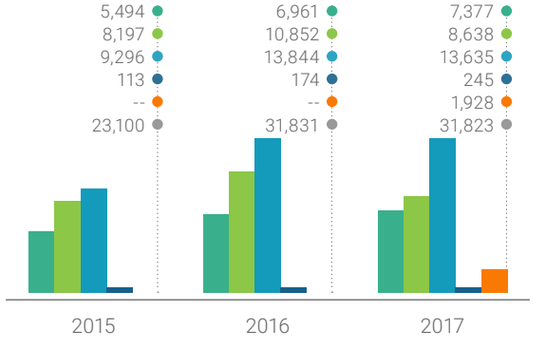
37,973 attendees (including Taiwan, Shanghai, Nanjing and VisEra) received health care services. Taiwan and China sites provide annual examinations whose frequency and number of tests are above regulatory requirements. After the examination, health administrators proactively provide health instructions 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

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

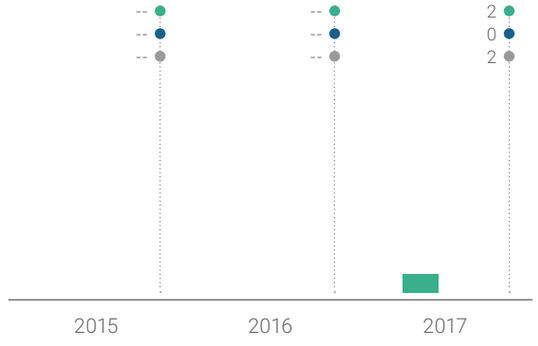
Attendance of Health Care Service: Taiwan Sites

Unit: number of people



Attendance of Health Care Service: TSMC (Nanjing)

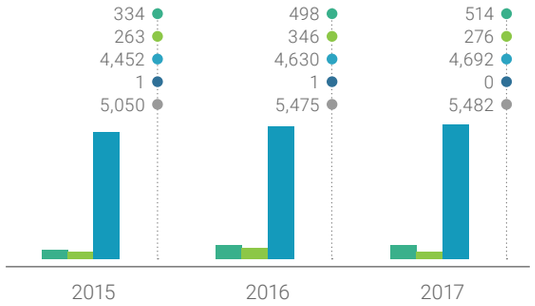
Unit: number of people



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

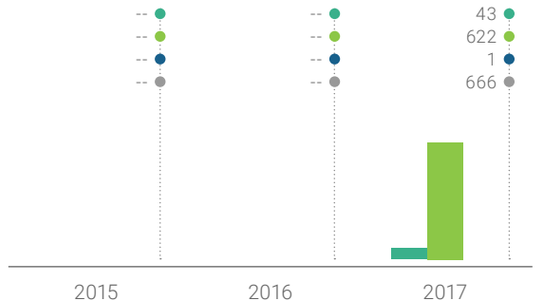
Attendance of Health Care Service: TSMC (China)

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 ≥ 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 [Note]

● 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

Lecture of Chinese medicine

Health Promotion Programs

Infuse Lohas into Your Life

2017 Achievements

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

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

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

Tasks of 2018

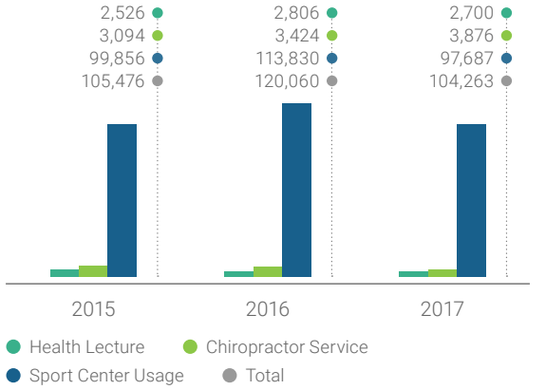
Identify risk and establish exposure assessment tool, arrange occupational medical experts to execute on site observation of 24 high risk areas, and occupational disease prevention training and promotion

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

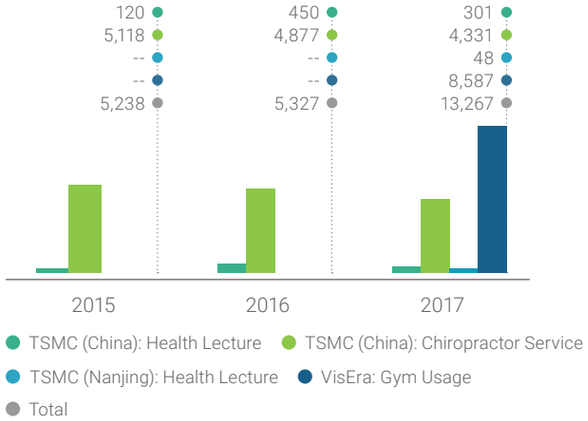
Attendances of Health Promotion Service: Taiwan Sites

Unit: Number of Attendances



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

Unit: Number of Attendances

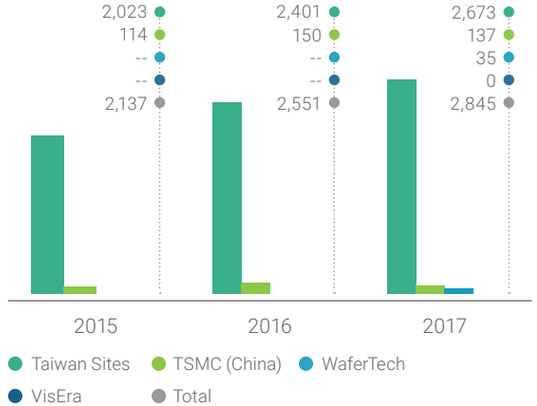


Employee Assistance

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

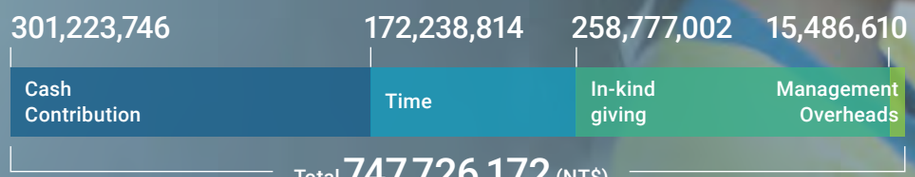
The Power to Change Society

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$)



Total 747,726,172 (NT$)

Note: Our social investments include endeavors made by the Company (e.g. University Collaboration Programs, etc.), TSMC Education and Culture Foundation, TSMC Charity Foundation, and TSMC employees (volunteer services and charity donations)

Since its founding in 1987, TSMC has thrived and grown with the support of society. We reciprocate by doing our utmost to realize a prosperous society. TSMC has integrated its cross-departmental resources and strengths, abiding by the vision and principles of the "Corporate Social Responsibility Policy", and actively contributes towards the United Nations Sustainable Development Goals (SDGs). The SDG 1 (No Poverty), SDG 3 (Good Health and Well-Being) and SDG 4 (Quality Education) are increasingly seen as our primary directions of social participation. By setting long-term targets and actions, SDGs are incorporated in our organizational operations.

TSMC strings two important pillars in uplifting society. The "TSMC Education and Culture Foundation" strives to deepen education, enrich artistic pursuits and passes on the torch of culture to all corners of Taiwan. With love at its core, the "TSMC Charity Foundation" has long been concerned about the needs of the disadvantaged and the elderly who live alone. The Foundation also spares no efforts in promoting filial piety and protecting the environment, with the expectation of gathering more warmth and philanthropy.

Stemming from a desire for a bright future, TSMC endeavours to bridge the gap in resources, strengthen the power of goodness, and serves as a positive force in society.

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 & 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** Note **"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

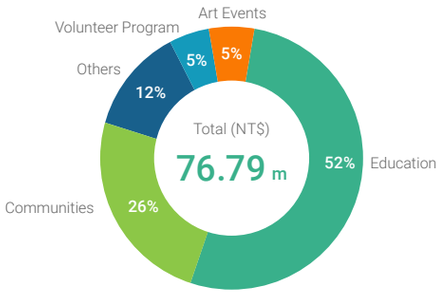
> Education is the foundation of a country, and culture is the soul of a society. TSMC values education and culture, and uses diverse educational programs and moving artistic performances by the TSMC Foundation to fill gaps in regular education, to uplift the spirit of citizens, and to make our society 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.

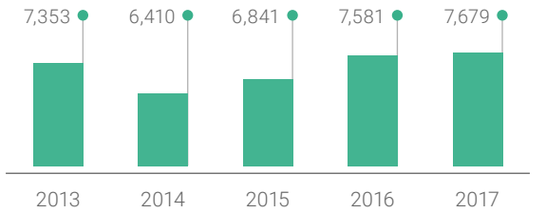
The TSMC Foundation established a website www.tsmc-foundation.org to offer the public online lectures, activity information, and details of the Foundation's projects.

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.

2017 KPI

- **Hope Reading 2.0**
  - Offered 20,000 good-quality reading materials to 200 elementary and high schools in the remote rural areas
  - From 2017, we sponsored NT$6 million for "Hope Reading 2.0" for three years
- **Science Tours and Aesthetic Tours**
  - Led a total of 3,600 students from 17 counties and cities to visit science and arts museums all over Taiwan to inspire them
- **Top University Hardship Scholarship Program**
  - Donated a total of NT$2.42 million for 29 Hardship Scholarships to Rising Sun Scholarship of Tsing Hua University and Sunflower Scholarship of Central University
- **Teach for Taiwan (TFT)**
  - Sponsored five teachers in the teaching recruiting and training program; each teacher with NT $300,000 annually, and overall donation was NT$1.5 million
- **Junyi Academy**
  - Sponsored NT$1.5 million for Junyi Academy

Hope Reading 2.0

In response to the waves of digitalization, the TSMC Foundation reacts to the initiatives of "Hope Reading 2.0" project and provides digital carriers to schools which run the pilot projects, in stages. Apart from guiding pupils to learn programing languages with "Cloud Professor", "Hope Reading 2.0" further introduces digital learning system and encourages school kids to read. 545 participating children from 11 schools running pilot projects have read 10,000 recommended books in four months. The pupils at these schools have apparently formed a better reading culture.

> The utmost significance of "Hope Reading 2.0" lies in the opportunity it offers children to make contact with and experience a different world. The reason why I fought tooth and nail for this project is because this project is a system founded in physical books and supported by technology so that the children can keep track of what they have read. Some children who have never read a book now fall in love with reading; now they can read up to 40 to 50 books a year. Children from the remote rural areas can improve literacy, reading fluency and comprehension from reading. You read to gain knowledge and 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 enrolment from other school districts; the number of overall students has risen from 50-plus to 90 and thereabouts.

School kids at the Yunlin Jeeng-min Elementary School are experiencing the online courses of Yunyi Academy

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.

2017 KPI

TSMC Youth Calligraphy and Seal-Carving Competition

- For the first time we moved the spotlight event to Lukang, Changhua county. Echoing the local cultural heritage, we invited students to scribe classic calligraphic inscriptions and form the biggest jigsaw composed of Chinese characters in Taiwan.
- The competition now includes two new categories: the "seal characters" and an additional "Scribes' Group" with extra prizes in order to encourage young people to learn calligraphy.
- The competition-and-campaign has attracted nearly 800 participants in total.

TSMC Youth Literature Award

- We have received 616 manuscripts of fiction, modern poetry, prose and internet composition.
- Vote for 'the young's favorite author' to paying homage to established writers: this year writer Zhen Jian has won the award.

TSMC Cup–Competition of Scientific Short Talk

- It was the first time we utilized popular science fiction and television dramas to make scientific short talk more comprehensible in everyday context, which further attracted the public's attention.
- Take mathematics for instance, we attracted 700 students from 9th grade to 12th grade to participate, who have formed 212 teams.

TSMC Dream Builders of Youth

- We held Dream Builders of Youth Forum, and inspired 400 members of audience.
- The second TSMC Dream Builders of Youth attracted 66 teams from colleges across Tauyuan, Hsinchu and Maoli. At the final stage, the 3-million-Dream-Builder-Prize has been awarded to 6 teams.

Ministry of Culture Arts and Business Awards “Arts and Culture Talents Cultivation Award”

The premier honor for institutions, awarded by the government’s highest cultural institution

TSMC Dream Builders of Youth: Dream Builders of Youth Forum

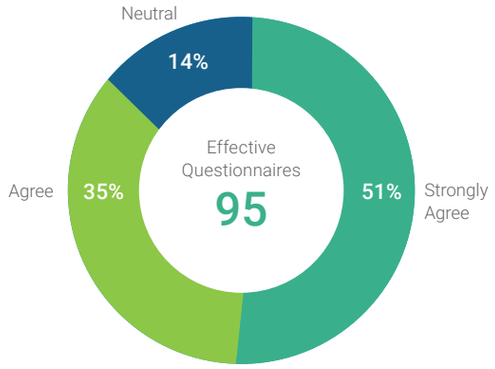
In order to broaden the young people’s horizon of dream-building, the TSMC Foundation holds a special "Dream Builders of Youth Forum" and invites veteran media figure Cathy Ling as the host to lead the short talks and conversations between three pioneering dream-builders and the first three dream-builder teams, and share their moving behind-the-scene dream-building stories with 400 college freshmen and the public. The three pioneers are the founder of Taiwan Black Bear Conservation Association and also the protagonist in the documentary Black Bear Forest, Mei-Hsiu Hwang; the peripatetic artist Belle Chuang, who has traveled to over 20 countries with her painting; the youngest itinerant large animal veterinarian and also co-founder of ILoveMilk, Chien-Chia Kung. The three first dream-builder teams are After Orchid, Dear Storyteller and Kitchen-Troop. In the meantime, the TSMC Dream Builders of Youth Forum responds to societal expectation via questionnaire where the public and the college students are asked of their opinions on the project.

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

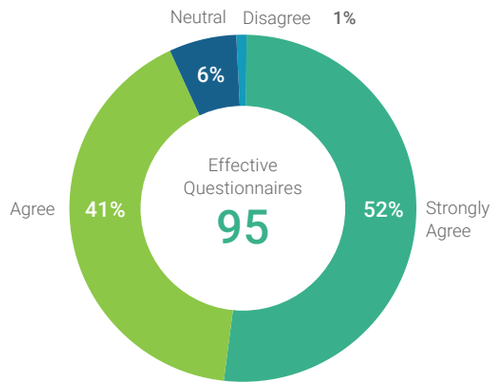
The TSMC Culture and Education Foundation is dedicated to the humanities education for the youth, and to keeping our traditional classical arts alive by running TSMC Youth Calligraphy and Seal-Carving Competition and TSMC Youth Literature Award for 10 and 14 years, respectively. The two awards provide 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 footstep: centring the competition and campaigns in Taipei and Kaushiung 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 Scrip 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, 12th Grader

I observe, I read and therefore I am

In early 2016, I happened to learn of the news of the 8th TSMC Youth Calligraphy and Seal-Carving Competition in the Arts page of the China Times. I gave the paper clipping to our on-campus military instructor and have been seen the "Sailing on the Wind" and "Intrepid Lad" exhibitions of selected calligraphy works at Chiang Kai-Shek Memorial Hall with the instructor for two years in a row.

This year when I was at the exhibition at the Memorial Hall, I overheard commentaries from some Chinese tourists, which really exited me … Here I enclose five photos which show that our military instructor at the 8th and the 9th exhibitions and his joy of receiving the work collection album. One of the photos shows you the instructor's own calligraphic work, "A Visitor on a Chilly Night" and the first page of my pharmacology notes. These photos are reminders of a life-long friendship between the instructor and the student as witnessed by your Foundation's exhibitions.

Wei-Ming Chen

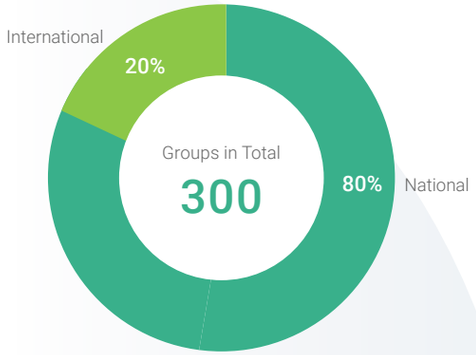
A Letter to F. C. Tseng, the chairman of TSMC Culture and Education Foundation (extract)

(The complete article is published in the National Defense Medical 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 15th Anniversary of TSMC Hsinchu Arts Festival

In 2004 the TSMC Hsinchu Arts Festival has the good fortune to produce selected parts from professor Hsien-Yung Pei's classic Kunqu (Kun Opera) Peony Pavilion-Young Lovers' Edition in Hsinchu. In its 15th anniversary of the Arts Festival in 2017, the Foundation teamed up with the National Taichung Theater to produce the complete Peony Pavilion-Young Lovers' Edition so that our mutual relationship with professor Pei can be continued and presented as a gift to the audience.

Audience Feedback on the TSMC Hsinchu Arts Festival

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.

The 6 talks attracted 755 literature lovers to attend the events

93% of the audience felt that these events are significant for them

As a student I've learnt a lot. I've come to love writing and am now more willing to look at the world from a different perspective.

My family also has a Green Park

"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 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

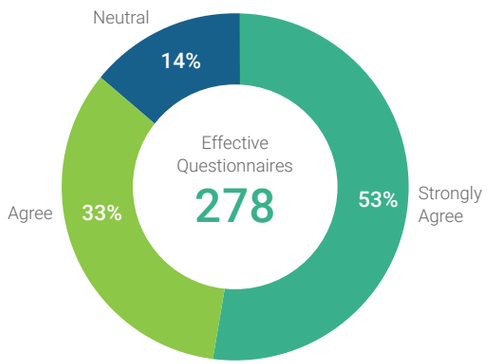
TSMC Lectures: History of Western Civilization, the Final Chapter of the Trilogy

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 18th century French salons where the local people can exchange thoughts at cafés.

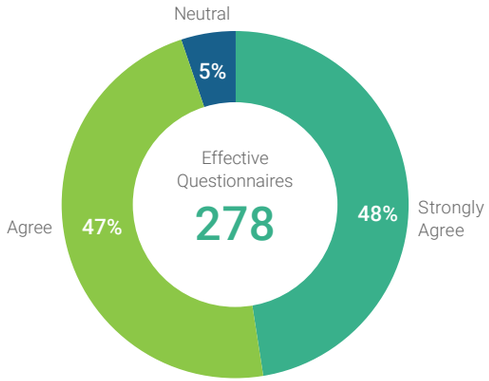
After the lecture series of "Renaissance" and "Reformation", the Lecture invited Professor Lee back to talk about the final chapter in the Trilogy of the Western Civilization: "Enlightenment". These talks first reviewed Renaissance's impact on the historical background of Europe's religion, culture and 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.

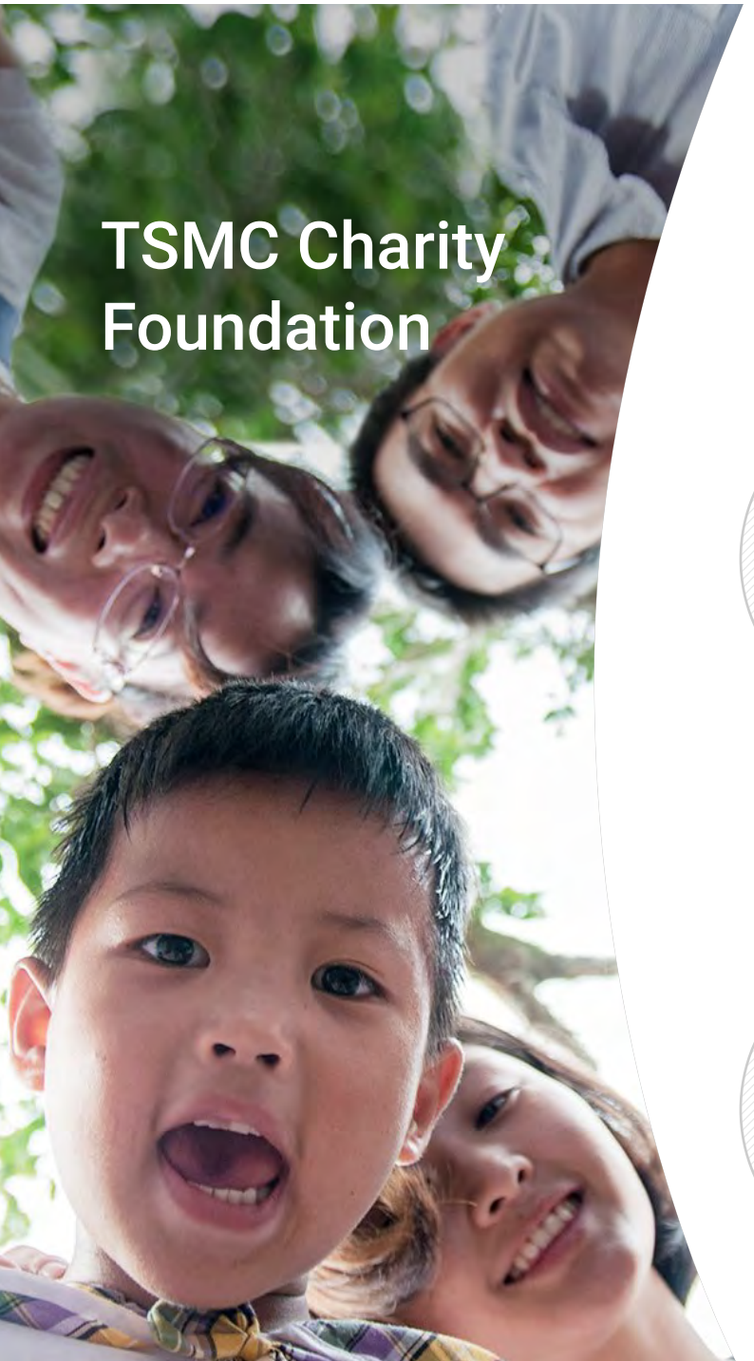
For more information, please visit our website

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 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 Disadvantages We provide various resources to underprivileged groups through book reading, community and Fab/Division volunteers, to support underprivileged groups living and education. Meanwhile, we proactively pay attention to the needs of emergency assistance in Taiwan, and provide assistance in a timely manner	Invest at least NT$10 million for underprivileged groups every year 2020 Over 8,000 book reading service hours every year 2020	
Protect the Environment We provide environment protecting resources and knowledge through energy-saving, ecology and Fab/Division volunteers, and help schools save energies and promote knowledge of protecting environment	At least 1,000 person-time environment protecting related volunteers 2020	

Strategies & 2020/2025 Goals	2017 Achievements	2018 Targets
	7,200 person-time **Elder people who lived alone served through the Networking of Love**	Served 7,500 person-time elder people who live alone through the Networking of Love
Target: Serve 6,500 person-time		
	Co-worked with the Ministry of Education to successfully add filial piety education material to the education outline in October **Completed filial piety teaching material and the demonstration teaching and publishing at the Wu Feng Feng Gu Elementary School**	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
Target: Add filial piety education material to the education outline of the Ministry of Education Target: Complete filial piety teaching material and the demonstration teaching		
	22,128 person-time **Book reading / Community / Fab and Division / Holiday volunteer services**	Invest at least NT$10 million for underprivileged groups Over 8,000 book reading service hours
Target: 20,000 person-time care for the disadvantages related volunteer services		
	1,134 person-time **Ecology / Energy-saving volunteer services**	At least 1,000 person-time environment protecting related volunteers
Target: 1,000 person-time care for the environment protecting related volunteer services		

Surpassed Achieved Unachieved

> 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

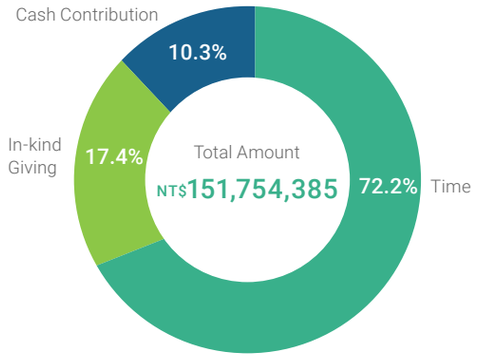
TSMC established the TSMC volunteer program in 2004, and the program persists on the objective of "long-term commitment to chosen service themes", encourages our employees to participate in volunteer programs with joy and wisdom, making contributions to the society by actions. In 2017, there were more 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

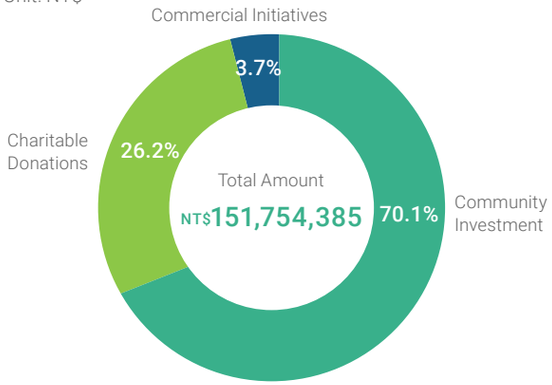
Type of Contribution[Note 1]

Unit: NT$



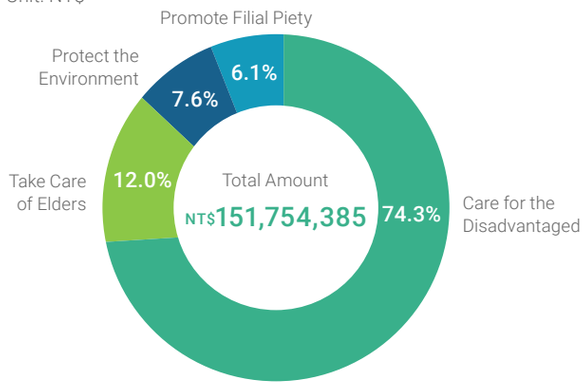
Type of Philanthropic Activities[Note2]

Unit: NT$



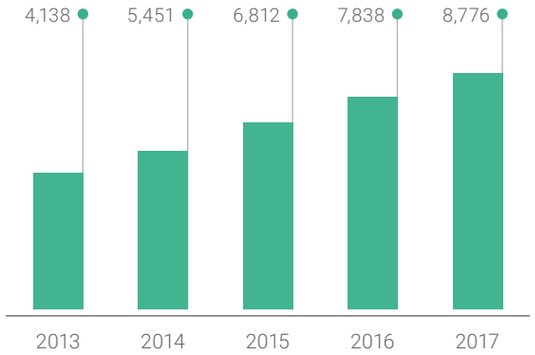
Type of Philanthropic Focus

Unit: NT$



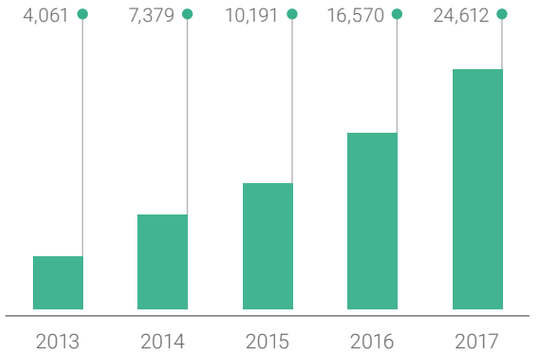
Volunteer Head Count

Unit: numbers



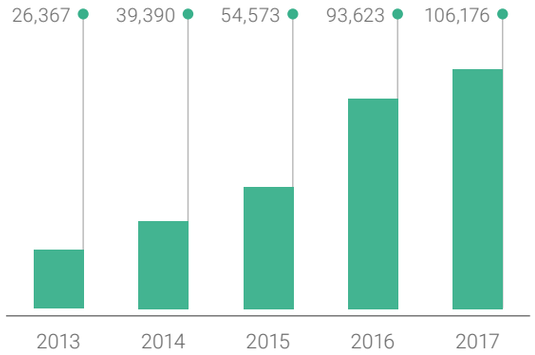
Volunteer Person-time

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

According to the data from the Ministry of Health and Welfare, Taiwan will soon become an aged society in 2018. The population of 65 years old and above will be over 14% of total pupation, an old age population dependency ratio that means four young adults will raise one older person and is still increasing. The needs of taking care of elder people who live alone is increasing, and it has become an urgent priority.

How We Respond and Act

The TSMC Charity Foundation cooperates with external organizations to establish a Networking of Love system which connects several medical organizations in northern, middle and southern Taiwan. Through donating goods and money, helping medical organizations extend their scope of elders caring services and the number of elder people who have been severed, to help elder people who lived alone have better prevention and treatment and promote mental health and well-being, meanwhile having safe, effective, quality and affordable essential medicines and medical services.

Our Major Achievements

Built the highest altitude day-care center in Taiwan

8	12	7,200	over 8 million
Cooperated with 8 medical organizations	12 Networking of Love partners	Served 7,200 elder people who live alone	Invested over NT$8 million

What We Have Done

Networking of Love

- In 2017, we cooperated with 8 medical organizations, served over 7,200 elder people who live alone.
- Established the highest altitude day-care center in Taiwan in order to provide comprehensive medical services for elder people who live alone in remote areas. It also helps elder people increase well-being and delays aging from social connection support.
- Continually supporting round visits in remote areas, in 2017, we donated a medical van for visiting rural areas to Doctor Yang-wei Kao who received a Medical Contribution Award, which assisted him to take care of elder people who live alone in remote areas.
- We are dedicated to improve the equipment of exiting tribe day-care centers in remote areas. For example, we assigned professional employees to help local day-care center to build rehabilitation center in Mudan Township, Pindong County, and provided goods for living.

Other Project Based Activities

In 2017, several divisions and factories held projects regarding taking care of elder people who live alone. Nearly 1,000 employees donated over NT$1.5 million, and over 130 employees devoted nearly 700 service hours.

Spreading Love at Year End; Sending Warmth to Elders' Home

In 2017, Fab 3, Fab 12A, Fab 12B, Fab 15A and Fab 15B all launched Year-end meals projects. A total of 416 employees donated more than NT$160,000. Year-end meals, Chinese New Year couplet, and red pockets had been passed to around 270 elder people who live alone. We also spent Chinese New Year eve with these elder people with joy, and learnt the importance of showing our love to elder people in a timely manner.

Hualien Mennonite Social Welfare Foundation — Depart with Meal-box with Love

In 2017, the TSMC Charity Foundation responded to the needs of Mennonite Social Welfare Foundation, donating NT$1 million through employee donation as the maintenance fee for delivery cars TSMC No.1 and TSMC No.2 which have already driven for more than 100,000 kilometers for delivering meal-box for elder people who live alone. Part of the donation was also used as the payment for meal-box delivery volunteers.

> I can't go out due to my foot pain, so I am so happy so many people come to visit me today.

Appreciation from the elderly
Fab 15B, Hugging elders, love infinity, caring elders in Chinese New Year activity

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 21th 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 serious 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 though 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 serious 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

What We Have Done

Community Volunteer

Community volunteers regularly visit Veterans Home and Children's center to acompany 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.

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

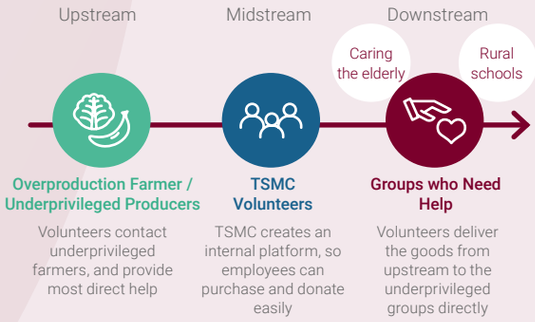
Care for the Disadvantaged

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.



> Really appreciate TSMC's help this time, which made our effort become harvests.
>
> **Banana farmer who benefited from Love supply chain**

> The old lady holding the banana with a big smile, and all the volunteers here can feel her joy and appreciation.
>
> **Fab 15A volunteers**

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.

> 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 Wufeng, 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.

The Manufacturing Technology Center initiated painting project for the Holy Family for Special Education, and helped them become excellent grade from good grade of the government's evaluation system. It was also the first time they received excellent level in 30 years since they established. Every employees in the Holy Family for Special Education received extra 2% pay raise by the government founding, also increased other funding percentage. These helped the organization to operate and take care of the residents better.

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!

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

Climate change has become a global issue, and it is an urgent priority to increase the public awareness of protecting environment.

How We Respond and Act

The TSMC Charity Foundation spreads the knowledge of environment protection. We expect to increase citizen's awareness of protecting environment by

1. helping schools improve their energy utility by TSMC professional energy-saving volunteers;
2. promoting environment protection spirit through ecology volunteers;
3. other project based activities.

Our Major Achievements

1,134	5,870	nearly 0.8 million	over 1,000
Volunteer person-time	Volunteer services hours	Invested nearly NT$800,000	Over 1,000 people were benefited

What We Have Done

Energy-saving Volunteer

The "energy-saving volunteer team" gathered engineers who have energy saving and professional safety knowledge to actively go to schools in rural areas to implement water saving, energy saving and safety checks, helping every level of schools to evaluate and improve their energy utility, to prevent and slow down climate change. In 2017, around 170 person-times energy-saving volunteers provided 1,050 hours energy-saving check services, and provided professional evaluation report and improvements for schools for further reference for future actions. Fab 6 energy-saving volunteers have provided 25 times services since they were founded, helped the schools to build a safer learning environment.

Ecology Volunteer

TSMC kept certain area for ecology engineering when we built the factories, created an environment with ecological diversity to achieve the goal of protecting ecology environment. Meantime, we established ecology volunteers, provided rural students to reserve ecology tour and taught them green knowledge. In 2017, around 964 person-times ecology volunteers provided over 4,800 hours ecology tour for at least 9,776 person-times students.

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 awoke when protecting the earth.

A Trip of Eco-friendly Farming

Fab 12A volunteers led students of the Nei Wan elementary schools to experience farming, personally experienced how much effort a famer make when farming, to introspect the environmental impact of mountain reclamation, and further grew the awareness of protecting environment in their mind.

Tainan Jacana Sanctuary

Tainan Guantian Jacana Sanctuary water chestnut field is the habitat of Jacana. TSMC provides tour services every year. In 2017, the habitat field for Jacana was nearly dried because the water well was broken and not able to provide water due to poor maintenance for years. After personally visiting the Jacana Sanctuary by TSMC professional volunteers, we donated around NT$470,000 for repairing the water well, and we expect the water well digging to be completed in early 2018.

TSMC Museum of Innovation and the Power House

Fab 2 and Fab 5 volunteers led children to visit the TSMC Museum of Innovation and the Power House. Along with the climate change board games provided by the Hsinchu County Environment Protection Bureau, children have better understanding on the contribution of semiconductor industry for the society. They also realize a small action/decision could have an impact on climate changing of the world through the board games.

Tour Volunteer

TSMC believes that sharing technology knowledge is one of the important ways to contribute to the society. Except the four key focuses, we hope the knowledge of semiconductor can be known widely by the public, making technology easier to understand. Currently there are volunteers providing tour services in the Taichung National Science and Technology Museum and TSMC's Museum of Innovation in Hsinchu. In 2017, 1,350 person- times tour volunteers provided over 8,100 service hours.

Appendix

About This Report

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

If you have any feedback, advice or suggestions regarding this report or the sustainable development of TSMC, please feel free to contact us.

Corporate Social Responsibility Committee
Website http://www.tsmc.com.tw/csr/en/index.html
E-mail csr@tsmc.com
Phone +886-3-5636688
Address 8, Li-Hsin Rd. 6, Hsinchu Science Park, Hsinchu 30078

Reporting Guidelines and Principles

Sustainability

Standard

- GRI Standards: Comprehensive Option
- AA 1000 Accountability Principle

Certification Organization

- DNV GL Business Assurance

Financial

Standard

- Taiwan-IFRSs 2013 version
- Guidelines Governing the Preparation of Financial Reports by Securities Issuers

Certification Organization

- Deloitte & Touche

Environmental

Standard

- ISO 14001 Environmental Management System
- ISO 14064 Greenhouse Gas Inventory

Certification Organization

- DNV GL Business Assurance

Reporting Quality Management Process

Compilation

Data completeness and accuracy are reviewed by the departmental management. The CSR Report Team is in charge of overall planning, data compilation, editing and report assurance

Editing

CSR Committee members act as an interdepartmental editorial team for the CSR Report and provide goals, performance indexes/guidelines, achievements in 2017, and future focuses of TSMC's CSR initiatives

Examination

Internal

The information and data of this report is verified by the relevant managers or vice presidents of each organization

External

DNV GL Business Assurance reviewed this report against the DNV GL VeriSustain™ Protocol[Note] and the comprehensive option of the GRI Standards. For the United Nations Global Compact comparison table, GRI Standards index comparison table, the assurance statement and certification / verification, please refer to TSMC's CSR website.

Finalization

The report is approved by the Chairperson of the CSR Committee

Note: DNV GL VeriSustain™ Protocol is consistent with AA 1000 and ISAE 3000

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.

Step 1 — **6** Major Categories of Stakeholders

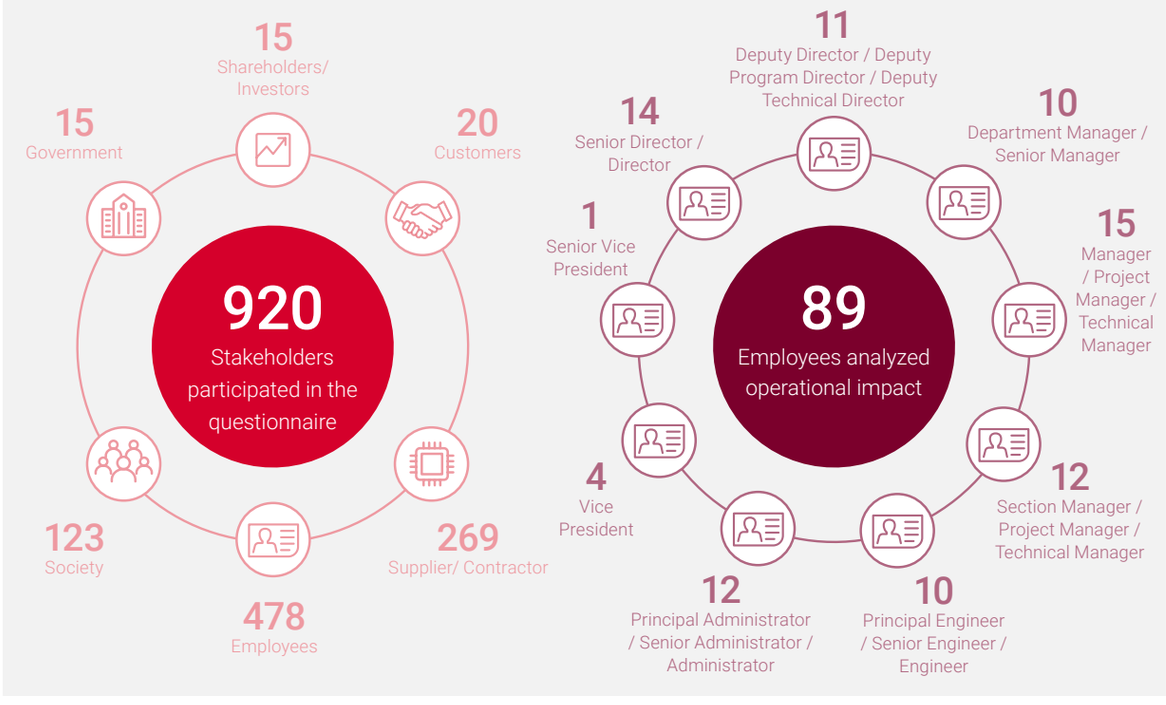
Define major stakeholders

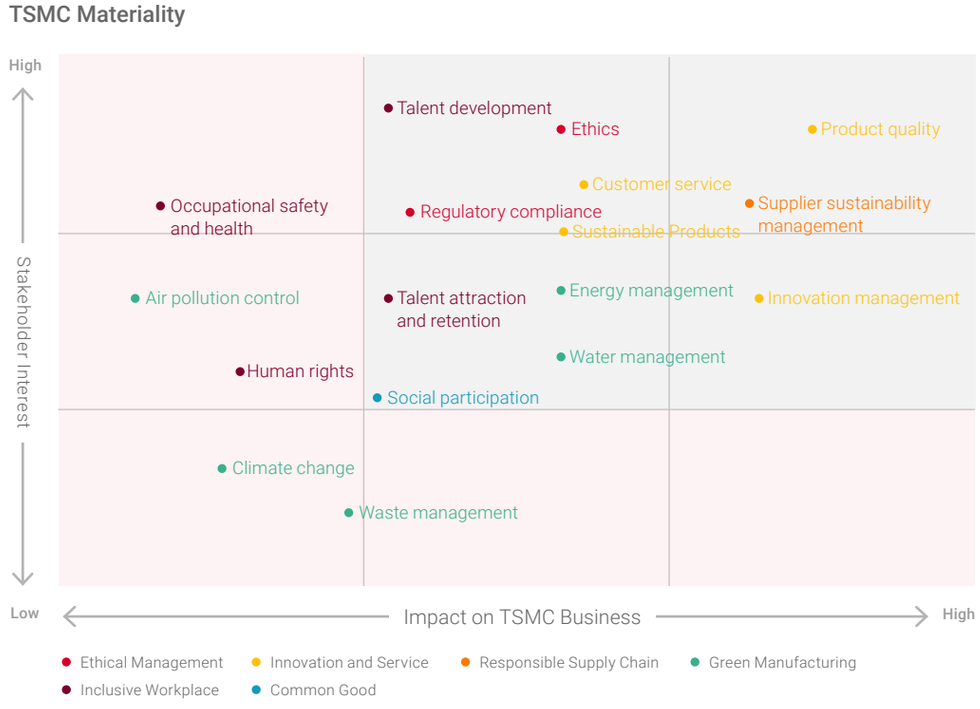
TSMC defined major stakeholders as "internal and external groups or individuals who have an impact on or are affected by TSMC." By that definition, six major categories of stakeholders were identified: shareholders/investors, employees, customers, suppliers /contractors, government, and society (community, academic institutions, media, NGO/NPO, etc.)

Step 2 — **20** Issues

Identify sustainability issues

Twenty sustainability issues relevant to TSMC were derived from four major sources: the international sustainability standards and regulations (GRI Standards, ISO26000, UN Global Compacts, RBA); sustainable investment institutions (DJSI, CDP, MSCI ESG Index); organization's internal development goals and vision; and communication with stakeholders.





Phase 2 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.

Step 3 — 920 Valid Samples

Investigate the level of interest

Collecting valid feedback from stakeholders is one of the keys to determining material issues. TSMC identified key stakeholders within the six major categories of stakeholders based on their interaction with the Company, level of impact, and level of importance to the Company. An online questionnaire survey was conducted among the key stakeholders on their level of interest in different sustainability issues, and a total of 920 valid samples were collected.

Step 4 — 89 Employees

Analyze operational impact

TSMC, taking into account economic, environmental, and social dimensions, measured the impact of the sustainability issues on the Company's operations against six factors: innovation/R&D, revenue, cost, customer satisfaction, brand/reputation, and risk. A total of 89 employees who were in charge of corporate sustainability, including a senior vice president, vice presidents, senior plant managers, and vice plant managers, participated in this process.

Step 5 — 17 Material Issues

Draft materiality matrix

Based on the analysis results of Steps 3 and 4, materiality matrix for 2017 CSR report was drafted and reviewed by TSMC's CSR Committee. By merging six issues into three, the committee reduced the number of sustainability issues to 17 and determined the 17 as material issues.

Step 6 — 4 Stages of Value Chain

Determine disclosure boundaries

Procurement, wafer fabrication, packaging/testing ,and customer usage are the four main stages of TSMC's value chain, which were also used to define the disclosure boundaries for the 17 material issues. The boundaries helped the Company understand the impact of sustainability issues on upstream, operations, and downstream stages.

Step 7 — 27 Topics

Review disclosure content

From the 17 material issues, 27 corresponding topics in the GRI Standards were identified. Following the reporting requirements and management approach of each topic, information on sustainability was gathered and disclosed. Other sustainability issues deemed relevant by TSMC's CSR Committee were also publicly disclosed.

Material Issues in TSMC Value Chain

Focuses	Material Issues	Operational Impact						GRI Standards Topics	Upstream[Note1]	TSMC Operations[Note2]		Downstream[Note3]
		Innovation/ R&D	Revenue	Cost	Customer Satisfaction	Brand/ Reputation	Risk		Procurement	Wafer fabrication	Packaging/ testing	Customer usage
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		●	●	

Note 1: Upstream Boundaries: materials, equipment and related services procured by TSMC

Note 2: Operation Boundaries: wafer fabrication and packaging/testing provided by TSMC

Note 3: Downstream Boundaries: end products destined for customers provided by TSMC

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.

Employees

640
Number of employee communication meetings [Note]

33,167
Number of employees participating in communication meetings

"I appreciate how the Company provides challenging work while at the same time encourages employees to broaden social participation. I've been working here for more than 30 years and have been a TSMC volunteer for more than 10 years, and have gained much more than I imagined.

Merry Chang
Employee working for TSMC more than 30 years

Note: Employee communication meetings are convened by Operations' deputy directors or above

Overview	• Encourage a healthy work-life balance, uphold employees' human rights, and enhance employees' skills
Communication Channels (Frequency)	• Meetings (periodically), questionnaires (annually) and employee opinion box (periodically)
Issues	• Talent attraction and retention • Talent development • Human rights
Key Concerns	• Limiting maximum workweek to 50 hours • Establishing on-site childcare facilities at other fabs • Multiple and varied corporate entertainment events • Sufficient training for managers and engineers
Responses from TSMC	• Implemented automated overtime system in 2017 to reduce employees' time spent on tracking and claiming overtime pay • Established kindergarten at Taichung site in 2017 • Completed post-event satisfaction survey in 2017 and developed corporate entertainment functions more aligned with employee needs • Implemented annual training program to prevent workplace bullying and increase personnel sensitivity of first-line managers in Operations; adjusted training structure for technicians

Shareholders / Investors

374
Number of institutional investors to communicate with

235
Investor conferences and other meetings

TSMC has been a core holding of the Cadmos Emerging Markets Engagement Fund since its inception in 2009. Through our yearly engagement meetings involving several key staff and management of TSMC, you have shown an outstanding level of transparency and interest in learning from our comprehensive sustainability assessment. As an engaged shareholder, it was and will be a pleasure for Cadmos to accompany TSMC on the road of continuous improvements related to its most material ESG topics

Melchior de Muralt
President, Cadmos Funds

Overview	• Focus on strategies for continuing growth, market development and profitability of TSMC; understand the Company's renewable energy strategies and responses to sustainability assessments
Communication Channels (Frequency)	• Shareholder meetings (annually), earnings conferences (quarterly), domestic and international institutional investor seminars (periodically) and conference calls (periodically)
Issues	• Innovation management • Sustainable governance • Energy management
Key Concerns	• Future growth potential and profitability • Dividend policy • Renewable energy policy
Responses from TSMC	• Continuously researched market trends and developed growth strategies in mobile devices, high-performance computing, automotive semiconductors and the Internet of Things in 2017 • Distributed a NT$8 cash dividend per common share in 2017 • Continuously enhanced sustainability actions by attending DJSI and CDP assessments • Purchased 100 GWh of green power in 2017, reaching a cumulative 400 GWh of total green power

Customers

33
Number of customers holding quarterly reviews

111
Number of quarterly meetings

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

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 Mihayashi
President, FUJIFILM Electronic Materials Co., Ltd.

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

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 creat 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

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

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

A big thank-you to the uncles and aunties 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 [Note1]

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[Note2]. In 2017, TSMC participated in more than 30 industry associations and non-profit organizations, with expenditures of over NT$21.2 million[Note3].

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 Ho 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

continues on next page

	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[Note1] (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[Note2] (Taiwan Sites)	0.25	0.36	0.47	0.54	0.56
	Safety - Injury Severity Rate[Note3] (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[Note4]

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

Contact Information

- Corporate Headquarters & Fab 12A
  8, Li-Hsin Rd. 6, Hsinchu Science Park, Hsinchu 30078, Taiwan, R.O.C.
  Tel: +886-3-5636688 Fax: +886-3-5637000
- R&D Center & Fab 12B
  168, Park Ave. II, Hsinchu Science Park, Hsinchu 30075, Taiwan, R.O.C.
  Tel: +886-3-5636688 Fax: +886-3-6687827
- Fab 2, Fab 5
  121, Park Ave. 3, Hsinchu Science Park, Hsinchu 30077, Taiwan, R.O.C.
  Tel: +886-3-5636688 Fax: +886-3-5781546
- Fab 3
  9, Creation Rd. 1, Hsinchu Science Park, Hsinchu 30077, Taiwan, R.O.C.
  Tel: +886-3-5636688 Fax: +886-3-5781548
- Fab 6
  1, Nan-Ke North Rd., Tainan Science Park, Tainan 74144, Taiwan R.O.C.
  Tel: +886-6-5056688 Fax: +886-6-5052057
- Fab 8
  25, Li-Hsin Rd., Hsinchu Science Park, Hsinchu 30078, Taiwan, R.O.C.
  Tel: +886-3-5636688 Fax: +886-3-5662051
- Fab 14A
  1-1, Nan-Ke North Rd., Tainan Science Park, Tainan 74144, Taiwan R.O.C.
  Tel: +886-6-5056688 Fax: +886-6-5051262
- Fab 14B
  17, Nan-Ke 9th Rd., Tainan Science Park, Tainan 74144, Taiwan, R.O.C.
  Tel: +886-6-5056688 Fax: +886-6-5055217
- Fab 15A
  1, Keya Rd. 6, Central Taiwan Science Park, Taichung 42882, Taiwan R.O.C.
  Tel: +886-4-27026688 Fax: + 886-4-25607548
- Fab 15B
  1, Xinke Rd., Central Taiwan Science Park, Taichung 40763, Taiwan R.O.C.
  Tel: +886-4-27026688 Fax: +886-4-24630372

- TSMC North America
  2851 Junction Avenue, San Jose, CA 95134, U.S.A.
  Tel: +1-408-3828000 Fax: +1-408-3828008
- TSMC Europe B.V.
  World Trade Center, Zuidplein 60, 1077 XV Amsterdam
  The Netherlands
  Tel: +31-20-3059900 Fax: +31-20-3059911
- TSMC Japan Limited
  21F, Queen's Tower C, 2-3-5, Minatomirai, Nishi-ku, Yokohama
  Kanagawa, 220-6221, Japan
  Tel: +81-45-6820470 Fax: +81-45-6820673
- TSMC China Company Limited
  4000, Wen Xiang Road, Songjiang, Shanghai, China
  Postcode: 201616
  Tel: +86-21-57768000 Fax: +86-21-57762525
- TSMC Nanjing Company Limited
  16, Zifeng Road, Pukou Economic Development Zone, Nanjing
  Jiangsu Province, China
  Postcode: 211806
  Tel: +86-25-57668000 Fax: +86-25-57712395
- TSMC Korea Limited
  15F, AnnJay Tower, 208, Teheran-ro, Gangnam-gu, Seoul 06220, Korea
  Tel: +82-2-20511688 Fax: + 82-2-20511669
- TSMC Design Technology Canada Inc.
  535 Legget Dr., Suite 600, Kanata, ON K2K 3B8, Canada
  Tel: +613-576-1990 Fax: +613-576-1999