Innovation is the foundation that keeps TSMC growing.

High-performance computing propels humanity to a future with AI
Smartphones breaks the limitation of time and space and bridge us
with the cloud and to freedom
Advanced automotive electronics carry our imagination to the infinite
world of mobility
IoT ushers in the era of smart cities and industrial 4.0

ESG is in the DNA of every TSMC employee

TSMC uses concrete action to connect people with people and with
nature to welcome beautiful change
With an infinite stream of innovative technology solutions,
TSMC strives to achieve sustainability and connect to a future of
common good
Letter from the ESG Steering Committee Chairperson

Over the past two years, COVID-19 has continued to impact our world while the threat of extreme climate conditions has steadily increased. As a key player in the global semiconductor supply chain, TSMC has the responsibility of working with industry partners to take continuous action with regard to ESG (Environmental, Social and Governance) issues.

Our vision is to uplift society and we link TSMC’s core advantages with the United Nations’ Sustainable Development Goals (SDG), integrating five ESG development focal points including “Drive Green Manufacturing,” “Build a Responsible Supply Chain,” “Create a Diverse and Inclusive Workplace,” “Develop Talent,” and “Care for the Disadvantaged.” Since 2019, the ESG Steering Committee has integrated cross-organizational resources and strengths, formulated long-term goals, and reviewed the implementation of these goals. In 2021, in addition to focusing on improving the industry’s core capabilities, we also continued to implement corresponding sustainable practices. We now integrate sustainability target results into the compensation structure for senior executives, integrate SDGs into both the organizational culture and employees’ daily tasks, and actively respond to concerns raised by stakeholders both inside and outside the company.

We firmly believe that corporate growth and the natural environment can coexist prosperously, and we implement green practices to ensure this. In 2021 TSMC further committed to actively implement emission reduction measures and optimize related sustainable actions. The Company set a short-term goal of achieving zero emission growth by 2025, a medium-term goal of returning to 2020 emissions level by 2030 and a long-term goal of reaching net zero emissions by 2050. In 2021, we also released our first Taskforce on Climate-Related Financial Disclosures (TCFD) Report, promoting climate adaptation and mitigation management through governance, strategies, risk management, metrics and targets, becoming an industry pioneer in disclosing information in related fields. We hope that by expanding our green influence, we will drive the industry to move towards low-carbon sustainability.

At TSMC, ESG means driving positive environmental and societal change. We work diligently to integrate the ESG ethos into our daily operations with the aim of sustainable development, formulating systematic management strategies, implementing related measures and reviewing action plans. We also rely on all our employees to champion their work while having the courage to posit innovative ideas. On our road to sustainability, TSMC not only strives to fulfill its role as a responsible corporate citizen, we also look forward to working with partners and stakeholders from all walks of life to create a sustainable future.

Over the past two years COVID-19 has continued to threaten our lives. Throughout this time, TSMC has not only remained resilient in protecting employee health and safety and maintaining normal operations, we have also extended our expertise and resources to support global pandemic prevention efforts. In 2021, during a period when the epidemic situation in Taiwan was deteriorating, we happily did our part to support the country by successfully purchasing 5 million doses of BNT (BioNTech) 162b2 vaccine and donating them to the Center for Disease Control (CDC) of the Ministry of Health and Welfare with the support of the government. At the same time, we also continued to offer support overseas, including India, helping them deal with overburdened local medical facilities.

At TSMC respect for human rights is regarded as a universal value. In 2021, in order to provide migrant workers with a decent work environment and to create a responsible supply chain, we issued the statement Supply Chain Partners Should Ensure Protection of Human Rights During the COVID-19 Pandemic so that our subsidiaries and supply chain partners carry out anti-pandemic measures in an appropriate fashion. The statement addresses four major areas: personal freedoms, how migrant workers are informed of anti-pandemic measures, handling of accidents and casualties, and dormitory management.

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Mark Liu
Chairman and ESG Steering Committee Chairperson
The year 2021 was a year of global upheaval as the world faced the COVID-19 pandemic, war, and political instability. As a global citizen, we have shared the impact of these changes.

The year 2021 was also a year of growth for TSMC. Benefiting from the strong demand for advanced process technologies from 5G mobile networks and high-performance computing, TSMC was able to achieve record high revenue for the 12th consecutive year. As COVID-19 continued to ravage the world, TSMC launched the COVID-19 global epidemic prevention program to protect colleagues, suppliers and contractors working in TSMC fabs and ensure normal operations at our global wafer fabs. In 2021, TSMC shipped 14.2 million 12-inch equivalent wafers and realized 12,302 product innovations for our customers, providing humanity a safer and more convenient lifestyle. TSMC also supported the Sustainable Development Goals proposed by the United Nations with tangible actions and has remained steadfast to our five ESG directions.

In terms of “Green Manufacturing”, in 2021, TSMC updated our Climate Change Statement to include a commitment to Net Zero Emissions by 2050, invested NT$28.9731 billion into environmental protection, and successfully promoted 780 innovative programs for energy conservation, water conservation, and waste reduction. TSMC also achieved the target of net zero emissions from energy consumption at all overseas subsidiaries for the fourth consecutive year and responded to Taiwan’s drought in the first half of 2021 with outstanding water management capabilities, ensuring that our production capacity was unaffected. In addition, we are currently building a Zero Waste Manufacturing Center to realize a low-carbon business model and circular economy.

As for “Build A Responsible Supply Chain,” in 2021, TSMC continued to strengthen supplier sustainability through the Supply Online360 global responsible supply chain management platform and the TSMC Supplier Sustainability Academy, promoting EP&L across the supply chain and uncovering opportunities to lower our impact on the environment. In 2021, TSMC also became the first semiconductor company in Taiwan to release the Supplier Transportation Management White Paper. Our efforts in the supply chain also included safety and health support and training to all critical high-risk suppliers and helping suppliers establish long-term sustainability targets. To increase climate resiliency across the supply chain, TSMC also joined the CDI Supply Chain Program.

In terms of “Create a Diverse & Inclusive Workplace,” in 2021, TSMC introduced 8,536 job opportunities across the world and drew on our Human Rights Policy and Diversity and Inclusion Statement to develop Women@tsmc, an employee resource group aimed at achieving equality in the workplace. Looking ahead, TSMC will continue to make timely responses to employee needs and suggestions through the Engagement Survey and other diverse reporting channels to support employee work-life balance. For “Develop Talent,” TSMC adopted the 70-20-10 rule to empower employees and cultivate talents for the future.

TSMC also continued to expand university programs such as the Semiconductor Programs, Advanced IC Design Program, and University Research Center as well as the TSMC Journeys of Female Scientists Lectures for female high school students in an effort to cultivate the next generation of STEAM professionals. In terms of “Care for the Disadvantaged,” the TSMC Education and Culture Foundation and TSMC Charity Foundation have long been investing in this area by tapping into the power of our employees’ volunteer services. We consulted the impact principles of the London Benchmark group and evaluated the impact of all social participation programs along the two dimensions of “depth” and “type” to create a strong foundation of common good for social progress.

As the Chairperson of the ESG Committee, I look forward to strengthening and expanding our sustainable actions to bring about innovative breakthroughs. The Sustainability Report that we compile each year keeps pace with global sustainability trends and has become a guide for organizations to continue advancing their ESG efforts. We expanded our information disclosure and external communications and continued to accumulate our ESG intellectual property. In addition to the existing EP&L Report and TCFD Report, TSMC also released, for the first time this year, Materiality Analysis Report and the UN SDGs Action Report.

Sustainability is a journey without end. TSMC is the only semiconductor company in the world to be selected for the Dow Jones Sustainability Index (DJSI) for 21 consecutive years. As the company continues to grow, we find ourselves with growing responsibilities as well. We will continue to hold true to our ESG vision to uplift society as we strive on forward with steadfast resolve.

Lora Ho
Senior Vice President and ESG Committee Chairperson
About TSMC

Facing global turmoil brought by the COVID-19 pandemic as well as developments in the semiconductor industry, TSMC continues to strengthen services, R&D, and capacity while staying true to our four core values of Integrity, Commitment, Innovation, and Customer Trust. As a trusted technology and capacity provider to the global logic IC industry, TSMC also continues to invest in customer growth; in 2021, we increased capital expenditure to US$30 billion. At the same time, strong customer demand for industry-leading advanced processes and specialty process technologies helped TSMC achieve a consolidated income of NT$1,587.42 billion, a 18.5% increase from 2020. TSMC also remains committed to business philosophy and collaborates with employees, shareholders/investors, customers, suppliers/contractors, the government, and society to create sustainable value for the economy, environment, and society.
Innovation Value

TSMC continues to advance semiconductor manufacturing technologies and services to enable our customers to unleash more than 12,300 chip innovations in 2021. These innovations make products more advanced, capable, intelligent, energy-efficient, and safer, allowing us to greatly increase quality of life and move towards a sustainable well-being society.

Enable 5G, Artificial Intelligence (AI), cloud, and data centers for transferring and processing vast amounts of data anywhere and anytime

- Central Processing Unit (CPU)
- Graphics Processor Unit (GPU)
- Field Programmable Gate Array (FPGA)
- Server CPU
- Artificial Intelligence/Machine Learning (AI/ML) Accelerator
- Network Processing Unit (NPU)
- High-speed Networking Chip, etc.

Empower innovations for artificial intelligence of things (AIoT) and accelerate digital transformation to make a more convenient and greener living, and improve health care quality

- Microcontroller Unit (MCU)
- Application Processors (AP)
- Baseband
- RF Transceivers
- Wireless Local Area Networks (WLAN)
- CMOS Image Sensors (CIS)
- Near Field Communication (NFC)
- Bluetooth
- Embedded Flash Memory
- Radio Frequency Identification, (RFID) etc.

Make vehicles, including hybrid/electrical cars, safer, smarter, and greener

- Microcontroller Unit (MCU)
- Baseband
- RF Transceivers
- Wireless Local Area Networks (WLAN)
- CMOS Image Sensor (CIS)
- Near Field Communication (NFC)
- Radar
- Ethernet Switches
- Power Management ICs, etc.

Enable AI-powered smart devices

- Microcontroller Unit (MCU)
- Baseband
- RF Transceivers
- Wireless Local Area Networks (WLAN)
- CMOS Image Sensor (CIS)
- Near Field Communication (NFC)
- Bluetooth
- Embedded Flash Memory
- Power Management ICs
- Timing Controllers (T-CON) for Smart 8K/4K Digital TV (DTV)
- 4K Streaming Set-top Box (STB) / Over-the-top (OTT)
- Digital Single-lens Reflex (DSLR) Devices, and so on.

TSMC Technology Platforms

- Smartphone
- High Performance Computing
- Internet of Things (IoT)
- Automotive
- Digital Consumer Electronics
Sustainability at TSMC

**Economic**
- $1.3 trillion: Generated NT$1 trillion in output value and 224,000 jobs in Taiwan (NT$).
- $16.2 trillion: Market capitalization (NT$).
- 100%: Leading the world in 3nm process risk production to empower the next-generation technology products.
- 1: Number 1 in the global semiconductor industry as well as in Taiwan with the largest LEED-certified building area.
- 20%: Driving innovation by investing US$4.465,000,000 in R&D, a 20% increase from 2020.

**Environmental**
- 0: Announced to reach Net Zero Emissions by 2050.
- 98.4%: 98.4% reduction rate of volatile organic gases.
- 14.9%: Reduced unit water consumption by 14.9% (Base year: 2010).
- 1: Received the highest UL 2799 platinum rating for zero waste to landfill.
- 98.4%: Reduction rate of volatile organic gases.

**Social**
- $164.9 billion: Total compensation and welfare handed out to TSMC employees around the world, a 17% increase from 2020 (NT$).
- $5.09 billion: Invested into social engagement (NT$).
- Over 6,500: Over 6,500 students from top universities and graduate institutes around the world that participated in TSMC’s diverse industry-academia cooperation programs.
- 1: Number of certificates awarded to employees for completing TSMC training programs.
- 2.24 million: Beneficiaries of social engagement programs.
- 891,962: Total compensation and welfare handed out to TSMC employees around the world, a 17% increase from 2020 (NT$).
## Awards, Recognitions, and Ratings

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<td>Climate Change B Ratings</td>
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<tr>
<td>Alliance for Water Stewardship (AWS)</td>
<td>“Platinum” class certification – Fab 5, Fab 12A, Fab 12B, Advanced Backend Fab 3</td>
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</table>

### Sustainalytics
- Company ESG Risk Ratings: Low ESG Risk – Semiconductor Industry

### TIME Magazine
- TIME100 Most Influential Companies 2021

### Corporate Knights
- Global 100 Most Sustainable Corporations

### Taiwan Institute of Sustainable Energy
- The Most Prestigious Sustainability Awards – Top Ten Domestic Corporates – for six consecutive years
- Sustainability Action Awards – Gold Award
- Best Sustainability Report Award
- English Report – Gold Award
- Circular Economy Leadership Award
- Information Security Leadership Award
- Supply Chain Leadership Award

### Institutional Investor Magazine
- Most Honored Company (Technology/Semiconductors) – All-Asia
- Best Overall ESG (Technology/Semiconductors) – First Place (buy-side and sell-side) – All-Asia

### Taiwan Stock Exchange
- Top 5% in Corporate Governance Evaluation of Listed Companies for seven consecutive years

### Corporate Knights & As You Sow
- 2021 Carbon Clean 200™ List

### Environmental Protection Administration, Executive Yuan, R.O.C.
- National Enterprise Environmental Protection Award

### FORTUNE
- 2021 World’s Most Admired Companies

### Cheers
- Ranked Number One in Top 10 Most Admired Companies to Young Generations for five consecutive years

### Forbes
- World’s Best Employers 2021
ESG Feature Stories

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Relief Efforts for Global Pandemic Prevention against COVID-19 15
TSMC is committed to creating a sustainable semiconductor supply chain. Since the power consumption of the process manufacturing equipment accounts for over 50% of the Company’s energy use, and the number of advanced manufacturing equipment increases every year, TSMC launched 365 action plans under the Energy Conservation Action Project for Next-generation Fab Tools in 2021. 159 action plans have been verified and applied to 119 advanced manufacturing tool models for 5nm process manufacturing and 3nm process manufacturing in the future. Moreover, the program introduced high-efficiency parts and energy-saving designs in 17 energy-intensive components and successfully saved 400 GWh of electricity in a year.

The New Generation Equipment Energy Conservation Program holds over 100 meetings every year in search of opportunities and innovative mindsets for equipment energy conservation. TSMC is engaged in-depth with the design of energy-conserving modules for advanced manufacturing equipment with the top six power-consuming equipment suppliers and provides implementation guidelines. Also, through regular technical review meetings, TSMC repeatedly validates the green benefits of the solutions. The energy-saving specifications are incorporated in the standards for new equipment purchases as well. As the first semiconductor company to drive the adoption of energy conservation measures in advanced manufacturing equipment among equipment suppliers, we strive towards the sustainability goal of saving energy by 20% on average for each machine by 2030.

TSMC is committed to practicing green manufacturing. We will continue to develop innovative energy-conserving designs in partnership with our equipment suppliers and adopt them in new manufacturing equipment in the future to optimize energy efficiency.

Chen-Bin Lin
Director of Intelligent Engineering Center at TSMC

**Milestones and Results of the Energy Conservation Action Project for Next-generation Fab Tools**

- **2016**: Set a 20% energy-saving benefit target for new process machines
- **2017**: Require the top five power-consuming equipment suppliers to develop the energy-saving design for their equipment
- **2018**: Launch the Energy Conservation Action Project for Next-generation Fab Tools
- **2019**: Meet with the top six power-consuming semiconductor equipment manufacturers suppliers
- **2020**: Apply energy-saving solutions to 5nm process manufacturing equipment
- **2021**: Increase energy efficiency by 20% in all equipment
- **2030**:

  - Equipment (types)
  - Energy conservation action plans (items)
  - Average energy conservation efficiency (model)

  - 2018: 10%
  - 2019: 12%
  - 2020: 14%
  - 2021: 15%
Launch Supplier Fire Protection Personnel Project to Improve Supply Chain Resilience

TSMC strives to improve supply chain resilience. To reduce the risk of supply chain interruption caused by fires, TSMC has created the "Supplier Fire Protection Sustainability Management Mechanism," which advises and inspects supplier fire protection systems by standards exceeding local codes. In 2021, TSMC further activated the Supplier Fire Protection Personnel Project for critical suppliers and suppliers that have shown room for improvement in fire protection audits conducted in previous years. Each supplier plant has one staff dedicated to fire protection management. TSMC offers resources and technologies to all fire protection dedicated personnel, who will receive a capability grading, training, and training result evaluation.

In addition to the fire protection dedicated personnel project, TSMC also consolidated its experience from years of on-site inspections and counseling centered on the "Supplier Fire Protection Sustainability Management Mechanism" into learning materials available in Supply Online. Suppliers can download materials such as the disaster prevention management form and fire protection designs from the platform. By referring to TSMC practices, suppliers can improve their management capabilities more efficiently. TSMC also ensures all fire prevention and fire extinguishing equipment at our suppliers functions properly through in-depth audits, on-site inspections on fire extinguishing equipment and fire prevention management practices.

In 2021, 48 dedicated staffs of suppliers that didn’t meet the criteria for Grade 3 in the professional capability grading all completed training. The percentage of trainees in Grade 3 and Grade 4 has increased from 58% to 82%. In 2022, TSMC plans to collaborate with academic partners. By offering teaching materials applicable to all industries, professional instructors, and teaching equipment that supports practical training, the Company will continue to improve supply chain resilience as a globally trusted provider of technologies and manufacturing capacity.

2021 Supplier Fire Protection Personnel Project Implementation Results

<table>
<thead>
<tr>
<th>Item</th>
<th>Project Details</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated personnel to fire protection management</td>
<td>• Requested 91 suppliers to designate a dedicated single-point liaison for plant fire protection management and participate in professional capability grading and training</td>
<td>91 suppliers have designated 106 dedicated personnel for a total of 106 plants.</td>
</tr>
<tr>
<td>Course planning and evaluation</td>
<td>• Training courses for the fire protection personnel planned by TSMC - On-site lessons on fire extinguishing equipment and operational training - Fire extinguishing equipment maintenance</td>
<td>Supplier fire protection dedicated personnel is equipped with professional capabilities as follows: - The person is familiar with the function and operation of the fire extinguishing equipment in the plant - The person is capable of planning for fire extinguishing equipment maintenance - The person is familiar with fire compartmentation and fire stopping techniques</td>
</tr>
<tr>
<td>Effectiveness</td>
<td>• Held two sessions of “Fire Protection Personnel Operational Training”</td>
<td>Conducted a test to evaluate the learning effectiveness of the trainees by the criterion of 90 points. The percentage of trainees in Grade 3 and Grade 4 increased from 58% to 82%.</td>
</tr>
</tbody>
</table>
To fulfill our commitment to our Diversity and Inclusion Statement, the Company treats its workforce as the most important asset and is committed to empowering more than 60,000 employees globally to unleash their full potential in the right roles. In supporting employees to balance family life and career development, TSMC offers a welfare system that is better than legal requirements and has established four preschool for fabs in Taiwan. In 2021, TSMC launched the TSMC Child Care Benefit Program, extending maternity leave from 8 weeks to 12 weeks and paternity leave from 5 days to 10 days. It also increased maternity subsidy from NT$1,000 to NT$10,000 per child and organized Holiday STEAM camps to support the growth of TSMC babies. In 2021, the number of TSMC newborns accounts for 1.7% of newborns nationally in Taiwan, setting a new record exceeding the 1.5% from the previous year.

In support of female employees, TSMC established the Women@tsmc Employee Resource Group (ERG). The association aspires to connect female colleagues and enable them to realize their full potential in the pursuit of personal growth and achievements.

Employees are important assets to TSMC. They are also the driving force of industrial upgrading and social development. We strive to foster a diverse and inclusive work environment that integrates people from different backgrounds. By strengthening collaboration through mutual understanding, acceptance and respect, we will create a better and brighter future for TSMC together.

Connie Ma  
Vice President of Human Resources, TSMC

It is a huge challenge for first-time moms as they bring home their newborns from the postpartum nursing center. The adapting and learning process requires considerable time and energy. The “TSMC Child Care Benefit Program” has extended maternity leave to 12 weeks. It gives me time to properly adjust my life, physical and mental well-being, and make childcare arrangements when I return to work. I hope that the Company can develop more flexible work schedules so that employees can more easily achieve work-life balance.

Catherine Chang  
TSMC Employee

The childcare benefits the Company offers help dual-income families a lot especially during the adaptation period after the newborn was brought home from the postpartum nursing center. The paternity leave allows me to fulfill my responsibilities caring for the family. In the meantime, my wife and I look forward to participating in the Company’s Holiday STEAM Camp with our children. We also hope that the Company can plan activities for children of all ages, and we can accompany our children along the way.

Kevin Chu  
TSMC Employee

The association aspires to connect female colleagues and enable them to realize their full potential in the pursuit of personal growth and achievements.
Cultivate New-Generation STEAM Talent

To enhance the quality of talent in Taiwan, TSMC is dedicated to youth incubation, the potential realization of diversified education, and caring for the disadvantaged communities lacking educational resources. The Company strives to achieve SDG4 of ensuring quality education by providing students in all educational stages development opportunities within and outside the scope of formal education, as well as learning resources linked to industry practices.

For university and graduate students and teachers, TSMC collaborates with schools in Taiwan and overseas in launching university programs primarily focused on "industry-academia collaboration," "course collaboration," and "career guidance." We are committed to the cultivation of next-generation semiconductor talent through the support of teacher recruitment, mentoring programs, lectures, competitions, scholarships, and groundbreaking industry-academia collaborative research programs. TSMC also offers its production capacity to top university students and teachers worldwide for them to turn their IC designs into actual chips.

For students currently in the nine-year compulsory education system, TSMC Education and Culture Foundation and TSMC Charity Foundation jointly allocate educational resources to encourage them to explore their potential. Striving to achieve equal access to education and empower children with STEAM capabilities, we have held Chemistry Camps for high school students, occupational training, science tours specifically for female students, and learning companion programs and tours for elementary and junior high school students.

In addition to training students to exert creativity and complete IC designs independently, the University Shuttle Program effectively bridges students with the industry and further introduces our efforts to the world.

Shen-Iuan Liu
Distinguished Professor at the Department of Electrical Engineering, National Taiwan University

572 million
An annual expenditure of NT$572 million is dedicated to talent cultivation

TSMC doubles down on holding Journeys of Female Scientist Lectures, offering female students diverse learning opportunities in technology.

Note: Junyi Academy Foundation offers free online learning materials for elementary school, junior high school, and high school students.
Relief Efforts for Global Pandemic Prevention against COVID-19

In 2021, TSMC allocated NT$4.26 billion to support global efforts against COVID-19 pandemic. Our endeavors include vaccine donations, sponsoring university medical research on pandemic prevention and control, and providing relief through TSMC Charity Foundation in healthcare, rural education, and care for the disadvantaged.

Adequate testing capacity is the key to COVID-19 pandemic control and prevention. We’re grateful for TSMC Charity Foundation’s timely donation of contactless testing stations to the NTUH medical team when most needed.

Ming-Shiang Wu
Superintendent of National Taiwan University Hospital
Sustainable Business Practices

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A Responsible Purchaser 76
A Practitioner of Green Power 90
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Power to Change Society 170
With uplifting society as our vision, the TSMC ESG Policy serves as the foremost guiding principle for our sustainable development. The ESG Matrix set by TSMC’s Founder, Dr. Morris Chang clearly defines TSMC’s ESG scope. Based on the vision of “Uplift Society,” TSMC implements sustainability governance effectively in its core business of dedicated IC foundry services through its ESG Implementation Framework. TSMC actively develops positive relationships with all stakeholders including employees, shareholders/investors, customers, suppliers/contractors, and society to create value through common good.
In accordance with the vision and mission of the TSMC ESG Policy, TSMC employs the ESG Steering Committee and ESG Committee as a management platform to align with global trends in sustainable development and corporate growth. TSMC takes tangible action on our sustainability mindset and continues to create value for stakeholders.

Chairman Mark Liu serves as the Chairperson for the ESG Steering Committee and Senior Vice President Lora Ho serves as the executive secretary for the ESG Committee. Together with senior executives from various fields, Chairman Liu and Senior Vice President Ho review ESG topics relevant to TSMC operations, set mid-to-long-term development directions and goals, and align UN SDGs with the Company’s core competencies to develop a blueprint for ESG. The board of directors supervises progress towards sustainable development and the Chairperson of the ESG Committee reports to the board of directors each quarter about ESG achievements and future plans.

Chairperson
Quarterly
Chairman Liu and the management team discuss and formulates the Company’s ESG vision and strategies, collaborates with the ESG Committee for implementation, strives towards a culture of sustainability, and becomes a driver for positive change.

Executive Secretary
Quarterly
ESG Committee Chairperson

Members
Senior Executives from Information Technology and Materials Management & Risk Mgt, Business Development, Legal, Human Resources, Research & Development, Operations, Finance, TSMC Education & Culture Foundation and TSMC Charity Foundation

Tasks
- Identify pressing sustainability topics and formulate action plans
- Supervise interdepartmental communication and coordinate resource integration
- Compile ESG-related budgets for all functions
- Track achievements across various sustainability issues and formulate plans for further improvement

The Committee Chairperson shall report achievements and work plans to the Board of Directors every quarter.

Chairperson
Senior executive appointed by Chairman Liu

Management representatives nominated by functional organizations relating to the economy, environment, society, and governance

Meetings
Quarterly

Tasks
- Identify pressing sustainability topics and formulate action plans
- Supervise interdepartmental communication and coordinate resource integration
- Compile ESG-related budgets for all functions
- Track achievements across various sustainability issues and formulate plans for further improvement

The Committee Chairperson shall report achievements and work plans to the Board of Directors every quarter.

Dr. Michael Wu
Vice President, Research & Development/Platform Development

Technology leadership is one of the key cornerstones enabling TSMC’s continuous growth. We are committed to fostering an open and innovative environment for research and development to create maximum value by unleashing employees’ potential, and to realize the goal of corporate sustainability.

Dr. Kevin Zhang
Senior Vice President, Business Development

The semiconductor is at the core of modern technological innovation and continues to drive the advancement of our lives. We are committed to building meaningful partnerships with our customers around the world, developing a sustainable technology roadmap, and together, we provide eco-friendly products that are more powerful and more energy-efficient.

Dr. Y.L. Wang
Vice President, Operations/Fab Operations I

Digital transformation and AI have brought revolutionary changes to wafer fabrication. TSMC will continue to use innovative technologies and advanced processes to offer high-quality and sustainable products that can satisfy customer demands and benefit all people.

Sylvia Fang
Vice President, Legal and General Counsel/Corporate Governance Officer

TSMC’s core value is integrity, committing us to reach the highest corporate governance standards, conduct business with accountability and transparency, and appropriately balance the interests of all our stakeholders.

Note: Listed in the order of chapters that senior executives are responsible for
The ESG Committee is tasked with carrying out resolutions from the ESG Steering Committee and is equipped for vertical integration and horizontal connections to facilitate interdepartmental communication and resource allocation. The ESG Committee instructs the ESG Department, the responsible organization, and inter-organizational management representatives to identify sustainability topics relevant to TSMC operations that stakeholders are concerned about. The ESG Committee will assemble task forces, formulate strategies, targets, and actions plans, and convene quarterly meetings to track progress and performance for sustainability issues to ensure that ESG strategies are fully implemented into the daily operations of TSMC.

Based on the comprehensive infrastructure of Open Innovation Platform®, we collaborate with alliance partners to continuously research and develop innovative design solutions through Design Technology Co-Optimization (DTCO), and enable customer’s rollout of products with optimum performance & energy efficiency.

Dr. L.C. Lu  
TSMC Fellow and Vice President, Research & Development/Design & Technology Platform  
Based on the comprehensive infrastructure of Open Innovation Platform®, we collaborate with alliance partners to continuously research and develop innovative design solutions through Design Technology Co-Optimization (DTCO), and enable customer’s rollout of products with optimum performance & energy efficiency.

Connie Ma  
Vice President, Human Resources  
As TSMC is heading for another stage of substantial growth, we would continue to implement the business philosophy of open-style management system and to foster a diverse and inclusive workplace, so that employees can enjoy their work, grow with the company, and share the fruits of success.

TSMC is fully dedicated to quality. With our quality culture that is always pursuing excellence and our consistently evolving quality capabilities, we work with customers and suppliers to achieve high-quality products and facilitate sustainable prosperity in the industry.

J.K. Lin  
Senior Vice President, Information Technology and Materials Management & Risk Management  
TSMC is working with suppliers to pave a new path to sustainability by building a low-carbon supply chain together, ensuring labor rights, strengthening business ethics, and reducing ESH risks. We aim to take the lead in ESG actions and drive our responsible supply chain to become even better.

Dr. Jun He  
Vice President, Quality and Reliability  
TSMC is working with suppliers to pave a new path to sustainability by building a low-carbon supply chain together, ensuring labor rights, strengthening business ethics, and reducing ESH risks. We aim to take the lead in ESG actions and drive our responsible supply chain to become even better.
The TSMC Education and Culture Foundation never faltered in the face of the COVID-19 pandemic. By adopting innovative mindsets and with the help of technology, we were able to continue injecting new life into the fields of education and culture, guiding younger generations and the public through this challenging time.

Dr. F.C. Tseng
Chairman, TSMC Education and Culture Foundation

TSMC has a lot of ESG ideas that span a wide scope. So long as we are able to contribute to society, the TSMC Charity Foundation will remain on the frontlines to promote and share our experiences to help more people begin their journey towards sustainability.

Sophie Chang
Chairperson, TSMC Charity Foundation

TSMC cares about environmental protection. We've introduced energy-efficient designs to advanced processes and optimized raw material usage through innovative ideas like source management and reduction, which will be applied to future facilities as well to expand our carbon reduction and waste reduction efforts as part of our contribution to a sustainable society.

Dr. T.S. Chang
TSMC Fellow and Vice President, Operations/Advanced Technology and Mask Engineering

TSMC is resolute in maintaining our commitment to strengthening environmental protection. We aim to facilitate green manufacturing through innovative mindsets, collaborate with suppliers to achieve green action, and actively introduce renewable energy to lower our impact on global climate change and become a stabilizing force for environmental sustainability.

Dr. Arthur Chuang
Vice President, Operations / Facility

Striving to become the benchmark of eco-friendly companies in the semiconductor industry, TSMC is dedicated to developing a sustainable operational environment, pursuing the best pollution prevention technologies, and developing a renewable circular economy.

Wendell Huang
Vice President, Finance and Chief Financial Officer / Spokesperson

TSMC is committed to achieving excellent financial performance, implementing sound corporate governance, and bringing long-term profitable growth to investors. At the same time, we set challenging ESG goals, and go out of our way to actively respond to stakeholder needs and expectations.

Lora Ho
Senior Vice President, Europe & Asia Sales

In the era of rapid change and uncertainty, TSMC uphold the "Customer Trust" core value, continuously strengthen customer collaboration, and elevate customer partnerships. We expect ourselves to be the critical enabler of customer success and achieve the win-win objectives together with our customers.

Y.H. Liaw
Vice President, Operations/Fab Operations II

TSMC is resolute in maintaining our commitment to strengthening environmental protection. We aim to facilitate green manufacturing through innovative mindsets, collaborate with suppliers to achieve green action, and actively introduce renewable energy to lower our impact on global climate change and become a stabilizing force for environmental sustainability.

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Chairman, TSMC Education and Culture Foundation

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Note: Listed in the order of chapters that senior executives are responsible for
2021 ESG Reporting to the Board of Directors

Achievements

- Formulated an incentive program that ties the compensation of senior executives and key talents to shareholder interests and ESG (environmental, social, and governance) achievements
- Increased purchase of renewable energy, supported carbon-neutral natural gas, continued to develop green equipment and machines, and announced the strategies and goals for Net Zero Emissions by 2050 to combat climate change
- Leveraged the Sustainability Report as an ESG self-management tool, continued to align with global sustainability standards and management trends, and compiled our first TCFD Report
- Continued to strengthen energy conservation, GHG reduction, water conservation, and pollution reduction in suppliers by asking for mid-to-long term reduction goals and concrete actions toward such goals to achieve a low-carbon supply chain
- Published an announcement declaring that "Supply Chain Partners Should Ensure Protection of Human Rights During the COVID-19 Pandemic" to create a dignified workplace
- Carried out the winning proposal from the first ESG Award and went on to host the second ESG Award to encourage sustainability and innovation in the organization and among employees

2022 Work Plans

- Continue to enhance the performance of green manufacturing, achieve a low-carbon value chain, and steadily move towards net zero emissions
- Extend manufacturing standards from TSMC to the supply chain and work with suppliers to create an eco-friendly green supply chain
- Cultivate a diverse and inclusive culture, training programs, and related measures as well as develop Women@tsmc
- Expand the TSMC University Collaboration Programs and TSMC STEM for High School Girls Program to continue fostering semiconductor and STEM professionals

2021 ESG Steering Committee

Achievements

- Explored global ESG trends, evaluation standards, and corporate best practices to achieve sustainable development
- Announced net zero emission strategies and pathways, formulated milestones and concrete action plans, committed to achieving Net Zero Emissions by 2050, and reviewed plans for stakeholder communication
- Deepened ESG culture at TSMC and launched the second ESG Award, attracting 1,257 sustainability proposals from employees and organizations, a 60% increase from the first ESG Award
- Reviewed ESG-related budgets and expenses and took stock of resource demands and implementation plans for ESG-related dimensions

2021 ESG Committee

Achievements

- Strengthened communication of sustainability messages by complying with the TCFD Recommendations and SASB Standards, ahead of regulatory requirements for the Sustainability Report and adding an ESG FAQ section
- Carried out green manufacturing by continuing to promote source reduction for chemicals, building a water reclamation plant and zero waste center, developing the first System of Waste Intelligent Fast Track, and receiving the highest platinum rating for zero waste to landfill in compliance with UL2799
- Mitigated climate change impacts with 400 GWh saved from 159 energy conservation plans proposed by the Energy and Carbon Reduction Committee and 17,044 arbors and 277,898 shrubs planted through the “Plant a Tree Program”
- Facilitated sustainable development in the supply chain by carrying out the second stage of the On-site Contractor Personnel Support Program, publishing the White Paper on Supplier Transportation Management, and implementing the supplier EP&L Program and low-carbon value chain management approaches
- Developed and promoted online courses and a survey system for TSMC Human Rights Policy and Implementation
- The TSMC Education and Culture Foundation and the TSMC Charity Foundation have actively supported fostering our young generation, promoting arts, culture, and education, and assisted students in remote areas as well as the disadvantaged to bring positive change to society
Materiality Analysis and Stakeholder Communication

In 2021, TSMC published the first Materiality Analysis Report to formally build up know-how in ESG management. Materiality analysis is an important directive for compiling the Sustainability Report, formulating long-term sustainability goals, and communicating with stakeholders. TSMC developed a methodology for materiality analysis in compliance with GRI Standards and the AA 1000 Accountability Principle: 2018. The methodology also integrates stakeholder concerns and sustainable management requirements for TSMC to identify material ESG issues.

Starting in 2021, TSMC changed the frequency of materiality analysis from once every year to once every three years. TSMC continues to observe changing trends in ESG topics and track progress toward long-term sustainability goals. The next materiality analyses will be conducted in 2024. Before then, TSMC will continue to collect and respond to stakeholder feedback and suggestions through diverse communication channels and facilitate ESG strategies and commitments through the ESG Committee.

The latest materiality analysis was completed at the end of 2021. A total of 206 TSMC managers and colleagues and 1,082 stakeholders participated in discussions and analysis of the identification, prioritization, and validation of material issues. Changes made to material issues from 2020 include the addition of three issues: Business Continuity Management, Biodiversity, and Diversity & Inclusion. TSMC also integrated Climate Change and Energy Management into Climate and Energy and changed the names of Product Quality, Customer Service, Supplier Sustainability Management, Waste Management, and Social Participation to Product Quality and Safety, Customer Relations, Sustainable Supply Chain, Circular Resources, and Social Impact, respectively. The changes were made to correspond with the spirit and significance of issue management. In the end, TSMC selected a total of 23 ESG issues as the basis for materiality analysis.

Results from the materiality analysis, the Company’s ESG policies, ESG focus areas, and long-term sustainability goals were considered before TSMC finally confirmed 14 material issues of significance that should be prioritized for disclosure and long-term goals. Biodiversity is a potential material issue at TSMC; related practices and achievements will be disclosed in the sustainability report.
2021 Sustainability Report

Overview  ESG Feature Stories  Sustainable Business Practices  Operations and Governance  Appendix

TSMC Materiality Matrix

Impact on TSMC Operations

- An Innovation Pioneer
- A Responsible Purchaser
- A Practitioner of Green Power
- An Admired Employer
- Power to Change Society

Note: Corporate governance, risk management, ethics, regulatory compliance, financial performance, taxation, and information security issues are classified under General Disclosures by GRI and are generally result-oriented. The above issues will, therefore, not be represented in the materiality matrix but relevant information will be regularly disclosed in the Company’s annual report, Company website, Sustainability Report, ESG website and ESG Newsletter.
## Material Issues and Value Chain

<table>
<thead>
<tr>
<th>Sustainability Roles</th>
<th>Material Issues</th>
<th>GRI-specific Topics</th>
<th>SASB Standards</th>
<th>Upstream Notes</th>
<th>TSMC Operations Notes</th>
<th>Downstream Notes</th>
<th>Operational Impact</th>
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<td>Packaging/Testing</td>
<td>Customers Use</td>
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</tbody>
</table>

**Note 1:** "Upstream" boundaries are raw materials, equipment, and related services purchased by TSMC.

**Note 2:** "TSMC Operations" boundaries are wafer fabrication and packaging/testing services offered by TSMC.

**Note 3:** "Customer Use" boundaries are customer products manufactured by TSMC.

**Note 4:** "✓" signifies the issue has real impact on this stage or that the issue is a spotlight issue.
Material Issues and Risk Management

**Innovation Management**
- Failure to foresee changes in technologies or develop innovative technologies
- Patent Protection - R&D results unprotected due to lack of patent

**Product Quality & Safety**
- Challenges to product quality and yield rate
  - Wafer quality control grows increasingly difficult as products become more complex.
  - Inability to detect defects could incur a loss to our clients and impact Company reputation.
  - If defects remain undetected in raw materials, it could lead to scrapping the final product, impacting customers and Company operations.
  - Please refer to “Product Quality & Safety” in this report.

**Customer Relations**
- TSMC production capacity cannot be fully utilized
  - If TSMC is unable to timely address customers' product issues, it may lead to idle capacity in TSMC.
  - If customers are not aware of TSMC's technology offering, customers may seek for alternative foundry suppliers' solutions.
  - Please refer to "Customer Relations" in this report.

**Sustainable Supply Chain**
- Concentrated sourcing and suppliers noncompliant with TSMC or regulatory requirements
  - Disruptions in the supply chain (for raw materials or equipment) will impact Company operations and our commitment to customers.
  - Please refer to "6.3 Risk Management" in the 2021 Annual Report and "Sustainable Supply Chain" in this report.
Unstable water supplies will limit production capacity, TSMC will therefore be unable to satisfy customer demands and, if demands are not met, fab construction progress and customer orders might be impacted. Please refer to "Climate and Energy" in this report.

Anomalies in effluents will pollute the environment and negatively impact Company reputation. Please refer to "Water Stewardship" in this report.

Waste management vendors failing to handle waste in compliance with regulations may cause competent authorities to request TSMC to share liabilities for waste cleanup and environmental recovery, impacting Company reputation. Please refer to "Circular Resources" in this report.

Unstable power supply will limit production capacity and impact Company reputation. Customer’s trust could decline and result in fewer orders. Please refer to "Climate and Energy" in this report.

Improper use or failure of air pollution control equipment could result in excess emissions, penalties from the authorities, and impact on Company reputation. Please refer to "Air Pollution Control" in this report.
The Company's understanding of society and grasp of various aspects of the market may suffer if the mix of employees is unable to reflect the current social landscape, further impacting the Company's advantage. Please refer to "Diversity and Inclusion" in this report.

Failure to uncover TSMC employees' full potentials could suffer from failure to attract and retain a sufficient number of high-quality talents when needed. The Company operations could suffer from failure to attract and retain a sufficient number of high-quality talents when needed. Please refer to "Talent Attraction and Retention" in this report.

Talents failing to progress with evolving landscapes. The Company's competitive advantage and growth momentum will suffer if talents fail to progress with evolving landscapes. Please refer to "Talent Development" in this report.

Failure to protect the human rights of TSMC employees and suppliers. Company reputation, employee morale, and talent recruitment could suffer from the lack of proper protection for the human rights of our employees. Please refer to "Human Rights" in this report.

Earthquakes or fires could lead to damages to Company equipment or supplier equipment and result in disrupted operations and financial losses. Employees could suffer from disabling injuries if they do not follow proper safety guidelines. Please refer to "Occupational Safety and Health" in this report and "6.3 Risk Management" in the 2021 Annual Report.

Employees could suffer from disabling injuries if they do not follow proper safety guidelines. Please refer to "Occupational Safety and Health" in this report and "6.3 Risk Management" in the 2021 Annual Report.

Cluster infections of pandemic inside the Company could result in disrupted operations. Please refer to "Occupational Safety and Health" in this report and "6.3 Risk Management" in the 2021 Annual Report.

Company reputation, employee morale, and talent recruitment could suffer from the lack of proper protection for the human rights of our employees. Please refer to "Human Rights" in this report.

Employees could suffer from disabling injuries if they do not follow proper safety guidelines. Please refer to "Occupational Safety and Health" in this report and "6.3 Risk Management" in the 2021 Annual Report.

Cluster infections of pandemic inside the Company could result in disrupted operations. Please refer to "Occupational Safety and Health" in this report and "6.3 Risk Management" in the 2021 Annual Report.
Stakeholder Communication

**Employees**

Concerned with the continued growth and success of the Company as well as meaningful work, a safe and healthy workplace, competitive compensation and welfare, opportunities to grow, and work-life balance.

- **64** Labor-management meetings
- **4,437** Cases handled through internal communication channels

**Engagement**

- Intra-organizational engagement and work meetings/daily
- Communication meetings at all levels/quarterly
- Labor-management meetings/quarterly
- Fab Caring Circle, Employee Opinion Box, and Ombudsman System/as needed
- Organizational climate survey/annually
- Professional ethics and human rights training/annually
- Employee core values survey and employee survey/ biannually

**Issues**

- Company’s long-term development
- Talent recruitment, cultivation, and retention measures
- Diversity and inclusion
- Social impact
- Professional ethics and regulatory compliance

**Focus Areas**

- Company growth, success and contribution to the society
- Company global product capacity expansion, digital transformation and work efficiency
- Gender equality and women potential unleashing in the Company
- More ESG activities and social participation opportunities for employees
- Work-life balance and individual growth
- Latest regulatory updates relevant to job functions, i.e., zero tolerance of corruptions, recusal to avoid conflict of interest, etc.

**Responses from TSMC**

- Strengthened internal communication channels to help colleagues learn more about the Company's future prospects
- Promoted digital transformation and continued to strengthen smart manufacturing with further integration with mobile applications, IoT, AI, and big data to develop a new generation of smart factories
- Organized a training program on “TSMC’s Human Rights Policy: Say No to Sexual Harassment and Build up a Friendly Workplace!”
- Launched the TSMC Child Care Benefit Program to support work-life balance
- Organized Women@tsmc to encourage women at TSMC to pursue their career goals and achieve self-growth
- Provided an “Annual Ethics and Compliance Training Course” (mandatory 0.5 hour online course) covering various important regulatory compliance topics and a total of 59,366 (99.9% completion rate) employees (including employees in subsidiaries) completed this training course

**Kelly Huang**

TSMC Employee

Starting from my pregnancy, the Company offered a series of events to help new parents. Employees can also enroll their kids at TSMC kindergarten and feel assured that their beloved ones are in good hands.

TSMC builds four kindergarten at Taiwan facilities to ensure employee feel safe and care in the workplace.
Shareholders/ Investors
Concerned with the investment value of TSMC including market prospects, growth strategy, profitability, dividend policies, shareholder returns, and sustainability performance

305
Institutional investors
210
Conferences and meetings

Engagement
- General shareholders’ meeting/annually
- Investor conference/quarterly
- Domestic and overseas brokerage conferences/as needed
- Face-to-face meetings, video conference calls, and telephone conference calls/as needed
- Annual Report, Sustainability Report, and Form 20-F with the U.S. Securities and Exchange Commission/annually
- Major announcements on the Market Observation Post System/as needed

Issues
- Financial performance
- Innovation management
- Risk management
- Climate and energy

Focus Areas
- Capital risk and long-term profitability
- Technology development and competitive advantage
- Supply-demand dynamics in the industry and changes in the competitive environment
- Impact of the international political and economic landscape on the business environment and corresponding measures
- Climate change responsive measures and supplier management

Responses from TSMC
- With the support of strong operating performance and future growth potential, TSMC has been providing positive returns to investors for 13 consecutive years
- Distributed cash dividends on a quarterly basis. Shareholders of TSMC common shares received a total of NT$10.25 cash dividend per share in 2021
- Continued to communicate recent technology developments at the quarterly investor conferences
- In 2021, through quarterly investor conferences and 210 investor meetings, TSMC communicated with its investors on growth strategies and profitability and expressed its opinions on changes in the business environment
- Published the TCFD Report, committed to achieving Net Zero Emissions by 2050, and required 100% of high-electricity consumption suppliers to acquire ISO 14064-1 GHG emissions certification

"Understanding the sustainability profiles of companies in our investment universe is an important part of our investment process at Fidelity. Active engagement with TSMC on sustainability-related issues helps us yield insights that allow us to make better investment decisions on behalf of our clients.

Priyanshu Bakshi
Portfolio Manager & Analyst
Fidelity Management & Research (Hong Kong) Limited"
Customers
Concerned with TSMC’s technology development and production planning, including production capacity, product quality and safety, that meets customer demands, comprehensive protection of proprietary customer information assisting customers with successful production application and gaining time-to-market advantage.

99
Quarterly assessment meetings

1,200
Customer meetings

Engagement
- Business and technology assessment/quarterly
- Customer satisfaction survey/annually
- Customer meetings/as needed

Issues
- Innovation management
- Product quality and safety
- Customer Relations
- Information security

Focus Areas Responses from TSMC

- Technology development schedules and plans
  - Offered 894 process technologies and 98 advanced packaging technologies in line with the technology roadmap

- Product quality
  - Continued perfecting production technologies and product quality. Reduced engineering deficiencies per one million 12-inch wafers to 55% of 2019

- Capacity planning and production information
  - TSMC-Online™ provides real-time design, engineering, and backend assistance services to help customers quickly access comprehensive and real-time information

- Information transparency and information protection
  - Established an automatic information security management system with ISO/IEC 27001 certification; Fab 14B and Advanced Backend Fab 2 received ISO/IEC 15408 certifications for facility safety

TSMC and MediaTek are long-term partners. We share the same philosophy of integrity and relentlessly contribute to the supply chain improvements in areas from technology quality to environmental protection, carbon reduction, and human rights and safety. We're leading the industry suppliers to achieve both business growth and environmental sustainability and create a green semiconductor supply chain.

MediaTek

TSMC’s attitude of working collaboratively with customers to develop creative solutions to challenging problems is remarkable and stems fundamentally from their "excellence in customer service" DNA.

Broadcom
Suppliers/Contractors

Concerned with the development of new process technologies, improving product quality, ESH regulations, ethics and regulatory compliance, and information security; desire to strengthen and deepen partnerships for sustainable supply chain management.

111
Supplier audit & communication meetings

201
Suppliers participated in the Supply Chain ESH Training Forum

Engagement

- Supply Chain ESH Training Forum/annually
- Supply Online 360 Global Responsible Supply Chain Platform/as needed
- On-site support & audit/as needed
- Supplier meetings/as needed
- Supplier Information Security Association Meeting/monthly

Issues

- Sustainable Supply Chain
- Ethics and regulatory compliance
- Product quality and safety
- Occupational safety and health
- Information security

Focus Areas

- Sustainable actions and consistent improvement
- TSMC regulations on ethics and the supplier code of conduct
- Quality of raw materials
- Effective ESH management mechanisms
- Information security compliance, assessment results, and experience sharing

Responses from TSMC

- Built Supply Online 360, a global supply chain management platform; established online TSMC Supplier Sustainability Academy with 25 lessons on Supplier Code of Conduct now available online.
- All tier 1 suppliers signed the Supplier Code of Conduct and complied with business ethics (completion rate: 100%).
- 36 critical suppliers completed third-party supplier audits on sustainability risks by RBA-certified institutions, ten suppliers received consultation on process advancement and quality improvement.
- Continued to enhance ESH and loss prevention capabilities in the supply chain and commended outstanding suppliers; in 2021, outstanding suppliers were MGC Pure Chemicals Taiwan and Sunlit Fluor & Chemical Co.
- Published four issues and over 200,000 copies of the Supply Chain Security Newsletter.

As a reliable materials supplier, Chang Chun continues to provide eco-friendly processes and product services in the hopes of taking on a more important role in TSMC’s sustainable supply chain.

Tsai Chih-Chuan
President of Chang Chun Petrochemical Co., Ltd.

We will continue providing raw materials that can help industries and people. We will fulfill our role as a critical supplier to TSMC and dedicate ourselves to fulfilling SDG programs.

Kazumasa Maruyama
Director of New Functional Materials Division
Shin-Etsu Chemical Co., Ltd.
TSMC joins the Taiwan Climate Partnership and declares carbon reduction goals, introducing net zero actions into the supply chain.

- Founded a subsidiary, JASM (Japan Advanced Semiconductor Manufacturing, Inc.), in Kumamoto Prefecture, Japan. Facility construction will begin in 2022 with production before the end of 2024.
- Commenced construction of the TSMC Water Reclamation Plant in Southern Taiwan Science Park and made plans to introduce domestic reclaimed water as a water source; the reclaimed water plant is slated to be in commission in 2022.
- Represented the Taiwan Semiconductor Industry Association in discussions with the EPA on reasonable and viable air pollutant emission standards and GHG Reduction and Management Act for the semiconductor industry.
- Held three ESH Experience-sharing Workshops and one Supplier Emergency Response Drill and asked suppliers to set goals for energy conservation, carbon reduction, fire prevention, occupational safety and health, and emergency response.

Dexter Galvin
Global Director, Corporations & Supply Chains
CDP
Concerned with the resources for education and arts offered by the TSMC Education and Culture Foundation to cultivate well-rounded talents for the new era;

Concerned with the support for remote education and the disadvantaged, Network of Compassion, Public Welfare Green Energy Project, and Cherish Food Program provided by the TSMC Charity Foundation.

325 Charity partners
179 Charity programs

Focus Areas
- Young generation cultivation, educational collaboration, arts and culture promotion
- Measures in response to social issues and major events (e.g., COVID-19), volunteer services, and investments into environmental education

Responses from TSMC
- In 2021, the TSMC Education and Culture Foundation invested NT$87.79 million to support diverse education programs and arts & culture programs with our three cornerstones: Young Generation Cultivation, Educational Collaboration, and Arts and Culture Promotion. To encourage young people to spotlight the 17 UN SDGs, TSMC hosted the TSMC Youth Dream Building Project in 2021, revolving around the theme of SDGs. A total of 67 universities and 122 teams of students participated in the competition.

We're grateful that the TSMC Charity Foundation realized that remote schools needed better lighting. Now students have a better environment for reading that also conserves energy.

Huang Wei-chie
Tainan Mayor

I'd like to thank the TSMC Education and Culture Foundation for hosting the TSMC Journeys of Female Scientist Lectures and showing me potential pathways and professions in the industry. The hands-on experience also strengthened my understanding and curiosity for science.

Student
National Tainan Girls’ Senior High School

Issues
- Social Impact

Engagement
- Volunteer services/at least once per week
- TSMC LinkedIn/as needed
- TSMC Education & Culture Foundation and TSMC Charity Foundation websites/as needed
- Sending Love charity platform/as needed
- Project cooperation and visits/as needed
- TSMC ESG Newsletter/monthly
- TSMC iCharity Platform

Ecological volunteers of Fab 12B give a tour to students, educating them about protecting our trees.
Sustainability Impact

TSMC aims to drive economic growth and reduce the depletion of environmental resources to further advance social welfare and exert influence across the economy, environment, and society. TSMC believes in leading with integrity, and has developed the Triple Bottom Line (TBL) to serve as the sustainability impact management framework based on the Company’s six major capitals, four core elements, six sustainable management competencies, and Environmental Profit and Loss (EP&L) valuation model to evaluate TSMC’s externalities and social costs as well as measure the contribution of the company’s overall value chain’s to society. For more details, please refer to Sustainability Impact Valuations.

Six Major Capitals

<table>
<thead>
<tr>
<th>Six Major Capitals</th>
<th>Finance</th>
<th>Manufacturing</th>
<th>Intelligence</th>
<th>Human Resources</th>
<th>Environment</th>
<th>Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generate economic value and returns through the effective management of financial resources</td>
<td>Provide services that customers need and carefully maintain manufacturing resources for equipment and buildings</td>
<td>Strengthen our knowledge capital through continued investment into innovative R&amp;D and patents</td>
<td>Recruit like-minded talent and strengthen talent cultivation so employees may grow with the Company</td>
<td>Give back to society and obtain its trust through social participation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Process and Methods

Senior Management Support
Chairman Dr. Mark Liu is personally involved in ESG efforts and has invited senior executives to lead their functional organizations in proposing sustainable solutions based on core competencies in order to expand positive influence.

Mid-level Management Involvement
Mid-level management is the backbone of the Company’s pursuit of sustainability, cooperating across organizations and departments in the face of complex sustainability issues to bring about real change.

ESG Governance
The ESG Executive Committee and ESG Committee meet regularly to formulate long-term strategies, engage in interdepartmental communication and cooperation, supervise program progress and performance, and maintain momentum for sustainability within the organization.

Innovative R&D
- Innovation Management
- Product Quality and Safety

Human Resource Management
- Diversity and Inclusion
- Talent Attraction and Retention
- Talent Development
- Human Rights
- Occupational Health and Safety

Customer Service
- Customer Relations

Supply Chain Management
- Sustainable Supply Chain

Environmental Management
- Climate and Energy
- Water Stewardship
- Circular Resources
- Air Pollution Control

Integrity Leadership
Six Sustainable Management Competencies
- Integrity
- Leadership

Organization Culture
Foster an organizational culture that doesn’t commit casually, but devotes fully to the commitment when it does. Set long-term goals for sustainability issues, strive for change, review progress regularly, and continue to commit to doing better.

Value Chain
- Procurement
- TSMC Operations
- Customer Use

Operational Impact:
- Employee Cohesion
- Operational Risk
- Revenue Growth
- Customer Satisfaction

(continued on the next page)
For the economic dimension, in 2021 TSMC generated NT$1,587.4 billion in operating revenue, booked NT$422.4 billion in depreciation and amortization, issued NT$265.8 billion in cash dividends, and created an output value of NT$1,332.3 billion in the supply chain through procurement. TSMC not only helped customers succeed and suppliers become more sustainable, but also offered good returns to its investors. In the social dimension, TSMC paid NT$258.5 billion in taxes and payroll, supported our government in expanding infrastructure and social welfare, improved quality of life, and drove economic growth. While cultivating an advantage in our core business, TSMC also continued to generate 260,000 job opportunities and NT$214.1 billion in payroll through the supply chain. Volunteer services from TSMC also created NT$34.3 million in social benefits, while occupational injuries resulted in NT$16.8 million in social costs. In the environmental dimension, environmental footprints from the implementation of environmental protection projects, please refer to Environmental Cost in TSMC’s 2021 annual report. For the costs and economic benefits arising from the implementation of environmental protection projects, please refer to Environmental Profit and Loss (EP&L) Report.
Sustainability Impact Valuation

TSMC has comprehensively evaluated the direct and indirect impacts from the value chain and established a Sustainability Impact Strategy Map derived from causal relationships from an outside-in perspective. The map converts all potential external costs and values from upstream procurement, TSMC operations, and customer use into monetary values to construct a tool to manage sustainability impact.

In the upstream procurement stage, TSMC leverages its leadership position in the global semiconductor industry to improve the technology and capability of local suppliers. TSMC employs an input-output model to assess output value, job opportunities, and income created from TSMC’s procurement demands as well as the resulting economic growth and improvements in living conditions. To address supply chain sustainability issues, TSMC is actively promoting a responsible supply chain, using environmentally extended input-output (EEIO) analysis to identify environmental hot spots in the supply chain and evaluating raw material suppliers with Life Cycle Assessment (LCA) to identify the environmental impact from production and service processes. TSMC aims to collaborate with suppliers to uncover opportunities for change and growth to help drive sustainable transformation in the industry.

In the TSMC operations stage, TSMC is using the GVA (gross value added) approach to assess the positive impact generated for stakeholders by our operations. Such positive impact may include equal employment opportunities, competitive compensation and benefits, cash dividends, taxes, depreciation and amortization, and others. TSMC also continues to apply environmental profit and loss (EP&L) to evaluate social costs and negative impacts generated from energy/resource consumption and pollution from the production process to then mitigate our environmental impact by working on creating positive impact through renewable energy, reclaimed water, and circular economy.

In the customer use stage, TSMC continues to develop world-leading energy-efficient semiconductor technologies to help customers produce advanced, energy-efficient products and facilitate the evolution of energy-saving ICT technologies and product applications to fulfill our commitment to green manufacturing both internally and externally. The Industry, Science and Technology International Strategy Center conducted a model analysis based on global energy consumption, GDP, and the number of electronic products, and found that TSMC effectively facilitates global energy conservation by continuing to innovate semiconductor technologies to realize smart applications for a wide range of electronic products.

TSMC hopes to drive economic growth, reduce consumption of environmental resources, and further enhance social welfare to realize cross-domain ESG influence.
Sustainability Impact Strategy Map

The TSMC Sustainability Impact Strategy Map employs the concept of performance management to connect predicted results in value chain activities with causality among driving factors. We then apply the concept of P&L to identify positive or negative impacts on the economy, environment, and society.

**Economic Value**
- $1,332.3 Billion
- $1,587.4 Billion
- $258.5 Billion

**Environmental Value**
- $-14.3 Billion
- $-16.2 Billion
- $214.1 Billion

**Social Value**
- $217,100 GWh
- $214.1 Billion
- $12,302

Note: The "Strategy Map" is derived from the Balanced Scorecard, a performance management tool researched and developed by Robert S. Kaplan and David P. Norton in the late 1990s. The Balanced Scorecard connects goals with driving factors to serve as a tool for management.
TSMC is dedicated to reducing environmental and social impacts and introduced EP&L in 2018 to evaluate environmental externalities and resulting social costs created from the production process. In 2019, TSMC further applied EP&L to the upstream supply chain, converting the environmental impact generated from product life cycles into external social costs, identifying significant environmental impact factors to formulate improvement measures and reduce the environmental externalities and social costs generated from TSMC procurement.

In 2021, EP&L analysis showed that TSMC experienced a minor increase in environmental externalities generated from production and operations, which is mainly caused by a growing demand for energy, water, and raw materials from the increasing number of new manufacturing facilities and evolution of advanced process technologies. GHG emissions from TSMC facilities are the primary source, accounting for 96% of TSMC’s total environmental externalities, which also include air pollution, wastewater, and incineration/burial of waste. Across the supply chain, TSMC conducted an environmental hotspot analysis of 1,149 tier 1 suppliers and found that chemical suppliers are the largest source of environmental externalities from the supply chain, accounting for 50%. We further inspected 23 critical raw material suppliers and found that sulfuric acid, developers, and ammonia solutions generated the largest number of environmental externalities out of all raw materials.

TSMC continues to promote innovative green practices to continue reducing the environmental impact of production processes in our facilities. In 2021, we successfully reduced environmental externalities per unit product by 8% from 2020, mainly by significantly lowering GHG emissions. We also witnessed a significant increase in waste from various environmental externalities per unit product. Unfortunately, this is caused by new advanced processes and expanding capacity; developing new processes and maintaining stable yield rates are challenging, which has led to an increase in demand for raw materials and a significant increase in waste. TSMC has already built the world’s first Zero Waste Manufacturing Center, which will be operational starting in 2023. The Center can effectively increase the recycling rate of chemical waste liquid and achieve a circular economy model to reduce environmental externalities. For sustainable supply chain management, TSMC is employing environmental audits to help suppliers identify potential risks and ways to improve. In 2021, TSMC inspected 54 suppliers and mainly uncovered chemical leaks to storm drains and failure to establish a GHG inventory and management system. TSMC has requested all suppliers to establish a management system as well as reduction goals for energy, water, and GHG emissions to reduce environmental impact. We aim to collaborate with suppliers to build a green, low-carbon supply chain to exert a positive influence on society. For more details, please refer to the TSMC 2021 Environmental Profit and Loss (EP&L) Report.
Carry Out the UN Sustainable Development Goals

In 2022, TSMC published the first TSMC UN SDGs Action Report. In line with the reporting framework developed by the GRI, the report details how TSMC supports the 2030 Agenda for Sustainable Development through five principles of disclosure: Plans, Commitments, Actions, Progress, and Collaboration. Under the leadership of ESG Steering Committee Chairman Mark Liu, TSMC continued to spotlight nine SDGs: SDG 3 (Good Health and Wellbeing), SDG 4 (Quality Education), SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), and SDG 17 (Partnership for the Goals). TSMC has also deployed 44 ESG programs and 23 measurable long-term goals for 2030 to effect change through real action.

**ESG Directions**

- **Drive Green Manufacturing**: Implement green production, innovative high efficiency semiconductor technologies to mitigate climate change and pursue sustainable development.
- **Build a Responsible Supply Chain**: Collaborate with suppliers and contractors to promote sustainable operation and manufacturing standards.
- **Create a Diverse and Inclusive Workplace**: Establish a safe and healthy workplace that respects human rights and and unleashes employees’ full potential.
- **Develop Talent**: Support career development and collaborate with academia to develop STEAM (Science, Technology, Engineering, Art and Mathematics) programs that cultivate talent.
- **Care for the Underprivileged**: Aggregate resources to deploy educational, cultural and social programs that reduces inequality and uphold the common good.

**Process & Reporting**

1. **Understand and Prioritize SDGs**: TSMC identifies the link between SDGs, the five sustainability roles, and value chain stages through the following three steps: Understand & Prioritize SDGs, Goals & Integration, and Disclosure and Communication. Long-term goals and action plans are then formulated accordingly.

2. **Goals & Integration**: Set measurable goals for SDGs and deploy a comprehensive action plan for sustainability so that TSMC can become the global benchmark for green corporations.

3. **Disclosure and Communication**: Declare support for SDGs, collaborate with stakeholders, and provide updates on progress and achievements.

**TSMC Sustainability Roles**

- **An Innovation Pioneer**: TSMC focuses on developing our primary business as a dedicated pure-play IC foundry and service provider. TSMC continues to expand the R&D scale and use innovation to pave the way for global technological development. A leader in the global semiconductor industry, TSMC is committed to manufacturing high-quality, energy-efficient, and sustainable products to enable our customers to achieve product innovation and success.

- **A Responsible Purchaser**: TSMC strives for sustainable management and responsible purchases. We ask our suppliers to make advancements in the following areas: technology, quality, delivery, environmental protection, human rights, safety, and health. We also take climate risks into consideration, actively trying to strengthen our climate resilience so that we can develop a low-carbon, sustainable semiconductor supply chain.

- **A Practitioner of Green Power**: Striving to realize our belief in co-existence and shared prosperity with the environment, TSMC is actively developing and applying innovative green technologies to climate and energy, water stewardship, circular resources, and air pollution control to roll out a comprehensive action plan for sustainability so that TSMC can become the global benchmark for green corporations.

- **An Admired Employer**: TSMC remains committed to the core value of Commitment and strives to foster a diverse and inclusive culture as well as an open-style management system to attract and retain talents of different backgrounds and professions. We offer competitive compensation and benefits as well as a safe and fun workplace for growth. It is our mission to become a company that our employees can be proud of.

- **Power to Change Society**: With a sustainable vision to “better society,” the TSMC Education and Culture Foundation and the TSMC Charity Foundation have galvanized internal and external resources to spotlight the following areas: cultivate our youth, rural education, and support arts, culture, and the environment. We also care for the disadvantaged as well as seniors living alone to build a strong foundation for society through common good.
An Innovation Pioneer

TSMC focuses on developing our primary business as a dedicated pure-play IC foundry and service provider. TSMC continues to expand the R&D scale and use innovation to pave the way for global technological development. As a leader in the global semiconductor industry, TSMC is committed to manufacturing high-quality, energy-efficient, and sustainable products to enable our customers to achieve product innovation and success.

Over 8,800 patent applications globally/Over 20,000 trade secrets registered

894/98
TSMC was able to provide customers with 894 process technologies and 98 advanced packaging technologies in line with its technological roadmap

100%
Develop the ability to analyze 100% of Carcinogenic, Mutagenic and Reprotoxic substances and help all of the suppliers that supply materials with potential risks to develop the same capabilities
Innovation Management

Strategies & 2030 Goals

Technology Leadership
Continuous investment in advanced technology development to maintain TSMC's technology leadership in the semiconductor industry

- Maintain TSMC's technology leadership and invest 8.5% of revenue in R&D expenses annually
- 3nm process technology in risk production

2021 Achievements

- 3nm process technology in risk production
- Target: 3nm process technology in risk production

Intellectual Property Protection
Patent protection: Continue to strengthen patent portfolio by keeping patent applications in sync with the Company's R&D resources to ensure all research achievements are fully protected.
Trade secret protection: Strengthen business operations and intellectual property innovation through trade secret registration and management which documents and consolidates the TSMC competitive trade secret applications

- Over 80,000 global patents granted
- Over 200,000 trade secret registrations

2021 Achievements

- Exceed 6,600 global patent applications
- Exceed 25,000 trade secret registrations
- Share TSMC's trade secret registration mechanism with 6 companies
- Assist 2 companies to successfully build a trade secret registration and management system

- Submitted over 8,800 global patent applications
- Register over 20,000 trade secret

- Target: >5,500
- Target: >20,000

Industry-Academia Collaboration Enhancement
Link academic institutions in Taiwan and overseas by investing resources in university programs based on a long-term mechanism for interaction to cultivate the next generation of semiconductor talents

- Cultivate more than 8,000 undergraduate and graduate students globally through university programs that deepen industry-academia collaboration
- Cultivate over 5,500 undergraduate and graduate students globally through university programs to enhance industry-academia collaboration
- Launched a variety of industry-academia collaboration projects, including the comprehensive semiconductor programs on device integration, manufacturing process and equipment engineering, internship programs, cooperative education, and various contests; the number of undergraduate and graduate students involved globally reached 6,500

2021 Achievements

- Exceeded
- Achieved
- Missed Target

Note 1: In the wake of adjustments made to the patent portfolio plan for leading technologies and the continuous expansion of R&D investment, the annual target for the number of global patent applications in 2021 was exceeded, and the long-term goal for 2030 is adjusted accordingly.

Note 2: The long-term goal for 2030 is adjusted based on a comprehensive assessment considering the growth trend in the number of trade secret registrations in the past years, the anticipated momentum for the Company's innovation in technical and commercial trade secrets, and the Company's advocacy on the development of environmental-friendly and energy-saving green trade secrets.

Note 3: Companies targeted for collaboration in the first phase will be suppliers that work closely with TSMC in technology, green manufacturing, and critical materials.

Note 4: In compliance with the Company's development strategies, the sustainable goals for "industry-academia collaboration enhancement" are adjusted accordingly, and the segment has been moved to this chapter from "Talent Attraction and Retention"
In response to the rapidly evolving semiconductor industry, TSMC has been striving to build an innovative workplace that inspires innovation since its establishment. In the face of challenges imposed by competitors and advanced process technologies in 2021, TSMC continued to enhance the company’s leading technological competitive advantages through an internal incentive scheme for innovation. TSMC encourages employees to carry out various innovations to boost vitality for organizational innovation. Meanwhile, the Company also fuses innovative thinking into its interdisciplinary innovation collaborations, including product innovation with customers, technical talent innovation and cultivation with research institutions, and innovative green industrial chain build-up with suppliers.

**Innovation Management Framework**

- **Technology Leadership**
- **Sustainable Products**
- **Intellectual Property Protection**
  - Comprehensive Patent Management Mechanism
  - Trade Secret Protection
- **Intelligent Precision Manufacturing**

- **Idea Forum**
  - Operations
  - R&D
  - Quality and Reliability
  - Corporate Planning Organization
  - Finance
- **Total Quality Excellence and Innovation Conference (TQE)**
- **ESG AWARD**

- **Innovation Cases**
- Using STOP & FIX to Strengthen Mechanisms for Handling Unusual Events
- CIS Applications Innovation
- Digital Transformation of Customer Audits
- Energy & Water Conservation from Advanced Tools

- **Open Innovation Platform®**
- Collaboration with World-class R&D Institutes
- Industry-Academia Collaboration
  - University Research Center
  - Industry-Academia Joint Development Project
  - University Shuttle Program
  - National Academy for Key Fields of Research
- Course Collaboration
  - Semiconductor Programs
  - Information Technology Talent Cultivation in Partnership with Major International Businesses
- Career Coaching
  - TSMC Ph.D. Scholarship
  - TSMC X Microsoft Careerhack Competition

- **MAU Humidifier System Installation for Cleanroom Energy Saving**
- Launch of Hydrofluoric Acid Waste Regeneration System
- Intelligent Waste Management Procedure with Full Traceability
- Development of High-Efficiency Central Scrubber
- Using Handheld Acoustic Imaging Cameras to Reduce Fire Alarms

**Accumulate Internal Innovation Energy**

**Innovate through Interdisciplinary Collaboration**

**Realize Innovation**

**ESG Feature Stories**

Overview: Sustainable Business Practices

- An Innovation Pioneer
- A Responsible Purchaser
- A Practitioner of Green Power
- An Admired Employer
- Power to Change Society

Appendix
Technology Leadership

In 2021, TSMC continued to enlarge its scale of research and development with an investment of US$4,465 million, which compared to last year was a 20% growth in R&D expenditures, amounting to 7.9% of total revenue. As for R&D’s manpower, it increased 5% to 7,809 in 2021 compared to 2020, achieving a level that equals or exceeds the R&D investment of many other leading high-tech companies.

Faced with the continuous challenge to significantly scale up semiconductor computing power every two years, thereby extending Moore’s Law, the Company has focused its R&D efforts on contributing to customers’ product success by offering first-to-market, combined leading-edge technologies and design solutions. In 2021, the Company started risk production of 3nm technology, the sixth generation platform to make use of 3D transistors, while continuing the development of 2nm, the leading-edge technology in the semiconductor industry today. Furthermore, the Company’s research efforts pushed forward with exploratory studies for nodes beyond 2nm.

In 2021, TSMC maintained strong partnerships with many world-class research institutions, including SRC (Semiconductor Research Corporation) in the U.S. and IMEC (Interuniversity Microelectronics Centre) in Belgium. The Company also continued to expand research collaboration with leading universities throughout the world for two grand purposes: the advancement of semiconductor technologies and the nurturing of human talent for the future.

Continuous Investment in R&D

<table>
<thead>
<tr>
<th>Year</th>
<th>R&amp;D personnel (number of people)</th>
<th>R&amp;D expenditure (million US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>3,392</td>
<td>1,152</td>
</tr>
<tr>
<td>2012</td>
<td>3,901</td>
<td>1,366</td>
</tr>
<tr>
<td>2013</td>
<td>4,367</td>
<td>1,621</td>
</tr>
<tr>
<td>2014</td>
<td>4,766</td>
<td>1,875</td>
</tr>
<tr>
<td>2015</td>
<td>5,123</td>
<td>2,067</td>
</tr>
<tr>
<td>2016</td>
<td>5,423</td>
<td>2,211</td>
</tr>
<tr>
<td>2017</td>
<td>6,145</td>
<td>2,651</td>
</tr>
<tr>
<td>2018</td>
<td>6,216</td>
<td>2,850</td>
</tr>
<tr>
<td>2019</td>
<td>6,534</td>
<td>2,959</td>
</tr>
<tr>
<td>2020</td>
<td>7,404</td>
<td>3,720</td>
</tr>
<tr>
<td>2021</td>
<td>7,809</td>
<td>4,465</td>
</tr>
</tbody>
</table>

Note: Benefiting from growing demands for semiconductors, TSMC’s revenue growth is higher than the R&D expenditure growth which thus is slightly under 8.5% in 2021.
## Technology Leadership and Innovation

### CMOS Logic Technologies
- **5nm FinFET technology** led the foundry to successfully enter risk production.
- **7nm FinFET plus technology** entered volume production and led the world to deliver customer products to market in high volume.

### Specialty Technologies/Interconnect & Packaging Technologies
- **2019**
  - Completed process validation for System on Integrated Chips (SoIC®), an innovative wafer-level package technology.
  - Achieved high-volume production of Gen-4 integrated Fan-Out Package on Package (InFO-PoP) for mobile processor packaging.
  - Successful qualification of Gen-5 InFO-PoP advanced packaging technology for mobile applications and Gen-2 integrated Fan-Out on Substrate (InFO-oS) for HPC applications.
  - Developed 40nm Bipolar-CMOS-DMOS (BCD) technology-unique in the industry-offering leading edge 20-24HV devices with full compatibility to 40nm ultra-low-power platform and integration of resistive random access memory (RRAM), in turn, enabling low power, high integration, and small footprint for high-speed communication interface in mobile applications.
  - Developed 28nm embedded flash (eFlash) for high-performance mobile computing and high-performance low-leakage platforms, which achieved technical qualification for automobile electronics and micro controller units (MCU).
  - Developed the latest generation of CMOS image sensors of sub-micron pixel for mobile applications and embedded 3D metal-insulator-metal (MIM) high-density capacitors for global shutter and high dynamic-range sensor applications.
  - The world’s first 7nm automotive platform.

- **2020**
  - Accomplished process validation of SoIC® for both chip-on-wafer (CoW) and wafer-on-wafer (WoW) stacking using micron-level bonding-pitch processes with promising electrical yield and reliability results.
  - Entered high-volume manufacturing of InFO-PoP Gen-5 packaging for mobile application processors and successfully qualified InFO-PoP Gen-6 for mobile applications with enhanced thermal performance.
  - Developed InFO-oS Gen-3, which provides more chip partition integration with larger package size and higher bandwidth.
  - Expanded the 12-inch BCD technology portfolio on 90nm, 55nm and 22nm in 2020, targeting a variety of fast growing applications for mobile power management ICs with various levels of integration.
  - Achieved technical qualification of 28nm eFlash to support automobile electronics and MCU applications.
  - Entered volume production of CMOS image sensors technology, with shrunk sub-micron pixel size and sensors meeting automotive grade reliability compliance.
  - Began production of 28nm RRAM technology as a low-cost solution to support the price-sensitive IoT market.
  - Achieved technical qualification of 22nm magnetic random access memory (MRAM) technology to successfully volume-produce MRAM and received the Flash Memory Summit 2020’s Best of Show award for the most innovative AI application.

- **2021**
  - 3nm technology successfully entered risk production.
  - Qualified the fifth generation chip on wafer on substrate (CoWoS®) with record-breaking Si interposer area up to 2,500 mm², which can accommodate at least two SoC logic and eight high bandwidth memory (HBM) chiplet stacks.
  - Successfully qualified InFO-PoP Gen-7 for mobile applications with enhanced thermal performance.
  - Initiated high-volume manufacturing of InFO-oS Gen-3, which provides more chip partition integration with larger package size and higher bandwidth.
  - Expanded the 12-inch BCD technology portfolio on 90nm, 55nm, 40nm and 22nm, targeting diverse mobile power management ICs applications with different integration levels.
  - Maintained stable high yield and achieved technical qualification of 28nm eFlash for consumer electronics grade and automobile electronics grade-1 applications.
  - Achieved 13% pixel size scaling down on Quad Phase Detection (QPD) CMOS image sensors structure for the mobile imaging market.
  - Entered volume production of 28nm and 40nm RRAM as a low-cost solution for the price sensitive IoT market.
<table>
<thead>
<tr>
<th>Process Technology</th>
<th>Product Application</th>
<th>Innovation / Breakthrough</th>
<th>Customer Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>4nm Fin Field-Effect Transistor (FinFET) (N4) Technology</td>
<td>5G</td>
<td>Led the industry to start risk production for customer products</td>
<td>Led the industry to deliver advanced products</td>
</tr>
<tr>
<td>5nm FinFET Plus (N5P) Technology</td>
<td>5G</td>
<td>Led the industry to start volume production for various customers’ products</td>
<td>Introduced products with industry-leading performance and energy efficiency</td>
</tr>
<tr>
<td>6nm FinFET (N6) Technology</td>
<td>5G</td>
<td>Widely adopted in mobile, high performance computing, and consumer electronics products</td>
<td>Introduced products with industry-leading performance and energy efficiency</td>
</tr>
<tr>
<td>N12e™ Technology</td>
<td></td>
<td>Introduced new ultra-low-leakage extreme high threshold voltage (eHVT) devices</td>
<td>Introduced edge AI-products with industry-leading power efficiency to prolong their battery life</td>
</tr>
<tr>
<td>N6 Radio Frequency (N6 RF) Technology</td>
<td>5G</td>
<td>Completed development for customer product tape-outs scheduled for 2022</td>
<td>Introduced products with industry-leading RF performance and cost-effectiveness</td>
</tr>
<tr>
<td>22ULL Embedded Magnetic Random Access Memory (MRAM) Technology</td>
<td></td>
<td>IPs completed qualification for over one million cycles endurance and reflow capability</td>
<td>Introduced leading low-power-consumption MCU to extend battery life for wearables</td>
</tr>
<tr>
<td>12-inch 90nm Bipolar-CMOS-DMOS (BCD) Plus Technology</td>
<td></td>
<td>Passed qualification, helped customers complete new tape-outs and started volume production for this technology</td>
<td>Introduced products with industry-leading performance and energy efficiency</td>
</tr>
<tr>
<td>CMOS Image Sensor (CIS) Technology</td>
<td></td>
<td>Helped customers gain market leadership by introducing the world’s smallest pixel size products</td>
<td>Led the industry to deliver advanced products</td>
</tr>
<tr>
<td>TSMC-SoIC® (System on Integrated Chip) for 3D Silicon Die Stacking Technologies</td>
<td></td>
<td>Successfully demonstrated Chip on Wafer (CoW) technology with good electrical performance on heterogeneous integration of SRAM with logic on a customer product</td>
<td>Introduced products with industry-leading performance and energy efficiency</td>
</tr>
<tr>
<td>CoWoS®-S (Chip on Wafer on Substrate with Silicon Interposer) Technology</td>
<td></td>
<td>Featuring a new embedded deep trench capacitor (eDTC) option and an interposer up to three-reticle size, this technology was qualified to enable more logic and high band width memory (HBM) integration for customers' high performance computing applications</td>
<td>Led the industry to deliver advanced products</td>
</tr>
</tbody>
</table>

5G mobile communications, 4G mobile communications, High performance computing, Consumer electronics, AI-enabled Internet of Things (IoT) edge computing, True wireless stereo (TWS), WiFi, Digital TV/Set Top Box (STB) | Wireless IoT, Microcontroller (MCU), Wearable devices, Smartphones
Sustainable Products

With a sustainable mindset, TSMC is dedicated to reducing environmental impact throughout all phases of our product life cycle, from raw material manufacturing and transportation to product manufacturing, testing, and assembling. TSMC makes continuous efforts during manufacturing processes to reduce greenhouse gas emissions, save energy and resources, prevent pollution, minimize waste, and manage hazardous substances. The Company also requires and offers guidance for suppliers to join its consistent endeavors in reducing carbon footprint, water footprint, and other environmental footprints from semiconductor products. In terms of the application of products, TSMC’s chips manufactured for customers are widely adopted in a variety of fields including computers, communications, consumer electronics, industrial applications, electric vehicles, servers, and data centers. Through consistent advancement in manufacturing technologies, TSMC continues to drive progress for modern society, further contributing to global energy conservation, faster and more convenient life with mobile communication services, and enhanced health and safety for all mankind.

TSMC Product Carbon Footprint

Unit: Kg CO₂e / Wafer

<table>
<thead>
<tr>
<th>Year</th>
<th>N7-N10 wafer fabs</th>
<th>N16-N90 wafer fabs</th>
<th>8” wafer fabs average</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
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</tbody>
</table>

TSMC Product Water Footprint

Unit: M³ / Wafer

<table>
<thead>
<tr>
<th>Year</th>
<th>N7-N10 wafer fabs</th>
<th>N16-N90 wafer fabs</th>
<th>8” wafer fabs average</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td></td>
<td></td>
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<tr>
<td>2017</td>
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<tr>
<td>2020</td>
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</table>

Every three years, TSMC conducts assessments on product life cycle, water footprint, and carbon footprint. Assessment results are verified by a third party through the acquirement of ISO 14040, ISO 14046, and ISO 14067 certification. The wafer product life cycle assessment results in 2021 show that among the 16 indicators, "mineral, renewable and fossil resource depletions" and "water resource depletions" are more significant in the upstream raw material stage, accounting for approximately 75%. The other 14 indicators are mainly in the manufacturing stage, accounting for about 53-84%, and transportation accounts for less than 2%, and the impact is relatively small. Meanwhile, the product carbon and water footprints for all TSMC technology nodes are trending down. For example, the carbon footprint and water footprint per unit wafer from advanced TSMC fabs (7nm to 10nm) in 2020 dropped by 54% and 53%, respectively, from 2017. In fabs of mature process technologies including 16nm and above, the carbon footprint per unit wafer in 2020 dropped by 38% from 2014. The water footprint per unit wafer, however, increased due to fluctuations in production and the extra water resources required to reduce air pollution. For more information on TSMC water conservation measures, please refer to Water Stewardship in this report.

Environmental/Social Impact Considerations for TSMC Product Life Cycles

- Greenhouse gas reduction
- Energy and water conservation
- Waste minimization, recycle and reuse
- Pollution prevention, waste proper disposal
- Hazardous substance management
- Product life cycle / carbon footprint / water footprint assessment
- Audit and guidance on supplier performance in environmental protection
- Audit and guidance on supplier requirements in energy conservation, carbon reduction and water conservation
- Occupational safety and health management
- TSMC Supplier Code of Conduct
- Audit and guidance on suppliers’ occupational safety and health
- Assist the manufacturing of customer-designed chips for mobile computing and wireless communications
- Improve human health and safety through MEMS chip innovation
- Increase convenience of living through the application of mobile computing and wireless communication
TSMC Continues to Advance Technology to Unleash Customer Innovation

Semiconductors are transforming many key industries, including information and communication, transportation, education, health care, entertainment, and agriculture, with greater computing power and better energy efficiency through many innovations and breakthroughs. These advancements of electronics will bring more positive impact to our lives. As a trusted dedicated semiconductor foundry service provider, TSMC continues to deliver industry-leading, next-generation semiconductor technologies, as well as offers comprehensive specialty technologies and leading 3D chip stacking and packaging services, to help customers unleash different types of innovation and deliver more advanced, capable, energy-efficient, and affordable electronic products.

Collaborate with Customers to Deliver Innovative DNA Sequencing Chips that Help Quickly Identify COVID-19 Variants

One noteworthy example was our collaboration with Thermo Fisher Scientific to deliver its next-generation DNA sequencer - the Ion Torrent Genexus System - which has supported researchers in quickly identifying variants of the COVID-19 virus, including the first case of the Omicron variant, contributing enormously to the understanding of the epidemiology and controlling the pandemic.

Leveraging Thermo Fisher Scientific’s innovative super-fast sequencing technology together with TSMC’s industry-leading CMOS MEMS manufacturing technology, which greatly reduces signal noise of sensors, the Ion Torrent Genexus Integrated Sequencer offers faster, easier to use, and more flexible Next Generation Sequencing (NGS) solutions.

Collaborate with Customers to Deliver Innovative DNA Sequencing Chips that Help Quickly Identify COVID-19 Variants

The Ion Torrent Genexus Integrated Sequencer ("the sequencer") is the industry’s first NGS solution that automates the specimen-to-report workflow. Combining its Ion Torrent Genexus Purification System and intelligent design of highly sensitive assays, the whole system takes only two touch points and ten minutes of hands-on time to sequence billions of base pairs in-house with high accuracy, and deliver results within a single day, a significant improvement compared to the previous methods. The sequencer can run up to 16 COVID-19 samples simultaneously with its innovative Ion Torrent GX5 chip manufactured by TSMC, greatly reducing the cost and time. All these features enable researchers to quickly turn their focus to interpreting results, thus helping research institutes swiftly identify COVID-19 variants like Omicron and improving the ability of governments and international organizations to predict the virus’ evolution and control the pandemic effectively.

In addition to COVID-19 virus sequencing, the Ion Torrent platforms with TSMC chip manufacturing solutions also play an important role in the analysis of cancer and inherited disease testing, as well as human reproductive health. By making them easier to use, and generate results more flexibly and quickly, these more affordable, breakthrough sequencing solutions mark a big step forward for accelerating life sciences research, improving patient diagnosis, and delivering the promise of precision medicine at the community level.

In total, TSMC deployed 291 distinct process technologies, and manufactured more than 12,300 products for 535 customers in 2021 to continue to bring significant contributions to the advancement of modern society.

Customer Product

- Thermo Fisher Scientific next-generation DNA sequencer - the Ion Torrent Genexus System
- The industry’s first NGS solution that automates the specimen-to-report workflow
- Takes only two touch points and ten minutes of hands-on time to complete DNA sequencing with high accuracy and delivers genomic results within a single day
- Cost-effective as it can run up to 16 samples simultaneously with its innovative Ion Torrent GX5 chip manufactured by TSMC

Product Innovation & Breakthrough

- Enables researchers to quickly identify variants of the COVID-19 virus variants, contributing enormously to the understanding of the epidemiology and control of the pandemic
- Plays an important role in the analysis of cancer and inherited disease testing, as well as human reproductive health
- Accelerates life sciences research, improving patient diagnosis and delivering the promise of precision medicine at the community level

Impact on Society

- Provides industry-leading CMOS MEMS manufacturing technology that greatly reduces signal noises of sensors, contributing significantly to the accuracy of DNA sequencing
- Dedicates a professional engineering team to help Thermo Fisher Scientific unleash its product innovation

Thermo Fisher Scientific collaborates with TSMC to deliver its next-generation DNA sequencer, contributing enormously in supporting researchers to quickly understand the COVID-19 epidemiology and controlling the pandemic. (Photo: Courtesy of Thermo Fisher Scientific)
### Intellectual Property Protection

In accordance with TSMC’s business development and R&D plans, we have been protecting R&D innovation and operation development by way of utilizing patents and trade secrets as dual tracks protection, and strengthening Company’s Trinity of Strengths of "Technology leadership, Manufacturing excellence, and Customer trust," so as to fulfill the company’s ESG vision. To ensure technology leadership, TSMC’s IP and R&D teams work closely throughout each step from the beginning of technology planning to risk production and volume production. Such teamwork enables TSMC to build an IP portfolio for each generation’s critical innovative technology ahead of schedule, including the latest 3nm and 2nm process technologies, to ensure the Company’s technology leadership in the semiconductor industry. In manufacturing excellence, TSMC secure critical information such as capacity planning, manufacturing process management, and intelligent operation related information as trade secrets with rigorous protection measures; we also actively apply patents for manufacturing technology with strategic value to secure the Company’s competitive advantage obtained through manufacturing excellence and quality assurance. In maintaining customer trust, TSMC protects confidential information concerning the Company and its customers while maintaining strategic leadership in the global patent ranking. The effort translates into business success and ensures the freedom of TSMC’s operations around the world, and increases customer trust and strengthen partnership.

### Comprehensive Patent Management Mechanism

TSMC’s comprehensive patent management system includes: Patent management strategies, such as Global patent deployment, Exploratory invention mining, Patent portfolio expansion, and Patent exploitation and exercise; and Patent management rules, such as Tier-based IP evaluation, Patent competition rewards, Educational patent promotion, and Patent professional training.

### Management Policy for Intellectual Property

- Manage IP based on corporate business objectives
- Continue to enhance technology intellectual property portfolio
- Protect TSMC IP and respect the IP of others
- Promote simultaneous upgrade on industry technology and IP

### Management Goals for Intellectual Property

- Ensure global operations freedom
- Protect leadership in technology innovations
- Strengthen Market Competitiveness
- Establish IP Reputation in the Industry

### Strategies Implementations

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Implementations</th>
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<tr>
<td>Deployment Strategies</td>
<td>Evaluation System</td>
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<tr>
<td>Application Strategies</td>
<td>Reward System</td>
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<tr>
<td>Maintenance Strategies</td>
<td>Education and Promotion</td>
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<tr>
<td>Utilization Strategies</td>
<td>Talent Cultivation</td>
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<tr>
<td>Infringement Countermeasures</td>
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</table>
TSMC classifies the patent cases by tiers and utilizes the tier-based control mechanism to manage the entire patent application process and expand the patent family, which maximizes patent protection and resource utilization efficiency. Meanwhile, TSMC’s diverse reward system encourages innovation and improves invention quality. A wide range of IP promotion activities are launched to educate employees with better knowledge of IP laws. IP professional training programs are also available for the IP team to enhance their professional management capabilities. In 2021, TSMC held several events to promote patents. Over 2,000 TSMC employees participated in twenty-one in-house training sessions where they received assistance for inventions and proposals for valuable patents. The Patent Week event was launched along with eight seminars, the annual TSMC Patent Campaign received 3,306 invention proposals, and about 2,000 employees took part in the online quiz on patents. As of 2021, a total of 110 TSMC employees were awarded the Prolific Inventor Award for receiving more than 100 U.S. patents during their employment. In addition, 426 U.S. patents are attributed to 476 TSMC employees who just received the New Inventor Award in 2021.

In December 2021, TSMC obtained a AAA certification of the Taiwan Intellectual Property Management System (TIPS) becoming the first and only company honored with the highest-level of certification. TSMC continues to simultaneously promote upgrading of industrial technology and intellectual property rights for the vision of improving sustainability for our society.

Patent Achievements with Quality and Quantity in 2021

<table>
<thead>
<tr>
<th>Patent Applications</th>
<th>Patents Granted</th>
<th>Patent Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 8,800</td>
<td>&gt; 5,100</td>
<td>100%</td>
</tr>
</tbody>
</table>

- Over 8,800 global patents applications
- Over 5,100 global patents issued
- Highest allowance rate for U.S. patent applications at 100% among the top 10 patentees

- Ranked third among U.S. Patent Applicants, securing the best record for two consecutive years
- Ranked fourth among U.S. Patentees, setting a new company record
- Ranked first among Taiwan Patent Applicants for six consecutive years
- Ranked first among Taiwan Patent Applicants for a second year consecutively

Trade Secret Protection

TSMC is the first among the industry to introduce a trade secret registration system and the Golden Trade Secret Award. Over the past nine years, the Company has been advancing our trade secret management methods to implement intellectual property strategies, enhance the Company’s competitive advantages, encourage the vibrant company culture of innovation, and achieve TSMC’s four corporate sustainability visions.

With the trade secret registration system, TSMC keeps a record of the Company’s versatile technology inventions and innovations, a treasured component for patent mining. The system keeps technical trade secrets in two fields where TSMC enjoys competitive advantages: technology leadership and manufacturing excellence. It also supplements the patent management system at the heart of TSMC’s intellectual property management. Furthermore, advanced technology including intelligent automation and artificial intelligence are integrated into the system to enable intelligent trade secret registration management.

The Golden Trade Secret Award initiated in 2013 is another key tool serving to implement innovation. The reward system with a rigorous evaluation process identifies important registration cases and effectively facilitates an innovative culture. As of 2021, a total of 1,919 Golden Trade Secret Awards have been awarded to 5,155 employees. 25,134 employees took part in the registration of 150,172 technical or commercial trade secrets.

TSMC's Vision of Trade Secret Management Innovation

- Sustainable Operations
- Innovation Culture
- Competitive Advantage
- Intellectual Property Strategy
An Intelligent Automation (IA) and Artificial Intelligence (AI) Powered Intelligent Trade Secret Management System

Integrated with Human Resources System
TSMC’s trade secret registration system is integrated with the Company’s human resources system and automatically updates employees’ registration information in their personnel file. This serves to highlight employees’ contributions to TSMC’s technological innovations and is an important indicator for supervisors to consider for performance evaluation and promotion.

Connected to Contract Management System
TSMC’s trade secret registration system is connected to its contract management system, reminding employees involved in technology development and transfer to register the relevant trade secrets in a timely fashion.

AI Chatbot Support
TSMC’s trade secret AI chatbot works 24/7 to provide instant replies to support employee trade secret registration and protection queries, thereby enhancing employee trade secret competency.

Real Time Data Visualization Analysis
The use of advanced information analysis software in TSMC’s system to visualize trade secret registration data provides employees with real-time updates and precise data on the quantity of registrations, allowing them to understand their registration status and adjust their registration strategies more efficiently and effectively.

Technology Cluster
Systematically categorize and annotate registered cases with technology family relation to identify technology clusters.

Innovation Talent Pool
Analyze Golden Trade Secret award winners’ backgrounds to generate an “innovation talent pool” for TSMC’s talent development planning and strategic management.

First Green Trade Secret Award Celebrates Advancement in Eco-Friendly Technologies
Green manufacturing is among TSMC’s five ESG directions. To make steady progress toward the goal of Net Zero Emissions by 2050, TSMC launched the first Green Trade Secret Award in 2021. The Green Trade Secret Registration Section was also introduced to encourage inventions and innovations that can specifically contribute to increasing resource utilization efficiency and circular economy in relation to climate change, energy management, water management, waste management, and air pollution control.

Seven Key Contributions Rewarded in the Green Trade Secret Registration Section

- Facilitate energy conservation in wafer manufacturing processes
- Enhance environmental protection management
- Reduce supply chain carbon emissions
- Promote energy-saving green fab tools
- Enhance energy efficiency
- Assist supply chain with energy conservation and environmental protection innovations
- Reduce carbon emissions from wafer production

Number of Trade Secrets Registered Each Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Trade Secrets</th>
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<tbody>
<tr>
<td>2017</td>
<td>&gt;8,000</td>
</tr>
<tr>
<td>2018</td>
<td>&gt;8,800</td>
</tr>
<tr>
<td>2019</td>
<td>&gt;10,000</td>
</tr>
<tr>
<td>2020</td>
<td>&gt;12,000</td>
</tr>
<tr>
<td>2021</td>
<td>&gt;20,000</td>
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Transparent and Open Trade Secret Management System Enhances the Soft Power in Sustainable Supply Chain

To improve the IP management capabilities throughout the supply chain, TSMC launched the Supply Chain Trade Secret Management Sharing project in 2021. Initially, the pro bono service project selects strategic partners in the supply chain that shares TSMC’s vision in intellectual property protection. By sharing global IP management trends, TSMC helps its suppliers increase trade secret management effectiveness and encourages them to promote a culture of sustainable development and innovation, hence increasing technical quality and capabilities. To further extend TSMC’s influence from the supply chain to the industry chain, the Company also generously shares our know-how and practical experiences in trade secret management with the Taiwan Semiconductor Industry Association and Taiwan Association for Trade Secrets Protection, aiming to enhance the industry’s awareness and effectiveness on trade secret management.

As of the end of 2021, TSMC has helped two technology companies successfully adopt a trade secret registration system through course sharing. Three semiconductor companies completed their trade secret registration system with TSMC’s help and are currently advocating for the launch of the system in 2022. In the future, TSMC sets out to assist at least three companies per year with the establishment of a trade secret management system. To substantially contribute to the protection and management of trade secrets domestically and globally, TSMC also plans to gradually reach further outside of the semiconductor industry to encourage universal adoption of green trade secret registration and intelligent management.

Intelligent Precision Manufacturing

As the world’s leading semiconductor foundry service provider, TSMC has achieved intelligent manufacturing through three phases. In the first phase, TSMC converted to a fully automated manufacturing model that covers manufacturing equipment, material transfer, and wafer processing dispatch. Secondly, with big data for wafer production and the integrated data platform completed, the Company successfully established an intelligent manufacturing expert knowledge database thanks to the introduction of machine learning and high-performance computing. In the third phase, we focused our efforts on artificial intelligence and digital transformation. Following the introduction of Digital Transformation and Digitized Fabs in 2020, TSMC remained committed to the work process automation in 2021. The Company has leveraged the artificial intelligent technology and intelligent robotic assistance to make improvements in three primary fields including intelligent scheduling and dispatching, equipment and people efficiency enhancement, and product quality optimization, resulting in abnormal lots process efficiency by 30 to 40%.

In terms of intelligent scheduling and dispatching, TSMC continues to expand the capacity of GIGAFAB®, each of which involves hundreds of millions of combinations. Having considered all production constraints, TSMC strives to improve our AI algorithm to get the best scheduling result in less than three minutes. While processing nearly 10 million dispatching orders per day, the AI algorithm also ensures that the capacity of the Intelligent Automated Material Handling System (AMHS) can meet customer’s expectations and delivery dates. To improve manufacturing equipment and people efficiency, TSMC has developed an AI Process Control Platform to ensure the consistency of tool matching and process stability in manufacturing. Over 1,000 AI models have been deployed to import and process the big data in manufacturing and quickly generate optimal parameters. By offering diversified product efficacy, TSMC is able to meet customer-requested specifications. When it comes to optimizing product quality, the smallest defect can result in inferior products due to the increasingly reduced line width in advanced manufacturing processes. To ensure prime product quality for our customers, TSMC has adopted intelligent auto-detect classification, which can enhance the accuracy of visual inspection through Deep Learning.

Looking to the future, TSMC will continue to implement digital transformation to enable rapid technology transfer among fabs and talent collaboration across different regions and time zones via cloud tools. The Company will strive to create a global manufacturing model that injects innovation vitality into the semiconductor manufacturing industry and become customers’ long-term trusted partner.
Development History of Intelligent Precision Manufacturing

- **2000**: Launch the world’s first fully automated 12-inch GIGAFAB®
  - Nearly 100% automated production

- **2012**: Build an exclusive internal machine learning platform to accelerate the technology development process and expand the scope of application
  - Cross-field talent cultivation

- **2015**: Integrate highly repetitive and low-efficiency tasks
  - Workforce productivity at mature-node fabs improved by 10-15%

- **2017**: Integrate the automated manufacturing system with machine learning to effectively increase productivity, flexibility, and quality while maximizing cost-effectiveness and accelerating innovation

- **2012**: Establish big data platform
  - Build an exclusive internal machine learning platform to accelerate the technology development process and expand the scope of application
  - Cross-field talent cultivation

- **2015**: Initiate the plan of intelligent fab
  - Cross-field talent cultivation

- **2017**: Adopt machine learning for manufacturing systems
  - Cross-field talent cultivation

- **2020**: Digital transformation
  - Work process automation, artificial intelligent judgment, and AI robotic assistance

- **2021**: Intelligent platform
  - Cross-fab remote collaboration
  - Technology transfer among fabs

**Automation**
- Equipment automation
- Material handling automation
- Wafer dispatch automation

**Intelligent manufacturing phase 1**
- Equipment automation
- Material handling automation
- Wafer dispatch automation

**Intelligent manufacturing phase 2**
- Integrated data platform
- High-performance computing
- Wafer big data

**Intelligent manufacturing phase 3**
- Expert knowledge database
- Artificial intelligence
- AR/MR remote collaboration and support
- Digital fab intelligent platform

- Intelligent scheduling and dispatching
- Equipment productivity optimization
- People productivity improvement
- Product quality optimization

**Intelligent manufacturing**
- Cross-fab remote collaboration
- Technology transfer among fabs
Open Innovation Platform®

TSMC’s Open Innovation Platform® (OIP) empowers continuous innovation for a comprehensive design infrastructure in the semiconductor design community by infusing TSMC process technologies in its OIP partners’ products & services. Since the inception of OIP in 2008, TSMC has been collaborating with its alliance partners to offer continuous innovative design enablement solutions, which provide the foundations to reinforce TSMC’s core values of Manufacturing Excellence, Technology Leadership, and Customer Trust, for the ultimate goal of supporting customer success.

In 2021, TSMC held its online Technology Symposium and OIP Ecosystem Forum to stay connected with worldwide customers and ecosystem partners, marking the tenth anniversary of its annual OIP Ecosystem Forum since 2011. TSMC and OIP partners have shared collaborated ecosystem solutions through DTCO to support the optimization of Power, Performance and Area (PPA) in customer products. The Company has worked closely with these OIP partners to expand its libraries and silicon IP portfolio to more than 40,000 IP titles and provide more than 38,000 technology files and over 2,600 process design kits (PDKs), from 0.5-micron to 3-nanometer, to support customer designs using TSMC’s industry-leading process technology for the applications of High Performance Computing, Mobile, Automotive, and IoT. These combined efforts have helped customers accelerate innovation for their differentiated products that fuel consistent growth in global technology development.

“Through the industry’s most comprehensive and vibrant ecosystem, TSMC has been able to help our customers achieve next-generation silicon design and deliver best possible outcomes with our OIP partners’ collaborative power.”

Dr. L.C. Lu
TSMC Fellow and Vice President of Design and Technology Platform at TSMC
**Comprehensive Ecosystem Design Solutions**

During the OIP Ecosystem Forum in 2021, TSMC introduced a comprehensive set of the latest design solutions jointly with its OIP ecosystem partners for platforms of Mobile, High Performance Computing (HPC), Automotive and IoT, as well as TSMC 3DFabric™.

To recognize the outstanding support and collaborative achievements of our OIP ecosystem partners, TSMC announced the 2021 OIP Partner of the Year Awards to celebrate excellence in accelerating semiconductor innovation.

- **Enhanced voltage scaling** to support 0.4V operation with corresponding design solutions for IoT devices to further reduce power consumption

- **Low Vdd design solutions** are ready for customer adoption

- **16nm, 7nm, 5nm**
  - 16nm and 7nm Automotive Design Enablement Platform (ADEP) with design solutions and ecosystem are ready and have been applied to real customer production chips
  - 5nm ADEP is under development to support comprehensive automotive design solutions and ecosystem

- **3nm (N3)**
  - Continue with full-node scaling trend to offer the most advanced foundry technology in both PPA and transistor technology
  - Complete platform support for both mobile and HPC applications, as well as the offering of design solutions through DTCO
  - Complete certifications for EDA tools

- **4nm (N4)**
  - Facilitate easy migration from N5 for customers to obtain the benefit of chip area reduction
  - Complete certification for EDA tools

- **5nm (N5)**
  - Complete certification for EDA tools
  - Design solutions and ecosystem are ready and have been applied to real customer production chips

- **6nm, 16nm, 22nm, 28nm, 40nm, 0.13um**
  - Comprehensive RF technology portfolio, from 0.13um to 6nm, are available to support general RF, millimeter Wave (mmWave), and RF frontend products
  - RF enhancements for 16nm mmWave and 6nm sub-6GHz are available to achieve DTCO
  - Collaborate with EDA partners to provide robust RF PDKs and design flows to customers
Industry-Academia Collaboration Enhancement

TSMC values universities as important partners. Over the years, TSMC has been dedicating resources to universities in Taiwan and overseas under a mechanism for sustained interaction in three primary aspects: industry-academia research collaboration, course collaboration, and career coaching. Through university programs, TSMC encourages more professors to join the research front of cutting-edge semiconductor technologies focusing on the most advanced semiconductor devices, manufacturing processes, materials technologies, semiconductor manufacturing, engineering science, and specialty technologies that are related to the electronics industry. On the other hand, TSMC makes continuous efforts to cultivate technical talent for the semiconductor industry by offering a wide variety of channels for students to obtain knowledge and practical experience. By 2030, the estimated number of students involved in TSMC’s global university programs will reach 8,000.

Since the launch of university research centers in 2013, TSMC has been working with university professors on advancing semiconductor research and industrial technology development. In 2021, TSMC dedicated over NT$462 million to various research projects and industry-academia collaboration programs in 28 universities in Taiwan and overseas. Furthermore, the TSMC University Shuttle Program enables university professors and students globally to verify the performance of their designs in application. TSMC also strongly supports the establishment of the National Academies for Key Fields of Research in 2021. In the following decade, TSMC will allocate funds to support forward-looking semiconductor research and faculty recruitment.

Meanwhile, TSMC actively gets involved in talent cultivation through course collaboration with domestic universities. Since 2019, over 2,200 students have registered to join the semiconductor programs. To shorten the industry-academia gap, TSMC took the initiative to invite industry partners and TSMC managers to collaborate with professors on course design and lecturing. In 2021, TSMC university program launched three courses on intelligent manufacturing, semiconductor manufacturing processes and tools, and big data and cloud applications. A total of 1,200 students have been benefited from the courses.

In cultivating talent through career coaching, TSMC offers students opportunities to learn more about the semiconductor industry through a variety of programs including the summer internship program, contests, workshops, and career seminars. A total of 2,700 students have been benefited from the courses.

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<tr>
<th>TSMC University Collaboration Programs</th>
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<tr>
<td><strong>Industry-Academia Collaboration</strong></td>
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<tr>
<td>- University Research Centers</td>
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<tr>
<td>- Industry-Academia Joint Development Project</td>
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<tr>
<td>- University Shuttle Program</td>
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<tr>
<td>- National Academy for Key Fields of Research</td>
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<tr>
<td><strong>Course Collaboration</strong></td>
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<tr>
<td>- Semiconductor Programs</td>
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<tr>
<td>- Information Technology</td>
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<tr>
<td>- Talent Cultivation in Partnership with Major Universities</td>
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<tr>
<td><strong>Career Guidance</strong></td>
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<tr>
<td>- TSMC Ph.D. Scholarship</td>
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<tr>
<td>- TSMC x Microsoft Careerhack</td>
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</tbody>
</table>

TSMC University Collaboration Programs

- **Total investment (NT$)**: 462.76 million
- **Number of beneficiaries**: >6,500
- **Number of domestic and overseas universities involved**: 28
- **Number of courses given**: 16
Industry-Academia Collaboration

- **University Research Centers**
  TSMC has established research centers in collaboration with National Yang-Ming Chiao Tung University, National Taiwan University, National Cheng Kung University, and National Tsing Hua University. Research funds are allocated to encourage professors and students to actively propose groundbreaking semiconductor research projects aimed at developing leading-edge technologies in semiconductor devices, materials, manufacturing processes, and IC design. Meanwhile, the research centers are talent incubators for the semiconductor industry. By 2021, over 230 professors and 3,200 top students specializing in electronics, physics, chemistry, chemical engineering, and mechanical engineering have been involved in the research endeavors at the research centers. In addition, TSMC allocated budgets to collaborate with ten top universities overseas through university research centers, forming international research partnerships to carry out specific research projects.

- **Industry-Academia Joint Development Project**
  Through collaboration programs at universities, TSMC encourages professors to focus on the study of the most advanced technologies pertinent to the semiconductor industry. Students interested in the field are offered opportunities to learn from practical experience, hence joining the workforce in the semiconductor industry in the future. In 2021, a total of 125 professors at nine universities in Taiwan and 16 universities overseas initiated 118 industry-academia joint development projects with TSMC. The projects have yielded over 190 U.S. patent applications.

- **University Shuttle Program**
  In 2021, TSMC’s University Shuttle Program helped professors and students of 15 top universities globally turn IC designs into actual chips, solidifying theories and research discussed in class into tangible results. The research projects in 2021 focused on 5G and wireless transmission, high-speed wired transmission technology, biotechnology, artificial intelligence, memory applications, the Internet of Things and energy-saving technologies, automotive electronics, and radar applications for drones. In 2021, a total of 100 academic papers were published, 27 of which were in reputable academic journals like the IEEE Journal of Solid-State Circuits (JSSC) and the IEEE International Conference on Solid-State Circuits (ISSCC), a prestigious conference known as the "Olympics of IC design."

- **National Academy for Key Fields of Research**
  In 2021, in the wake of the enactment of the National Key Fields Industry-University Cooperation and Skilled Personnel Training Act by the Ministry of Education in Taiwan, TSMC was committed to supporting the establishment of national academies at National Yang-Ming Chiao Tung University, National Taiwan University, National Cheng Kung University, and National Tsing Hua University, bridging corporate resources with the research capacity of universities. In the following decade, TSMC will sponsor at least NT$100 million annually to support forward-looking research on semiconductor technologies, faculty recruitment, and scholarships for outstanding students. TSMC strives to provide incentives to attract talent to join the semiconductor industry and to cultivate high-end research talent in Taiwan.

The summer internship at TSMC helped me learn about the work content and environment in advance. In the future, I can achieve further personal growth and figure out how to apply academic skills to the work upon joining the workforce.

Chun-Ge Lai
Graduate student at the Institute of Communications Engineering, National Yang-Ming Chiao Tung University

When I first joined the fab, everything was new to me. With the senior colleagues’ guidance and help, I began to learn from different parts to manufacturing tools cleaning. It was very rewarding.

Jia-Cheng Hua
Student of the Department of Electrical Engineering, National Chin-Yi University of Technology

TSMC University Shuttle Program gave me a chance to take part in the manufacturing processes comprehensively from IC design to layout, simulation, and tape-out. I was able to experience the actual industrial practices in advance.

Kang-Lun Chiu
Ph. D. student at the Institute of Electronics, National Yang-Ming Chiao Tung University
Course Collaboration

- Semiconductor Programs

TSMC launched the TSMC Semiconductor Program at National Tsing Hua University in 2019 aiming to raise the competencies of semiconductor talent in Taiwan and attract more brilliant students to join the industry. Following the launch, TSMC extended the program to other universities in 2020. In 2021, the semiconductor programs were also launched in National Central University and National Sun Yat-sen University. The programs encompass five primary fields of study: Device/Integration, Process/Module, Equipment Engineering, Intelligent Manufacturing, and Forward-looking IC Design. Over 2,200 students have registered to take courses under the programs.

In addition to launching semiconductor programs, TSMC also dispatched employees to give lessons for two courses, "Advanced Manufacturing Technologies and Tools" and "Intelligent Manufacturing," in partnership with several universities. The courses aim to equip students with knowledge of the most advanced manufacturing tools and industry practices, hence bridging the gap between education and industry practices. In 2021, a total of 750 students completed the course.

Career Guidance

- TSMC Ph.D. Scholarship

Fostering Ph.D.-level scientific research talent is key to the sustained advancement of the semiconductor industry. TSMC launched a Ph.D. Scholarship in 2020 as an incentive for elite students to pursue doctoral degrees in scientific specialties related to the semiconductor field. The program consists of three pillars: scholarship, mentorship, and internship. An annual subsidy of NT$500,000 thousand issued for a maximum of five years offers Ph.D. students financial support. After attaining the degree, they can directly join the semiconductor industry or become an educator to cultivate more talents. As of 2021, a total of 49 Ph.D. students have benefited from the scholarship.

- TSMC x Microsoft Careerhack

Amidst the tide of globalization and digital technology, information technology talent is now the most valuable resource to the enhancement of industry competitiveness. To expand the pool of existing talent and cultivate more outstanding semiconductor talent, TSMC has been the pioneer in Taiwan's domestic semiconductor industry to collaborate with Microsoft Taiwan in launching the Careerhack competition. First introduced in 2020, the Careerhack competition is a combination of in-person workshops, technical training courses, and a hackathon. It enables the semiconductor industry, software industry, and academia to interact and exchange with each other on the topic of industry practices and new information technologies. In an effort to bridge the industry and academia, the winner and runner-up enjoy priority in job interviews or internship opportunities. A total of over 900 students participated in the competition in 2021. Due to the COVID-19 pandemic, nearly 100 students who were shortlisted for the finals joined the activity online.

Case Study

TSMC STEM for High School Girls Program

To encourage high school girls to pursue science, technology, engineering, and mathematics, TSMC Education and Culture Foundation launched TSMC Journeys of Female Scientist Lectures for the second consecutive year. In 2021, TSMC held career lectures titled Lean in and Attain a Better Version of Yourself aimed at inspiring students' interests in STEM as they learn about the unique strengths and capabilities of women as well as in-depth information on TSMC and the semiconductor industry. More than 700 participants joined the journey. In 2022, TSMC will continue to hold a series of events under the TSMC Journeys of Female Scientist Lectures to encourage female students to choose STEM as their career goals, strengthening female presence in the technology sector in the long run.

TSMC holds career lectures titled Lean in and Attain a Better Version of Yourself for high school girls to learn about the semiconductor industry.
## Strategies & 2030 Goals

### Enhance Quality Culture

- **Promote continuous improvement programs to enhance the internal quality culture**
- **Encourage local suppliers to participate in Taiwan Continuous Improvement Award (TCIA) to strengthen quality culture and competitiveness within TSMC’s local supply chain**

<table>
<thead>
<tr>
<th>2021 Achievements</th>
<th>2022 Targets</th>
<th>2022 Target Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generate up to NT$20 billion in value from improvement projects and involve outstanding projects in TCIA</td>
<td>Generate NT$13 billion in value from improvement projects and involve at least 6 outstanding projects in TCIA</td>
<td>Generated more than NT$12 billion in value from improvement projects</td>
</tr>
<tr>
<td>Encourage 100% of major local raw materials suppliers and 75% back-end packaging materials suppliers to participate in TCIA with 60% of them to advance to the finals Note 1</td>
<td>Encourage 100% major local raw materials suppliers and 60% back-end packaging materials suppliers to participate in TCIA, with 20% of them to advance to the finals</td>
<td>Involved 8 outstanding projects in TCIA</td>
</tr>
<tr>
<td>64% of major local raw materials suppliers to participate in TCIA</td>
<td>67% of back-end packaging materials suppliers to participate in TCIA</td>
<td>64% of major local raw materials suppliers to participate in TCIA</td>
</tr>
<tr>
<td>16% of raw materials and backend packaging material suppliers advanced to the finals of TCIA</td>
<td></td>
<td>16% of raw materials and backend packaging material suppliers advanced to the finals of TCIA</td>
</tr>
</tbody>
</table>

### Improve Quality Capability

- **Develop innovative testing methods to enhance product, technology, and production quality**

<table>
<thead>
<tr>
<th>2021 Achievements</th>
<th>2022 Target Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a cumulative of 3,000 innovative testing methods for quality and reliability</td>
<td>Developed 254 innovative testing methods for quality and reliability</td>
</tr>
</tbody>
</table>

**Notes:**

1. Major local raw materials suppliers are those that meet at least one of the following conditions: 1. accounted for 85% of purchasing expenses; 2. single-source supplier; 3. ongoing orders in each quarter

2. Due to the impact of the COVID-19 pandemic, some suppliers were unable to join the competition but still participated online as part of the audience

3. The Quality and Reliability Lab launches innovative testing methods each year to continue bolstering TSMC’s quality capabilities; this indicator is added in 2021 and will be tracked annually
**Improve Quality Capability**

Develop hazardous substance analysis capabilities in chemical laboratories to ensure occupational safety and health (OHS)\(^4\)

Strengthen management for hazardous substances to improve green manufacturing

- Develop the ability to analyze 100% of CMR (Carcinogenic, Mutagenic, and Reprotoxic) substances and help the suppliers that supply materials with potential risks develop the same capabilities\(^5\)

- N-methylpyrrolidone (NMP) 100% replacement (Base year: 2016)

- No process involves Perfluoroalkyl Substances (PFASs) that have more than 4 carbons

- Reduce the use of NMP by 95%

- VisEra will collaborate with suppliers for the Photoresist Substitute Program to replace 50% of PFHxA substances

**2021 Achievements**

- Developed the ability to analyze 100% of CMR substances and help 100% of the suppliers that supply materials with potential risks to develop the same capabilities

- Reduced the use of NMP by 75%

- VisEra has selected substitutes for all photoresists containing PFHxA-related substances (total 41) and launched production line testing

**Realize Quality Application**

Complete quality and reliability certification for advanced process technologies, specialty process technologies, and wafer-level package process in the design and development stage based on the Company’s technology roadmap

- Complete quality and reliability certification for advanced process technologies, specialty process technologies, and wafer-level package process in the design and development stage based on the Company’s technology roadmap

- Complete quality and reliability certification for advanced process technologies, specialty process technologies, and wafer-level package process per the R&D targets

- Completed quality and reliability certification for 4nm process technology, 40nm embedded RRAM IP, and larger scale InFo and CoWoS\(^\circ\) technologies

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\(^{4}\): In response to developments in process technologies, all materials with potential risks supplied by new suppliers must pass CMR testing

\(^{5}\): The definition of “major suppliers” in the 2020 report is different from “major local raw material suppliers”. To avoid confusion, the term was renamed as “the suppliers that supply materials with potential risks” in 2021

\(^{6}\): In 2021, TSMC strengthened management strategies, requiring the suppliers that supply materials with potential risks to list CMR substances as mandatory items in Certificate of Analysis

\(^{7}\): Reduction of NMP usage is limited to facilities in Taiwan. Since the substitute chemicals affected product yield in several sites, formula testing and adjustments were necessary. TSMC subsidiaries will proceed with chemical substitution in 2021
TSMC is dedicated to delivering outstanding semiconductor foundry services to our customer’s full satisfaction. The Quality and Reliability Organization spotlights quality standards of all operational aspects and collaborates with internal organizations to continue advancing the quality management system as we strive toward the goal of zero defects. To bolster advanced quality analysis capabilities, TSMC has established Quality and Reliability Laboratories across the globe. Starting from technology development to product application, TSMC has adapted quality control measures such as material characteristics analysis, micropollutant analysis, and failure analysis for returned products, establishing a highly efficient defense system for product quality control.

In response to growing and rapidly evolving demands, in 2021, TSMC’s Quality and Reliability Laboratories launched a total of 254 innovative testing methods to facilitate technology development and ensure meeting commitments to customers for device characteristics, process yield, and product reliability. In 2021, the Quality and Reliability Organization set up a new advanced chemical laboratory to enhance continuous quality monitoring of raw materials. This helped R&D organizations make significant material innovations and provide services to enhance the technologies in the industry supply chain. TSMC also assisted suppliers to upgrade technologies and transform them into the semiconductor supply chain, thereby cultivating a more comprehensive local industry chain.

To better allocate resources and increase operational efficiency, the Quality and Reliability Organization established the AI Team in 2021 to accelerate digital transformation in areas of raw materials management, statistical process control (SPC), metrology, and laboratory analysis through integrating inter-departmental resources and centralized management. Use of machine learning to identify correlation has enabled intelligent quality defense and remote management of manufacturing quality, which helped overcome the impact of the COVID-19 pandemic and make seamless quality control across worldwide fab network a reality, further injecting drive for sustainable development in TSMC.

### Quality Management System

<table>
<thead>
<tr>
<th>Design Service</th>
<th>Tech Development</th>
<th>Mask Making</th>
<th>Wafer Manufacturing</th>
<th>Backend Service</th>
<th>Customer Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>• IP/Library Development Quality Assurance</td>
<td>• SPICE Model Management</td>
<td>• Remote Mask DB Check</td>
<td>• Incoming Quality Control NEW</td>
<td>• Process Quality Control</td>
<td>• Customer Claim Management</td>
</tr>
<tr>
<td>• Design Kits Deliverables Management</td>
<td>• Process Technology Development Management</td>
<td>• iTapeOut</td>
<td>• Advanced Process Control</td>
<td>• Package Reliability Monitor</td>
<td>• Annual Customer Satisfaction Survey</td>
</tr>
<tr>
<td></td>
<td>• Built-in Reliability Test</td>
<td>• eJobView</td>
<td>• EQ Real Time Monitor</td>
<td>• Process Reliability Monitor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Process Release Standard</td>
<td>• Mask Defect Inspection</td>
<td>• Process Reliability Monitor</td>
<td>• Wafer Acceptance Test</td>
<td></td>
</tr>
</tbody>
</table>

**Quality Tools Application**
- Potential Failure Mode & Effect Analysis
- Control Plan
- Statistical Process Control
- Measurement System Analysis
- Continuous Improvement - 8Ds

**Potential Failure Mode & Effect Analysis**
- Change Control Platform
- Failure Analysis
- Supplier/Subcontractor Quality Management

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Note 1: Established a dedicated laboratory of incoming quality control for photoresist materials, and greatly increased analysis efficiency with division of labor based on specialization

Note 2: Optimized parameters for wafer acceptance tests, increasing testing accuracy through more accurate control over changes in electric currents

Note 3: Formulated a comprehensive recycling process and guideline for cushion materials to mitigate materials shortages and realize a circular economy
Achievements of Cross-Functional Collaborations with the Quality and Reliability Organization in 2021

Quality Culture Enhancement

Quality is the cornerstone of sustainable development for TSMC. To advance product quality and increase customer satisfaction, TSMC is committed to cultivating a quality culture that engages all TSMC employees, encourages colleagues to strive for excellence, drives cross-departmental observation and learning, and enhances their innovative and problem-solving abilities. In 2021, the Quality and Reliability Organization held company-wide conferences such as the Total Quality Excellence and Innovation Conference (TQE) and quality audit symposium to keep sparking innovation in quality systems and tools.

In 2021, TSMC enters its 29th year of hosting the TQE conference. In pursuit of perfection, TSMC launched the Quality Academy platform in September 2021 where integrated the existing Case Sharing with Quality Activity, Quality Tool, Quality Publication, Quality Expert sections to facilitate discussion on quality among employees, bolster quality awareness, and inspire more innovative ideas. As of December 2021, the Quality Academy has received over 22,000 views. In 2021, employees submitted over 8,500 improvement projects and generated over NT$12 billion in value. To encourage employees to take initiative in preventing abnormal quality or outdated operations, TSMC launched a new theme - STOP & FIX - in 2019 to collect and share improvement projects every year. By the end of 2021, the STOP & FIX projects have generated over NT$5.4 billion in value.

<table>
<thead>
<tr>
<th>STOP &amp; FIX Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
</tr>
<tr>
<td>STOP &amp; FIX Projects</td>
</tr>
<tr>
<td>Value Generation (NT$)</td>
</tr>
<tr>
<td>Total Projects</td>
</tr>
</tbody>
</table>

Total Estimated Value (NT$) $5,449,886,835
Using STOP & FIX to Strengthen Mechanisms for Handling Unusual Events and Reduce IC Chip Defect Rate

In 2019, TSMC launched a new theme - STOP & FIX - to encourage employees to take initiative in preventing abnormal quality or outdated operations. TSMC continues to promote a quality culture where all employees can "uncover unusual events and correct accordingly" through educational training, posters, competitions, and sharing of outstanding improvement projects.

In 2021, the Testing Operation Division found that IC chips were being damaged by testing equipment. Upon closer inspection, the Division realized that damages were caused by unusual standby times and electrical leaks in the circuit board. They brought up the strategy of "strengthening software and defending hardware" and used self-developed software to force the circuit board to discharge power before and after testing. They also introduced a self-developed high-voltage detection system to monitor high voltages to ensure that there are no electrical leaks in the circuit board. In the meanwhile, abnormal detection items were added to the equipment maintenance checklist to ensure electrical leakages. Their efforts successfully increased testing quality, reduced IC chip defect rate, and ensured customers were able to launch products on time. The project received first place at the 2021 TQE conference for the STOP & FIX category.

Case Study

Company-Wide Quality Culture

<table>
<thead>
<tr>
<th>Average of outstanding projects recognized each year</th>
<th>Projects recognized as of 2021</th>
<th>Cash prize</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>&gt;6,700</td>
<td>NT$11.8M</td>
</tr>
</tbody>
</table>

Note: In 2021, TSMC introduced a new platform - the Quality Academy - that integrates Case Sharing, Quality Activity, Quality Tool, Quality Publication, Quality Expert sections.
2021 TQE-Winning Cases

**Production Capacity Improvement**
Increase capacity for CIS products

1. Develop capacitor components with FinFET structures to expand surface area
2. Improve the linearity of capacitors

Achieved 20% capacity utilization after volume production

**Quality Improvement**
Increase yield for photosensitive products

1. Optimize wafer grinding and reduce light spots in videos and images
2. Improve process parameters to reduce damages to silicon wafers and white pixel noise

65% Reduced light spots by 5X in videos and images
19% Reduced white pixel noise
30% Increased yield

**Cost and Production Support**
Adjust machine programs to increase gas utilization rate

1. Innovative three-step process to strengthen performance of gas cleaning
2. Optimize program parameters for the season layer and reduce uneven gas distribution
3. Health management and early warnings for machines

Reduced electricity bills by 65%
Reduced micropollutants by 60%
Estimated Benefit (NT$) $360 million

**Process and Efficiency Improvement**
Advanced Packaging Technology and Service billing forecast process re-engineering

1. Develop algorithms to make appropriate inferences
2. Build quick forecasting processes to reduce operational times
3. Build an integrated billing forecast platform

Boosted data accuracy, data integrity
83% Slashed process time
Estimated Benefit/year (NT$) $5 million

**ESH and Green Corporation**
Reduce hydrogen chloride levels in air pollution and reduce the frequency of repairs for machines

1. Upgrade machines that produce high-concentration hydrogen chloride such as enhancing hydrogen chloride removal capabilities by installing atomizing nozzles on local scrubbers
2. Connect the facility monitoring system with the cell phone alert system to achieve real-time monitoring

88% Reduced hydrogen chloride
571 hours Saved working hours/month
$17 million Estimated Benefit/year (NT$)

**Assistant Engineers**
Mitigate clogged pipelines to increase machine repair efficiency

1. Remove the bent sections of the pipelines, preserve the straight sections, and ensure consistent diameter sizes
2. Ensure that the pipelines are non-stick and do not clog by using opening holes and anti-corrosive coatings
3. Reorganize the exhaust gas emissions systems to make it safer and more convenient for repair personnel to enter and exit

0% Reduced pipeline flow alerts
40% Reduced machine repair times
$1.2 million Estimated Benefit/year (NT$)

**STOP & FIX**
The great leap forward of testing quality

1. Develop software to discharge residual energy
2. Abnormal detection items were added to the equipment maintenance checklist

0% IC chip defect rate lowered to 0%
$87.7 million Estimated Benefit/year (NT$)

**Outstanding Proposals from Direct Labor**
Perfect the management system for wafer cassettes

1. Develop management reports to ensure the gate-keeping mechanism is systematic
2. Automatic inspection mechanism ensures manual operations are correct
3. Establish a monitoring system to regularly replace cassettes to avoid exceeding the cleaning deadline

0% Contamination in wafer cassettes
$50 million Estimated Benefit/year (NT$)
In addition to cross-functional learning within the Company, TSMC is also a long-term participant of the Taiwan Continuous Improvement Award (TCIA). By participating in the competition, TSMC exchanges practical knowledge on quality improvement with peers from other industries and facilitates the advancement of all local industries. Employees are also encouraged to learn from other companies, which sparks innovation in problem-solving. In 2021, TSMC received five Gold Awards, three Silver Awards, and one Best Innovation Award at TCIA. In addition to Operations Organization, the Corporate IT Organization, as a first-time participant, also received the Gold Award at TCIA, a reflection that quality culture at TSMC is carried out in the daily works of administrative and management organizations.

In line with our beliefs of strengthening the supply chain, TSMC also encourages suppliers to participate in TCIA. In compliance with COVID-19 prevention measures, some suppliers were unable to join the TCIA competition in 2021. The Quality and Reliability Organization promptly adjusted the strategies and ensured that 64% of major local raw materials suppliers and 67% of backend packaging materials suppliers were able to participate in the competition. Suppliers that were unable to join the competition were invited to attend online sharing sessions after the competition where TSMC quality experts provided consultations remotely. In addition to encouraging suppliers to join the TCIA competition, TSMC also helps suppliers with their submissions. In 2021, a total of 16% of TSMC suppliers advanced to the finals and won three Gold Awards, two Silver Awards, and four Bronze Awards. TSMC has announced the list of winners on its corporate website to encourage suppliers to continue innovating and advancing their practices.

To deepen our sustainability impact, in 2021, the Quality and Reliability Organization launched two interactive courses - “Problem Solving Using 8D & 3L5W” and “A Guide to Process Change Notification” - and two common courses - “Proper Procedure for New Material or Supplier Introduction” and “Basic Quality Tools” on the TSMC Supplier Sustainability Academy to share our quality tools and methodology with suppliers and the public for free, sowing the seeds of positive change.
In 2021, TSMC participates in the TCIA competition to much success.

### 2021 TCIA-TSMC Winning Cases

<table>
<thead>
<tr>
<th>Gold Award &amp; Best Innovation Award</th>
<th>In pursuit of perfect quality of automotive chips!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased yield</td>
<td>9.4%</td>
</tr>
<tr>
<td>Decreased use of sulfuric acid and waste generation</td>
<td>610 million Estimated Benefit/year (NT$)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gold Award</th>
<th>Advanced logistics enhance production capacity of 8-inch wafers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased total transmission throughput</td>
<td>83.8%</td>
</tr>
<tr>
<td>Reduced cross-fab transfer time</td>
<td>38.8%</td>
</tr>
<tr>
<td>Benefited people/day</td>
<td>5,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gold Award</th>
<th>Breaking the bottleneck in production capacity by increasing oxide deposition productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased daily productivity</td>
<td>8.1%</td>
</tr>
<tr>
<td>Estimated Benefit/year (NT$)</td>
<td>79 million</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gold Award</th>
<th>Expand diffusion process capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased capacity</td>
<td>14.4%</td>
</tr>
<tr>
<td>Conserved energy</td>
<td>75%</td>
</tr>
<tr>
<td>Estimated Benefit/year (NT$)</td>
<td>250 million</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gold Award</th>
<th>Automatically compile financial reports for more efficient strategic analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased operational efficiency</td>
<td>94%</td>
</tr>
<tr>
<td>Increased the number of completed customer income statements</td>
<td>150x</td>
</tr>
<tr>
<td>Estimated Benefit/year (NT$)</td>
<td>20 million</td>
</tr>
</tbody>
</table>

### Percentage of Major Local Raw Materials Suppliers Participating in TCIA

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Participation Rate (%)</th>
<th>Target Participation Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>2015</td>
<td>26</td>
<td>40</td>
</tr>
<tr>
<td>2016</td>
<td>43</td>
<td>60</td>
</tr>
<tr>
<td>2017</td>
<td>74</td>
<td>80</td>
</tr>
<tr>
<td>2018</td>
<td>94</td>
<td>100</td>
</tr>
<tr>
<td>2019</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>2020</td>
<td>79</td>
<td>100</td>
</tr>
<tr>
<td>2021</td>
<td>64</td>
<td>100</td>
</tr>
</tbody>
</table>

In 2021, TSMC participates in the TCIA competition to much success.
Quality Capability Improvement

With the goal of satisfying customers, TSMC’s quality and reliability laboratories have been dedicated to perfecting, researching, and developing testing methods. In 2021, the Laboratories proposed 254 innovative testing methods while ensuring that device characteristics, process yield, and product reliability all comply with customer demands and standards. From device, packaging to system level, TSMC continues to minimize quality risks in customer products and maintains strict monitoring of raw material stability and safety acquired from the upstream or through recycling, aiming to realize our vision of being a green, safe, and healthy workplace. In addition to applying quality capabilities to innovate our primary business, TSMC is also dedicated to developing energy-saving testing methods for quality and reliability. In 2021, the Quality and Reliability Organization made progress on wafer-level electro-migration testing method, and achieved shorter testing times and reduced energy consumption by optimizing qualification processes. The methods have been gradually introduced to mature manufacturing process for pilot testing. In 2022, TSMC will continue innovating to realize more eco-friendly testing methods.

TSMC Quality and Reliability Laboratory Network

Shanghai/ Nanjing
- Chemical Lab
- Scanning Electron Microscope (SEM) Lab
- Surface Analysis (SA) Lab
- Transmission Electron Microscope (TEM) Lab

Taichung
- Chemical Lab
- Transmission Electron Microscope (TEM) Lab
- Reliability Analysis (RA) Lab

Tainan
- Chemical Lab
- Transmission Electron Microscope (TEM) Lab
- Special Gas Lab
- Surface Analysis (SA) Lab

Hsinchu
- Advanced Materials Analytic Center (AMAC)
- Chemical Lab
- Scanning Electron Microscope (SEM) Lab
- Transmission Electron Microscope (TEM) Lab
- Reliability Analysis (RA) Lab
- Surface Analysis (SA) Lab
- Advanced Failure Analysis (AFA) Lab
- Process Failure Analysis (PEFA) Lab
- Package & Assembly Failure Analysis (PAFA) Lab
- Product Failure Analysis (PFA) Lab

Washington State
- Chemical Lab
- Transmission Electron Microscope (TEM) Lab

TSMC Quality and Reliability Laboratory Network

- Component fingerprint of photoresist materials
- Mechanical simulation of packaging materials

Sustainable Strategies from the Quality and Reliability Laboratory

- Chemical Lab
- Accelerate replacement rate of hazardous substances and help new TSMC facilities with designs for discharging Substances of Very High Concerns (SVHC)

- Advanced Materials Analytic Center (AMAC)
- Develop the ability to analyze 100% of CMR substances and facilitate source management in suppliers
- Evaluate and select technologies and materials for advanced processes

- Surface Analysis (SA) Lab
- Develop processes with low energy consumption and high capacity; increase utilization efficiency of EUV energy
- Select eco-friendly materials and replace in processes

- Reliability Analysis (RA) Lab
- Complete reliability certification for the latest advanced processes, special processes, and wafer-level packaging processes

- Advanced Failure Analysis (AFA) Lab
- Accelerate advanced process development, yield improvement and products DPPM reduction learning curve (reliability point of view)/
- Apply for domestic and foreign patents through innovation and invention

- Process Failure Analysis (PEFA) Lab
- Package & Assembly Failure Analysis (PAFA) Lab
- Product Failure Analysis (PFA) Lab
- Continue to promote industry-academia cooperation programs
To continue tracking where materials with potential risks end up, TSMC has established mechanisms for screening CMR materials and continued building 100% inspection capability in 2021. In addition to self-management, TSMC incorporated hazardous substance management regulations in TSMC Supplier Sustainability Standard, and provided training, auditing and guidance to suppliers to enhance their hazardous substance management capabilities. In 2021, TSMC strengthened management strategies, requiring the suppliers that supply materials with potential risks to list CMR substances as mandatory items in Certificate of Analysis, enabling TSMC to achieve target ahead of time. Furthermore, the Quality and Reliability Organization assisted VisEra in setting up inspection capability for hazardous substances to enhance corresponding monitoring and control capability. At the same time, the Quality and Reliability Organization provided state of art material analysis and applied the best knowledge management method to assist the capacity expansion of new raw material production lines or new suppliers with quality fundamental to optimize the balance between quality and capacity. In 2021, TSMC actively promoted CMR screening technologies in major international conferences to strengthen the overall supply chain control capability. Meanwhile, TSMC again collaborated with the Semiconductor Equipment and Materials International (SEMI) to host the third Strategic Materials Conference in Taiwan to share the win-win strategy for technology and sustainable development in TSMC and industrial wide topics to elevate the competitiveness of the local supply chain.

The Quality and Reliability Organization also worked with manufacture teams for the recycling and reuse of chemical acids and successfully achieved several impurity improvements in recycling chemical acids, and enabled several recycling chemicals to achieve the quality level for electronic grade in 2021. In 2022, the Quality and Reliability Organization will continue sharing its technical knowledge to assist chemical suppliers in developing further recycling and reuse projects and will work with operations to implement engineering validation for recycling chemicals to achieve TSMC’s quality requirements and the sustainable goal of friendly environment.

Management of Hazardous Substances
TSMC has always aimed to avoid entirely or minimize the use of hazardous substances that may affect human health or pollute the environment. The Corporate Environment, Safety and Health Division and fab Industrial Safety and Environmental Protection Department are responsible for ensuring that the storage, transportation, use, and disposal of any hazardous materials that cannot be replaced are compliant with regulations as well as TSMC’s own ESH requirements to guarantee the health and safety of all workers, prevent pollution to the environment, and ensure that products do not contain restricted hazardous substances. TSMC complies with all ESH regulations during the production stage. All products produced for customers are also in full compliance with the EU Restriction of Hazardous Substances Directive (EU RoHS), EU Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals (EU REACH), other international regulations, and customer regulations on restricted hazardous substances.
Perfluoroalkyl substances (PFASs) break down very slowly in the environment and may damage the human body. As such, in 2006, TSMC started a Photoresist Substitute Program targeting PFASs as well as long-chain PFASs. By early 2021, photoresists used in TSMC processes were completely free from PFASs with eight or more perfluorocarbon chains. Existing and developing advanced processes were also completely free from PFASs with more than four perfluorocarbon chains. Only some of the photoresists used by VisEra still contain PFASs with more than four perfluorocarbon chains, which is the six-carbon perfluorohexanoic acid (PFHxA). Starting from 2020, VisEra has started to evaluate replacements for 41 photoresists containing PFHxA. In 2021, VisEra has completed formulating the Photoresists containing PFHxA Substitute Program.

PDCA for Hazardous Substance Management

- **Plan**
  - Identify and register in compliance with regulations and customer demands
    - Each month, the Corporate ESH Division identifies regulations on hazardous substances management in Taiwan and beyond as well as customer demands to inform related units to take the necessary measures through the internal electronic notification system.
  - List of banned or restricted substances
    - Compile according to regulations, customer requirements, or TSMC requirements.
  - Programs to remove or reduce hazardous substances
    - Formulate related plans in compliance with regulations, customer requirements, or TSMC requirements.

- **Do**
  - Review of new materials
    - All new chemical materials must undergo ESH Review Processes for New Chemicals to confirm the new chemical complies with regulations related to ESH and banned/restricted substances before R&D evaluations.
  - Carry out programs to remove or reduce hazardous substances
    - Raw material hazardous substance test
      - Suppliers are required to provide proof of compliance with hazardous substance specification test report issued by ISO 17025-certified labs. TSMC may take random samples to ensure the compliance of raw materials.
    - Product hazard substance test
      - Sample and send main products to an external qualified lab for the test each year.

- **Check**
  - Raw material hazardous substance test
  - Product hazard substance test
  - Management review

- **Act**
  - Raw material hazardous substance test
  - Product hazard substance test
  - Management review

Key Tasks in 2021

- The EU added 14 SVHCs to REACH and customers have amended management measures for hazardous substances. TSMC complies with all new requirements.
- The Restricted Substance List now includes 5 types of hazardous substances banned by the US Environmental Protection Administration’s Toxic Substances Control Act for persistence, bioaccumulation, and toxicity.
- VisEra has completed formulating the Photoresists containing PFHxA Substitute Program.

Work Items

- Reviewed a total of 212 new chemicals, of which 198 were approved. Of the 14 new chemicals that failed to pass reviews, one was rejected for containing restricted substances, three were rejected because TSMC was unable to treat resulting wastewater, and ten were rejected because suppliers were unable to provide necessary information.
- TSMC facilities in Taiwan continued to reduce NMP usage in processes; in 2021, NMP usage decreased by 75% from 2016.
- Sampling test for 89 raw materials; all test results are in line with TSMC regulations.
- Completed hazardous substance tests for main products produced for customers; results showed compliance with related regulations, customer and TSMC’s specifications.
- TSMC was unable to meet NMP reduction targets due to necessary process adjustments but was able to meet targets for supplier audit & follow-up, new material reviews, and compliance in incoming material inspection.
Quality Application in Practice

During the technology development stage, the Quality and Reliability Organization helps customers design superior product reliability into their products. In 2021, the Quality and Reliability Organization worked with R&D in advanced logic, specialty, and advanced packaging technologies throughout development and qualification stages. For advanced logic technology, the Quality and Reliability Organization in 2021 successfully certified technology quality and reliability for risk production of 4nm FinFET, an enhanced version from 5nm; for specialty technologies, completed IP qualification of 40nm embedded RRAM (resistive random access memory). In high voltage technologies, the Quality and Reliability Organization qualified second generation 0.5µm 650V GaN. In addition, TSMC’s advanced packaging solutions enabled system improvement of the wafer level process by integrating the frontend wafer process and the backend chip packaging. In 2021, the Quality and Reliability Organization successfully qualified larger scale InFO and CoWoS® technologies for HPC products and to provide better system level integration through heterogeneous chip package interaction.

Stepping into the production stage, the Quality and Reliability Organization collaborates with Operations to establish real-time defense systems with advanced statistical methods and quality tools to ensure consistent quality products. In 2021, TSMC had no major product recalls. Meanwhile, TSMC continued to optimize quality control mechanisms and increase tool level detection rate by 18%, allowing it to uncover product defects as early as possible. By strengthening the accuracy of defense systems, TSMC has improved its in-house detection rate by 16%. This helps prevent quality events affecting customers and mitigate environmental impacts by reducing resource consumption for wafer remanufacturing and waste from end-of-life product.

Development Focus of Quality Application Value Chain

The effectiveness of TSMC’s quality management system is verified by third-party audit in compliance with IATF 16949:2016 and IECQ QC 080000:2017 requirements. In 2021, TSMC’s four backend fabs also acquired the certification of American National Standards Institute ANSI/ESD S20.20 standard for the first time. TSMC has also collaborated with our customers on quality and reliability testing to reduce product defect rates and mitigate risks of product returns. In 2021, the Quality and Reliability Organization provided diverse courses to customers, sharing technical knowledges of dynamic voltage stress, burn-in, and screening, aiming to help global customers enhance competencies in quality control as well as strengthen trust and partnerships with TSMC.

Grounded in the consistent dedication to quality culture, innovative quality capabilities, and quality applications that align with market demands, TSMC collaborates closely with customers and suppliers to achieve excellence in product and service quality.

- Collaborate with R&D to help customers design superior product reliability into their products to accelerate time to market
- Work with Operations to develop real-time defense systems to reduce product defects and prevent quality events
- Offer diverse courses to help customers develop comprehensive knowledge in quality management and work together on quality and reliability testing

Customers

- Conduct training, auditing, and consultations to develop CMR substance inspection capabilities
- Share technological knowledge to help transform suppliers into a semiconductor supply chain
- Encourage suppliers to participate in TCIA to improve supply chain’s sustainability

Raw Material Suppliers

- Collaborate with R&D to help customers design superior product reliability into their products to accelerate time to market
- Work with Operations to develop real-time defense systems to reduce product defects and prevent quality events
- Offer diverse courses to help customers develop comprehensive knowledge in quality management and work together on quality and reliability testing

Quality and Reliability Organization

- Conduct training, auditing, and consultations to develop CMR substance inspection capabilities
- Share technological knowledge to help transform suppliers into a semiconductor supply chain
- Encourage suppliers to participate in TCIA to improve supply chain’s sustainability

An Innovation Pioneer A Responsible Purchaser A Practitioner of Green Power An Admired Employer Power to Change Society
Capitalize on Quality Tools to Increase Product Yield and Innovate CIS Applications

With smartphones trending towards having multiple cameras, high resolutions, HD, the CMOS image sensors (CIS) market is also growing and developing. TSMC has spent many years dedicated to developing scaling high-res image sensors. In 2020, Fab 14A successfully mass produced super-resolution, small pixel photosensors. Since then, Fab 14A has gone on, in 2021, to use CIS theory analyses and quality tools such as Pareto Charts, System Diagrams, Design of Experiments, and Matrix Diagrams to uncover methods for optimizing process parameters, parts replacement, and adjusting maintenance times. Fab 14A continues to overcome challenges in new processes and has been able to ultimately improve yield by 30%. The IC chip’s photography functions have also been drastically improved and can now achieve ultra-high resolutions, giving our customers a time-to-market advantage in the CIS market.

**Case Study**

5x Wafer grinding process was drastically improved and ridges on the edge have been drastically reduced, which reduces the source of wafer edge deficiencies and drastically reduces light spots by 5x in videos and images.

19% Deep reactive-ion etching was drastically improved and TSMC was able to adjust process parameters and reduce damages to silicon wafers through design of experiments, successfully reducing white noise by 19%.

30% Reduced light spots and white noises, with yield increased by 30%.
## Customer Relations

### Strategies & 2030 Goals

<table>
<thead>
<tr>
<th>Precise Response</th>
<th>2022 Targets</th>
<th>2021 Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain a customer satisfaction rating of over 90%</td>
<td>Maintain a customer satisfaction rating of over 90%</td>
<td>Customer satisfaction rating of 83.9%&lt;sup&gt;Note 2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Reduce cases of problematic engineering quality to 50% of the level in 2019 for every million 12-inch wafers shipped&lt;sup&gt;Note 1&lt;/sup&gt;</td>
<td>Reduce cases of problematic engineering quality to 55% of the level in 2019 for every million 12-inch wafers shipped</td>
<td>Reduced cases of problematic engineering quality to 55% of the level in 2019 for every million 12-inch wafers shipped</td>
</tr>
</tbody>
</table>

### Virtual Fab

| Provide >1,200 wafer manufacturing and process technologies and >170 advanced packaging technologies in line with the TSMC technology roadmap | Provide >932 wafer manufacturing and process technologies and >107 advanced packaging technologies in line with the TSMC technology roadmap | Provided >894 wafer manufacturing and process technologies and >98 advanced packaging technologies in line with the TSMC technology roadmap |
| Pass customer product information security audit with no major flaws           | Pass customer product information security audit with no major flaws           | Provided customer product information security audit with no major flaws |

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**Note 1:** In 2021, cases of problematic engineering quality have been reduced to meet the 2030 Goal. As such, the 2030 Goal for reducing cases of problematic engineering quality or poor reliability has been adjusted from 60% to 50%.

**Note 2:** Please refer to the section on "Precise Response" for reasons that the goals were not achieved.
Customer trust is a core value integral to TSMC. We believe that TSMC’s competitiveness hinges on how competitive our customers are and in becoming a long-term and trusted partner that is critical to their success. To create an optimal customer service experience, TSMC has assembled a committed professional team, which is a dedicated coordination liaison, to provide timely assistance in design support, mask making, wafer manufacturing, and backend services. TSMC also commits to protecting proprietary customer information to the highest standards to develop long-term partnerships with our customers and collaborate with them to gain time-to-market advantage.

**Precise Response**

TSMC cares about customer relationships and believes that customer feedback and opinions are important foundations for advancing customer relationships. To better satisfy customer demands, the TSMC customer service team learns about customer’s future expectations and feedback on the performance of business behavior, technology, quality, yield, design support, manufacturing, customer relations, and customer services through various channels including irregular meetings, quarterly reviews, and annual satisfaction surveys. By regularly reviewing, analyzing, and proposing corresponding measures for improvement, TSMC has developed a comprehensive protocol for responding to customer demands that continues to deepen our relationship with customers. In 2021, TSMC held more than 1,200 online and face-to-face meetings with over 90 customers, 99 quarterly reviews with 27 customers, and annual satisfaction surveys with nearly 200 customers.

In 2021, customer satisfaction dipped to a relative low point. The primary reason for the drop in customer satisfaction was the surging demand for electronic products due to the COVID-19 pandemic and acceleration in digital transformation, meaning that production capacities for customers were not fully

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**Various Communication Channels for Customers**

<table>
<thead>
<tr>
<th>Various Communication Channels</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irregular Meeting Customer Meeting</td>
<td>Customer Needs</td>
</tr>
<tr>
<td>Quarterly Review Customer Meeting</td>
<td>Technology, Quality, Yield Rate, Design, Manufacturing, and Customer Service</td>
</tr>
<tr>
<td>Annually Annual Customer Satisfaction Survey</td>
<td>Behavior, Impression and Execution</td>
</tr>
</tbody>
</table>

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Customer trust proactively provides integrated services. The Virtual fab proactively provides integrated services. Precise response to customers' needs. Comprehensive & timely information via TSMC-Online. Close collaboration with customers. Neutral third-party consulting firms conduct interviews or online surveys.
Annual Customer Satisfaction

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Customer Satisfaction (%)</th>
<th>Customer Service Satisfaction Ratios of the Quarterly Business Review (QBR)(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>93</td>
<td>71</td>
</tr>
<tr>
<td>2019</td>
<td>92.5</td>
<td>81</td>
</tr>
<tr>
<td>2020</td>
<td>92.8</td>
<td>84</td>
</tr>
<tr>
<td>2021</td>
<td>83.9</td>
<td>72</td>
</tr>
</tbody>
</table>

Note: Figures for the 2021 customer satisfaction ratings are from TSMC fabs in Taiwan and its overseas subsidiaries.

Cases of Problematic Engineering Quality for Every Million Wafers Shipped

<table>
<thead>
<tr>
<th>Year</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases of Problematic Engineering Quality</td>
<td>100%</td>
<td>70%</td>
<td>55%</td>
</tr>
</tbody>
</table>

Virtual Fab

Real-time interaction and information exchange as well as comprehensive protection for proprietary customer information are critical for TSMC to build customer trust. For real-time interaction and information, customers have 24-7 access to important information on design, engineering, and logistics through TSMC-Online™. It also allows customers to create customized reports according to their management requirements to increase wafer management efficiency. In 2021, further enhance our customer’s user experience, we continued to optimize the system framework for TSMC-Online™ to ensure the system is able to update while simultaneously offering uninterrupted service.

For design integration, TSMC-Online™ delivers the latest, comprehensive, and accurate information during the design stage to help customers quickly complete product designs; for engineering
Create a Win-Win Situation with Digital Transformation of Customer Audits

To meet the demands of terminal customers, auditing is an essential step before volume production. Due to the impact of COVID-19 pandemic, customers are no longer able to take international business trips. To ensure our customer’s products can receive immediate certification, TSMC has overcome the time and space limits of traditional on-site audits. In 2020, the Company capitalized on digital transformation to develop a virtual auditing technology that complies with TSMC safety standards and proprietary information protection and uses different forms of remote conferencing and sharing tools to serve as a customer auditing platform. Even if customers are unable to travel to TSMC in time for audits, our virtual auditing technology can ensure that the audit will be conducted on schedule for volume production.

In 2021, TSMC further introduced a "mixed reality" technology to enhance virtual auditing technologies. In addition to the existing remote information sharing, customers can also use a head-mounted wearable device that will display the insides of TSMC fabs for "real-time production line audits," achieving the same effects as traditional on-site audits but saving our customers the energy and time consumed by long-distance travels. This can further effectively reduce time to volume production and help us earn our customers’ trust.

As of the end of 2021, TSMC and customers have successfully completed 30 remote audits, accelerating time-to-market of new products and creating a win-win partnership.
TSMC Delivers Unrivalled Manufacturing Flexibility

2021 total managed capacity reached over 13M 12-inch wafer equivalents

<table>
<thead>
<tr>
<th>Technologies</th>
<th>2021</th>
<th>2020</th>
<th>2019</th>
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<tbody>
<tr>
<td></td>
<td>291</td>
<td>281</td>
<td>272</td>
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<table>
<thead>
<tr>
<th>Customers</th>
<th>2021</th>
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<tr>
<td></td>
<td>535</td>
<td>510</td>
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<table>
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<tr>
<th>Products</th>
<th>2021</th>
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<th>2019</th>
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<tr>
<td></td>
<td>12,302</td>
<td>11,617</td>
<td>10,761</td>
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<table>
<thead>
<tr>
<th>Fab 2</th>
<th>Fab 3</th>
<th>Fab 5</th>
<th>Fab 6</th>
<th>Fab 8</th>
<th>Fab 10</th>
<th>Fab 11</th>
<th>Fab 12</th>
<th>Fab 14</th>
<th>Fab 15</th>
<th>Fab 16</th>
<th>Fab 18</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>69</td>
<td>24</td>
<td>61</td>
<td>43</td>
<td>44</td>
<td>22</td>
<td>73</td>
<td>77</td>
<td>29</td>
<td>5</td>
<td>5</td>
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<tr>
<td>69</td>
<td>143</td>
<td>58</td>
<td>155</td>
<td>157</td>
<td>166</td>
<td>40</td>
<td>143</td>
<td>250</td>
<td>159</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>1,078</td>
<td>1,424</td>
<td>284</td>
<td>1,185</td>
<td>1,838</td>
<td>1,536</td>
<td>436</td>
<td>1,070</td>
<td>2,259</td>
<td>1,304</td>
<td>44</td>
<td>39</td>
</tr>
</tbody>
</table>
A Responsible Purchaser

TSMC strives for sustainable management and responsible purchases. We ask our suppliers to make advancements in the following areas: technology, quality, delivery, environmental protection, human rights, safety, and health. We also take climate risks into consideration, actively trying to strengthen our climate resilience so that we can develop a low-carbon, sustainable semiconductor supply chain.

100% Committed to the responsible sourcing of minerals and purchases only conflict-free minerals

340 GWh Cumulative energy conserved by suppliers with TSMC’s support

>200,000 Certificates awarded for completing the annual TSMC Supplier Sustainability Academy program
Sustainable Supply Chain

Strategies & 2030 Goals

Improve Sustainability Risk Management
TSMC requires all suppliers to adhere to the TSMC Supplier Code of Conduct, taking actions to improve labor rights, safety and health, environmental protection, business ethics, and the efficiency of the management system; the Company has also taken the initiative to help suppliers continue to improve their core capabilities to reduce risks of disruption to business operations.

Ensure 100% Tier 1 suppliers complete the Sustainability Management Self-Assessment Questionnaire
Note 2: Ensure 60 critical suppliers receive Code of Conduct audits by RBA-certified agencies every 3 years
Note 3: Ensure 980 critical high-risk suppliers receive S.H.A.R.P. audits at a pace of 100 suppliers a year

Supplier due diligence on responsible mineral sourcing: 100% of the minerals used are sourced responsibly
Audit a cumulative total of 30 suppliers (≥3 suppliers per year) for due diligence on responsible mineral sourcing
Continue to diversify production plant sites and assess new suppliers; develop 145 multi-source supply solutions (Base year: 2018)
Ensure a cumulative total of 3145 local raw materials suppliers receive consultation on process advancement and quality improvement (Base year: 2016)
Ensure a cumulative total of 300 raw materials suppliers participate in the annual emergency response drill (Base year: 2016)

2022 Targets

- Ensure 100% Tier 1 suppliers complete the Sustainability Management Self-Assessment Questionnaire
- Ensure 60 critical suppliers receive third-party audits
- Ensure 100 critical high-risk suppliers receive S.H.A.R.P. audits
- Supplier due diligence on responsible mineral sourcing: 100% of the minerals used are sourced responsibly
- Complete audits on ≥3 suppliers for due diligence on responsible mineral sourcing
- Develop 130 multi-source supply solutions for raw materials
- Ensure ten local raw material suppliers receive consultation, reaching a cumulative total of 65 suppliers
- Ensure a cumulative total of 150 suppliers participate in the annual emergency response drill

2021 Achievements

- 100% Tier 1 suppliers completed the Sustainability Management Self-Assessment Questionnaire
- A total of 36 critical suppliers completed third party supplier audits and annual completion rate is 60%
- Completed S.H.A.R.P. Audits of 86 Critical Suppliers
- 100% responsible mineral sourcing
- Completed audits on ≥3 suppliers for due diligence on responsible mineral sourcing
- Developed 109 multi-source supply solutions
- Ten suppliers received consultation on process advancement and quality improvement, reaching a cumulative total of 55 suppliers
- 21 raw materials suppliers participated in the annual emergency response drill, reaching a cumulative total of 132 suppliers

Note 1: In 2021, TSMC adjusted the strategies for this subject from Sustainability Risk Management and Local Procurement Optimization to Improving Sustainability Risk Management and Promoting Green and Low-carbon Supply Chains to follow the Company’s direction for supply chain management.
Note 2: Tier 1 suppliers: Suppliers trading directly with TSMC with more than three orders per year, with order amount exceeding NT$5 million; In 2021, 1,065 suppliers met the criteria.
Note 3: Critical suppliers: Suppliers accounting for top 85% of the purchasing expenses or of a single source of purchase, or suppliers recognized as critical by TSMC after assessing multiple risk indicators, including the suppliers’ market share, inventory levels, and other characteristics; set annual goal as 60 suppliers site.
Note 4: Due to safety measures put in place to prevent the spread of COVID-19, TSMC lowered the target number for on-site audits in 2021.
Note 5: Mainly focused on suppliers based in Taiwan.
<table>
<thead>
<tr>
<th>Strategies &amp; 2030 Goals</th>
<th>2022 Targets</th>
<th>2021 Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure a cumulative total of 1,500 suppliers participate in the Environmental Safety and Health (ESH) training program (Base year: 2016)</td>
<td>Ensure a cumulative total of 900 suppliers participate in the ESH training program</td>
<td>A cumulative total of 759 suppliers participated in the ESH training program</td>
</tr>
<tr>
<td>Ensure 100% critical high-risk suppliers complete Safety and Health consultation</td>
<td>Ensure 100% critical high-risk suppliers complete Safety and Health consultation</td>
<td>Target: 680 in total</td>
</tr>
<tr>
<td><strong>Promote Green and Low-carbon Supply Chains</strong></td>
<td><strong>Source 60.5% of indirect raw materials locally</strong></td>
<td><strong>Sourced 60.4% of indirect raw materials locally</strong></td>
</tr>
<tr>
<td></td>
<td>Source 50% of spare parts locally</td>
<td>Target: 60.5% / 50%</td>
</tr>
<tr>
<td></td>
<td>Reduce supplier energy consumption by a cumulative total of 430 GWh</td>
<td><strong>Reduced supplier energy consumption by a cumulative total of 340 GWh</strong></td>
</tr>
<tr>
<td></td>
<td>Reduce supplier water consumption by a cumulative total of 20 million metric tons</td>
<td><strong>Reduced supplier water consumption by a cumulative total of 19.71 million metric tons</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Ensure 55% high energy consumption suppliers receive ISO 14064 Greenhouse Gas Emission verification</strong></td>
<td><strong>51% high energy consumption suppliers received ISO 14064 Greenhouse Gas Emission verification</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Reduce waste production among local major suppliers by 35%</strong></td>
<td><strong>Reduce waste production among local major suppliers by 32%</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Sourced 60.4% of indirect raw materials locally</strong></td>
<td><strong>Sourced 46.4% of spare parts locally</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Target: 60.5% / 50%</strong></td>
<td><strong>Target: 60.5% / 50%</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Reduced supplier energy consumption by a cumulative total of 340 GWh</strong></td>
<td><strong>Target: 320 GWh</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Reduced supplier water consumption by a cumulative total of 19.71 million metric tons</strong></td>
<td><strong>Target: 4.5 million metric tons</strong></td>
</tr>
<tr>
<td></td>
<td><strong>51% high energy consumption suppliers received ISO 14064 Greenhouse Gas Emission verification</strong></td>
<td><strong>Target: 50%</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Reduce waste production among local major suppliers by 32%</strong></td>
<td><strong>Reduce waste production per unit among local major suppliers by 31%</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Target: 30.4%</strong></td>
<td><strong>Target: 30.4%</strong></td>
</tr>
</tbody>
</table>

**Note 6**: In 2020, TSMC audited 33 critical high-risk suppliers, among which five suppliers scored below 70 for Safety and Health and had received consultation in 2021, having made necessary improvements and passing follow-up assessments.

**Note 7**: For indirect raw materials and spare parts, the proportion of advanced packaging increased, the quality requirement became stricter. Currently, suppliers in Taiwan have not been able to meet TSMC requirements, and since TSMC had to increase inventory levels due to COVID-19, it missed the annual local sourcing target.

**Note 8**: Mainly focused on suppliers based in Taiwan, which is the main operation region of TSMC.

**Note 9**: For indirect raw materials and spare parts, since the proportion of advanced packaging increased, the quality requirement became stricter. Currently, suppliers in Taiwan have not been able to meet TSMC requirements. Since TSMC had to increase their inventory levels due to COVID-19, it missed the annual local sourcing target.

**Note 10**: Definition for high energy consumption suppliers: Suppliers in Taiwan whose energy consumption at a single site exceeds 5 GWh per year.

**Note 11**: ISO 14064-1 is one of the sub-standards of ISO 14064. In 2021, it will be described as the official name of the ISO 14064 series of standards.

**Note 12**: Focusing on suppliers in Taiwan producing 80% of the waste in raw materials.

Calculation formula: A/(A+B)(%); A: waste reduced by the factory in the underlying month (tons); B: waste produced by the factory in the underlying month (metric tons).
TSMC is dedicated to building an environmentally and socially responsible operation model, exerting influence towards sustainability as the global leader of the semiconductor industry. In 2021, TSMC restructured the guidelines for Supplier Sustainability Management to respond to current trends in supply chain sustainability and previous years’ management experience, changing to two main strategies - Improving Sustainability Risk Management and Promoting Green and Low-carbon Supply Chains. The Company continued to require suppliers to adhere to the TSMC Supplier Code of Conduct in operations, taking actions to improve safety in the workplace, dignity for labor, ethical operations, and comprehensive protection of the environment, and continued to reduce risks of disruption to business operations. Additionally, to answer the calls for green manufacturing, TSMC has taken the initiative to reduce the environmental impact of supply chains, prompting suppliers to set reduction targets for power and water consumption, waste generation, and carbon emission. TSMC aims to mitigate climate change’s impact on society and lay the foundations for sustainable development for supply chains.

Improve Sustainability Risk Management

Improve Measures of Sustainability Management

TSMC worked closely with supplier partners through the four guiding principles: Compliance guidance, Risk Assessment, Audit Participation, and Continuous Improvement, to urge suppliers to continue improving, commit to values, and take the initiative to promote sustainable practices to their upstream suppliers. To prompt common growth among supplier partners worldwide, TSMC established the global responsible supply chain management platform, Supply Online 360. It serves as an integrated communication channel with all suppliers, propelling tangible change with virtual data monitoring and bringing sustainable semiconductor supply chain practices into reality.

Four Guiding Principles of Sustainable Supply Chain Management

**Compliance Guidance**

Suppliers comply with the TSMC Supplier Code of Conduct and extend the scope of management to their upstream suppliers.

**Risk Assessment**

Suppliers determine the level of Code compliance via Sustainability Self-Assessment Questionnaire or Sustainability Risk Assessment by the TSMC Team.

**Audit Participation**

Critical Suppliers are audited by RBA-certified third-party institutions or the TSMC Supplier Healthiness Assessment Rectification Program team, conducting on-site audits.

**Continuous Improvement**

Suppliers implement improvement measures according to the audit results and receive relevant consultation or follow-up evaluation.
Code Compliance

As a member of the Responsible Business Alliance (RBA), TSMC sets up its Supplier Code of Conduct according to RBA's Code of Conduct. TSMC requires Tier 1 suppliers to comply with the Code of Conduct while encouraging them to ask their upstream suppliers, contractors, and service providers to adopt the same Code in practices and management. New suppliers must sign the TSMC Supplier Code of Conduct to be eligible for partnership.

Risk Assessment

To have an in-depth understanding of the current status of supply chain development and potential risks, TSMC conducts a three-phase risk assessment in supplier management, identifying the improvement measures required for the suppliers according to supplier classification.

First, TSMC investigates and analyzes all suppliers' Self-Assessment Questionnaire (SAQ) results to evaluate their performance on sustainability. In 2021, Tier 1 Suppliers in Taiwan, where TSMC headquarters is located, completed 1,065 SAQs, in which the five major categories of the TSMC Supplier Code of Conduct are covered. The assessment results show that, for the Labor category, suppliers often lack management rules for the work environment. For Health, Safety, and Environmental Standards, 7% of the suppliers did not conduct identification for risks of operations in confined spaces and environmental protection laws. For the Code of Business Ethics, SAQ results show that 17% of the suppliers do not have a management system for business ethics.

TSMC categorizes critical suppliers according to indicators such as procurement expenses, product criticality, and business relations with TSMC and determines the risk levels based on SAQ results and supplier records of priority incidents. Using the two dimensions, criticality and risk levels, TSMC establishes a Supplier Risk Matrix that classifies suppliers annually. Such classification is then used in determining exclusive management measures to effectively understand the supply chain's overall risk.

In 2021, TSMC included two new categories in the SAQ for raw materials suppliers, Supply Chain Risk Management, and Process Reliability. Suppliers that scored below 70 have to receive on-site audits to ensure the supply chain's resilience.

### Critical High-risk Suppliers Assessment Process

**Tier 1 Suppliers**

Suppliers trading directly with TSMC with more than three orders per year, with order amount exceeding NT$5 million.

**Critical Suppliers**

Suppliers accounting for the top 85% of the purchasing expenses or of a single-source purchase, or suppliers recognized as critical by TSMC after assessing multiple risk indicators, including the suppliers' market share, inventory levels, and other characteristics.

**Critical High-risk Suppliers**

On-site Audits

**High-risk Suppliers**

Determined according to SAQ results and priority incident records.

Critical Suppliers

- Suppliers accounting for the top 85% of the purchasing expenses or of a single-source purchase, or suppliers recognized as critical by TSMC after assessing multiple risk indicators, including the suppliers’ market share, inventory levels, and other characteristics.

Critical High-risk Suppliers

On-site Audits

High-risk Suppliers

Determined according to SAQ results and priority incident records.
Audit Participation and Continuous Improvement

After identifying risks using the Supplier Risk Matrix, TSMC conducts on-site or remote audits focusing on the six major categories: Supply Chain Risks, Quality and Reliability, Environmental Safety and Health, Fire Safety System, Labor Ethics, and Management System, which was added in 2021, to enhance supply chain resilience. In the audits, TSMC looks for potential risks and ways to improve them, requires suppliers to propose improvement plans and schedules, and assigns the TSMC S.H.A.R.P. Team to follow up on improvements regularly. The Company constantly updates benchmark practices in the six major categories and prompts the continuous improvement of the supply chain by conducting topical consultations and follow-up evaluations. In 2021, TSMC conducted 122 on-site audits of Critical High-risk Suppliers, including 15 follow-up evaluations, to properly track the risk status of the suppliers and improve their operational sustainability. By doing so, TSMC can ensure stable materials supply and services, provide a safe and healthy work environment for workers, and reduce environmental and social impact.

TSMC Supplier Risk Matrix, Classification and Management Measures

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>!</td>
<td>!</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>Medium</td>
<td>!</td>
<td>!</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>Low</td>
<td>!</td>
<td>!</td>
<td>✅</td>
<td>✅</td>
</tr>
</tbody>
</table>

- Signing the TSMC Supplier Code of Conduct
- Risk Assessment via SAQ
- Completion of the TSMC Supplier Code of Conduct Program of the Supplier Sustainability Academy
- On-site Audit

TSMC Consultation Measures

- Monthly review on whether supplier/contractor employees work at TSMC sites for seven consecutive days

Records of supplier/contractor employees working at TSMC sites for seven consecutive days

Problems and Challenges

- Labor Ethics
- Environmental Safety and Health
- Management System
- Supply Chain Risks
- Quality and Reliability
- Environmental Safety and Health
- Fire Safety System

TSMC Supplier Healthiness Assessment Rectification Program

2018: 33, 0
2019: 46, 0
2020: 24, 35
2021: 36, 86

The new online badge application system automatically generates monthly reports; any workers working for seven consecutive days would trigger an alert requiring adjustments.
2021 Critical High-risk Suppliers Audits and Areas for Improvement

### On-site Audit

**Auditor:** TSMC S.H.A.R.P. Team and RBA-certified Third-Party Institutions

**Suppliers Audited:** Factories of 122 Critical High-risk Suppliers, including 15 follow-up evaluations

**Audit Methods:** 97 on-site audits and 25 remote audits conducted virtually

### Distribution of the Audit Violations

**Priority Violations:** 12%

**Minor Violations:** 43%

**Major Violations:** 45%

#### Supply Chain Risks

- **Priority Violations:** 28%
- **Minor Violations:** 56%
- **Major Violations:** 16%

#### Quality and Reliability

- **Priority Violations:** 24%
- **Minor Violations:** 58%
- **Major Violations:** 18%

#### Environmental Safety and Health

- **Priority Violations:** 12%
- **Minor Violations:** 43%
- **Major Violations:** 45%

#### Fire Safety System

- **Priority Violations:** 6%
- **Minor Violations:** 35%
- **Major Violations:** 59%

#### Labor Ethics

- **Priority Violations:** 2%
- **Minor Violations:** 39%
- **Major Violations:** 59%

#### Management System

- **Priority Violations:** 0%
- **Minor Violations:** 36%
- **Major Violations:** 64%

### Key Achievements of TSMC Suppliers

- Established and verified multiple sources for raw materials and finished goods, and have safety stock in place
- Established water and electricity backup plans and complied with the plans in advance when building new production lines
- Created a management system of critical parts and components
- Established a regular equipment maintenance mechanism and a maintenance log
- Established a platform for documenting abnormalities, properly investigate the root causes and prevent recurrences
- Established a stormwater drainage protocol and ensure separated sewage for rainwater and wastewater
- Established a control list and protocols for ergonomic risks
- Established a compliant list of confined spaces
- Assigned designated fire safety management personnel
- Implemented management rules for hot work and fire safety equipment
- Set up complaint fire safety equipment and received expert consultation from TSMC
- Established checklists for fire safety maintenance and organized fire safety equipment drills
- Ensure employers pay costs of employment of employees
- Established a whistleblower protection mechanism and strictly forbid retaliation
- Required and supervised upstream suppliers to adhere to the TSMC Supplier Code of Conduct

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**Note 1:** Priority violations may present higher risks of production halt, life, serious illegal affairs, or systematic failure. For example: lack of response mechanism for an unexpected halt in production lines, environmental pollution, hiring child labor, or forced labor

**Note 2:** Major violations refer to significant differences between implementation and proper ESH procedures, such as daily operations not adhering to ESH procedures

**Note 3:** Minor violations refer to risks other than priority or major violations, such as incomplete training records or incomplete ESH procedures
TSMC values people above all else and establishes a public reporting channel for supplier employees on Supply Online 360. This offers protection for supplier employees, extends and deepens TSMC’s management practices, and builds a more inclusive workplace for the supply chain. In 2021, a total of nine reports were collected, among which five were erroneous claims, and four involved business disputes and unfair treatment and pay. TSMC has required the suppliers reported to adhere to the TSMC Code of Conduct immediately. To expand the availability of the reporting channel, TSMC invites base-level employees of the suppliers during supplier audits to communicate and informs them of the purposes and operation of the supplier employee reporting channel. In 2021, TSMC completed interviews with more than 360 supplier employees.

Case Study

TSMC Supplier Sustainability Academy Systematically Shares Experiences to Drive Supply Chain Excellence

TSMC supply chains have a global reach. Therefore, TSMC set up the TSMC Supplier Sustainability Academy on the Supply Online 360 platform to improve supplier capabilities. As a pioneering open-source educational platform for industry peers in Taiwan, the Academy produces and puts out educational animation videos on the cloud platform, systematically sharing TSMC manufacturing and operational experiences with suppliers. TSMC designates mandatory courses for the suppliers to ensure effective learning. Furthermore, the Academy is available for the general public to register and access, promoting the common good in society. In 2021, TSMC Supplier Sustainability Academy was connected to the construction management system for internal contractors, moving the contractor badge application process online and imposing stricter qualification requirements for high-risk operations to reduce potential construction safety risks. Please refer to the section Digitizing Contractor Training Programs at a 100% Completion Rate for further information.

External Collaboration - Expanding Sustainability Impacts

Intending to improve supply chain capabilities, the TSMC Supplier Sustainability Academy continues to provide diverse training courses and seeks to expand influence. In 2021, TSMC invited non-semiconductor industries, including the medicine, electrical engineering, chemicals, machining, transportation, food, and textile industries, to use the training materials via the Corporate Synergy Development Center (CSD). TSMC also showcased the Academy resources at SEMICON Taiwan 2021, which TSMC co-hosted with SEMI, exerting influence on TSMC suppliers, the upstream suppliers, and beyond.

Reporting Procedure

1. Supplier Employees
   - Supply Chain Worker Grievance Channel

2. TSUCC (TSMC Grievance Handling Committee)
   - Investigation and supervision
   - Penalties
   - Report to the top supervisor of supply chain management for penalty

3. Suppliers
   - Examine problems and make improvements

- Case Study

TSMC Supplier Sustainability Academy Systematically Shares Experiences to Drive Supply Chain Excellence

- External Collaboration - Expanding Sustainability Impacts

- Required Tier 1 suppliers to complete the training program on the TSMC Supplier Code of Conduct; the completion rate was 92%.
- Tier 1 suppliers have adopted the TSMC Supplier Sustainability Academy as the training program for 210 of their suppliers.
- A cumulative total of over 200 thousand people completed the training program, with a satisfaction rating of 4.8 (highest score: 5).
Responsible Minerals Sourcing

TSMC supports sourcing conflict-free raw materials as a practice of humanitarianism and compliance with the ethical code of the society. Based on such beliefs, TSMC incorporated a series of industry benchmark practices into its compliance measures, including establishing a due diligence framework following the Model Supply Chain Policy for a Responsible Global Supply Chain of Mineral from Conflict-Affected and High-Risk Areas published by the Organization for Economic Cooperation and Development (OECD). Meanwhile, TSMC is an RBA member and one of the staunchest supporters of the Global e-Sustainability Initiative (GeSI). The Company adheres to the Responsible Minerals Assurance Process (RMAP), requiring suppliers to procure conflict-free raw materials. TSMC requires suppliers to comply with responsible minerals sourcing policy and sign the statement of responsible minerals for products containing tantalum, tin, gold, and tungsten. Since 2017, TSMC has also disclosed the source smelters for the cobalt used in TSMC products to the clients. In 2021, TSMC audited at least three suppliers of tantalum, tin, gold, and tungsten annually, ensuring that these suppliers formulate and implement Conflict-free Minerals Management Processes and conduct due diligence on upstream suppliers. For the latest TSMC disclosure documents, please visit TSMC’s official website or the US Securities and Exchange Commission website.

Conflict-free Minerals Due Diligence

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of compliant smelters</th>
<th>Number of suppliers</th>
<th>Percentage of conflict-free minerals</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>253</td>
<td>29</td>
<td>100%</td>
</tr>
<tr>
<td>2018</td>
<td>259</td>
<td>31</td>
<td>100%</td>
</tr>
<tr>
<td>2019</td>
<td>229</td>
<td>37</td>
<td>100%</td>
</tr>
<tr>
<td>2020</td>
<td>234</td>
<td>36</td>
<td>100%</td>
</tr>
<tr>
<td>2021</td>
<td>231</td>
<td>39</td>
<td>100%</td>
</tr>
</tbody>
</table>

Note: Figures from Tier 1 Suppliers of TSMC fabs in Taiwan, WaferTech, TSMC (China), TSMC (Nanjing), and VisEra

Responsible Minerals Management Process

- **Statement on Responsible Procurement of Raw Materials**
- **Investigate the sources of mineral raw materials**
- **Due Diligence**
- **Public Disclosure**

- **Publication**
- **Response**
- **Audit**
- **Evaluation**

Note: Figures from Tier 1 Suppliers of TSMC fabs in Taiwan, WaferTech, TSMC (China), TSMC (Nanjing), and VisEra
Strengthen Supply Chain Resilience

Through practical leadership examples and detailed requirements, TSMC propels suppliers to progress together with the Company. TSMC works with suppliers to build a workplace with dignity and ethics, offering consultations on capacity expansion, process and quality advancement, as well as implementing safety and health management rules for the work environment. Using various auditing and consultation methods, TSMC forms a close and comprehensive partnership with suppliers to maintain a supply chain that is resilient against disruption.

Sustainable Management of the Supply Chain on Environmental Safety and Health

- **Improve Environmental Safety and Health and Loss Prevention Capabilities of the Supply Chain**
  TSMC ensures sustainable supply chain management on environmental safety and health with four separate steps - establishing standards and systems, auditing and follow-ups, consultation and training, and supplier follow-up consultation. In 2021, consultation and training were the priorities of the year. TSMC offered training courses and visited supplier sites for consultation. Furthermore, the Company included environmental safety and health as indicators of the comprehensive supplier evaluation, recognizing suppliers with awards. The 2021 Supplier Environmental Safety and Health Best Performance Award went to MGC Pure Chemicals Taiwan, while the Supplier Environmental Safety and Health Improvement Award went to Sunlit Fluor & Chemical. In the future, TSMC will continue its suppliers’ leadership in improving the performance on environmental safety and health, fire safety, and emergency response.

### Supplier Follow-up Consultation
- Follow-up evaluations for high-risk suppliers
- Remote and on-site follow-up evaluations for suppliers

### Standards and Systems Establishment
- Constantly update Supplier Code of Conduct and Sustainability Standards
- Supplier leadership commitment to the Code of Conduct and Sustainability Standards
- Introduce fire safety and environmental safety & health to new factories
- Establish designated fire safety management personnel

### Consultation and Training
- Experience-sharing on energy conservation and carbon reduction
- Violation cases and improvement for sustainability audits
- Fire safety drills
- Participation or observation of the emergency response drills
- On-site diagnosis and consultation for energy conservation and carbon reduction

### Audit
- Supplier ESH/fire safety audit
- Violations mitigation and follow-up
- Auditor training, strengthening auditing capabilities

### Number of Suppliers Participating in the ESH Training Programs

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Suppliers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>89</td>
</tr>
<tr>
<td>2018</td>
<td>108</td>
</tr>
<tr>
<td>2019</td>
<td>115</td>
</tr>
<tr>
<td>2020</td>
<td>147</td>
</tr>
<tr>
<td>2021</td>
<td>201</td>
</tr>
</tbody>
</table>

### Number of Suppliers Observing TSMC Annual Emergency Response Drills

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Suppliers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>21</td>
</tr>
<tr>
<td>2018</td>
<td>20</td>
</tr>
<tr>
<td>2019</td>
<td>22</td>
</tr>
<tr>
<td>2020</td>
<td>21</td>
</tr>
<tr>
<td>2021</td>
<td>21</td>
</tr>
</tbody>
</table>
Key Points in Promoting Supply Chain Environmental Safety and Health and Loss Prevention

Safety
- Personal protection equipment
- Contractor management
- Machinery protection and maintenance
- Emergency response
- Natural disaster risks

Environmental Protection
- Pollution prevention
- Reduction of energy and water consumption
- Hazardous substance management and control

Health
- Occupational injuries
- Occupational illnesses
- Chemicals management

Fire Safety
- Fire prevention
- Fire safety equipment maintenance
- Earthquake protection

Key Points in Promoting Supply Chain Environmental Safety and Health and Loss Prevention

- Supplier consultation (ESH training / emergency response drills)
- Supplier consultation
- Supplier on-site Audit

- Supplier consultation and power reduction
- Fire safety system training and exercises
- Sharing common supplier violations
- Consultation on reducing energy and water consumption
- Continuous participation or observation of the emergency response drills

- Supplier Fire Protection Personnel Project
- Consultation topic: RBA 7.0
- Exercises - Fire safety system exercises
- On-site evaluations to follow up on supplier improvement
- Participating tabletop exercises for emergency response
- Introducing energy conservation standards to new supplier factories
- New supplier water reduction targets
- Suppliers with high energy consumption to receive ISO 14064 verification

- Add stricter supplier fire safety requirements exceeding that of RBA standards
- Strengthen auditing, add on-site operation inspections for supplier employees
- Build a supply chain parallel management system to improve management efficiency
- Add ESH workshops to ensure effectiveness of supplier training
- Supplier Fire Protection Personnel Project 2.0
- Increase the number of supplier-participating TSMC emergency response drills
# Problems and Challenges

<table>
<thead>
<tr>
<th>Problems and Challenges</th>
<th>TSMC Consultation Measures/Number of Suppliers</th>
<th>2021 Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suppliers lack awareness of climate change and environmental safety and health</td>
<td>• Organize workshops exchanging practices and experiences on Environmental Safety and Health</td>
<td>201</td>
</tr>
<tr>
<td>Suppliers lack awareness of emergency response and fire safety</td>
<td>• Participation or observation of the emergency response drills</td>
<td>21</td>
</tr>
<tr>
<td>Percentage of imported high-level spare parts for several advanced processes is still too high, as local suppliers lack critical technologies</td>
<td>• Assemble a team of experts to provide consultation for local suppliers, offer technical support, and assist in certification, ensuring that supplier technology progresses in steps with TSMC business needs</td>
<td>7</td>
</tr>
<tr>
<td>The parts of specific advanced machinery have to be sent abroad for repair and maintenance, which affects production schedules</td>
<td>• Production line expansion and process advancement</td>
<td>10</td>
</tr>
<tr>
<td>Capacity insufficient to meet advanced process requirements</td>
<td>• Add analytical instruments</td>
<td>9</td>
</tr>
<tr>
<td>Measurement technology insufficient to meet advanced process requirements</td>
<td>• Introduce advanced instruments</td>
<td>9</td>
</tr>
<tr>
<td>The supply chain lacks emergency response capabilities and may lead to disruption risk in supply</td>
<td>• Publish Supplier Transportation Management White Paper</td>
<td>121</td>
</tr>
<tr>
<td></td>
<td>• Require raw materials suppliers to formulate specific regulations on vehicles, drivers, and management of transportation operations</td>
<td></td>
</tr>
</tbody>
</table>

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Promote Green and Low-carbon Supply Chains

Continue to Reduce Environmental Impact

TSMC is committed to mitigating the impact of climate change and resource depletion; the Company conducts an annual Supplier Environmental Profit and Loss (EP&L) assessment to quantify the impact. In 2021, TSMC inspected 30 raw materials suppliers, prompting suppliers to investigate their carbon emissions and follow up on key indicators, including the suppliers’ performance of meeting their reduction targets of energy and water consumption, waste generation, and carbon emission. TSMC also requires suppliers to receive external verification for their greenhouse gas emissions.

Percentage of Local Sourcing in Taiwan

- Promote Constant Upgrade of Local Supply Chain
  - TSMC’s main production site is located in Taiwan. Its procurement can be divided into six categories: equipment, spare parts, raw materials, facility services, IT, and goods. Besides promoting local sourcing in Taiwan, TSMC also set up independent procurement organizations for TSMC subsidiaries, including TSMC (China), TSMC (Nanjing), and WaferTech. Such organizations extend the TSMC global supply chain, which helps local suppliers improve technology and quality, reduce costs and carbon emissions to build a highly effective and competitive semiconductor industry chain.

Percentage of Local Sourcing in the US

- Set procurement targets
  - Increase or maintain the percentages of local sourcing to meet long-term goals

Percentage of Local Sourcing in China

- Improve technology quality
  - Proactively improve the technology and quality of critical equipment, spare parts, and raw materials and increase local sourcing

- Invite international companies to set up factories in Taiwan
  - Invite foreign suppliers to set up manufacturing, R&D, and training sites in Taiwan

2021 Supply Chain Management Activities From Taiwan Fabs

- Promote Low-carbon Supply Chains
  - In 2021, TSMC declared that the Company will achieve Net Zero Emissions by 2050. Since the supply chain plays a critical role in TSMC’s roadmap to Net Zero Emissions, the Company will continue to lead suppliers in improving low-carbon operating capabilities. TSMC’s supply chain carbon emission management working group signed a Memorandum of Understanding with the CDP to collaborate on supply chain climate change and water resource initiatives. With comprehensive data collection and analysis, TSMC expects to publish the reduction targets for the supply chain in 2022 to push forward sustainability efforts.

In 2021, TSMC continued to require and assist suppliers to improve their performance in making the supply chain greener. The annual total of energy reduction reached 130 GWh, and the accumulative total reached 340 GWh (base year: 2020). The annual total of water reduction reached 17.58 million metric tons, and the cumulative total reached 19.71 million metric tons (base year: 2020). Additionally, 51% of the high energy consumption suppliers received ISO14064 verification. TSMC also required suppliers to introduce energy conservation assessments when building new factories. The waste production per unit among major waste-producing suppliers reduced by 31%, exceeding the annual target of 30.4%.
TSMC complies with the Energy Conservation and Carbon Reduction program put forth by the Industrial Development Bureau, MOEA, encouraging eligible suppliers to participate in the efforts to establish an energy consumption baseline by the Foundation of Taiwan Industry Service. The goal is to identify opportunities to conserve energy and reduce carbon emission at factory sites. In 2021, 18 suppliers participated in the program, identifying 37 cases of potential energy conservation via document evaluation and on-site diagnosis. TSMC has actively provided improvement recommendations, contributing to energy conservation and carbon reduction among suppliers to achieve Net Zero Emissions of the value chain by 2050.

Four Directives of Low-carbon Supply Chain Management

**Targets and Achievements of Suppliers’ Efforts to Reduce Energy and Water Consumption, Waste, and Carbon Emission**

- **Electricity Consumption Reduction**
  - For Tier 1 Suppliers
  - Cumulative total of energy consumption reduced (100 GWh)

- **Water Reduction**
  - For Tier 1 Suppliers
  - Cumulative total of water consumption reduced (10,000 metric tons)
  - 2020: 213, 2021: 1,971, 2022: 2,000, 2030: 3,500

- **Waste Reduction**
  - For Suppliers with high waste production per unit
  - Reduction rate (%)

- **Carbon Management**
  - For Suppliers with high electricity consumption
  - Percentage of ISO 14064 verification (%)

**Four Directives of Low-carbon Supply Chain Management**

1. **Setting Targets**
2. **Data Collection and Inspection**
3. **Performance Assessment**
4. **Carbon-reduction Actions**
A Practitioner of Green Power

Striving to realize our belief in co-existence and shared prosperity with the environment, TSMC is actively developing and applying innovative green technologies to climate and energy, water stewardship, circular resources, and air pollution control to roll out a comprehensive action plan for sustainability so that TSMC can become the global benchmark for green corporations.

1. Leads the global semiconductor industry with 94% reduction in F-GHGs

2. Achieved a 95% waste recycling rate for 7 consecutive years and a burial rate of less than 1% for 12 consecutive years

3. Reduced the unit air pollutant emissions by 54% (Base year: 2015)
**Climate and Energy**

**Strategies & 2030 Goals**

- **Strengthen Climate Resilience**
  - Develop climate change response and measures to reduce the impact of climate risks
  - 0 days of production interruption due to climate disasters
    - Target: 0 days

- **Drive Low-carbon Manufacturing**
  - Continue to use best available technology to reduce emissions of greenhouse gases (GHG) and become an industry leader in low-carbon manufacturing
  - Reduce unit GHG emissions compared to the base year (metric ton of carbon dioxide equivalent (MTCO₂e)/12-inch equivalent wafer mask layer) by 30%, and restore GHG emissions to the 2020 level
    - Target: 20% (Base year: 2010)
  - Reduced unit GHG emissions (metric ton of carbon dioxide equivalent (MTCO₂e)/12-inch equivalent wafer mask layer) by 27%
  - Reduced unit environmental externalities by 18% (NT$/12-inch equivalent wafer mask layer)
    - Target: 8% (Base year: 2010)

- **Use Renewable Energy**
  - Continue to purchase renewable energy and install solar-energy power systems to achieve target of 100% renewable energy use
    - Starting from 3nm new fabs, renewable energy accounts for more than 20% of energy consumption and the purchasing of renewable energy to increase annually to achieve 40% renewable energy company-wide
    - Used 1,670 GWh of renewable energy and Renewable Energy Certificates (REC); TSMC overseas sites used 100% renewable energy
      - Accounting for 9.2% of TSMC’s power consumption
    - Target: 9% of TSMC power consumption and 100% of power consumption in overseas sites

- **Increase Energy Efficiency**
  - Plan and implement new energy-saving measures each year to increase energy efficiency
    - Save 5,000 GWh between 2016 and 2030 through new energy-saving measures
    - Double energy efficiency after five years of volume production for each process technology
      - Increase energy efficiency of 5nm process technology 0.4 times higher in the 3rd year of volume production
      - Increase 10nm and 7nm process technologies energy efficiency 1.5 times higher in the 5th year of volume production; increase 5nm process technology energy efficiency 0.2 times higher in the 2nd year of volume production
    - 700 GWh energy saved, and cumulatively saved 2,400 GWh
      - Target: 500 GWh; 2,200 GWh

**2021 Achievements**

- **Strengthen Climate Resilience**
  - 0 days of production interruption due to climate disasters

- **Drive Low-carbon Manufacturing**
  - Reduced unit GHG emissions (metric ton of carbon dioxide equivalent (MTCO₂e)/12-inch equivalent wafer mask layer) by 27%
  - Reduced unit environmental externalities by 18% (NT$/12-inch equivalent wafer mask layer)

- **Use Renewable Energy**
  - Used 1,670 GWh of renewable energy and Renewable Energy Certificates (REC); TSMC overseas sites used 100% renewable energy
    - Accounting for 9.2% of TSMC’s power consumption
  - Target: 9% of TSMC power consumption and 100% of power consumption in overseas sites

- **Increase Energy Efficiency**
  - 700 GWh energy saved, and cumulatively saved 2,400 GWh
  - Target: 500 GWh; 2,200 GWh
As the world’s largest provider of semiconductor technologies and capacity, we are keenly aware of our responsibility to local and global environments. After joining the RE100 initiative, we decided to further our commitment by announcing our target of Net Zero Emissions by 2050. We believe that the use of renewable energy is a critical strategy to achieve net zero emissions. Considering the current landscape and development trends of Taiwan’s renewable energy market, future demands of semiconductor products, TSMC’s own capacity growth, and continued implementation of the best GHG reduction practices, we plan to achieve zero growth in carbon emissions by 2025 and to start decreasing carbon emissions from there on out. In 2030, we aim to restore carbon emissions to the 2020 level. In 2050, we aim to achieve net zero emissions in not just TSMC but also our entire value chain. By optimizing gas usage in manufacturing processes, introducing exhaust gas abatement equipment and decarbonized energy, enhancing existing energy efficiency, expanding resource recycling, selecting low-carbon-footprint materials, developing energy-efficient equipment, and practicing other green actions, TSMC is gradually progressing towards the net zero emissions target.

**Roadmap to Net Zero Emissions**

<table>
<thead>
<tr>
<th>Scope 1</th>
<th>Direct Emissions from Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Install equipment with F-GHG reduction technologies</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Develop nitrous oxide reduction equipment</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Use carbon-neutral natural gas</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scope 2</th>
<th>Indirect Emissions from Energy Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Use renewable energy</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Increase energy efficiency of existing processes</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Develop next-generation energy efficient tools</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Recycle thermal energy from process tools</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scope 3</th>
<th>Indirect Emissions from the Value Chain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conduct carbon inventory and offer consultations for energy conservation and carbon reduction</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Request suppliers to set targets, formulate management strategies, and develop technologies</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Develop a zero-waste manufacturing center and launch a recycling program for electronics-grade chemicals</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Zero Emissions Growth by 2025
- Join RE100
- Continued expansion of advanced process capacities will increase carbon emission levels

### 2030 GHG Emissions back to 2020 Levels
- Renewable energy will gradually be used more by primary manufacturing hubs, reducing emission levels

### Net Zero Emissions by 2050
- Launch alternative programs to reduce GHG emissions from processes
- Use 100% renewable energy
- Increase next-generation energy efficient process tools
- Use low-carbon raw materials
- Collaborate externally for carbon reduction and carbon negative programs
- Launch alternative programs to reduce GHG emissions from processes and acquire carbon credits externally

Achieve RE100 & net zero emissions
Milestones of Responses to Climate Change

- ESG Policy issued
- Set 2030 SDGs
- Establish ESG Steering Committee led by Chairman
- TSMC joins TCFD as Supporter
- Establish Carbon Credit Development Program
- TSMC receives Carbon Credits through TM002 published by the Taiwan EPA
- Climate Change Statement revised, declaring the target of Net Zero Emissions by 2050
- TSMC joins Taiwan Climate Partnership
- TSMC joins Association of Taiwan Net Zero Emissions
- The BOD approves to link corporate executives’ compensation with ESG achievements
- TCFD Report issued
- Carbon-neutral Natural Gas Program Launched
- Environmental Policy issued
- Carbon Management Platform established
- Energy Saving and Carbon Reduction Committee established
- Renewable Energy Program established
- Climate Change Statement issued
- TSMC joins Bureau of Industrial Development Voluntary GHG Emissions Reduction Platform
- TSMC joins RE100
- Net Zero Emission Program established
- Green Bonds issued
- All TSMC offices use 100% renewable energy and achieve net zero GHG emissions
- Overseas Sites begins using 100% renewable energy
- Tainan Science Park Reclaimed Water Plant, planning
- Financial Impact Analysis of the Risks and Opportunities of Climate Change disclosed

Strengthen Climate Resilience

In 2021, extreme climates intensified around the world and many countries suffered from various climate disasters. Taiwan also suffered from the worst drought in 70 years during the first half of 2021. To uncover potential risks and opportunities, TSMC follows the Task Force on Climate-related Financial Disclosures (TCFD) recommendations and refers to research from international institutes to evaluate climate change risks and opportunities cross-functionally. In 2021, TSMC ranked the risks and opportunities identified by relevant organizations in the Climate Change Risk and Opportunity Workshop on issues such as policy, legal, market, technology, reputation, and physical risk, and also promoted low-carbon transformation and climate adaptation through four directions of governance, strategy, risk management, metrics and targets, including committing to net zero emissions, using renewable energy and carbon-neutral natural gas, building TSMC Tainan Science Park Reclaimed Water Plant, planning and building green buildings, and implementing energy-saving, carbon-reduction and water-saving projects, actively investing in energy-saving product development and raising the elevation of building foundations to further drive the development of the green semiconductor industry chain and achieve environmental sustainability.

In September 2021, TSMC issued its first TCFD Report which spotlights three major risks: net zero emission trends, the impact of drought on TSMC operations, and impact on corporate reputation. Considering environmental changes internally and externally and in reference to disclosure methods adopted by companies in Taiwan and beyond, TSMC conducted a quantified financial assessment of impact from the three major risks and developed four major management strategies in response. The four major management strategies are mitigation, adaptation low-carbon products and services, and carbon reduction in the supply chain and they are aimed at minimizing the operational and financial impact from climate change and strengthening the organization’s climate resilience.

Identify Climate Risks

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Note 1. Renamed TSMC Corporate Social Responsibility Policy as ESG Policy since 2021.
Note 2. Science Based Targets Initiative (SBTI) is jointly established by the Carbon Disclosure Project, We Mean Business Coalition, UN Global Compact and World Wildlife Fund. The initiative provides companies with a clearly-defined path to reduce emissions in line with the Paris Agreement goals. TSMC pledged to set a science-based target in 2017.
Note 3. Renamed CSR Executive Committee as ESG Steering Committee since 2021.
The Board will regularly review risks and opportunities related to climate change. The ESG Steering Committee, TSMC’s top organization in climate change management, chaired by the Chairman of TSMC, meets with the chairperson of the ESG Committee serving as executive secretary. The Committee reviews TSMC’s climate change strategies and goals every quarter and reports to the Board of Directors.

- Energy Saving and Carbon Reduction Committee: The Energy Saving and Carbon Reduction Committee is the Company’s management organization for taking action on climate change risk and opportunity. It is chaired by the Vice President of Fab Operations. Every quarter, this Committee formulates management plans, reviews implementation status, and discusses future plans.

- Risk Management Steering Council: The Risk Management Steering Council briefs the audit committee each year on the ever-changing risk environment facing TSMC, the focus of the Company’s enterprise risk management, and risk assessment and mitigation efforts, including climate change issues.

Organize interdepartmental discussions and identify short, mid, and long-term climate risks and opportunities.

Assess the potential financial and operational impact on TSMC from major climate risks and opportunities.

Conduct scenario analysis and assess SBT (Science-Based Target) and net zero emission targets and actions.

Use the TCFD framework to develop a process for identifying climate risks.

Set management metrics related to climate change.

Through ISO 14064-1 annual inventory and disclosure of greenhouse gas emissions, review the impact on the company’s operations, and assess the risks of Scope 1, 2 and 3 and their mitigation strategies.

Set climate change management targets and review progress & performance.

Planned and carried out 499 energy saving measures across eight major categories, saving an additional 700 GWh in 2021. See Increase Energy Efficiency for more information.

See Climate Change Risk and Opportunity Matrix for more information on how response measures were formulated and enforced according to interdepartmental discussions on climate risks and opportunities.

Based on the SSP-1-1.9 scenario set forth by the Intergovernmental Panel on Climate Change (IPCC) AR6, TSMC analyzed climate risks in production and formulated climate change strategies and mitigation measures while also striving toward net zero emission targets.

Evaluated the qualitative and quantitative financial impact of major climate-related risks/opportunities discussed in the TCFD workshop by related departments.

Reported assessment results of the climate risks/opportunities and response plans to the ESG Committee Chairperson. See 5.3 Risk Management for more information.

Established the following as climate change performance indicators: GHG emissions per unit product, amount of renewable energy purchased, total electricity saved, improved production efficiency, and days of production interruption due to climate disasters. See Climate and Energy Strategies, Goals, and Outcomes for more information.

Based on carbon inventory and evaluation results, the risks of Scope 1 emissions were reduced effectively because of consistent carbon reduction actions; the risks of Scope 2 indirect GHG emissions due to electricity consumption and the risks of Scope 3 due to supplier indirect emissions continue to increase. See Greenhouse Gases (GHG) Inventory for more information.

Set climate change and energy management goals for 2030 in accordance with climate change performance indicators for senior executives to regularly review implementation performance. See Climate and Energy Strategies, Goals, and Outcomes and GHG Reduction Best Practices for more information.
Climate and Energy Strategies, Goals, and Outcomes

**Key Response Measures**

- Set ambitious carbon reduction targets: commit to zero carbon emissions from global operations by 2050
- Assemble a renewable energy task force to work with related associations and government agencies to accelerate the development of renewable energy and actively seek to purchase green energy
- Work with associations to propose suggestions to the government about building a carbon credit market
- Map out the company’s net zero emissions roadmap, formulate net zero emission strategies, and enforce related measures
- Continue carrying out GHG reduction actions and participate in government carbon offset programs for carbon reduction to earn carbon credits
- Implement long-term plans for purchasing carbon credits
- Continue investing in R&D resources to develop energy-saving products
- Diversify water sources and start using reclaimed water
- Strengthen water resource management and apply for AWS (Alliance for Water Stewardship) certification
- Promote energy saving and carbon reduction actions and track facility outcomes every quarter through the Energy Saving and Carbon Emission Reduction Committee
- Build a green factory, obtain green building licenses, and share experiences with external parties
- Insist on green manufacturing and green innovation and use transparent disclosure to enhance the company’s green reputation

**Risk Type**

- **GHG restrictions and carbon taxes/carbon levy**
  - Participate in renewable energy programs
  - Participate in carbon trading markets

- **Net zero emission trends**
  - Receive rewards from the public sector for offsetting carbon reductions
  - Develop low-carbon products and services
  - Increase energy efficiency in customer products

- **EIA commitment**
  - Promote water efficiency and diversification

- **Uncertainty in new energy saving/carbon reduction technologies**
  - Improve plant energy efficiency

- **Impact on Company reputation/image**
  - Rising temperature
  - Drive low carbon manufacturing

**Transition Risk**

- **GHG restrictions and carbon taxes/carbon levy**
- **Net zero emission trends**
- **EIA commitment**
- **Uncertainty in new energy saving/carbon reduction technologies**
- **Impact on Company reputation/image**

**Physical Risk**

- **Floods**
- **Droughts**
- **Higher natural disaster insurance premium**
- **Increase resilience against natural disasters**
- **Rising temperature**
- **Drive low carbon manufacturing**

- **Assess flood and drought risks at fabs and formulate and carry out risk mitigation measures**
- **Establish a comprehensive water monitoring system and emergency response processes and hold regular drills**
- **Implement carbon reduction actions through the Energy Saving and Carbon Reduction Committee**
Drive Low-Carbon Manufacturing

With the net zero emissions commitment, TSMC reviews overall carbon reduction efforts by looking at the annual GHG inventory results to formulate the emission reduction strategies accordingly. In 2021, direct emissions from processes accounted for 13% and were primarily from F-GHGs and nitrous oxide processes; indirect GHG emissions from purchased energy accounted for 50%; and indirect GHG emissions from the value chain accounted for 37%, which were primarily from producing raw materials, energy related activities in the upstream, and transportation.

In 2021, TSMC continued to establish industry best practices for GHG reduction. We replaced a total of 3400 metric tons CO₂e reduction from raw material and carbon reduction targets, achieving 0.18 million metric tons CO₂e reduction from raw material production and transportation as we work together to strive towards net zero emissions.

GHG Reduction Standard Practices

Scope 1 Direct GHG Emissions

Processes that use F-GHGs and nitrous oxide

- Introduce optimized process parameters in accordance with the manufacturing specifications by the Intelligent Engineering Center
- Apply optimized carbon reduction technology - remote plasma dissociation of nitrogen trifluoride (NF₃) to all 12-inch fabs
- Apply nitrogen trifluoride (NF₃)/pentafluoroethane (CF₅Br) to 6-inch and 8-inch fabs
- Install equipment with new F-GHG and nitrous oxide reduction technologies

100% 100% 100% 3,285

Scope 2 Indirect GHG Emissions (From Purchased Energy)

Energy usage

- Build Green buildings
- Increase energy efficiency
- Use energy-saving & low-carbon emission designs in next-generation process tools
- Purchase renewable energy

499 Measurables

TSMC led the global semiconductor industry with the largest LEED-certified building area, three buildings received green building certification in 2021, bringing TSMC's total to 37 LEED-certified buildings and 25 EEWH-certified buildings.

Energy efficiency of advanced technologies led industry peers; TSMC carried out 499 energy-saving measures over 8 major categories and saved 700 GWh, equivalent of 350,000 metric tons CO₂e.

The world's only semiconductor company to launch energy-saving programs for next-generation semiconductor fab tools, completed energy-saving programs on 119 models and saved 400 GWh electricity.

In addition to using 100% renewable energy for global offices, TSMC also purchased 1,670 GWh of renewable energy around the whole world, accounting for 9.2%.

Scope 3 Indirect GHG Emissions (Value Chain)

Raw material production, energy-related activities upstream, and transportation

- Supplier required to obtain external verification
- Reduce carbon footprint from raw materials
- Optimize delivery schedules

51%

High Energy Consumption Suppliers must pass GHG emissions inventory and third-party verification; 51% of suppliers have been verified.

High Energy Consumption Suppliers were asked to set annual targets and implement real energy-saving actions; in 2021, TSMC suppliers conserved 130 GWh and reduced 65,000 metric tons CO₂e.

Improved the delivery schedule for process tools and replaced air freight with ocean freight, reducing 17,848 metric tons CO₂e.

Note 1: Figures from Joint Steering Committee (JSTC) report of the World Semiconductor Council
Note 2: High Energy Consumption Suppliers are suppliers that use >5 GWh/year in a single facility
Use Renewable Energy

Purchase Renewable Energy

In 2021, TSMC announced the Net Zero Emissions to 2050 target and we believe that expanding our use of renewable energy will be a critical action to achieve the target. With full support from the Board and the management team, TSMC was able to invest in purchasing renewable energy and increased the 2030 Sustainable Development Goal from “25% renewable energy for fabs and 100% renewable energy for non-fab facilities” to “40% renewable energy for all TSMC fab operation sites around the world” to expand our use of renewable energy continuously.

As Taiwan is currently in the early stages of developing renewable energy, TSMC and related departments of MOEA, Taipower, the Chinese National Federation of Industries, Allied Association for Science Park Industries, Taiwan Semiconductor Industry Association, and renewable energy companies remain in close communications to discuss how to close the gap with regulations and practices. In 2020, TSMC first received renewable energy from solar plants and onshore wind farms. In 2021, TSMC collaborated with more onshore wind farms, increasing renewable energy usage in Taiwan fabs from 250 GWh to 660 GWh, which is a 160% yearly increase. We also signed a renewable energy purchase agreement for 0.3 GW, which can increase 750 GWh of green energy each year. As of the end of 2021, we have signed renewable energy purchase agreements for 1.6 GWh cumulatively, which will reduce approximately 2,600,000 metric tons of carbon emissions each year and achieved the target of “100% renewable energy used in global offices.”

In addition to renewable energy actions taken for Taiwan facilities, TSMC has been purchasing renewable energy and RECs in the countries with comprehensive regulations and ample supply, aiming to completely offset carbon dioxide emissions from the power used in locations around the world including the United States, Canada, Europe, China, Japan, and Korea; 2021 marks the fourth consecutive year that TSMC has achieved zero carbon emissions from power consumption in overseas subsidiaries.

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**Appendix**

**Use Renewable Energy**

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Renewable Energy Systems
In addition to purchasing renewable energy, TSMC has also installed solar panels in TSMC facilities to produce carbon-free renewable energy for our own fabs. In 2021, 231 kWp of solar panel capacity was installed and has already provided 4.88 GWh, reducing carbon emissions by 2,449 metric tons (the equivalent of annual carbon absorbed by 210,000 trees); in 2022, an additional 200 kWp of solar panel capacity will be installed, which can generate up to 5.2 GWh of electricity.

In 2021, Fab 18 Phase 1 installed photovoltaic modules developed by NTUST on the office driveway canopy covers. The solar panel modules use a low-cost reflective material behind the solar panel for secondary energy generation and heat penetration reduction to increase power generation efficiency and minimize energy consumption of air conditioning, which achieves energy saving and carbon reduction.

TSMC Renewable Energy Consumption and Ratio

<table>
<thead>
<tr>
<th>Ratio (%)</th>
<th>Taiwan (100 GWh)</th>
<th>Overseas (100 GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>8.8%</td>
<td>0%</td>
</tr>
<tr>
<td>2018</td>
<td>7.0%</td>
<td>0%</td>
</tr>
<tr>
<td>2019</td>
<td>6.8%</td>
<td>0%</td>
</tr>
<tr>
<td>2020</td>
<td>7.6%</td>
<td>0%</td>
</tr>
<tr>
<td>2021</td>
<td>9.2%</td>
<td>0%</td>
</tr>
</tbody>
</table>

TSMC Renewable Energy Installed Capacity & Power Generation

<table>
<thead>
<tr>
<th>Year</th>
<th>Southern Taiwan Science Park (kWp)</th>
<th>Central Taiwan Science Park (kWp)</th>
<th>Hsinchu Science Park (kWp)</th>
<th>Overseas (kWp)</th>
<th>Power Generation (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>1,383,208</td>
<td>2,923,716</td>
<td>3,704,733</td>
<td>623,716</td>
<td>4,628,288</td>
</tr>
<tr>
<td>2018</td>
<td>1,426</td>
<td>572</td>
<td>1,392</td>
<td>572</td>
<td>4,879,001</td>
</tr>
<tr>
<td>2019</td>
<td>1,329</td>
<td>572</td>
<td>1,329</td>
<td>572</td>
<td>4,879,001</td>
</tr>
<tr>
<td>2020</td>
<td>1,329</td>
<td>1,654</td>
<td>1,654</td>
<td>1,654</td>
<td>4,879,001</td>
</tr>
<tr>
<td>2021</td>
<td>1,329</td>
<td>1,654</td>
<td>1,654</td>
<td>1,654</td>
<td>4,879,001</td>
</tr>
</tbody>
</table>

TSMC Renewable Energy Development Timeline

- In response to the Amendment to Electricity Act opening up the electricity market, a renewable energy team was established to evaluate renewable energy purchases.
- Join the Taiwan Renewable Energy Certification Platform and become one of the first semiconductor fabs to receive renewable energy certificates.
- Three consecutive years as Taiwan’s biggest buyer.
- Committed to achieving 40% of the company’s electricity consumption as renewable energy by 2030.
- Continued to be the largest purchaser of green power in Taiwan.
- Taiwan fabs sign long-term renewable energy contracts.
- Overseas sites start using 100% renewable energy.
- Complete one of the first renewable energy wheeling transactions in Taiwan.
- First semiconductor company to join the RE100.
- Sign the world’s largest PPA (920 MW).
Increase Energy Efficiency

TSMC is dedicated to optimizing energy efficiency for processes and, in 2021, we continued to expand energy conservation efforts. In addition to seeking ways to save more energy in existing facilities, we also collaborated with equipment suppliers to develop new energy saving programs. Over 159 energy saving programs have been verified and introduced into new facilities. In 2021, TSMC was able to increase energy efficiency of 10nm and above process technologies in the fifth year of volume production by two times and energy efficiency for 5nm processes have also achieved a 20% increase in energy efficiency by just the second year of volume production, meeting our 2021 Target.

In 2021, TSMC consumed a total of 19,190 GWh in energy, with electricity accounting for 94.2%, natural gases for 5.7%, and diesel for approximately 0.1%. Electricity is the main energy used to power TSMC’s manufacturing equipment and fab systems. Natural gas is used in the treatment of process air exhaust in order to extremely reduce the direct emission of F-GHGs and volatile organic compounds. Diesel is not used directly in production, but to run emergency power generators and fire pumps during emergencies, power outages, or during annual maintenance. The percentage of natural gases continues to increase every year as we install more preventive equipment to reduce air pollutants and GHG emissions. As for electricity, our conservation efforts have paid off and we’ve been able to overcome the high energy demands of new processes to bring electricity consumption down from last year.

### Energy Efficiency of 10nm, 7nm & 5nm Process Technologies

<table>
<thead>
<tr>
<th>Year</th>
<th>10nm/7nm</th>
<th>5nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Year 2</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Year 3</td>
<td>1.7</td>
<td>1.2</td>
</tr>
<tr>
<td>Year 4</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Year 5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Note 1: Standardized baseline for energy efficiency is the values taken from the first year of volume production.
Note 2: Figures from TSMC fabs in Taiwan, WaferTech, TSMC (China), TSMC (Nanjing) and VisEra.
Note 3: Energy Efficiency only includes electricity use.

### Unit Product Energy Consumption

Unit: kWh/12-inch equivalent wafer mask layer

<table>
<thead>
<tr>
<th>Year</th>
<th>10nm/7nm</th>
<th>5nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>21.4</td>
<td>21.4</td>
</tr>
<tr>
<td>2018</td>
<td>22.3</td>
<td>22.3</td>
</tr>
<tr>
<td>2019</td>
<td>28.1</td>
<td>28.1</td>
</tr>
<tr>
<td>2020</td>
<td>26.7</td>
<td>26.7</td>
</tr>
<tr>
<td>2021</td>
<td>25.9</td>
<td>25.9</td>
</tr>
</tbody>
</table>

Note: Figures from TSMC fabs in Taiwan, WaferTech, TSMC (China), TSMC (Nanjing) and VisEra.

### Total Energy Consumption

Unit: 100 GWh

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Consumption of Non-Renewable Energy (100 GWh)</th>
<th>Total Consumption of Renewable Energy (100 GWh)</th>
<th>Total Consumption of Natural Gases (100 GWh)</th>
<th>Total Consumption of Diesel Oil (100 GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>112.88 GWh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>115.64 GWh</td>
<td></td>
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<tr>
<td>2019</td>
<td>126.56 GWh</td>
<td></td>
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</tr>
<tr>
<td>2020</td>
<td>148.28 GWh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>164.1 GWh</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: 1 cubic meter of natural gas=10.5 kWh of electricity; 1 kWh=3,600 kilojoules.
Note 2: Figures from TSMC fabs in Taiwan, WaferTech, TSMC (China), TSMC (Nanjing), and VisEra.
Note 3: GHG emissions from fabrication processes include only direct emissions (Scope 1) and indirect emissions from using electricity (Scope 2).
Note 4: The total amount of renewable energy include solar energy, wind energy, thermal energy, and hydroelectric energy.

### GHG Emissions from Manufacturing Processes

- **Scope 1**: CO₂, CH₄, N₂O
- **Scope 2**: CO₂ from Energy Use
- **Scope 3**: 79% CO₂ from Energy Use
- **Scope 4**: 2% CO₂ + CH₄
- **Scope 5**: 5% N₂O

Note 1: Standardized baseline for energy efficiency is the values taken from the first year of volume production.
Note 2: Figures from TSMC fabs in Taiwan, WaferTech, TSMC (China), TSMC (Nanjing) and VisEra.
Note 3: Energy Efficiency only includes electricity use.
Expand Energy-saving Measures

In 2021, TSMC’s Energy Saving and Carbon Reduction Committee attempted to explore opportunities to save energy by defining five major energy conservation teams for different process technologies to conserve energy from manufacturing equipment and fab facilities. The five teams are the advanced processes R&D team, 12-inch wafer fab team, advanced backend and 8-inch wafer fab team, EUV (extreme ultraviolet lithography) team, and facility team. In 2021, Fab 18B also joined the ranks to conserve energy. Through a series of training courses, the Energy Saving and Carbon Reduction Committee shared case studies on existing energy conservation programs in facilities, measured and calculated energy conservation outcomes, and explained system registration and forms to help new facilities quickly learn about certification standards by local governments so they can begin taking action. In addition, the Energy Saving and Carbon Reduction Committee also actively complied with energy conservation programs for manufacturing equipment and facility systems in various facilities, rolling out existing measures to other facilities as well, and establishing measures as the standard for new facilities.

In 2021, TSMC carried out 499 energy-saving measures across eight different categories and was able to conserve 700 GWh in energy consumption, the equivalent of 350,000 metric tons of carbon emissions. The energy savings translated into NT$1.75 billion of actual financial savings and external carbon costs reduced from lower carbon emissions were around NT$530 million.

Encourage Innovative Energy Saving Measures

TSMC encourages employees to actively dedicate themselves to green innovation, and the Energy Saving and Carbon Emission Reduction Committee also gives out Energy Conservation Model Awards and Energy Conservation Innovation Awards according to the teams’ success with energy conservation targets and innovative ideas. The Senior Vice President of Operations upped the rewards and now gives out special awards to outstanding energy saving measures proposed by various facilities every six month to incentivize employees to come up with innovative ideas and take action. In 2021, the Senior Vice President of Operations rewarded 15 outstanding proposals that reduced waste and conserved energy in tools and facility affairs. These proposals will conserve an estimated 330 GWh in energy and reduce 50,000 metric tons of waste in the future.

15-year Energy-saving Targets

<table>
<thead>
<tr>
<th>Year</th>
<th>Accumulated Energy Saved in 2016-2020</th>
<th>Additional Energy Saved in 2021</th>
<th>Accumulated Energy Saved by end of 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>6 GWh</td>
<td></td>
<td>6 GWh</td>
</tr>
<tr>
<td>2018</td>
<td>9 GWh</td>
<td></td>
<td>15 GWh</td>
</tr>
<tr>
<td>2019</td>
<td>12 GWh</td>
<td></td>
<td>27 GWh</td>
</tr>
<tr>
<td>2020</td>
<td>17 GWh</td>
<td></td>
<td>44 GWh</td>
</tr>
<tr>
<td>2021</td>
<td>24 GWh</td>
<td></td>
<td>68 GWh</td>
</tr>
<tr>
<td>2022</td>
<td>50 GWh</td>
<td></td>
<td>118 GWh</td>
</tr>
</tbody>
</table>

Unit: GWh

1,700 GWh + 700 GWh = 2,400 GWh

700 GWh increase

Energy conserved

334 GWh

Waste reduced

50,000 Metric tons

Case study: Modified wet film installed to MAUs saves 42 GWh each year

Case study: Smart compression dry airflow control system saves 38.9 GWh each year

Case study: Recirculation Type Water Heater saves 15 GWh each year

Case study: Hydrofluoric acid waste regeneration system, which can convert hydrofluoric acid waste into high-purity cryolite, reduces around 46,000 metric tons of waste
Energy Conservation Measures

- **Lighting Energy Savings**
  - Fabs: All fabs
  - 10 Measures
  - 8.13 GWh Energy Saved
  - 4,100 Metric Tons CO₂e Reduced

- **A.C. Energy Savings**
  - Fabs: All fabs
  - 4 Measures
  - 38.7 GWh Energy Saved
  - 19,400 Metric Tons CO₂e Reduced

- **Increased Performance**
  - Fabs: 12-inch fabs
  - 26 Measures
  - 93 GWh Energy Saved
  - 46,600 Metric Tons CO₂e Reduced

- **Standby Energy Savings**
  - Fabs: All fabs
  - 8 Measures
  - 41 GWh Energy Saved
  - 20,500 Metric Tons CO₂e Reduced

- **Energy Usage Management**
  - Fabs: All fabs
  - 18 Measures
  - 8,000 GWh Energy Saved
  - 16,000 Metric Tons CO₂e Reduced

- **Unit Replacement**
  - Fabs: All fabs (excluding Fab 18)
  - 187 Measures
  - 86 GWh Energy Saved
  - 43,200 Metric Tons CO₂e Reduced

- **New Unit Specs**
  - Fabs: 12-inch fabs/ Advanced backend fabs
  - 183 Measures
  - 92,000 GWh Energy Saved
  - 92,000 Metric Tons CO₂e Reduced

- **Equipment Adjustments**
  - Fabs: All fabs
  - 175 Measures
  - 239 GWh Energy Saved
  - 120,000 Metric Tons CO₂e Reduced

- **Facility Affairs**
  - Smart lighting in non-cleanroom areas
  - Replace bulbs with LED lighting
  - 10 Measures
  - 8.13 GWh Energy Saved
  - 4,100 Metric Tons CO₂e Reduced

- **Manufacturing Machines**
  - Reduce cooling water and exhaust for manufacturing processes
  - Optimize temperature settings for heating equipment
  - 18 Measures
  - 8,000 GWh Energy Saved
  - 16,000 Metric Tons CO₂e Reduced

- **Increased Performance**
  - Fabs: 12-inch fabs
  - 26 Measures
  - 93 GWh Energy Saved
  - 46,600 Metric Tons CO₂e Reduced

- **Energy-saving mode for Uninterrupted Power Supply System**
  - Use standby mode for local scrubbers
  - 8 Measures
  - 41 GWh Energy Saved
  - 20,500 Metric Tons CO₂e Reduced

- **Energy-efficient fan blades for cooling towers**
  - Use high-efficiency, energy-saving auxiliary equipment and components for new equipment
  - Optimize water usage and exhaust settings
  - 183 Measures
  - 92,000 GWh Energy Saved
  - 92,000 Metric Tons CO₂e Reduced

- **Smart, energy-saving cooling unit**
  - Reduce speeds for fan filter units
  - 187 Measures
  - 86 GWh Energy Saved
  - 43,200 Metric Tons CO₂e Reduced

- **Modified wet film plate for makeup air handling unit**
  - Use frequency converter for vacuum equipment to conserve energy
  - 26 Measures
  - 93 GWh Energy Saved
  - 46,600 Metric Tons CO₂e Reduced

- **Energy-saving mode for Uninterrupted Power Supply System**
  - Replace tool components with energy-saving components
  - 175 Measures
  - 239 GWh Energy Saved
  - 120,000 Metric Tons CO₂e Reduced

Note: Carbon dioxide emission is 0.502 kg CO₂e/kWh
In addition to energy saving measures, TSMC is also building factories with green building certification, reducing energy and material consumption throughout the construction stage and beyond, strengthening the building’s climate resilience, and adding eco-friendly designs. In 2021, Fab 18 Phase 1 office, Fab 18 Phase 2 facility, and Fab 18 Phase 3 facility received LEED certifications; TSMC now has a total of 37 LEED gold or above certifications. Fab 18 Phase 1 office and Fab 18 Phase 2 facility also received EEWH certifications; TSMC now has a total of 25 EEWH certifications. In 2021, the Architecture and Building Research Institute, MOI commissioned the Taiwan Green Building Council to host an award for outstanding green buildings. TSMC led other Taiwanese corporations in the award with five TSMC buildings recognized by the awards.


TSMC is using innovative thinking to enhance energy efficiency. In addition to developing the Water Saving Control System for FOUP Cleaning Tools, TSMC implemented "Tool Parameter Optimization" and "New Technology Integration" strategies to continue exploring the water and power saving opportunities for advanced process tools. In 2021, the Intelligent Engineering Center designed six action plans to save water and conserve energy at the 12-inch wafer GIGAFAB® facilities in Taiwan, effectively saving over 10 million metric tons of pure water and 110 GWh of electricity, aiming to save 28 million metric tons of pure water and 1,100 GWh of electricity by 2030.

Case Study

Reducing water usage in processes through interpreting and optimizing tool parameters.
Launched TSMC Plant a Tree Program to Strengthen Biodiversity Protection & Collaboration

TSMC is dedicated to environmental sustainability and continues to follow through with various environmental protection practices. When building new plants, TSMC aims to reduce environmental impacts by planting trees, conserving existing trees and plants, and transplanting the plants to other areas according to Taiwan’s EIA mechanism. Starting from 2006, all new TSMC plants and offices have been designed and accredited in accordance with U.S. Green Building Council and Taiwan Green Building Council standards. We’ve also started to gradually introduce biodiversity concepts and practices, creating an eco-friendly habitat at TSMC facilities through multi-layered green landscapes and diversified biological/environmental management as part of our dedication to UN SDG 15: Protect and maintain sustainable use of terrestrial ecosystems and ensure biodiversity.

With our long-term efforts, the number of fireflies at Tainan facilities increased 5-fold in the past three years, growing from 200 fireflies in 2019 to 1,050 fireflies in 2021. In 2020, TSMC further replicated the habitat recovery experience to fabs in Hsinchu and Taichung and is already witnessing the emergence of a few fireflies by monitoring water quality, adjusting flora in the region, and controlling lighting at night. From April 2020 to March 2021, TSMC conducted a second On-site Ecological Survey, which revealed that TSMC’s sites boast a rich array of plants and animals: 493 animal species, such as palm civets; 15 rare and endangered wild animals such as the brown shrike; and 644 plant species, including 60 rare plants such as Drypetes littoralis, Cryptocarya elliptifolia, Dehaasia incrassata, Golden Bolly Gums, etc.

Using the three ecological parks in Northern, Central, and Southern Taiwan as bases, TSMC is extending this green power outwards, launching the TSMC Plant a Tree Program in 2021. On March 12, Arbor Day, TSMC held tree planting ceremonies in Taoyuan City, Hsinchu City, Taichung City, and Tainan City and then connected the ceremonies online. We also got 500 TSMC volunteers, city government departments, and elementary students that TSMC volunteers have been reading with to participate and plant their trees of hope as we wish for a more sustainable green future for our next generation. As of December 2021, TSMC has planted 17,044 arbors and 277,898 shrubs across 16.3 hectares, mitigating dust pollution in urban areas and creating a healthier urban environment that is better for living. In 2022, we will further focus on our coastlines to strengthen sand-binding along shores and mitigate dust pollution to have a greater green influence on society.

Plant & Animal Species in TSMC Fabs from the On-site Ecological Survey

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Animal Species</th>
<th>Rare Plant Species</th>
<th>Rare &amp; Endangered Animal Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017 - 2018</td>
<td>493</td>
<td>211</td>
<td>13</td>
</tr>
<tr>
<td>2020 - 2021</td>
<td>644</td>
<td>644</td>
<td>15</td>
</tr>
<tr>
<td>Plant Species</td>
<td>Animal Species</td>
<td>Rare Plant Species</td>
<td>Rare &amp; Endangered Animal Species</td>
</tr>
</tbody>
</table>
Dedicated to energy efficiency, TSMC has added modified wet films for large makeup air units (MAU) installed in cleanrooms. The MAUs act as a humidifier system that can strengthen rinsing effects and reduce 80% energy consumption from water pumps. In 2021, we further expanded the program and installed modified wet films to 190 MAUs, saving 42 GWh in energy and taking real action to implement green manufacturing.

The MAU humidifier system uses water as the transmission medium. Water pumps pressurize the water through specific spray nozzles that create small, fine water particles of a certain diameter. The system uses mass transfer, dissolution, and collision to remove micro-pollutants in the air and ensure the quality of airflow entering cleanrooms. Traditional humidifier systems are limited by A.C. unit sizes and are unable to hold rinsing water. Pumps for rinsing water account for 20% of the energy used by cleanroom A.C. units to transport air and water. To increase energy efficiency, TSMC worked with suppliers to co-develop a modified wet film that can be curved to absorb micro-pollutants from outside air, hold outside air for longer, increase humidity surfaces for airflow, and achieve the same effects. Rinsing water pumps can also be downgraded from 50 horsepower to 10 horsepower, reducing about 80% of energy usage and achieving benefits of energy conservation.

Install Additional A.C. Humidifier Systems for Cleanrooms and Save 42 GWh in Energy

By changing wired packing to wet film plate, a large area of water film is formed while fine water mist attaches to the surface of wet film panels to increase micro-pollutants absorption and improve scrubbing performance. The design reduces power required to circulate and pump rinsing water, which has reduced energy consumption by 80% and achieved energy saving benefits.

Cleanroom MAU Upgrade Program

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of MAUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>91</td>
</tr>
<tr>
<td>2018</td>
<td>135</td>
</tr>
<tr>
<td>2019</td>
<td>146</td>
</tr>
<tr>
<td>2020</td>
<td>118</td>
</tr>
<tr>
<td>2021</td>
<td>190</td>
</tr>
</tbody>
</table>

Upgrade 23 MAUs in existing fabs and introduced 167 modified MAUs to new fabs

Installing the modified wet film reduces the rinsing water pump’s energy consumption by 80%
## Water Stewardship

### Strategies & 2030 Goals

**Manage Water Resource Risk**  
Enforce climate change mitigation policies, implement water conservation and water shortage adaptation measures.

<table>
<thead>
<tr>
<th>2022 Targets</th>
<th>2021 Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce unit water consumption (liter/12-inch equivalent wafer mask layer) by 30% (Base year: 2010)</td>
<td>Reduced unit water consumption (liter/12-inch equivalent wafer mask layer) by 16%</td>
</tr>
<tr>
<td>Reduce unit water consumption (liter/12-inch equivalent wafer mask layer) by 16%</td>
<td>Target: 9%</td>
</tr>
</tbody>
</table>

**Develop Diverse Water Sources**  
Develop water reclamation technologies, continue to practice water conservation and use reclaimed water during manufacturing.

<table>
<thead>
<tr>
<th>2022 Targets</th>
<th>2021 Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase more than 60% replacement of water resources with reclaimed water</td>
<td>Complete the TSMC Tainan Science Park Reclaimed Water Plant and begin water supply</td>
</tr>
<tr>
<td>TSMC Tainan Science Park Reclaimed Water Plant is under construction and will start supplying water in 2022</td>
<td>Target: Complete the TSMC Tainan Science Park Reclaimed Water Plant and begin water supply</td>
</tr>
</tbody>
</table>

**Develop Preventive Measures**  
Improve the efficiency of water pollution prevention and removal of water pollutants

<table>
<thead>
<tr>
<th>2022 Targets</th>
<th>2021 Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water pollution composite indicator 50% above effluent standards</td>
<td>Water pollution composite indicator reduction rate of 45%</td>
</tr>
<tr>
<td>Water pollution composite indicator reduction rate of 45%</td>
<td>Target: 44%</td>
</tr>
</tbody>
</table>

---

**Notes:**
- Note 1: TSMC is actively working with the government to progress the water reclamation projects. In 2021, the replacement rate of reclaimed water increased from 30% to 60% in 2030.
- Note 2: Water supply works for the TSMC Tainan Science Park Reclaimed Water Plant was delayed as the government is still developing their reclaimed water supply system. The water plant is slated for operations and water supply in 2022.
- Note 3: The scope of water pollution projects and figures include TSMC fabs in Taiwan and Visera.
- Note 4: TSMC increased the use of cobalt sulfate for advanced processes. As such, starting from 2022, TSMC will be listing cobalt into the water pollution composite indicator.
- Note 5: Failed to meet target because we were unable to complete some COD mitigation works due to the pandemic. In 2022, TSMC will be deploying the rotating packed bed technology to reduce COD levels.
Throughout the drought, TSMC remained compliant with drought alerts issued by the Water Resources Agency and adopted necessary measures in accordance with the protocol of TSMC Water Supply Shortage Crisis Management C.I. As such, TSMC was able to maintain facility operations and production as usual even throughout the worst stages of the drought. In regard to long-term water management strategies, TSMC is adopting the AWS standards to strengthen the three major strategies of "managing water resource risks, developing diverse water sources, and developing preventive measures" to ensure sustainable action towards water recycling.

### Drought Contingency Measures

<table>
<thead>
<tr>
<th>Water Signal from the Water Resource Agency (WRA)</th>
<th>Government Response Measures</th>
<th>TSMC Response Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue Normal water levels</td>
<td>• Stable supply and demand</td>
<td>• Monitor WRA reservoirs supply for TSMC fabs</td>
</tr>
<tr>
<td>Green Fairly severe</td>
<td>• Farmers encouraged to suspend farming</td>
<td>• Host drills regularly</td>
</tr>
<tr>
<td>Yellow First stage</td>
<td>• Reduce water pressure at specific times • Suspended irrigation water in certain areas</td>
<td>• Drought Emergency Response Team in operation • Check water resources and water truck capacity • Spontaneously save water by 5%</td>
</tr>
<tr>
<td>Orange Second stage</td>
<td>• Reduce water supply to industrial users by 5-20%</td>
<td>• Reduce water consumption by 7% • Water truck drills</td>
</tr>
<tr>
<td>Red Third stage</td>
<td>• Water rationing by district</td>
<td>• Activate water trucks • Reduce water consumption by 7-20%</td>
</tr>
</tbody>
</table>

Note: When necessary, adopt related response measures in compliance with the TSMC protocol of TSMC Internal Control Procedures for Low Water Supply Crisis Management

### TSMC Water Consumption Rate in Three Science Parks

- **Hsinchu Science Park**
  - Daily Supply to Science Park: 547 thousand metric tons/day
  - Reservoirs: Baoshan Reservoir • Second Baoshan Reservoir
  - Water Consumption: 10.2% of 5,600 metric tons/day
- **Southern Taiwan Science Park**
  - Daily Supply to Science Park: 953 thousand metric tons/day
  - Reservoirs: Nanhua Reservoir • Zengwen Reservoir
  - Water Consumption: 10.4% of 9,900 metric tons/day
- **Central Taiwan Science Park**
  - Daily Supply to Science Park: 1356 thousand metric tons/day
  - Reservoirs: Liyutan Reservoir • Deji Reservoir
  - Water Consumption: 3.9% of 5,300 metric tons/day
Manage Water Resource Risk


In 2022, TSMC once again adopted the Water Risk Atlas from the World Resources Institute (WRI) to evaluate water risk levels in areas with TSMC facilities and yielded the same results as last year: TSMC facilities in Taiwan and Visea were both rated medium-to-low risk while WaferTech was rated low risk. TSMC (China) and TSMC (Nanjing) were rated high and medium-to-high risk as regional water quality differences requires them to first refine water, thereby increasing wafer unit water consumption. TSMC will continue to carry out the two measures of facility design and water management to reduce impact from water risks.

Effective Water Management with AWS

TSMC is employing AWS standards to achieve sustainable water management and deploying long-term fab matching water management strategies with the “AWS Blue Book” to obtain AWS certification across more fabs through the PDCA model. Following TSMC’s record-breaking evaluation scores from AWS and platinum certifications to Fab 6, Fab 14B, Fab 15A, and Fab 15B, TSMC facilities in HSIP such as Fab 12A, Fab 12B, Fab 5, and Advanced Backend Fab 3 also received AWS certification, showing TSMC’s dedication to optimize the use of water resources and move towards environmental sustainability.

AWS Water Management Model

- **Plan**: Regularly assess water resources risks at facilities, and draw up annual water resources management goals and plans
- **Do**: Ask water management organizations at fabs to promote water management plans in compliance with annual water resource management goals
- **Act**: Correction and adjustment for check gap items
- **Check**: The implementation results are checked annually by an external verification agency

Sustainable Water Balance

- **Good Water Quality**: Water management
  - Establish emergency response procedures
  - Develop diverse water sources
  - Recycle and reuse water
  - Set water pollution composite indicator
- **Healthy Water Environment**: Facility Design
  - Elevate facility
  - Install flood gates
- **Safe Drinking Water and Environmental Sanitation**: Facility Results
  - Flood Risk
    - Low Risk
      - 1 Facility
      - Seasonal variation
      - Drought
      - Flood risks
    - Mid-to-low Risk
      - 15 Facilities
      - Interannual variation
      - Tsunami risks
  - Water Risk
    - Mid-to-high Risk
      - 1 Facility
      - Decontamination
      - Untreated water bodies
    - High Risk
      - 1 Facility
      - Sustainable investment index
  - Water Quality Risk
    - Coastal erosion
    - Untreated water bodies
  - Regulation & Reputation
    - Drinking water quality
    - Sanitary conditions
Water Balance and Supply Chain Environmental Relationship

**AWS Five Achievements**

- **Excellent Management System**
- **Sustainable Water Balance**
- **Good Water Quality**
- **Healthy Water Environment**
- **Safe Drinking Water and Sanitation Environment**

**Water Source**

- **Rainfall**
  - Introduce in 2022
- **Water Plant**
  - **Reservoir**
    - Monitor reservoir water levels
  - **Rivers**
    - Water allocation

**Facility Water Balance**

- **Irrigation**
- **Domestic Water Consumption**
- **Air Scrubbing in Cleanrooms**
  - Reclaiming air-scrubbing water from cleanrooms
- **Tool Production**
- **Ultrapure Water System**
- **Exhaust Scrubber System**
  - Recycle and reuse wastewater produced by central wet scrubbing towers

**Water Discharge**

- **Biological Treatment System**
  - COD Decomposition
  - Organic wastewater recycle and reuse
- **Wastewater Treatment System**
  - Backwash wastewater recycling

**Water Stress Management Blueprint**

1. Replace city water with refined recycling water
2. Onsite recycling
3. Reclaiming exhaust scrubbing water
4. Smart water pumping model to regulate peak water consumption

**Onsite recycling**

- **ESG Feature Stories**
  - Overview
  - Sustainable Business Practices
  - Operations and Governance
  - Appendix

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Strengthen In-house Water Recycling and Water Use Efficiency

In 2021, wafer unit water consumption continued to increase due to stricter requirements for clean water from advanced processes and the opening of new facilities. TSMC continued to promote the four major water conservation measures of “Reduce Facility System Water Consumption, Increase Wastewater Recycling of Facilities, Improve Water Production Rate of the System, and Decrease Water Discharge Loss from the System” in an attempt to uncover opportunities to save water and achieve maximum water conservation. In 2021, TSMC was able to achieve stable water supply for fabrication processes by implementing water conservation measures.

The water recycling system conserved a total of 2.48 million metric tons of water and we achieved our annual goal for wafer unit water consumption: wafer unit water consumption was reduced to 119.9 (liter/12-inch equivalent wafer mask layer), a 14.9% reduction from the 140.9 (liter/12-inch equivalent wafer mask layer) in 2010, the base year; wafer unit wastewater discharge was also reduced to 78.9 (liter/12-inch equivalent wafer mask layer), an 8% reduction from the previous year, indicating that TSMC’s water conservation measures are effective in increasing water recycling and reducing wastewater discharge.

Water Conservation Measures & Achievements in 2021

Decrease Water Discharge Loss from the System
- Recycled 855,000 metric tons from MAU Drain (34.5%)
- Improved usage efficiency by allocating 527,000 metric tons of recycled water (21.2%)
- Increased the water production rate of RO recycling systems by 86,000 metric tons (3.5%)
- Reduced cooling tower and sand filter backwash water by 48,000 metric tons (1.9%)

Increase Wastewater Recycling by Facilities
- Reclaimed 320,000 metric tons from central wet scrubbers (12.9%)
- Reclaimed 205,000 metric tons of organic wastewater (8.3%)
- Purified 183,000 metric tons reclaimed water into industrial water (7.4%)
- Reclaimed 162,000 metric tons of acidic wastewater (6.5%)
- Recycled 94,000 metric tons of backwash wastewater (3.8%)

Annual Water Conservation

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Cumulative Water Conserved (10,000 metric tons)</th>
<th>Additional Water Conserved in 2021 (10,000 metric tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>338</td>
<td>465</td>
</tr>
<tr>
<td>2018</td>
<td>465</td>
<td>793</td>
</tr>
<tr>
<td>2019</td>
<td>793</td>
<td>985</td>
</tr>
<tr>
<td>2020</td>
<td>985</td>
<td>248</td>
</tr>
<tr>
<td>2021</td>
<td>248</td>
<td>985</td>
</tr>
</tbody>
</table>

City Water Consumption and Water Consumption per Wafer-Layer

<table>
<thead>
<tr>
<th>Year</th>
<th>Total City Water Consumption of Taiwan fabs (million metric tons)</th>
<th>Water Consumption per Wafer-Layer (Liter/12-inch equivalent wafer mask layer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>3.8</td>
<td>45.2</td>
</tr>
<tr>
<td>2018</td>
<td>5.7</td>
<td>51.0</td>
</tr>
<tr>
<td>2019</td>
<td>6.3</td>
<td>58.0</td>
</tr>
<tr>
<td>2020</td>
<td>6.7</td>
<td>70.6</td>
</tr>
<tr>
<td>2021</td>
<td>6.7</td>
<td>119.9</td>
</tr>
</tbody>
</table>

Wastewater Discharge per Unit Product

<table>
<thead>
<tr>
<th>Year</th>
<th>TSMC Wastewater (million metric tons)</th>
<th>Subsidiary Wastewater (million metric tons)</th>
<th>Wafer mask unit wastewater (Liter/12-inch equivalent wafer mask layer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>2.86</td>
<td>29.40</td>
<td>70.0</td>
</tr>
<tr>
<td>2018</td>
<td>4.13</td>
<td>33.70</td>
<td>71.2</td>
</tr>
<tr>
<td>2019</td>
<td>4.44</td>
<td>38.67</td>
<td>89.9</td>
</tr>
<tr>
<td>2020</td>
<td>5.12</td>
<td>46.69</td>
<td>86.3</td>
</tr>
<tr>
<td>2021</td>
<td>5.85</td>
<td>49.20</td>
<td>78.9</td>
</tr>
</tbody>
</table>
Develop Diverse Water Sources

Actively Develop Industrial Wastewater Recycling Technologies

TSMC adopts a two-pronged approach to strengthen water usage efficiency: develop diverse water sources & water conservation. In order to capitalize each drop of water, TSMC has been devoted to developing water recycling technologies, collaborating with government agencies to develop domestic wastewater recycling processes and industrial wastewater recycling technologies in compliance with tap water standards. Unfortunately, water supply works for the TSMC Tainan Science Park Reclaimed Water Plant was delayed as the government is still working on their reclaimed water supply system. Right now, water supply is slated for Q3 of 2022, which will help reduce demands for tap water, making 2022 the start of water reclamation for TSMC.

In addition, to maximize water usage efficiency, TSMC will continue to cooperate with the government’s water recycling projects and accelerate the city government’s plans to purify water for industrial usage.

Milestones in Water Reuse
Develop Preventive Measures

Water Pollution Composite Indicator

In 2021, the water pollution composite indicator reduction rate was 42.5%, which failed to meet our 2021 target of 44%. The main reason was the increased IPA usage for advanced processes that led to increased COD emissions and the pandemic delaying mitigation works. In 2022, TSMC will continue to build a COD treatment system in the hopes of reducing COD concentration in effluents. In addition, due to the increased usage of cobalt sulfate for advanced processes, TSMC also continues to expand the cobalt sulfate treatment system using resin adsorption to achieve effluent standards; cobalt was also added to the water pollution composite indicator in 2022.

Reduce Pollutant Concentration in Effluents

In response to evolving fabrication processes and increased use of organic chemicals, TSMC has introduced the membrane bio-reactor system to strengthen water pollutant treatment capabilities. In 2021, average COD concentration levels were reduced to 180ppm and TMAH effluent concentrations were reduced to 5.5ppm, mitigating the possible impact of TSMC operations on the environment. In 2022, TSMC plans to apply the high agravic rotating bed technology in Fab 15B to reduce IPA concentration in wastewater and continue improving the quality of our environment.

Water Pollution Composite Indicator Reduction

<table>
<thead>
<tr>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>38.7</td>
<td>36.8</td>
<td>43.8</td>
<td>42.4</td>
<td>42.5</td>
</tr>
</tbody>
</table>

Note: Figures from TSMC labs in Taiwan
Transform Effluents into Alternative Water Source and Strengthen Value for Water Reclamation

In 2021, TSMC actively sought for alternative water sources in an effort to combat the drought in Taiwan. Having considered distance, water supply, and available space on site, TSMC decided to collaborate with the Fukuda Water Recycling Center, collecting discharged recycled water from the center for reuse at TSMC facilities, thereby reducing our tap water consumption.

The Fukuda Water Recycling Center has a surface area of 13.6 hectares and is the largest domestic wastewater recycling center in Taichung, processing an average of 100,000 metric tons of wastewater each day. Originally, the Fukuda Water Recycling Center would discharge recycled water into the Han River. In April 2021, TSMC installed a water-intake and water filtration system to collect and filter recycled water. To monitor water quality, TSMC also formulated the Water Truck Water Quality Risk Control Measures and three processes: "monitoring the source, managing water trucks, and monitoring water quality" to ensure that water quality from alternative sources meets the standards for wafer products and strengthen the value of recycled water. After the drought alert was lifted, TSMC kept the water-intake on site for the public to benefit society.

TSMC Alternative Water Source Process

- **Domestic wastewater from Taichung 100,000 metric tons/day**
- **Tier 1/2 treatment at Fukuda Water Recycling Center**
- **Install Water filtration System at Fukuda Water Recycling Center (1,200 metric tons/day)**
- **Internal Control Procedures for Water Quality Risks from Water Trucks**
- **Han River**
- **TSMC Fabs**

**Monitor the Source**
Regularly monitor water quality at the water source; only water sources with qualified water can be sent to TSMC by water trucks.

**Manage Water Trucks**
Equip the water truck with a GPS system for tracking. Water trucks must sample the water and ensure the water quality meets the necessary standards before unloading from the truck. Drivers must also record the unload quantity and time into the cloud system for facilities to access and request for water.

**Monitor Water Quality**
Dual measures to guarantee water quality: 24H online water quality monitoring and a baseline to monitor changes in water quality; offline monitoring also adopted as we regularly send samples from various treatment stages to labs for testing.
## Circular Resources

### Strategies & 2030 Goals

#### Source Reduction
Promote waste reduction by source separation and require vendors to provide low chemical consumption equipment

Outsourced unit waste disposal per wafer \( \leq 0.50 \) (kg/12-inch equivalent wafer mask layer)

Outsourced unit waste disposal per wafer \( \leq 0.99 \) (kg/12-inch equivalent wafer mask layer)

Outsourced unit waste disposal per wafer \( 0.99 \) (kg/12-inch equivalent wafer mask layer)

Target: \( \leq 1.15 \)

#### Circular Economy
Collaborate with vendors to develop new waste recycling technology to increase the amount of waste recycled and reused

Develop multiple types of electronic-grade chemicals for resource recycling within TSMC

Reduce CO\(_2\) emissions from waste treatment to 2020 emission levels

In-house resource recycling rate \( \geq 23\% \)

Target: \( \geq 22\% \)

#### Audit and Guidance
Enhance vendor capabilities in self-management and implementing resource recycling through audits, guidance, and tracking with applied technologies

Note 1: In addition to existing auditing guidance and evaluations, we are also using applied technologies to strengthen tracking performance and intensity to help enhance vendor capabilities in self-management and implementing resource recycling

Note 2: TSMC requires waste treatment vendors to at least acquire ISO14001 or ISO45001 certifications as the basis for standardized management. Waste treatment vendors include waste treatment and recycling vendors. Government-owned enterprises, public-to-private enterprises, items exempted from online reporting, and timber waste and lubricant waste vendors, are exceptions to the aforementioned vendors

---

### 2021 Achievements

<table>
<thead>
<tr>
<th>Source Reduction</th>
<th>2022 Targets</th>
<th>2021 Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outsourced unit waste disposal per wafer ( \leq 0.50 ) (kg/12-inch equivalent wafer mask layer)</td>
<td></td>
<td>Up</td>
</tr>
<tr>
<td>Outsourced unit waste disposal per wafer ( \leq 0.99 ) (kg/12-inch equivalent wafer mask layer)</td>
<td></td>
<td>Up</td>
</tr>
<tr>
<td>Outsourced unit waste disposal per wafer ( 0.99 ) (kg/12-inch equivalent wafer mask layer)</td>
<td>Target: ( \leq 1.15 )</td>
<td></td>
</tr>
<tr>
<td>In-house resource recycling rate ( \geq 23% )</td>
<td>Target: ( \geq 22% )</td>
<td>✔</td>
</tr>
<tr>
<td>84% of waste treatment vendors shall acquire ISO 14001 or other international EHS Management certifications</td>
<td>82% of waste treatment vendors have acquired ISO 14001 or other international EHS Management certifications</td>
<td>✔</td>
</tr>
</tbody>
</table>

Note 1: In addition to existing auditing guidance and evaluations, we are also using applied technologies to strengthen tracking performance and intensity to help enhance vendor capabilities in self-management and implementing resource recycling

Note 2: TSMC requires waste treatment vendors to at least acquire ISO14001 or ISO45001 certifications as the basis for standardized management. Waste treatment vendors include waste treatment and recycling vendors. Government-owned enterprises, public-to-private enterprises, items exempted from online reporting, and timber waste and lubricant waste vendors, are exceptions to the aforementioned vendors
As TSMC continues to develop advanced processes and expand capacities, waste production has increased simultaneously due to the complexity of new process development, demands for reliable yield rates, and increasing demands for raw materials. In order to reduce the environmental impact of TSMC operations, TSMC is actively implementing the management principle of "minimizing waste, maximizing resource recycling, and optimizing vendor management" through the three major facets of "Source Reduction, Circular Economy, and Audit and Guidance" and working with vendors to ensure resource sustainability.

In 2021, outsourced unit waste disposal per wafer achieved annual targets and exceeded achievements in 2020 by a small margin through the implementation of source reduction and the resource recycling strategy of the Action Plan to Turn Waste into High-Value Products despite the continued expansion of Fab 18 Phases 4 & 5. Waste recycling rate reached 95% for the seventh consecutive year and the percentage of waste sent to landfills has remained at less than 1% for twelve consecutive years. Fab 12 Phases 1 & 2 also obtained UL 2799, the highest platinum rating for zero waste to landfill. In addition to TSMC’s pursuit for perfection internally, we have also assisted 82% of our waste treatment vendors with ISO14001 certification.

In 2021, we introduced the System of Waste Intelligent Fast Track (S.W.I.F.T.) and the Recycled Product Cloud Reporting Platform, which were integrated with reports submitted to the Environmental Protection Administration to gain insight into our vendor’s waste treatment and resource recycling statuses, allowing us to prevent illegal waste disposal and together create a sustainable environment.
### Outsourced Waste

<table>
<thead>
<tr>
<th>Year</th>
<th>Outsourced General Waste</th>
<th>Outsourced Hazardous Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit: Metric tons/year</td>
<td>Unit: Metric tons</td>
</tr>
<tr>
<td>2017</td>
<td>196,077</td>
<td>165,891</td>
</tr>
<tr>
<td>2018</td>
<td>208,340</td>
<td>169,427</td>
</tr>
<tr>
<td>2019</td>
<td>212,465</td>
<td>183,015</td>
</tr>
<tr>
<td>2020</td>
<td>269,640</td>
<td>280,635</td>
</tr>
<tr>
<td>2021</td>
<td>326,069</td>
<td>319,763</td>
</tr>
</tbody>
</table>

#### Percentage of Recycled Waste

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage Recycled Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>95%</td>
</tr>
<tr>
<td>2018</td>
<td>95%</td>
</tr>
<tr>
<td>2019</td>
<td>96%</td>
</tr>
<tr>
<td>2020</td>
<td>95%</td>
</tr>
<tr>
<td>2021</td>
<td>95%</td>
</tr>
</tbody>
</table>

### In-house Recycled Resources

<table>
<thead>
<tr>
<th>Year</th>
<th>In-house Recycled Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit: Metric tons/year</td>
</tr>
<tr>
<td>2017</td>
<td>63,658</td>
</tr>
<tr>
<td>2018</td>
<td>95,989</td>
</tr>
<tr>
<td>2019</td>
<td>112,829</td>
</tr>
<tr>
<td>2020</td>
<td>155,575</td>
</tr>
<tr>
<td>2021</td>
<td>182,761</td>
</tr>
</tbody>
</table>

#### Percentage of Waste Sent to Landfill

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage Waste Sent to Landfill</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>0%</td>
</tr>
<tr>
<td>2018</td>
<td>0%</td>
</tr>
<tr>
<td>2019</td>
<td>0%</td>
</tr>
<tr>
<td>2020</td>
<td>0%</td>
</tr>
<tr>
<td>2021</td>
<td>0%</td>
</tr>
</tbody>
</table>

### Note

1. Figures from TSMC fabs in Taiwan.
2. Data is compiled based on waste disposal declaration data and the processing capacity of in-house resource recycling facilities.
Source Reduction

The management strategy for resource recycling at TSMC spotlights source reduction. We attempt to reduce our use of resources at the production source and, after raw materials undergo our fabrication processes, we prioritize reusing internally to ensure that the raw material has been fully used and recycled, thereby delaying waste production. TSMC is implementing source reduction strategies through the Waste Management Task Force. At the beginning of the year, the Task Force formulates measures, conducts experiments, and tests measures out in related facilities and production lines to reduce various waste. We are utilizing the management cycle of Plan-Do-Check-Act (PDCA) to strengthen voluntary measures.

We attempt to reduce our use of resources at the production source and, after raw materials undergo our fabrication processes, we prioritize reusing internally to ensure that the raw material has been fully used and recycled, thereby delaying waste production. TSMC is implementing source reduction strategies through the Waste Management Task Force. At the beginning of the year, the Task Force formulates measures, conducts experiments, and tests measures out in related facilities and production lines to reduce various waste. We are utilizing the management cycle of Plan-Do-Check-Act (PDCA) to strengthen voluntary management mechanisms. In 2021, TSMC was able to reduce over 40,000 metric tons of waste in total and fulfill our commitment to source reduction with a three-pronged approach.

In 2021, TSMC released the TSMC Supplier Transportation Management White Paper on Supply Online 360 in the hopes of working with suppliers to manage and control materials from the source, ensure minimal packaging, and evaluate the viability of using recycled materials for packaging or reusing packaging materials. This approach achieves dual benefits of source reduction and resource recycling as it not only reduces packaging waste but also reproduces recycled materials into products and prevents incineration. In addition, as we are nearing the completion of various projects such as the Zero Waste Manufacturing Center and Electronics-Grade Chemicals Recycling Project, TSMC continues to exemplify commitment to fulfilling 2030 Goals of outsourcing less than 0.5 kg of unit waste disposal per wafer. We are also promoting the management principle of "minimizing waste, maximizing resource recycling, and optimizing vendor management" to facilitate waste reduction in our upstream supply chain and the reuse of wafer cassettes in our downstream packaging and testing facilities to ensure our partners are implementing source reduction strategies.

### TSMC Outsourced Unit Waste Disposal Per Wafer Trend

<table>
<thead>
<tr>
<th>Year</th>
<th>Unit: Kg/12-inch equivalent wafer mask layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>0.82</td>
</tr>
<tr>
<td>2018</td>
<td>0.79</td>
</tr>
<tr>
<td>2019</td>
<td>0.89</td>
</tr>
<tr>
<td>2020</td>
<td>1.01</td>
</tr>
<tr>
<td>2021</td>
<td>0.99</td>
</tr>
</tbody>
</table>

### Waste Reduction Measures and Results in 2021

**Manufacturing Equipment Waste Reduction**
- 149 cases: Chemical use-time/flow reduction
- 53 cases: Process simplification solution
- 47 cases: Chemical alternatives
- 5 cases: Life cycle extension of chemicals

**In-house Recycling Equipment**
- 2 cases: Copper-containing/cobalt-containing liquid waste electrolysis
- 1 case: Ammonium sulfate waste crystallization
- 1 case: Silicon containing liquid waste filter press dehydration
- 1 case: Sulfuric acid liquid waste reclamation
- 1 case: Hydrofluoric acid waste regeneration

In 2021, TSMC reduced over 220,000 metric tons of waste.
Capitalizing on Inter-Organizational Cooperation & Smart Copy across Facilities to Increase Benefits of Source Reduction

Without compromising our excellent product quality, we have been discussing projects for simplifying processes and extending the life cycle of chemicals and equipment maintenance to target source reduction. To expand the scope of our source reduction measures, we are utilizing inter-organizational cooperation to treat IPA wastewater so that it can be reused in cooling towers. We are also capitalizing on the Smart Copy approach to roll out ways to reuse hydrofluoric acid to new processes in other facilities.

Inter-Organizational Cooperation Leads to a Monthly IPA Wastewater Reduction of 682 Metric Tons

In 2021, TSMC discovered, through the Unit Waste Output Management System, that the total amount of IPA wastewater produced at Fab 18A and Fab 15B is higher than that of mature processes. Upon analysis, we realized that advanced processes require the use of IPA and deionized water to prevent the structure from collapsing when spin-drying wafers, which produces a large quantity of relatively low-concentration IPA wastewater. To reduce IPA wastewater effluents, TSMC launched an inter-organizational discussion and experiment involving the Processes, Equipment, and Facility Division and was able to successfully separate relatively low-concentration IPA wastewater from existing wastewater systems. The separated IPA wastewater is then biodegraded to produce effluents that can be reused by cooling towers. This has the dual effects of reducing our monthly IPA wastewater reduction by 682 metric tons as well as water conservation and reducing energy consumption by reducing outsourced distillation treatments.

Smart Copy across Facilities Leads to a Monthly Hydrofluoric Acid Wastewater Reduction of 870 Metric Tons

In 2021, to increase the yield rate of advanced processes, Fab 18A and Fab 15B introduced a process of back rinsing wafers with hydrofluoric acid. Originally, the hydrofluoric acid could only be used once before disposal into the wastewater tank. To fulfill our commitment to green manufacturing, we used the Smart Copy approach to replicate the circulatory mechanism of adding acid from mature processes and was able to successfully separate relatively low-concentration IPA wastewater from existing wastewater systems. The separated IPA wastewater is then biodegraded to produce effluents that can be reused by cooling towers. This has the dual effects of reducing our monthly IPA wastewater reduction by 682 metric tons as well as water conservation and reducing energy consumption by reducing outsourced distillation treatments.

Optimize IPA Wastewater Treatment

Original IPA Processes → IPA Wastewater → Distill & Recycle → Industrial-Grade IPA → Reused in Other Industries

New Inter-Organizational Cooperation leads to Separated IPA Wastewater → Biodegrade IPA Wastewater with Wastewater System → Legally Compliant Effluents → Reuse in Cooling Towers

Optimize Hydrofluoric Acid Wastewater Treatment

Original Hydrofluoric Acid Processes → Hydrofluoric Acid Waste → Chemical Reaction → Artificial Fluorite → Reused in Other Industries

New Acidification → Reused hydrofluoric acid waste by 870 metric tons each month by increasing the concentration of hydrofluoric acid waste
Circular Economy

In addition to source reduction, TSMC is also dedicated to promoting a circular sustainable resource project, facilitating the Action Plan to Turn Waste into High-Value Products, building the Zero Waste Manufacturing Center, testing the Electronics-Grade Chemicals Recycling Project, and expanding the Industry Cooperation to Co-Create Resources Project. Resource sustainability and renewal is the cornerstone of TSMC’s circular economy strategy and we hope to become a company that practices waste reduction, net zero emissions, and a circular economy.

The Action Plan to Turn Waste into High-Value Products reproduces sulfuric acid, copper sulfate, ammonium sulfate, and silicon-containing wastewater into renewed resources for in-house reuse or sale to related industries. In 2021, Taiwan facilities renewed a total of 180,000 metric tons of resources and created over NT$180,000,000 million in value from recycling resources. TSMC also successfully developed the first ever Hydrofluoric Acid Waste Regeneration System which can convert hydrofluoric acid waste into high-purity cryolite. We expanded the emerging circular economy model and have started building the Zero Waste Manufacturing Center, which will be operational in 2023. We also conducted pilot testing for the Electronics-Grade Chemicals Recycling Project, which can hopefully reproduce quartz disks as quartz rings. In addition, TSMC continues to evaluate resource recycling projects such as using pyrolysis to create oil products or solid fuel from plastic waste. This can reduce incineration rates, increase recycling rate, and is in line with TSMC’s EP&L management model where we actively try to reduce the environmental footprint and impact of our waste treatment as we strive towards net zero emissions.

In 2021, TSMC worked with manufacturers across industries and conceived the Industry Cooperation to Co-Create Resources Project. The Project has allowed TSMC to successfully recycle rather than bury 3 types of waste, e.g., reproducing construction surplus soil from facility repairs into lean concrete as well as recycling and reproducing quartz glass into construction materials and art. We were also inspired by our success with recycling electronic-grade copper materials to collaborate with vendors to reproduce quartz disks as quartz rings, we believe the quartz rings will be ready for applications in semiconductor processes in 2022, cutting our landfill rate in half from 0.2% to 0.1%.

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Circular Economy Milestone

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiate sulfuric acid waste renewal equipment</td>
<td>Initiate copper-containing wastewater renewal equipment</td>
<td>Complete amendments to the articles of association Add four business categories</td>
<td>Start selling or internally transferring recycled products produced by TSMC</td>
<td>Build the first pilot production line for recycling electronics-grade chemicals</td>
<td>Pass proposal for the first zero waste manufacturing center</td>
<td>Start construction for the first zero waste manufacturing center</td>
<td>Start reusing electronics-grade chemicals</td>
</tr>
<tr>
<td>Sulfuric Acid Waste</td>
<td>Copper-containing Wastewater</td>
<td>Ammonium sulfate Wastewater</td>
<td>Cobalt-containing Wastewater</td>
<td>Silicon-containing Wastewater</td>
<td>Hydrofluoric Acid Waste</td>
<td>NEW</td>
<td></td>
</tr>
</tbody>
</table>
Semiconductor Processes

Hydrofluoric acid wastewater produced by wafer processing and cleaning processes was originally outsourced for waste treatment. To reduce risks from mishandling by outside waste treatment vendors and enhance the reuse value of hydrofluoric acid waste, TSMC collaborated with suppliers to conduct research on hydrofluoric acid waste recycling technology and high-purity cryolite technology, overcoming various challenges of software design, hardware/equipment, and operations throughout the testing process. After repeated testing and verification, we successfully launched TSMC’s first Hydrofluoric Acid Waste Regeneration System in 2021, converting hydrofluoric acid wastewater into high-purity cryolite, which can be used as a high-quality fluxes required for electrolysis in the aluminum industry, thereby enhancing the regeneration technology of the domestic circular economy industry. TSMC plans to implement this system in advanced process fabs in 2023, with the expectation that it will reduce outsourced hydrofluoric acid waste by about 46,000 metric tons and create a benefit of more than NT$400 million per year.

**Case Study**

Hydrofluoric acid wastewater produced by wafer processing and cleaning processes was originally outsourced for waste treatment. To reduce risks from mishandling by outside waste treatment vendors and enhance the reuse value of hydrofluoric acid waste, TSMC collaborated with suppliers to conduct research on hydrofluoric acid waste recycling technology and high-purity cryolite technology, overcoming various challenges of software design, hardware/equipment, and operations throughout the testing process. After repeated testing and verification, we successfully launched TSMC’s first Hydrofluoric Acid Waste Regeneration System in 2021, converting hydrofluoric acid wastewater into high-purity cryolite, which can be used as a high-quality fluxes required for electrolysis in the aluminum industry, thereby enhancing the regeneration technology of the domestic circular economy industry. TSMC plans to implement this system in advanced process fabs in 2023, with the expectation that it will reduce outsourced hydrofluoric acid waste by about 46,000 metric tons and create a benefit of more than NT$400 million per year.
Audit and Guidance

While committed to source reduction and achieving a circular economy, TSCM also takes full responsibility of waste clean-up, treatment, and flow. We track the entire waste clean-up process through our GPS Satellite Fleet System and request that our waste clean-up vendors comply with the Supplier Transportation Management White Paper. We’re also implementing the Waste Clean-up Vendor Operations Enhancement Project to promote three major management protocols for waste-clean-up, operations, and post-departure across the 4 dimensions of company operations, management of clean-up personnel, specification certification for vehicles, and operational processes.

In 2021, TSMC conducted on-site audits at 42 waste clean-up vendors and completed 14 mitigation measures for 100% of tank trucks and sludge clean-up trucks. TSMC is also demanding clean-up vendors to obtain ISO 45001 management system certificates, and 78% of clean-up vendors have already obtained the necessary certification. In 2023, we aim to increase that percentage to 100%.

In regards to waste treatment vendors, TSMC is implementing the Waste Treatment Vendor Sustainability Enhancement Project. Starting with new vendor selection, TSMC conducts document review and on-site operational inspections across six dimensions to carefully choose outstanding vendors to work with. We then conduct on-site inspections comprised of eight dimensions and 166 inspections items for qualified vendors that pass.

Manage & Control the Operational Processes of Waste Clean-Up Vendors through the Waste Clean-up Vendor Operations Enhancement Project

Manage & Control the Operational Processes of Waste Treatment Vendors through the Waste Treatment Vendor Sustainability Enhancement Project

Vendor Selection Process
- Establish a standardized selection process to evaluate vendor qualifications
- Establish a certification system for clean-up personnel and vehicles to ensure operator competence and vehicle specifications

Vendor Inspection
- Environmental Safety & Health Department
- Purchasing Department
- Waste Management Section

Operating Management
- Waste Management
- Water Management
- Fire Safety Management
- Air Pollution Prevention

Waste Flow Control and Compliance with Management Requirements
- Environmental Safety & Health Department
- Waste Management Section
- Purchasing Department
- Legal Department

Before Clean-up
- Vendor Selection Process
- Vendor Inspection
- Operating Management

During Clean-up
- Observe tank truck operations
- On-site and review documents, vehicle specifications, and processes to evaluate operational compliance

After Clean-up
- Annual Vendor Audit
- Conduct comprehensive evaluation of waste clean-up vendor management through annual audits
- Strengthen awareness through examples of accidents and enforcing autonomous tank truck inspections through annual training plans for clean-up personnel and annual inspection plans for tank trucks
the selection process. Lastly, vendor replacement is carried out based on the three dimensions stipulated in the Annual Inspection for Waste Treatment Vendors. In 2021, TSMC audited 56 waste treatment vendors on site, reaching a 100% inspection rate, and 127 deficiencies were mitigated. The percentage of vendors evaluated as “excellent” and “good” has continued to increase from 36% in 2015 to 77%. The percentage of vendors certified for ISO 14001 increased to 82% and we plan to increase that percentage to 100% in 2025.

To strive for excellence, in addition to on-site audits and assisting vendors obtain certification, TSMC is also replacing manual inspections with systematic management of suspicious activities through auto-detection and reporting by introducing automated smart technologies as we move full-speed ahead towards intelligent waste management with full traceability. To further enhance supplier sustainability and expand the scope of influence of the green supply chain, TSMC launched interactive online courses on waste management on the TSMC Supplier Sustainability Academy platform, which is available for our supply chain and the public.

### Waste Treatment Vendor Audit and Guidance Results in 2021

<table>
<thead>
<tr>
<th>Environmental Management</th>
<th>Percentage of Deficiencies</th>
<th>Number of Deficiencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Management</td>
<td>45%</td>
<td>57</td>
</tr>
<tr>
<td>Safety and Health Management</td>
<td>30%</td>
<td>38</td>
</tr>
<tr>
<td>Wastewater Management</td>
<td>17%</td>
<td>21</td>
</tr>
<tr>
<td>Air Pollution Management</td>
<td>9%</td>
<td>11</td>
</tr>
</tbody>
</table>

### Legal Compliance
- Add due diligence requirements
- Amend waste disposal contracts to comply with laws and regulations
- Correct erroneous declarations

### Onsite Environment/Operational Improvement
- Correct erroneous labels in waste storage areas
- Ensure local waste storage area and management is consistent with license
- Increase employees with first response/occupational safety supervisor certificates to meet legally mandated quotas
- Enhance personal safety protection – raise awareness about wearing PPE equipment and optimized protection equipment for operations and safety
- Adjust the scope of operations in the water pollution prevention & control plan to comply with on-site practices
- Upgrade equipment to collect water from emergency shower stations
- Enforce wastewater meter reading & records
- Stabilize water quality and strengthen water quality control
- Correct operational parameters/handling quantity to comply with on-site practices
- Enforce record keeping for equipment operations

### Establishing Regulations & Procedures
- Formulate workspace monitoring items & frequencies based on hazard and risk exposure levels
- Formulate a Hazard Communication Management Plan
- Add internal repair & maintenance plans to the license
TSMC Timeline for Waste Treatment Vendor Management

- Establish & initiate the selection process for new waste treatment vendors
- Announced standards for waste treatment vendor annual evaluation
- Establish an exclusive TSMC GPS satellite fleet system
- Enforce the Waste Treatment Vendor Annual Audit Plan
- Build a Clean-up Receipt Cloud Reporting Process
- Establish the Clean-up Operations Enhancement Project
- Establish S.W.I.F.T for 100% of vendors

2021 Waste Treatment Vendor Evaluation Results

ISO-certified Waste Treatment Vendors

Note: The total score is 100 points; ≥ 90 points is "excellent"; ≥ 80 points “good” ≥ 70 points; <70 marks "average" ≥ 60 marks; <60 indicates the elimination of manufacturers
Integrate Digital Transformation for the Common Good - Perfecting the Intelligent Waste Management Procedure with Full Traceability

For the effective management of proper waste handling, TSMC finished building the System of Waste Intelligent Fast Track (S.W.I.F.T) in 2021 and selected vendors from 5 different types of waste treatment for pilot testing. We introduced AIoT mechanisms at five critical checkpoints and intend to roll-out the system to all waste treatment vendors in 2025, which will allow us to increase storage and treatment inspections by 65 fold and reduce 13,000 manual inspection hours each year. During the same time, TSMC will be using S.W.I.F.T to track recycled products after they leave TSMC facilities. In addition to quarterly on-site inspections of sales receipts and online inspections via the Recycled Product Cloud Reporting Platform, TSMC further collaborated with the EPA in 2021 to launch a function for institutional organizations to search how outsourced waste is treated and for reuse organizations to search the flow of their products, strengthening tracking and control over recycled products.

TSMC continues to strengthen full traceability management of three outsourced areas of waste clean-up, treatment, and recycled product transport and flow and is also actively promoting digital transformation among waste clean-up vendors. In 2021, TSMC launched the online receipt application for real-time delivery and convenient documentation. TSMC also simultaneously conceived the Digitalization of Proper Handling Documents which we plan to launch in 2022. The digitalization project is estimated to conserve 320,000 papers each year, creating value towards the common good of the environment.

Milestones for System of Waste Intelligent Fast Track (S.W.I.F.T)

- 2020
  - Map out system framework

- 2021
  - Categorize vendors into five types and appoint one vendor from each type for pilot testing
  - Conduct on-site inspections

- 2022
  - Install hardware
  - Integrate hardware signals
  - Define articulation
  - Begin pilot testing for Type 3 Vendor

- 2025
  - Roll-out to all TSMC’s waste vendors
## Air Pollution Control

### Strategies & 2030 Goals

**Best Available Technology**
Adopt The Best Available Technology to control the pollutants emitted from TSMC operations and minimize environmental impact

<table>
<thead>
<tr>
<th>2021 Achievements</th>
<th>2022 Targets</th>
<th>2022 Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reduce the unit air pollutant emissions by 60% Note 1</strong> (Base year: 2015)</td>
<td>Reduce the unit air pollutant emissions by 56%</td>
<td>Reduced the unit air pollutant emissions by 54% Target: 45%</td>
</tr>
<tr>
<td>Reduction rate of volatile organic gases &gt; 98% Note 2</td>
<td>Reduction rate of volatile organic gases &gt; 98.6%</td>
<td>Reduction rate of volatile organic gases &gt; 98.4% Target: &gt;96%</td>
</tr>
</tbody>
</table>

### Strengthen the Monitoring for Air Pollution Control Equipment
Leverage backup systems and dual-track management, along with pollutant monitors, to ensure that the equipment works as intended and to prevent abnormal occurrences

<table>
<thead>
<tr>
<th>2021 Achievements</th>
<th>2022 Targets</th>
<th>2022 Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report &lt;1 abnormal occurrence in air pollution control equipment</td>
<td>Report &lt;1 abnormal occurrence in air pollution control equipment</td>
<td>Reported 0 cases of abnormal occurrences to the supervising authorities Target: &lt;1</td>
</tr>
</tbody>
</table>

**Note 1:** The 2030’s goal for air pollutant emission reduction has already reached in 2021, thereby, TSMC increased the 2030 Goal from 50% to a 60% compared to the base year 2015.

**Note 2:** 2030 goal for reduction rate of volatile organic gases has reached in 2021, thereby, TSMC increased the 2030 Goal from 98% to 99% of reduction compared to the base year.

**Note 3:** The target in 2022 will be adjusted from "Abnormal Occurrences Reported to the Authorities" to "Unexpected Events In Air Pollution Prevention Equipment" for fully effective air pollution management. According to local regulations, an equipment failure must be reported to the authorities within 1 hour or remediate within 24 hours. 

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TSMC is committed to air pollution control and has adopted "separation emission sources" method and multi-phase BAT to enhance performances of pollution control equipment. We are also actively monitoring and managing the total emissions levels from pollution control systems and aiming for concentration levels from stack emissions to be lower than regulatory standards to achieve the emission reduction goal. TSMC continues to practice green manufacturing by enhancing the performance and control measures for air pollution systems. In 2011, the unit air pollutant emissions and reduction rate of volatile organic gases both reached 2030 goals ahead of schedule.

**Best Available Technology**

For acid and alkaline gases, TSMC uses two strategy, "effective reduction of emission from sources" and "strengthened management of terminal prevention facilities", to achieve Best available technology (BAT) controls air pollution at the source. Thereby enhancing treatment efficiency of exhaust gases. In the first stage of source separation, TSMC separates pollutants based on their properties. Toxic gases, corrosive gases, flammable gases, perfluorocarbon greenhouse gases, and other acid/alkaline gases will go to the high-efficiency local scrubbers for treatment before entering the central scrubber while the waste gases containing low concentrations of inorganic acid/alkaline gases will go directly to the central scrubber, which is the last-stage of the pollution control equipment for the air pollution removal. For the volatile organic gases, the engineers determine whether the condensing local treatment equipment are required by looking at its boiling point. Then, the exhaust gases will go into the zeolite rotor concentrators for two-stage adsorption, effectively reducing the emission levels.
Source Reduction & Management - High-Efficiency Local Scrubbers

As advanced processes continue to evolve, we also aim to control air pollution from new processes and chemicals. New Tool and New Chemical Review Committee at TSMC evaluates the impact of new tools and chemicals on safety, the environment, and health. TSMC adopts eight different types of local scrubbers to pretreat high-concentration exhaust based on their pollutant properties. The eight different local scrubbers include the thermal-type, the burn-type, the plasma-type, the wet+chemical dosage-type, the adsorption-type, the condensation-type, and the wet-type of local scrubbers. In 2021, TSMC conducted 403 reviews for 191 new tools and 212 new chemicals. In addition, TSMC installed high-efficiency spray devices to the thermal + wet scrubbers. The spray was applied to Fab 15B for testing. The test showed a 87% and 86% reduction in hydrochloric acid gases and derivative particulate matters, respectively, further reducing the load on the central scrubbers.

TSMC also continues to improve existing equipment to enhance performances. In 2021, TSMC introduced a large-capacity (2,500 liter/minute) burn-type scrubber to the Fab 12B. The burn-type scrubber not only reduced pollutants by over 95% but also was able to reduce thermal loss by 38% through its centralized high-temperature treatment mechanism. Furthermore, it reduced the required surface area by 37%, and pipeline installation fees/maintenance labor by 50%. As such, the new burn-type scrubber has now been listed as a standard for new facilities in the future.

Total Emission and Air Pollutants Emissions per Unit of Production

- **Epitaxial Dry Etching**
  - Target Pollutant: Corrosive Gases
  - Control Technologies: Burn-Wet
  - Equipment: NEW
  - Reduction Rate: >99%
  - Real-time Parameter Monitoring: Natural gas flow, Oxygen flow, Circulating water flow, Inlet pressure

- **Dry Etching**
  - Target Pollutant: Corrosive Gases
  - Control Technologies: Plasma-Wet
  - Equipment: NEW
  - Reduction Rate: >95%
  - Real-time Parameter Monitoring: Current amperage, Circulating water flow, Inlet pressure

- **Thin Film**
  - Target Pollutant: Corrosive Gases
  - Control Technologies: Thermal-Wet
  - Equipment: NEW
  - Reduction Rate: >95%
  - Real-time Parameter Monitoring: Reactor temperature, Circulating water flow, pH value, Inlet pressure

- **Diffusion**
  - Target Pollutant: Flammable Gases
  - Control Technologies: Thermal-Wet + Chemical Dosage (Process Site)
  - Equipment: NEW
  - Reduction Rate: >95%
  - Real-time Parameter Monitoring: Inlet pressure, Corona voltage, Corona current

- **Sputtering**
  - Target Pollutant: Hydrochloric Acids
  - Control Technologies: Thermal-Wet + Add High-efficiency Spray Device
  - Equipment: NEW
  - Reduction Rate: >95%
  - Real-time Parameter Monitoring: Reactor temperature, Circulating water flow, pH value, Inlet pressure

- **Ion Implantation**
  - Target Pollutant: Toxic Gases
  - Control Technologies: Adsorption
  - Equipment: NEW
  - Reduction Rate: >95%
  - Real-time Parameter Monitoring: Pressure difference of local scrubber, Inlet pressure

- **Thin Film**
  - Target Pollutant: Nitrous Oxide (N₂O)
  - Control Technologies: High-Temperature Thermal-Wet
  - Equipment: NEW
  - Reduction Rate: >90%
  - Real-time Parameter Monitoring: Reactor temperature, Circulating water flow, Inlet pressure

- **Wet Process**
  - Target Pollutant: Corrosive Gases
  - Control Technologies: Wet + Chemical Dosage (Process Site)
  - Equipment: NEW
  - Reduction Rate: >95%
  - Real-time Parameter Monitoring: Differential pressure of local scrubber, Circulating water flow, Inlet pressure, pH value

- **Sulfuric Acid (H₂SO₄)**
  - Target Pollutant: Electrostatic Precipitation
  - Equipment: NEW
  - Reduction Rate: >95%
  - Real-time Parameter Monitoring: Inlet pressure, Corona voltage, Corona current

- **Organic Process**
  - Target Pollutant: Specific High Boiling Point Organics
  - Control Technologies: Condensation
  - Equipment: NEW
  - Reduction Rate: >95%
  - Real-time Parameter Monitoring: Differential pressure of local scrubber, Condensation temperature

- **Storage Tanks**
  - Target Pollutant: Corrosive Gases
  - Control Technologies: Wet + Chemical Dosage (Facility Site)
  - Equipment: NEW
  - Reduction Rate: >95%
  - Real-time Parameter Monitoring: Differential pressure of local scrubber, Circulating water flow, Inlet pressure

Note 1: TSMC air pollutant emissions were reported in accordance with local laws and regulations.

Note 2: Air pollutant emissions include the total emissions of eight gases: hydrocarbons (THC), sulfuric acid (H₂SO₄), hydrochloric acid (HCl), nitric acid (HNO₃), hydrofluoric acid (HF), phosphoric acid (H₃PO₄), chlorine (Cl₂), and ammonia (NH₃).
Strengthen Management of Terminal Prevention Facilities - Central Scrubbers

After first-stage treatment, the exhaust gases undergo second-stage treatment: acid and alkaline gases are channeled into scrubber in central treatment facilities while volatile organic gases are channeled to zeolite rotor concentrators for adsorption and burning. To enhance the scrubber efficiency, the Facility Division collaborated with the Industrial Technology Research Institute to design a high-efficiency central scrubber, which was first introduced to Fab 18B in 2021, and enhance the reduction efficiency of acid and alkaline gases to 40%.

In terms of volatile organic gases, TSMC continues to carry out the Low-efficiency Single Zeolite Rotor Concentrators Upgrade Initiative in existing Taiwan facilities. New facilities started utilizing the dual zeolite rotor concentrator, which has already been installed to Fab 18B in 2021 and will be installed to Fab 12 Phase 8, Advanced Backend Fab 6, and other facilities in 2022. In addition, TSMC will apply smart control parameters to the zeolite rotor systems. Concentration level at the inlet, temperature, air flow, and other external parameters are imported into the tool so that it can adjust the optimal burning temperature, desorption temperature, rotor rotation, and other operating parameters. In 2021, the reduction rate of volatile organic gases reached 98.4%. Due to the continued increase in removal efficiency, the total air pollutant emissions have not increased with the addition of new facilities.

Timeline for Air Pollution Prevention Systems

<table>
<thead>
<tr>
<th>Year</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>Add chemical dosing system to thermal wet scrubbers</td>
</tr>
<tr>
<td>2018</td>
<td>Introduce high-temp electric heating and wet scrubber</td>
</tr>
<tr>
<td>2019</td>
<td>Add high-efficiency spray equipment to thermal wet scrubbers</td>
</tr>
<tr>
<td>2019</td>
<td>Introduce Parameter Optimization for Single Zeolite Rotor Concentrators to existing facilities</td>
</tr>
<tr>
<td>2020</td>
<td>Introduce the Improvement Program for Inefficient Thermal Oxidizer of Zeolite Rotor Concentrators</td>
</tr>
<tr>
<td>2021</td>
<td>Introduce the Low-efficiency Single Zeolite Rotor Concentrators Upgrade Initiative to new facilities</td>
</tr>
</tbody>
</table>

Annual Reduction Rate of Volatile Organic Gases

- Average Reduction Rates of Subsidiaries
- Average Reduction Rates of Taiwan Fabs
- Average Reduction Rates of TSMC (including subsidiaries)

Note: Figures from TSMC fabs in Taiwan, TSMC (China), TSMC (Nanjing), and VisEra. Data excludes WaferTech as there is no total hydrocarbon monitor to provide any record of reduction rates.
Environmental Laboratory to Drive Innovation for Prevention Technologies

TSMC is dedicated to reducing air pollutant emissions and continues to practice green manufacturing with concrete actions. In order to ensure TSMC’s air pollution prevention facilities remain highly efficient, the Environmental Laboratory was established to further strengthen stack emission monitoring and management measures. The Environmental Laboratory monitors and collects emission concentration levels from TSMC facilities across Taiwan and sets emission concentration levels for various pollutants to be stricter than regulatory standards. The Environmental Laboratory then uses baseline management to identify stacks that exceed TSMC’s emission concentration standards for confirmation at the source. For stacks with higher concentration levels of acid and alkaline gases that exceed TSMC’s emission standards, TSMC has a program to install the High-Efficiency Local Scrubber to increase reduction rate of the target pollutants. TSMC also has a Renovation Program for Air Pollution Prevention Equipment to replace the central scrubbers and other last-stage air pollution control equipment that have reached the end of their life cycles. For stacks with volatile organic gases that exceed TSMC’s emission standards, TSMC has an Improvement Program for Inefficient Thermal Oxidizer of Zeolite Rotor Concentrators to convert or replace the Regenerative Thermal Oxidizer into Direct-fired Thermal Oxidizer. In 2021, 43 stacks exceeded baseline concentration standards and TSMC was able to mitigate and verify mitigation outcomes for 21 stacks. TSMC regularly monitors and seeks to upgrade any stacks that fail to meet reduction standards. Facilities teams also communicate with other facilities teams to share and exchange experiences to accelerate the timeline for the upgrades.

In addition to implementing reduction measures and increasing reduction efficiency, the Environmental Laboratory has introduced air quality monitoring vehicles that travel to different facilities to monitor air quality on site and compile long-term records to show changes in air quality over the long run. Their records will serve as reference when TSMC is formulating air quality monitoring policies to continue strengthening the development of air pollution control technologies.

Prevention Technology Feasibility & Reduction Effectiveness Evaluation

Environmental Laboratory Regularly Monitors & Tracks All Stacks for Emissions Lower Than Regulatory Standards

Mission of Environmental Laboratory

- Strengthen pollutant monitoring and management for stacks, drive innovative technologies for pollutant treatment, and aim for stack emissions to align with surrounding background values
- Monitor and collect stack emission concentration levels for TSMC facilities in Taiwan
- Formulate a baseline standard for pollutant emission concentration levels
- Implement mitigation measures for stacks emitting concentration levels over TSMC’s baseline standards and track mitigation outcomes
- Continue to improve and protect the environment

Air quality monitoring vehicle monitors air quality for areas surrounding TSMC facilities

Note 1: Size of the bubble indicates the technology’s reduction efficiency
Note 2: Single circle indicates local/central treatment facilities; double circles indicate zeolite rotor concentrators
Strengthen Monitoring of Air Pollution Prevention Equipment

TSMC is actively enhancing the treatment efficiency of the control equipment as well as regularly monitoring and reporting emissions data in compliance with Taiwan and overseas regulations. TSMC is also installing automatic pollutant monitoring systems for all stacks. The systems include a hydrocarbon monitor, online IPA monitor, and online fluorine gas monitors, which were first installed in Fab 12A in 2018 and then, gradually, Fab 12B, Fab 14A, Fab 14B, Fab 15A, Fab 15B, and Fab 18A. Through rigorous control of monitoring data and accuracy as well as effective, real-time monitoring of actual emission levels, TSMC achieved zero abnormal air pollution events in 2021.

In addition, to ensure air pollution treatment facilities remain at optimal efficiency for operations all-year around, TSMC adopts the N+1 rule where all equipment must have at least one backup system. TSMC also has an Uninterrupted Power Supply System to help fulfill the management target of zero failure in control equipment. All control equipment is also equipped with a Dual-track Independent Monitoring System that allows the Facility Division and Industrial Safety and Environmental Protection Division to simultaneously check the equipment’s status and its related operational parameters. The Dual-track Independent Monitoring System is equipped with a comprehensive alert system. Once the system or the equipment becomes ineffective or fails, both the Facility Division and the Industrial Safety and Environmental Protection Division can independently monitor, conduct emergency repairs, or launch backup systems.

TSMC faces a growing demand for fab facility equipment as a result of rapidly evolving processes. In 2021, the Facility Division, Industrial Safety and Environmental Protection Division, and Instrument Control System Division worked together to build an Automatic System for Legal Air Pollutant Coefficient Upgrades & Inspection, where a third-party inspection agency will regularly conduct stack inspections and then hand over the data to the Industrial Safety and Environmental Protection Division to update and import the information to the internal monitoring platform, which will then automatically generate air pollution reports that will be stored to cloud platforms. The air pollution reports will then be read by the Facility Parameter Change Management System™ and Facility Monitoring and Data Collection System daily for automatic comparison and inspection. Compared to past air pollution reports compiled manually, the new automatic reports saved 60% of working time while preventing erroneous report to the government agencies as well as preventing data loss. This effectively increases the accuracy and reliability of TSMC reports to government agencies.

Note: TSMC’s 12-inch fabs first adopted the Facility Parameter Change Management System in 2020. The system automatically compares parameters to standard parameters at a fixed time each day to ensure that preventive facilities are operating on optimal parameters and effectively control operational parameters of treatment facilities.
Increase Reduction Rate of Acid and Alkaline Gases by 40% with Development of High-Efficiency Central Scrubber

TSMC is actively enhancing the efficiency of terminal prevention facilities and is collaborating with the Industrial Technology Research Institute to launch the Central Scrubber Optimization Program to optimize pollution treatment capabilities and tower structure for an added front filter and self-clean function that will help extend the period between maintenance and reduce any risks that may arise from switching in between prevention facilities. In 2020, TSMC completed design and testing for High-Efficiency Central Scrubbers. In 2021, TSMC successfully introduced the High-Efficiency Central Scrubber to Fab 18B Phase 4 and increased the reduction rate of acid and alkaline gases by 40%. We plan to introduce High-Efficiency Central Scrubbers to Fab 18B Phases 5 & 6 in 2022 and will be making it a standard prevention facility in all future facilities. For existing facilities, we will continue to optimize the tower structure to enhance emission treatment efficiency.

Reduction Rate of Hydrochloric Acid and Particulate Matters Increase by 87% & 86% with New Air Pollution Prevention Facilities

In order to enhance the efficiency of source reduction, TSMC is working with vendors to improve performances of existing local scrubbers, especially thermal wet scrubbers that target exhaust gases from boiler tubes as DCS and chlorine used in boiler tubes create hydrogen chloride and large amounts of particulate matters within the facility. As such, we developed high-efficiency spray devices that uses high-speed air to vaporize liquid droplets and reduce the diameter of particulate matters. This will increase the contact surface between liquid droplets and pollutants, allowing it to coagulate into a larger solid particulate matter that can then be intercepted by scrubber sprays for enhanced treatment efficiency.

In 2021, TSMC conducted pilot testing and introduced high-efficiency spray devices to Fab 15B, increasing the reduction rate of hydrochloric acid and particulate matters by 87% and 86%. We plan to introduce the high-efficiency spray device to Fab 18B in 2022 and will be making it a standard system for new facilities. For existing facilities, we will be carrying out a three-year upgrade plan to ensure total emissions do not increase with the addition or expansion of facilities.

Increase Air Pollution Reduction Rate by Upgrading Local Scrubbers

Mitigation Items

1. Add high-efficiency spray device to reduce droplet diameter and, thereby, expand contract surface with pollutant
2. Add a scrubber spray to intercept particulate matters and enhance treatment efficiency
An Admired Employer

TSMC remains committed to the core values of Commitment and strives to foster a diverse and inclusive culture as well as an open-style management system to attract and retain talents of different backgrounds and professions. We offer competitive compensation and benefits as well as a safe and fun workplace for growth. It is our mission to become a company that our employees can be proud of.

4x
The average total compensation for direct employee is four times the minimum monthly wage in Taiwan

8,536
New high-quality job opportunities around the world

100%
All employees and contractors passed safety and health training programs for operational qualifications
# Diversity and Inclusion

## Strategies & 2030 Goals

**Establish an Open-style Management System**
Fulfill Core Values and Business Philosophy and continue to shape an inclusive culture

Rank in the 75th percentile for Diversity and Inclusion; rank is determined by comparing results from the Engagement Survey against the WTW Global High Performance Norm.

**Unleash the potential of Women@tsmc**
Provide resources to support Women@tsmc to help them grow and flourish

<table>
<thead>
<tr>
<th>Women in management: ≥ 20%</th>
<th>Women in management: ≥ 14%</th>
<th>Women in management: 13%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target: 12.5%</td>
<td>Achieved</td>
<td>Exceeded</td>
</tr>
</tbody>
</table>

Ensure women account for 30% of all newly hired technical professionals

Ensure women account for 25% of all newly hired technical professionals

Ensured women account for 21.3% of all newly hired technical professionals

Target: 21%

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Note: The Engagement Survey is issued once every two years and will be issued next in 2023. For results from the 2021 Engagement Survey, please refer to the section on Strengthen Employee Commitment in Talent Attraction and Retention.
TSMC’s Diversity and Inclusion Statement proposes that the composition of TSMC employees should reflect current demographics. We should bolster the Company’s competitive advantage and facilitate sustainable development with diversity in our management and employees. TSMC is actively fostering a diverse work culture and creating an inclusive workplace to cultivate future semiconductor professionals so that the industry may benefit from the full potential of global talents.

Establish an Open-style Management System

With respect to the Business Philosophy written and published by TSMC Founder - Morris Chang, TSMC hopes to apply an open-style management system to respond to social development trends and actively foster a diverse and inclusive environment. TSMC established the Diversity and Inclusion Team in 2021 to continue working on the four areas of Diverse Communication Channels, Learning Resources, Employee Welfare, and Unleashing Female Potential. We hope to prove our commitment and actions to fostering talents, cultivating talents, and retaining talents as we fulfill our core values.

The Four Areas of Diversity and Inclusion

- Communication meetings at all levels/across levels
- A global Engagement Survey that regularly and systematically compiles employee opinions
- Establish multiple channels for employees to voice their feedback and respond to employee demands and suggestions as soon as possible

- Provide diverse learning resources and tools to strengthen the professional know-how and self-efficacy of our employees
- Diverse learning methods to help employees understand the significance of Diversity and Inclusion

TSMC has implemented an open-style management system designed to keep all lines of communication open. Employees openly cooperate with one another, while treating each other with honesty and sincerity. Everyone welcomes constructive criticism and is willing to seek improvement. This management style allows all opinions to be expressed before a final decision is made. Once a decision is made, everyone works together to achieve the set goal.

- Launched the TSMC Child Care Benefit Program to support employees balancing family life and work
- Free advanced health check-ups & leave for TSMC employees with five-year seniority and longer
- Upgrade the Service Award to recognize employees’ service and contributions to the company
- Organize an Inclusive Leadership Workshop
- Found the Women’s Employee Resource Group

NEW

NEW

NEW

NEW
Unleash Female Potential

In 2021, TSMC organized three Inclusive Leadership Workshops and established the Women’s Employee Resource Group - Women@TSMC to offer female employees a platform to support each other, strengthen the network of female employees at TSMC, and encourage them to pursue their career goals and self-growth. In 2022, TSMC will continue to organize the Inclusive Leadership Workshop and also introduce a series of courses on Diversity and Inclusion, lectures related to Diversity and Inclusion, and female forum activities. We will also be extending the reaches of talent cultivation to the TSMC STEM for High School Girls Program to cultivate future semiconductor professionals.

Percentage of Female Employees

Unit: %

<table>
<thead>
<tr>
<th>Year</th>
<th>Management</th>
<th>Professionals</th>
<th>Assistants</th>
<th>Technicians</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>39.3%</td>
<td>21.3%</td>
<td>13.4%</td>
<td>13.0%</td>
</tr>
<tr>
<td>2018</td>
<td>38.7%</td>
<td>25.5%</td>
<td>13.4%</td>
<td>13.0%</td>
</tr>
<tr>
<td>2019</td>
<td>37.8%</td>
<td>21.1%</td>
<td>12.7%</td>
<td>13.0%</td>
</tr>
<tr>
<td>2020</td>
<td>37.1%</td>
<td>23.4%</td>
<td>12.6%</td>
<td>13.0%</td>
</tr>
<tr>
<td>2021</td>
<td>35.4%</td>
<td>23.4%</td>
<td>12.6%</td>
<td>13.0%</td>
</tr>
</tbody>
</table>

Note: Before 2018, statistics of Japan, North America, and Europe were calculated separately. From 2018, statistics of Japan, North America, and Europe are calculated collectively.
### Promotion Rate by Gender

- Promotion Rate by Female
- Promotion Rate by Male

### Age

- 18-30
- 31-50
- 50+

### Work Location

- Taiwan
- Asia
- North America
- Europe

Note: "Asia" includes Shanghai, Nanjing, Japan, and South Korea

### Position

- Managers
- Professionals
- Assistants
- Technicians

### Education

- Ph.D.
- Master
- Bachelor
- Other Higher Education
- High School

Note: Data from 2017 does not cover VisEra or WaferTech
Talent Attraction and Retention

Fulfill the "Commitment" Core Values
Offer employees quality jobs and strengthen employee commitment

Conduct an Employee Core Value Survey every two years to reinforce core values
- Ensure that over 95% of employees are fully committed to their work
- Ensure that over 95% of employees are willing to continue working for TSMC in the next five years

For more details, please refer to “Strengthen Employee Commitment” in this section

Target: Reinforce core values based on the 2020 Employee Core Values Survey results, conduct the 2021 Employee Engagement Survey to increase employee engagement, and strive towards TSMC’s commitment to sustainability

Conduct an Employee Engagement Survey every two years to reinforce core values
- Rank in the 75th percentile for Sustainably Engaged; rank is determined by comparing results from the Engagement Survey against the WTW Global High Performance Norm

For more details, please refer to “Strengthen Employee Commitment” in “Talent Attraction and Retention”

Maintain position above 75th percentile among industry peers in total compensation

Maintained position above 75th percentile among industry peers in total compensation

Target: 75%

Maintain total turnover rate between 5%–10%

Maintain total turnover rate 5%–10%

Target: 5%–10%

Less than 10% new hire (< 1 year) turnover rate

Maintain less than 15% new hire (< 1 year) turnover rate

Target: ≤ 15%

Note 1: In response to materiality analysis results and development strategies in 2021, we have made adjustments to parts of the content for this strategy and sustainable target.

Note 2: The Employee Engagement Survey is issued once every two years and will be issued next in 2023. For results from the 2021 Employee Engagement Survey, please refer to the section on “Strengthen Employee Commitment” in “Talent Attraction and Retention”.

Note 3: The following targets have been moved to “Talent Development” due to adjustments in development strategies: "Fill over 50% of vacancies through internal transfers" and "Fill over 75% of manager positions through internal promotions.”

Note 4: For more details, please refer to “Maintain Healthy Turnover Rate”.
As the global semiconductor industry flourishes, TSMC has been welcoming accelerated growth in recent years as well. To meet global customer demands, TSMC continues to develop advanced technologies and expand production capacities in Taiwan but is also building factories in overseas locations such as the U.S., China, Japan, etc. We have, therefore, dedicated much of our efforts to talent recruitment, development, and retention. TSMC commits to providing quality job opportunities to employees. This entails competitive compensation, welfare programs better than statutory requirements, and a safe and healthy workplace. We hope this can encourage employee commitment and engagement with the Company as well as attract and retain more talents to sustain the Company’s long-term development.

**Fulfill the "Commitment" Core Values**

**Fulfill Core Values**

TSMC’s four core values of integrity, commitment, innovation, and customer trust were defined by TSMC Founder Dr. Morris Chang, Chairman Mark Liu and CEO Dr. C.C. Wei. We expect all TSMC employees to uphold the four core values, reinforcing Company business philosophy and visions through internal company websites, meetings, lectures, publications, and various communication channels. We also organize an Employee Core Values Survey every two years to listen to employee feedback, evaluate the efficacy of employee communication, and ensure that employees are growing with the Company.

When it comes to talent attraction and retention, TSMC has always believed in “putting the right people with shared visions and values in the right positions.” “Shared visions” means that all employees share the same vision and mission; “shared values” mean that all employees abide by the same core values and code of conduct; and “right people in the right positions” means that the Company is dedicated to helping employees unleash their full potentials in the right positions.

**Strong Talent Pool**

TSMC has remained true to the four core values and has always strived to be a Company that employees can be proud of. In 2021, Cheers Magazine ranked TSMC as No. one in the Top Ten Most Admired Companies to Young Generations for the fifth consecutive year. In 2021, TSMC hired 12,683 new employees around the world. As of the end of 2021, TSMC had a total of 65,152 employees, including 65,133 regular employees and 19 temporary workers that were about to become regular employees. There were also 307 contractors and 94 contractors signed for projects and short-term support omitted from our total employee count.

**Recruitment Criteria**

Abiding by the guidelines of “shared visions and values” and the basis of Diversity and Inclusion, TSMC does not discriminate against candidates because of their gender, religion, race, nationality, or political affiliation. TSMC prioritizes character and capability over professional skills when assessing candidates. All candidates must undergo rigorous selection criteria and interviews for a comprehensive evaluation before they are welcomed on board.

**Recruitment in Taiwan**

Recruitments at global branches are mainly through local hiring. However, in the principal place of business, Taiwan, we must consider technological development and diversity. Therefore, in addition to the recruitment of professionals and recent graduates, overseas special professionals are listed as a recruitment focus as well.

<table>
<thead>
<tr>
<th>TSMC Employees (Global)</th>
<th>Unit: People</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017 48,602 48,598</td>
<td></td>
</tr>
<tr>
<td>2018 48,752 51,289</td>
<td></td>
</tr>
<tr>
<td>2019 56,831 56,825</td>
<td></td>
</tr>
<tr>
<td>2020 65,152 65,133</td>
<td></td>
</tr>
<tr>
<td>2021 415</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interns Receiving Advance Offers - Taiwan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit: People</td>
</tr>
<tr>
<td>2017 278 97</td>
</tr>
<tr>
<td>2018 259 83</td>
</tr>
<tr>
<td>2019 240 92</td>
</tr>
<tr>
<td>2020 347 114</td>
</tr>
<tr>
<td>2021 415 154</td>
</tr>
</tbody>
</table>

**Strengthen Internship Program**

In 2021, TSMC’s DNA Internship Program, which revolves around the following three targets: Develop, Navigate, and Advance Offer, offered diverse learning activities and actual project involvement such as lectures, courses, workshops to give interns the opportunity to explore themselves and learn about the semiconductor industry and related technologies. Outstanding interns are given an advance offer to TSMC upon graduation, contributing to the success of both the students and the Company.
In 2021, TSMC welcomed 415 interns through the DNA Internship Program, of which 31% (127 interns) were female students. After the internship, 154 interns were evaluated as outstanding and received advance offers, accounting for 37% of total interns. Among them, 29% were women.

**Disabled Employees**

In compliance with local regulations, TSMC has hired a total of 413 employees with mild or moderate disabilities and 100 employees with severe disabilities. In 2021, VisEra also provided vacancies for disabled candidates. However, due to the nature of job vacancies, VisEra received a dearth of suitable applicants, leading to its failure to meet the 1% requirement, and has paid subsidies according to legal requirements.

**Overseas Recruitment for Special Experts**

To sustain the Company’s diversified talent pool and recruit talents in special fields, TSMC continues to recruit overseas talents around the world. In terms of industry-academia cooperation, TSMC has maintained close contacts with MIT, Stanford University, UC Berkeley, Tokyo University, and other prestigious universities around the world in recent years to incubate top research talents and ensure early engagement with global talents for future recruitment. In addition to recruiting experienced semiconductor professionals in key cities in the U.S., we are also expanding our scope to India, Canada, Japan, and Europe.

**Manage Risks from Foreign Employees**

TSMC is evaluating potential risks from recruiting overseas talents in accordance with SASB standards. In consideration of trade secret protection and related international laws, TSMC has also established a protocol for sensitive hiring and related risk evaluations that will be used in the recruitment process to effectively manage potential risks that comes with recruiting overseas talents. When carrying out protocols or risk evaluations, regulatory compliance is always the priority. TSMC’s recruiting team will have to verify the identities of all candidates and must comply with related regulations for visas, work permits, and other applications to ensure that the Company and employees are both compliant with government regulations and prevent any potential risks from materializing.

**Assimilate Foreign Employees**

To help foreign employees quickly adapt to the new environment, TSMC offers assistance for relocation and settlement (including couples housing, education for children, etc.) as well as exclusive newcomer orientation and subsidies for learning Chinese and rewards for receiving Chinese certificates to encourage foreign employees to assimilate into the workplace and environment of Taiwan. In addition, TSMC also invites foreign employees and their families to join an exclusive community and holds cultural festivals to increase communication and exchanges.
Support Program for Employees from Arizona Training in Taiwan

In 2021, TSMC welcomed over 600 new employees from the Arizona facility to Fab 18 for an 18-month training and launched the Employee Support Program to help employees-in-training adapt better to work and life in Taiwan:

(1) Before the employee-in-training arrived in Taiwan, TSMC employed the services of a senior therapist familiar with American culture to host online communication sessions and help mentally prepare the employees. This includes 3 sessions on cultural adaptation. A total of 118 people participated in the focus group while 62 people participated in one-on-one counseling services to reduce cultural impacts.

(2) While employees-in-training were in quarantine after arriving in Taiwan, TSMC designated personnel to follow up with them regularly and offered workout equipment to support body and mind health.

(3) Health Center professionals offer full-time health consultations and assistance for seeking medical attention.

Strengthen Employee Engagement

In 2021, TSMC introduced the Engagement Survey, created using WTW’s High Performing Employee Experience Model as a blueprint, to systematically learn about our employees’ experiences at work and analyze our advantages and opportunities to formulate improvement measures. The survey covered TSMC facilities in Taiwan as well as overseas subsidiaries. Only VisEra, because of its different industrial background, was not included in the survey. We received a total of 55,491 responses, of which 93% were valid.

TSMC’s long-term goal is to be in the 75th percentile for the issues of Diversity and Inclusion and Sustainably Engaged based on the WTW Global High Performance Norm for the 2030 Engagement Survey. According to the 2021 Engagement Survey results, TSMC employees agree that the company is highly competitive, can quickly respond to market dynamics, and is able to provide innovative products and services to create value for customers. TSMC employees also commend the company’s ability to make swift decisions and agree that we should continue pursuing improvements in working processes or organizational efficiency. At the same time, TSMC will strive to make improvements in the following areas based on survey results:

1. Establish an open-style management system and foster a workplace of mutual respect. Encourage employees to speak up and encourage management to be open to suggestions and make appropriate responses.

2. Management is responsible for unleashing employee potential and ensuring that employees are enjoying their work, learning, and growing so that they can feel engaged and have a sense of accomplishment.

3. In addition to cash incentives, we also recommend managers use non-financial incentives to motivate and retain talents.

Competitive Compensation Packages

TSMC provides competitive compensation packages to attract and retain the best talents as well as reward employee performance and encourage long-term contribution. Our packages include a base salary, allowance, employee cash bonuses, and profit-sharing schemes. The total compensation of an employee is determined based on individual expertise, job responsibility, performance, commitment to long-term contribution, and the company’s operations and profit. In recent years, TSMC has continued to grow in revenue and profit. We have increased total compensation and benefits for employees from around NT$104.1 billion to NT$164.9 billion between 2017 and 2021, and average compensation and benefits for every employee from NT$2.14 million to NT$2.53 million during the same period.

In 2021, TSMC’s revenue and profits reached new record high yet again. The cash bonus and profit-sharing scheme allocated for Taiwan facilities were valued at NT$71.2 billion. TSMC also adjusted the salary structure by converting some variable compensation into fixed compensation for all formal employees in Taiwan facilities in 2021.

The total compensation for TSMC employees includes base salary, allowances, cash bonuses, and the profit-sharing scheme. In 2021, the average total compensation for a newly graduated TSMC engineer with a master’s degree was higher than the average compensation and benefits per person of global employees.

Compensation and Benefits Expenses

<table>
<thead>
<tr>
<th>Year</th>
<th>Compensation and Benefits Expenses of Global Employees</th>
<th>Average Compensation and Benefits Per Person of Global Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>104,139 billion NT$</td>
<td>2.143 million</td>
</tr>
<tr>
<td>2018</td>
<td>108,215 billion NT$</td>
<td>2.219 million</td>
</tr>
<tr>
<td>2019</td>
<td>109,985 billion NT$</td>
<td>2.144 million</td>
</tr>
<tr>
<td>2020</td>
<td>140,817 billion NT$</td>
<td>2.478 million</td>
</tr>
<tr>
<td>2021</td>
<td>164,947 billion NT$</td>
<td>2.532 million</td>
</tr>
</tbody>
</table>
NT$2 million in Taiwan facilities. The average total compensation for direct laborers was higher than NT$1 million, which is four times the minimum monthly wage in Taiwan. In 2021, TSMC facilities in Taiwan experienced year-on-year growth in number of employees, average compensation, and median compensation (as shown in the table below).

### Bonus

The incentive program of TSMC facilities in Taiwan is implemented over a period of two years. Cash bonuses are paid quarterly to provide timely incentives and profit-sharing is paid annually in the following year to encourage long-term service and continuous contribution. The incentive programs of overseas regions are designed in consideration of local cultures and markets and are given out through the annual cash bonus or long-term one to three-year schemes. In 2021, the median total compensation of TSMC employees around the world (excluding pension and other benefits) was around NT$2.06 million, which is 1/194 of the CEO's total compensation. Considering the differences in compensation structure across countries, the data of median annual compensation is based on the actual amount paid to full-time employees with full-year seniority.

### Corporate Officer Shareholding Guidelines

TSMC believes that the long-term ownership of company shares by corporate officers helps align their interests with those of all shareholders, therefore, the Company formulated Corporate Officer Shareholding Guidelines in 2020. The required value for Chairman, CEO, and other corporate officers’ holding of TSMC shares is proportional to their annual base salary (18 times for Chairman and CEO, 9 times for other officers in Taiwan, and 3 times for overseas officers). Officers shall fulfill the required value within three years of appointment. Officers keep the required value for the entire period of employment. Furthermore, to attract and retain corporate executives and to link their compensation with shareholder interests and Environmental, Social, Governance (ESG) achievements, TSMC established the Employee Restricted Stock Awards Rules in 2021.

### Parental Benefits

After childbirth, TSMC employees can apply for unpaid leave in accordance with local laws and regulations. The Company also offers a comprehensive leave management system so that employees have flexibility in making use of their vacation days to take care of their children. In 2021, TSMC amended the Work Rules and will be launching the TSMC Child Care Benefit Program starting in 2022 to further support employees achieve a better work-life balance.

#### TSMC Child Care Benefit Program

The maternity/paternity allowance for each TSMC baby has been increased from NT$1,000 to NT$10,000.

Paid maternity leave has been increased from the legally required 8 weeks to 12 weeks.

Employees can take 10 days of paternity leave within one year of their partners giving birth.

Launched a weekend science camp that is great for families and can facilitate family interactions and bonds.

### Average and Median Compensation

<table>
<thead>
<tr>
<th></th>
<th>Average Compensation (NT$)</th>
<th>Full-time Employees (ppl)</th>
<th>Median Compensation (NT$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>2,277,000</td>
<td>2,425,000</td>
<td>1,891,000</td>
</tr>
<tr>
<td>2021</td>
<td>2,471,000</td>
<td>2,634,000</td>
<td>1,951,000</td>
</tr>
</tbody>
</table>

Note: In compliance with regulations set forth by the Taiwan Stock Exchange, TSMC started, in 2020, to disclose the number of full-time employees in non-executive positions, their average and median compensation, as well as respective differences in compensation from the previous year. The numbers are calculated in accordance with the regulations of the Taiwan Stock Exchange, which excludes executive officers (managers) and employees eligible for exemption. For those not employed with the Company for a full year, the data is prorated. And the profit-sharing amount is on a profit-year basis, therefore part of the compensation data is projected.
In 2021, a total of 600 employees in TSMC’s Taiwan facilities and VisEra applied for unpaid parental leave. We expected 546 employees to return from their parental leaves in 2021, a total of 445 employees returned on time or ahead of time, which is an 81.5% return rate. As for the retention rate after returning, of the 542 employees that returned in 2020, a total of 432 remain at TSMC as of the end of 2021, which is a 79.7% retention rate (refer to the chart below).

Maintain Healthy Turnover Rate

To ensure talent mobility and long-term growth, TSMC believes that a healthy employee turnover rate should be between 5% and 10%. In 2021, the turnover rate was 6.8%, a 1.5% increase from 2020 but still within the targeted range. The major causes for the increase were competitive labor markets as a result of rapid development in the high-tech industry and TSMC’s mass recruitment accompanied by increased new hire turnover rate of 17.6%.

Newborns in TSMC’s Taiwan Facilities and VisEra

In 2021, the number of employees in TSMC’s Taiwan facilities and VisEra aged between 20 and 64 accounted for 0.38% of Taiwan’s population of the same age group. During the same time, the numbers of employee’s newborns was 2,686, which was 1.7% of the total number of newborns in Taiwan, an example of our outstanding benefits mitigating the impact of sub-replacement fertility in Taiwan.

Historical Turnover Rates

In addition to statutory contributions, we commission professional accountants and consultants annually to conduct precise calculations of our Company’s pension fund, to assure sufficient funding for employee pension payments in the future.
### Talent Development

#### Equip People with Future Capabilities
---

**Build a talent pool based on TSMC Capability Model**

- **2022 Targets**
  - Fill over 80% of manager positions through internal promotions
  - Fill over 50% of vacancies through internal transfers
  - 90% completion of the talent pipeline within 3 years for fab directors/directors

- **2021 Achievements**
  - Filled over 82.5% of manager positions through internal promotions
  - Filled over 57.6% of vacancies through internal transfers
  - Reviewed 79% of the talent pipeline for fab directors/directors

---

#### Unleash Learning Momentum
---

**Offer diverse learning resources to facilitate self-learning in employees**

- **2022 Targets**
  - Achieve an annual average of 100 hours of learning in employees
  - Achieve an annual average of 50 hours of learning in employees

- **2021 Achievements**
  - Achieved an annual average of 48.9 hours of learning in employees
  - Self-learning accounted for 68% of learning programs designed for the specific needs of organizations
  - More than 50,000 visits to self-learning resources

---

**Note 1:** In response to materiality analysis results and development strategies in 2021, we have made adjustments to parts of the content for this strategy and sustainable target.

**Note 2:** The following targets have been moved from “Talent Attraction and Retention” due to adjustments in development strategies: “Fill over 50% of vacancies through internal transfers” and “Fill over 75% of manager positions through internal promotions”
Talent Development at TSMC aims to ensure that employees can progress with changing times to support the Company’s long-term growth but also fulfill lifelong learning in employees.

**Equip People with Future Capabilities**

TSMC attaches great importance to the early development of employee potential and actively seeks to fill the talent pipeline. We want to ensure that there are suitable candidates that can support the Company’s rapid growth for any new positions or appointments. In 2021, TSMC reviewed 79% of the talent pipeline for fab directors/directors.

Checking talent pipeline also allowed us to have systematic and detailed discussions regarding talent development plans to ensure alignment with the Company’s operational demands and a robust talent pool. For example, the New Manager Program was completed 2,000 times, and students were able to advance to the next position in 2021. The Operation Engineers Training Committee (OETC) also plans trainings for engineers at different jobs and levels, builds capability stages and learning roadmaps, and provides courses in regulations, technology, management, and personal effectiveness. The annual number of participants exceeded 30,000, which effectively nurtured future talents.

**TSMC Capability Model**

Based on the “TSMC Capability Model,” employees’ specific development needs are integrated and implemented through “70-20-10 Rule”, that is, experience learning (70%), feedback and guidance (20%) and education and training (10%). Please refer to the next page for “70-20-10 Rule”.

**Unleash Learning Momentum**

TSMC offers a wealth of classroom trainings and online courses. We’ve also produced livestream webinars that align with our employees’ work and life. The diverse offering of learning resources mean that employees can choose the best learning methods for them to help them enhance their performance at work and fulfill their self-worth.

TSMC measures the outcome with four levels of evaluation - reaction, learning, behavior, and results - based on the Kirkpatrick Model. In 2021, TSMC conducted reactive evaluations for all courses. We evaluated course design, lecturers, administrative services, and overall satisfaction level. Employees gave a score of 94 for overall satisfaction level. A total of 1.59 million participants completed over 5,400 online courses and completed learning evaluations. Behavioral evaluations were conducted for 4% of the training courses. The majority of on-the-job training organized at the organization level completed learning and behavioral evaluations, while outcome evaluations are built into the employee performance management and development system.
Experience Learning

Dual career ladder system for both management and technical talents
- For the technical track, the TSMC Academy selected one Outstanding Fellow, one Senior Fellow, and five Academicians in 2021, including the youngest female Academician ever elected since the TSMC Academy was established ten years ago.

Internal promotions, transfers, and rotations
- Internal transfer and rotation empower employees to arrange and plan personal careers and develop diverse capabilities, while promoting internal talent mobility and passing on organizational knowledge.
- Filled over 82.5% of manager positions through internal promotions.
- Internal transfers & rotations between management and technicians were 40% and 38.2%, respectively.
- Filled over 57.6% of vacancies through internal transfers.
- Achieved 100% internal transfer completion rate with over 22,792 employees transferred to new positions.

Transfers and Rotations in 2021

<table>
<thead>
<tr>
<th></th>
<th>Hsinchu Site</th>
<th>Taichung Site</th>
<th>Tainan Site</th>
<th>Overseas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outbound</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taiwan</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Hsinchu Site</td>
<td>7,813</td>
<td>297</td>
<td>1,256</td>
<td>18</td>
<td>9,384</td>
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<tr>
<td>Taichung Site</td>
<td>300</td>
<td>1,867</td>
<td>725</td>
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<tr>
<td>Tainan Site</td>
<td>468</td>
<td>229</td>
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<tr>
<td>Overseas</td>
<td>25</td>
<td>3</td>
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<td>2,173</td>
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<tr>
<td>Total</td>
<td>8,606</td>
<td>2,396</td>
<td>9,509</td>
<td>2,281</td>
<td>22,792</td>
</tr>
</tbody>
</table>

Note: In Taiwan, Hsinchu Site includes Fab 2, Fab 5, Fab 3, Fab 8, HQ, Fab 12A, R&D Center, Fab 12B, Advanced Backend Fab 1, Advanced Backend Fab 3, and Advanced Backend Fab 6; Taichung Site includes Fab 15A & B and Advanced Backend Fab 3; and Tainan Site includes Fab 6, Fab 14A & B, and Fab 18. Overseas areas include TSMC (Nanjing), TSMC (China), WaferTech, TSMC Arizona Corporation, and other overseas subsidiaries.

Feedback and Guidance

Buddy System
- New employees are able to understand and quickly adapt to the TSMC culture with the help of the Buddy system. The appointed buddy can continue to offer feedback and suggestions to the employee.

Mentor System
- Employees are encouraged to learn from other senior employees. Mentors can offer guidance on work or help adapt to TSMC to ensure employees' continuous growth.

Performance Management and Development
- Managers and colleagues are encouraged to continuously discuss and plan performance and development, and conduct performance reviews at mid-year and year-end.

Education and Training

- Based on the Individual Development Plans (IDP).
- Different training roadmaps for leadership and functional capabilities are provided for employees in different positions. At the same time, TSMC also provides a series of training courses on leadership and functional and general capabilities.
- Hosted 1,344 classroom trainings.
- Offered over 5,400 online courses.
Cultivate Internal Instructors & Excellent Instructor Award

Talent is a critical component of TSMC’s success, and internal instructors, by sharing their knowledge and experiences, are important drivers for fostering talents within the Company. Established 15 years ago, the Excellent Instructor Award has been recognizing excellent internal instructors each year and encouraging other outstanding employees to join the ranks of our instructors and share their knowledge and experience for more efficient education.

In 2021, TSMC employees were trained over 160,000 times cumulatively with the help of over 2,000 internal instructors. At the awards ceremony, CEO Dr. C.C. Wei presented awards to outstanding internal instructors to commend their contributions to the Company’s growth.

The 2021 TSMC Excellent Instructor Award Ceremony

Case Study

TSMC Newcomer Training Center

To cultivate the next generation of young semiconductor professionals, in 2021, TSMC opened the Newcomer Training Center at TC-Site so that new employees can quickly learn about fundamental semiconductor knowledge, the logical thinking behind semiconductor production lines, how people communicate on the production line, and work safety in a safe learning environment, with hands-on experiences and instructions from lecturers. The training can also help new employees cultivate capabilities for independent thinking and self-learning as well as familiarize them with the Company’s core values so that they can better assimilate into the corporate culture.

In 2021, the Newcomer Training Center trained over 2,000 TSMC employees with shortening the time for independent work by about 10%. They are now contributing to the Company’s success in their own roles, continuing to advance their individual capabilities and grow with the Company.

Four Main Courses at Newcomer Training Center

- **Equipment Courses**
  - Introduction to machine & component functions with hands-on experiences
  - Machine Problem Analysis & Solution

- **Process Courses**
  - Introduction to semiconductor processes and analysis/inspection capabilities

- **System Courses**
  - Introduction to common systems used on the production line with hands-on experiences

- **On-duty Skills**
  - Foster the capability to handle unusual events and emergency response capabilities

The Newcomer Training Center helps new TSMC employees understand their work in a safer and more efficient way.
Human Rights

Strategies & 2030 Goals

**Enforce the TSMC Human Rights Policy**

Raise awareness of human rights in employees and enforce the Responsible Business Alliance (RBA) Code of Conduct

In all factories that implement the Validated Assessment Program (VAP) of the Responsible Business Alliance, the "Human Rights Related Issues" are maintained at a zero-missing level

Optimize training and management systems to support zero sexual harassment, zero workplace bullying, work hour management to prevent overworking, labor rights of those with disabilities, and proprietary information protection

**2022 Targets**

In all factories that implement the Validated Assessment Program (VAP) of the Responsible Business Alliance, the "Human Rights Related Issues" have reached the zero-missing level

Organize a training program on "Say No to Workplace Harassment & Workplace Bullying and Personal Data Protection"

- > 95% employees complete training programs
- 100% passing rate in post-class tests

Compile annual plans for each year between 2023 to 2030

**2021 Achievements**

Maintained 100% e-voting at labor-management meetings in all Taiwan facilities

Target: 100%

No material regulatory violations (penalty: > NT$1 million)

Target: No material regulatory violations (penalty: > NT$1 million)

Organized a training program on "TSMC Human Right Policy: Say No to Sexual Harassment and Build Up a Friendly Workplace"

Target: Strengthen employee understanding of the TSMC Human Rights Policy and ensure it is applied into the workplace through full employee engagement in online courses

The completion rate was > 98%

Target: 95%

100% passing rate in post-class tests

Target: 100%

Note: In response to materiality analysis results and development strategies in 2021, we have made adjustments to parts of the content for this strategy and sustainable target.
Adhering to the TSMC core values, TSMC supports the Universal Declaration of Human Rights and internationally recognized human rights. TSMC abides by local laws and regulations in all countries and regions where we operate and treat our employees with dignity and respect.

**Enforce TSMC Human Rights Policy**

The TSMC Human Rights Policy is the highest guiding principle for human rights governance at TSMC. The TSMC Human Rights Policy offers clear guidelines for all human rights matters of concern. We’ve also adopted an action plan that is consistent with RBA standards to ensure that all employees are treated fairly and with dignity.

**Human Rights Protection Training**

In 2021, TSMC launched a wide range of human rights protection training programs on facility ESH, emergency response, first-aid training, and a friendly workplace. TSMC offered a total of 181,314 training hours to 62,822 employees, which is 96% of all TSMC employees. We counted a total of 150,000 attendees at the human rights protection training programs.

Furthermore, TSMC launched the training course “TSMC Human Right Policy: Say No to Sexual Harassment and Build-Up a Friendly Workplace” with 59,804 employees participated in the training and the passing rate for post-class test was 100%.

**TSMC Human Rights Management System**

The HR Organization’s Human Rights Operation Center will be responsible for human rights topics of daily relevance to employees and ensuring the Company meets RBA or higher standards by compiling and carrying out the Measures for Human Resources Management System and the Internal Control Procedures for Human Resource Management System.

Operations managers on site will be jointly responsible with senior executives in HR, Information Technology and Materials Management & Risk Management, and Legal. The senior executive for HR will be responsible for reporting major human rights topics in TSMC to the management team.

The IT Supply Chain Management Section of the Information Technology and Materials Management & Risk Management organization will be responsible for all human rights topics related to suppliers and for managing the topics by compiling and carrying out the TSMC Supplier Code of Conduct.
Risk Assessment & Management

As a full member of the Responsible Business Alliance (RBA), TSMC will conduct due diligence in compliance with the RBA Code of Conduct to ensure that TSMC either meets or exceeds the standard.

TSMC uses the RBA SAQ as a template to identify practices, risks, and management systems in internal operations bearing the highest, labor, health and safety, environmental, and moral hazards. In 2021, all TSMC facilities in Taiwan scored 88 or more on the SAQ, which qualifies as "low risk" (85 or higher is considered low risk). To comply with customer requests, TSMC also commissioned a third-party institute to carry out the RBA VAP for seven TSMC facilities. In 2021, all seven facilities received full marks on the VAP. The complete audit report will be disclosed to customers and related stakeholders on RBA-Online.

### Taiwan

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Corporate HQ</td>
<td>95.6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fab 2</td>
<td>92.6</td>
<td>200</td>
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<tr>
<td>Fab 3</td>
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<td>Fab 8</td>
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</tr>
<tr>
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<td>-</td>
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<tr>
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<td>Advanced Backend Fab 1</td>
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<td>Advanced Backend Fab 5</td>
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<td>-</td>
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</table>

### Subsidiaries

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<tbody>
<tr>
<td>VisEra</td>
<td>90.5</td>
<td>-</td>
<td>200</td>
<td>-</td>
<td>196.5</td>
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<tr>
<td>TSMC (China)</td>
<td>93.2</td>
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<tr>
<td>TSMC (Nanjing)</td>
<td>91.3</td>
<td>-</td>
<td>193.3</td>
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<td>-</td>
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<tr>
<td>WaferTech</td>
<td>88.7</td>
<td>-</td>
<td>200</td>
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</table>

SAQ Assessment Scores:
- 🟢 Low Risk (≥ 85)
- 🟢 Medium Risk (≥ 65 & <85)
- 🟢 High Risk (<65)
# Human Rights Policy Concerns and Practices in 2021

## Topics/Target Group

<table>
<thead>
<tr>
<th>Safe, Healthy, and Harassment-free Workplace</th>
<th>Targets and Actions</th>
<th>Risk Assessment</th>
<th>Mitigation Measures</th>
<th>Remedies</th>
<th>Reporting Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>All employees</td>
<td>Formulate OSH Management Procedures and establish the Employee Health Management Program Meeting and Occupational Disease Investigation Committee</td>
<td>Investigate whether there are any occupational diseases from chemical exposure</td>
<td>Quarterly meetings on occupational health management held by senior executives to manage and control the four major safety hazards of occupational diseases across departments</td>
<td>Immediate transfer from original post</td>
<td>Occupational Health and Disease Investigation Committee</td>
</tr>
<tr>
<td>Please refer to “Occupational Safety and Health” for more information on special hazards &amp; health management</td>
<td>Formulate Sexual Harassment Prevention Policies and establish the Sexual Harassment Investigation Committee</td>
<td>Increase voluntary participation rate for non-statutory employee health plans</td>
<td>Advanced medical imaging checks every five years for new employees and non-management employees</td>
<td>Provide ample medical support</td>
<td></td>
</tr>
<tr>
<td>Top 5% of employees with the highest level of stress recorded from the employee health survey</td>
<td>Case inquiry by the Sexual Harassment Investigation Committee and Ombudsman</td>
<td>Follow-up with employees with top 5% stress levels by therapists and counseling services</td>
<td>Follow-up with employees with top 5% stress levels by therapists and counseling services</td>
<td>Make necessary position or work station changes depending on the situation</td>
<td>Sexual Harassment Investigation Committee</td>
</tr>
<tr>
<td>11 incidents verified by the Sexual Harassment Investigation Committee</td>
<td>Offered classes to prevent harassment and bullying</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-discrimination &amp; Equal Employment Opportunity</th>
<th>Targets and Actions</th>
<th>Risk Assessment</th>
<th>Mitigation Measures</th>
<th>Remedies</th>
<th>Reporting Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>New employees, Indigenous peoples, migrant workers, contract employees, disabled workers, etc.</td>
<td>Declare principles of non-discrimination in the TSMC Recruitment Interview Internal Control Procedures and offer Recruitment &amp; Selection training courses and suggestions/ reminders to hiring supervisors</td>
<td>Eliminate discrimination in the workplace in compliance with Internal Control Procedures starting from recruitment</td>
<td>A total of 676 managers completed the Recruitment &amp; Selection training course in 2021</td>
<td>Violations to the non-discrimination principle by management shall be punished according to internal policies on rewards and punishment</td>
<td>Regular, Business, Contact Reporting System</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inquire candidate regarding willingness- to-work during interview</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Candidates must provide proof of identification for verification</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prohibit Forced Labor and Child Labor</th>
<th>Targets and Actions</th>
<th>Risk Assessment</th>
<th>Mitigation Measures</th>
<th>Remedies</th>
<th>Reporting Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>New employees</td>
<td>Comply with regulations on freely chosen employment in the RBA Code of Conduct</td>
<td>Eliminate discrimination in the workplace in compliance with Internal Control Procedures starting from recruitment</td>
<td>A total of 676 managers completed the Recruitment &amp; Selection training course in 2021</td>
<td>Violations to the non-discrimination principle by management shall be punished according to internal policies on rewards and punishment</td>
<td>Regular, Business, Contact Reporting System</td>
</tr>
<tr>
<td></td>
<td>Establish Recruitment &amp; Hiring Measures to declare that TSMC does not employ forced labor and employees under the age of 18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comply with regulations on freely chosen employment in the RBA Code of Conduct</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Establish Recruitment &amp; Hiring Measures to declare that TSMC does not employ forced labor and employees under the age of 18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Working Time</th>
<th>Targets and Actions</th>
<th>Risk Assessment</th>
<th>Mitigation Measures</th>
<th>Remedies</th>
<th>Reporting Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>All employees</td>
<td>Formulate Management Measures for Working Hours Procedure and build an Attendance-Record System and Overtime System</td>
<td>Understand employee work hours through reporting channels, facility-level communication meetings, and management systems</td>
<td>Managed and analyzed employee timesheets and provided early warnings to facility supervisors on work hour management</td>
<td>If there is any evidence of forced labor, supervisors will be required to make the necessary improvements and restitute the rights to which employees are entitled</td>
<td>Employee Voice Channels</td>
</tr>
<tr>
<td>Please refer to “Occupational Safety and Health” for more information on risks from overworking</td>
<td></td>
<td>Overall employee compensation is higher than the minimum wage and industry peers</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Encourage Work-Life Balance</th>
<th>Targets and Actions</th>
<th>Risk Assessment</th>
<th>Mitigation Measures</th>
<th>Remedies</th>
<th>Reporting Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>All employees/ Employees in need</td>
<td>Provide a variety of activities and clubs to enrich the concept of Work-Life Balance for employees</td>
<td>Examine participation rates</td>
<td>Collaborated with members of the TSMC Employee Welfare Committee and activity organizers to promote activities and encourage participation</td>
<td>Conduct questionnaires to make improvements in the future</td>
<td>Employee Voice Channels</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Responsible Mineral Sourcing</th>
<th>Targets and Actions</th>
<th>Risk Assessment</th>
<th>Mitigation Measures</th>
<th>Remedies</th>
<th>Reporting Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>All suppliers</td>
<td>Require suppliers to comply with and sign the TSMC Statement on Responsible Sourcing of Minerals for products containing tantalum, tin, gold, and tungsten</td>
<td>Establish a due diligence framework in compliance with the Model Supply Chain Policy for a Responsible Global Supply Chain of Minerals from Conflict-Affected and High-Risk Areas by the OECD</td>
<td>Suppliers of products containing tantalum, tin, gold, and tungsten must collaborate with more than one compliant smelter</td>
<td>Suppliers will be asked to terminate sourcing if there is evidence of sourcing from non-compliant mines</td>
<td>Reporting Channels for Supply Chain Employees</td>
</tr>
</tbody>
</table>
TSMC values employee opinions and interests. To protect the human rights of employees, TSMC has constructed a robust system for employee feedback, including the Ombudsman System managed directly by a senior executive appointed by the CEO, the whistleblower procedures, and the Irregular Business Conduct Reporting System available to external parties on the TSMC website.

### Employee Voice Channels and Case Management

TSMC values employee opinions and interests. To protect the human rights of employees, TSMC has constructed a robust system for employee feedback, including the Ombudsman System managed directly by a senior executive appointed by the CEO, the whistleblower procedures, and the Irregular Business Conduct Reporting System available to external parties on the TSMC website.

### Internal Communications Structure

#### TSMC Internal Employee Communication Structure

<table>
<thead>
<tr>
<th>Channel</th>
<th>Person in Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-Face Meeting</td>
<td>Managers of All Levels</td>
</tr>
<tr>
<td>Employee Voice Channels</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Human Resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>System/Committee Chair</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Board of Directors and Management Team</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Employee Voice Channels

- **Face-to-Face Meeting**
  - Chairmen’s/CEO’s Communication Meeting
  - Labor-Management Meeting
  - Communication Meetings in Individual Functions/Divisions
  - Functional Activity

- **Employee Voice Channels**
  - Ombudsman System
  - Employee Opinion Box
  - Whistleblower Procedures
  - Fab Caring Circle
  - Sexual Harassment Investigation Committee
  - Irregular Business Conduct Reporting
  - SMS
  - 113 Caring-dedicated Line

- **Board of Directors and Management Team**
  - Various Issues in Fabs
  - Personal in Charge: Fab Directors
  - Accounting & Legal Issues
  - Personal in Charge: Chairman of TSMC Audit Committee Chairperson
  - Various Company Issues
  - Personal in Charge: Director, HROC
  - Personal and Work-related Issues
  - 0987-571785 (help hotline)
  - Personal in Charge: Director, HROC
  - Major management missteps, workplace violence, and financial audit issues
  - Personal in Charge: Vice President
  - Personal and Work-related Issues (area code +113)
  - Personal in Charge: Director, HROC
  - Poor Business Conduct
  - Personal in Charge: Vice President

Note: Cases reported via 113 Caring Hotline and SMS are handled by designated people and directed to other voice channels.

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**Employee Voice Channels and Case Management**

TSMC values employee opinions and interests. To protect the human rights of employees, TSMC has constructed a robust system for employee feedback, including the Ombudsman System managed directly by a senior executive appointed by the CEO, the whistleblower procedures, and the Irregular Business Conduct Reporting System available to external parties on the TSMC website.
In 2020, TSMC’s internal communication channels handled a total of 4,469 cases of employee opinions and complaints, including 14 through the Sexual Harassment Investigation Committee, 231 through the Ombudsman System, 4 through the whistleblower procedures, and 92 cases through the Irregular Business Conduct Reporting System. All cases reported by employees are processed and addressed immediately and confidentially.

- In 2021, the Sexual Harassment Investigation Committee verified 11 cases of sexual harassment; the perpetrating employees were punished according to the severity of the situation. As the cases involved unwanted attention and verbal/physical harassment, TSMC has added a section on the different forms of sexual harassment and what constitutes sexual harassment in the 2021 sexual harassment prevention courses.

- There were four violations of business ethics and all employees have been punished or dismissed in compliance with Company regulations. TSMC continues to advocate important business ethics concepts in related courses. In 2021, 59,366 employees (99.9% completion rate) participated in the annual business ethics and regulatory compliance training.

Cases Reported through Employee Voice Channels

<table>
<thead>
<tr>
<th>Year</th>
<th>Fab Caring Circle</th>
<th>Ombudsman System</th>
<th>Sexual Harassment Investigation Committee</th>
<th>Irregular Business Conduct Reporting System</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>3697</td>
<td>3,698</td>
<td>1</td>
<td>43</td>
</tr>
<tr>
<td>2018</td>
<td>3,976</td>
<td>3,964</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>2019</td>
<td>4,037</td>
<td>4,022</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>2020</td>
<td>4,006</td>
<td>4,004</td>
<td>11</td>
<td>32</td>
</tr>
<tr>
<td>2021</td>
<td>4,469</td>
<td>4,469</td>
<td>11</td>
<td>32</td>
</tr>
</tbody>
</table>

Note 1: The figures for Ombudsman System, Sexual Harassment Investigation Committee, Irregular Business Conduct Reporting System, and Employee Opinion Box cover all TSMC facilities, while the figure for Fab Caring Circle covers only TSMC’s Taiwan facilities.

Note 2: Cases reported through the Irregular Business Conduct Reporting are from external parties and internal employees.

Freedom of Association and Labor-Management Meetings

TSMC continues to enforce an open-style management system, offer diverse internal communication channels, and respect employees’ freedom of association. TSMC facilities in Taiwan are also regularly hosting labor-management meetings in compliance with local laws and regulations. TSMC management appoints a representative to explain recent developments in TSMC operations to employee representatives. At the meetings, management and employee representatives discuss topics of concern to employees in an attempt to strengthen communication between management and employees.

According to local laws and regulations, labor representatives for labor-management meetings serve a four-year term and must be reelected after the term. TSMC first introduced e-voting in 2018 at TSMC facilities in TC-Site to elect labor representatives. As of the end of 2021, labor representative elections at all TSMC facilities in Taiwan are conducted through e-voting. We will continue to use e-voting to encourage employee engagement.

Long-term Commitment

TSMC is striving for progress to the 2030 Sustainable Goals, which includes all factories that implement the Validated Assessment Program (VAP) of the Responsible Business Alliance, the “Human Rights Related Issues” have reached the zero-missing level as well as better governance and training on zero sexual harassment, zero workplace bullying, work hour management, human rights of disabled employees, and proprietary information protection. TSMC will be launching a new training program on “Say No to Workplace Harassment & Workplace Bullying and Proprietary Information Protection” to educate management and employees about human rights. TSMC will also be assembling a task force of experts to inspect processes and advise better practices for a concrete work plan on annual human rights protection plans from 2023 to 2030.
### Promote Safety Culture
Advocate for a humanistic safety culture, manage safety risks, and establish an intrinsically safe working environment

<table>
<thead>
<tr>
<th>Category</th>
<th>2022 Targets</th>
<th>2021 Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Rate per 1,000 Employees</td>
<td>&lt;0.20</td>
<td>0.252</td>
</tr>
<tr>
<td>Target: &lt;0.2</td>
<td></td>
<td>Note 3</td>
</tr>
<tr>
<td>Disabling Injury Frequency Rate (FR)</td>
<td>&lt;0.3</td>
<td>0.38</td>
</tr>
<tr>
<td>Target: &lt;0.4</td>
<td></td>
<td>Note 4</td>
</tr>
<tr>
<td>Disabling Severity Rate (SR)</td>
<td>&lt;3</td>
<td>7</td>
</tr>
<tr>
<td>Target: &lt;4</td>
<td></td>
<td>Note 3</td>
</tr>
</tbody>
</table>

### Comprehensive Health Management
Prevent occupational diseases and promote comprehensive health management for employees

<table>
<thead>
<tr>
<th>Category</th>
<th>2022 Targets</th>
<th>2021 Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 cases of occupational disorders caused by exposure to chemicals</td>
<td>0 cases of occupational disorders caused by exposure to chemicals</td>
<td>- Exceeded</td>
</tr>
<tr>
<td>Employees with abnormal blood lipids, blood pressure, and blood sugar: ≤ 11%, 13.5% &amp; 2.5%</td>
<td>Employees with abnormal blood lipids, blood pressure, and blood sugar: ≤ 11%, 13.5% &amp; 2.5%</td>
<td>0 cases of occupational disorders caused by exposure to chemicals</td>
</tr>
<tr>
<td>Target: 0</td>
<td>Health Promotion Program Participation Rate: 73.7%</td>
<td>Note 1: Consider the original indicator, Health Promotion Program Participation Rate, can not fully represent the health of TSMC employees, starting from 2022, TSMC will be introducing physiological and psychological indicators for this dimension. The physiological indicators are the abnormal rate of blood lipids, blood pressure, and blood sugar of employees; the psychological indicator is percentage of employees with reported high stress levels. See Health Indicators and Health Risk Management for more information.</td>
</tr>
<tr>
<td>Employees with reported high stress levels: &lt;9%</td>
<td>Employees with reported high stress levels: &lt;9%</td>
<td>Note 2: High-risk contractors are contractors engaged in high-risk operations. TSMC continues to have new vendors that are considered as contractors engaged in high-risk operations each year and will therefore continue to offer assistance in this area.</td>
</tr>
</tbody>
</table>

### Internal-External Alliance
Collaborate with external parties to establish a safer working environment across the supply chain

<table>
<thead>
<tr>
<th>Category</th>
<th>2022 Targets</th>
<th>2021 Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assist all high-risk contractors to obtain ISO 45001 certification for occupational safety and health management system</td>
<td>65% of high-risk contractors to obtain ISO 45001 certification for occupational safety and health management system</td>
<td>Assisted 65% of high-risk contractors to obtain ISO 45001 certification for occupational safety and health management system</td>
</tr>
</tbody>
</table>

Note 1: Considering the original indicator, Health Promotion Program Participation Rate, can not fully represent the health of TSMC employees, starting from 2022, TSMC will be introducing physiological and psychological indicators for this dimension. The physiological indicators are the abnormal rate of blood lipids, blood pressure, and blood sugar of employees; the psychological indicator is percentage of employees with reported high stress levels. See Health Indicators and Health Risk Management for more information.

Note 2: High-risk contractors are contractors engaged in high-risk operations. TSMC continues to have new vendors that are considered as contractors engaged in high-risk operations each year and will therefore continue to offer assistance in this area.

Note 3: Missed target for incident rate per 1,000 employees. See Safety Performance Index for mitigation measures.

Note 4: Missed target for disabling severity rate. See Statistical Analysis of Disabling Injuries for mitigation measures.
TSMC believes in cultivating an intrinsically safe workplace through a humanistic safety culture and facilitating physical and psychological health as well as a healthy work-life balance in employees and vendors. As TSMC continues to expand facilities in Taiwan and overseas, we will collaborate with stakeholders to reduce occupational safety and health risks in the workplace. In 2021, TSMC added three new fabs in facilities in Taiwan: Fab 12B Phase 8, Fab 18B Phases 1 to 3, and Advanced Backend Fab 6. TSMC plans for the aforementioned fabs to receive ISO 45001 certification for occupational safety and health in 2022. Other existing fabs and subsidiaries (TSMC (China), TSMC (Nanjing), WaferTech, and VisEra) have already received ISO 45001 certification. Also, in response to the COVID-19 pandemic, TSMC’s Disease Prevention Committee continues to, according to the severity of the pandemic, adjust preventive measures, organize health committees, and ensure occupational safety and health. TSMC started working with the Department of Management Information System at National Chung Hsing University to develop an AI Hazard Analysis technology, which was then tested on the clean room ceiling maintenance work at Fab 15A. The AI Hazard Analysis technology uses existing 4G cameras originally used for emergency response and integrates big data, smart algorithms, and machine learning to successfully monitor high-risk workspaces with smart analysis functions. When the system identifies unsafe behavior or environments, it can be reported to the TSMC personnel responsible for the construction and the Emergency Response Center so that they can immediately ask contractors to make corrections. Contractors can only continue working upon verification of mitigation measures to prevent objects from colliding and falling from the clean room ceiling and resulting in occupational disasters. TSMC plans to begin introducing the Hazard Analysis technology in 2022.

In 2021, with rising production capacity, the number of contractors visiting TSMC subsequently set a new record, climbing from 39,470 people/day in 2020 to 48,602 people/day, making TSMC the most visited semiconductor company in Taiwan. To ensure the occupational safety of vendors, TSMC started working with the Department of Management Information System at National Chung Hsing University to develop an AI Hazard Analysis technology, which was then tested on the clean room ceiling maintenance work at Fab 15A. The AI Hazard Analysis technology uses existing 4G cameras originally used for emergency response and integrates big data, smart algorithms, and machine learning to successfully monitor high-risk workspaces with smart analysis functions. When the system identifies unsafe behavior or environments, it can be reported to the TSMC personnel responsible for the construction and the Emergency Response Center so that they can immediately ask contractors to make corrections. Contractors can only continue working upon verification of mitigation measures to prevent objects from colliding and falling from the clean room ceiling and resulting in occupational disasters. TSMC plans to begin introducing the Hazard Analysis technology in 2022.
## Promote Safety Culture

TSMC cares about global safety and health issues. In 2021, the pandemic put a pause on some of the offline training and courses on occupational safety and health. As such, TSMC offered the courses online and upgraded the one-time offline course to a rolling online training to strengthen memorization of occupational safety and health content and instill safety culture into the workplace. In 2021, the Facility Development Division assembled a new unit in response to TSMC’s growing number of facilities: Construction Site Behavior and Environment Unit. The new unit aims to strengthen implementation of safety management at TSMC construction sites and increase safety on construction sites.

## Safety and Health Measures

### Following the TSMC Safety and Health Policy, TSMC implemented the following health and safety measures and used the Safety Performance Index (SPI) to track performances. The Occupational Safety and Health Committees at the fab level and at the corporate level will regularly report safety and health efforts to labor representatives on a monthly and quarterly basis, respectively. In 2021, in response to the growing number of facilities and to quickly familiarize new employees in occupational safety and health, TSMC established a learning map for occupational safety and health personnel at the fab level; to enhance fab safety in response to our growing number of fabs, we are working with fire brigades for fire drills, helping them gain more insight into the fire, and optimizing incident reports to accelerate authority transfer to the fire brigade.

### Safety and Health Measures

### Measures | Safety and Health Efforts in 2021 | SPI | Taiwan Fabs | Overseas Fabs | VisEra
--- | --- | --- | --- | --- | ---
**Regulatory Updates** | • Kept up to date with latest regulations, tracked compliance in all fabs, and issued 5 changes to safety and health regulations. | ✔ | ✔ | ✔ | ✔
 | • In response to demands for overseas expansion, new facilities for the U.S. and Japan are currently in the design stage. We are also compiling a regulatory database of U.S. federal/state laws and Japanese laws and hiring legal counsel from abroad. | ✔ | ✔ | ✔ | ✔
**Standardized Management Procedures** | • In response to demand for overseas expansion, TSMC reviewed a total of 62 processes for safety and health management and provided an English version of all 62 processes. | ✔ | ✔ | ✔ | ✔
**Safety and Health Education** | • For employees and contractors, TSMC conducted workplace hazard identification, safety and health management plans, workplace analysis, workplace observation and operational safety analysis, and health management analysis. All identified risks were classified into different risk levels for future management, tracking, and monitoring to control, prevent, or reduce hazards and risks; carried out 31,419 cases of hazard assessment. | ✔ | ✔ | ✔ | ✔
**Hazard Identification and Assessment** | • Contractors engaged in a total of 32,880 high-risk operations | ✔ | ✔ | ✔ | ✔
 | • Added three new regulations: “High-Risk Operators Must Complete Annual Online Training,” “High-Pressure Waterjet License,” and “Guidelines for Charging Batteries.” | ✔ | ✔ | ✔ | ✔
**Change Management** | • A total of 5,037 cases of change management were completed with zero related incidents | ✔ | ✔ | ✔ | ✔
**Chemical Management** | • All new chemicals underwent safety review processes before entering facilities. In 2021, TSMC evaluated and introduced 212 chemicals with zero related incidents and without introducing any IARC carcinogens | ✔ | ✔ | ✔ | ✔
**Tool Management** | • Evaluated and introduced 191 new tools with zero related incidents | ✔ | ✔ | ✔ | ✔
**Contractor Management** | • Contractors engaged in a total of 32,880 high-risk operations | ✔ | ✔ | ✔ | ✔
**Compliance Audit** | • Internal audits raised 1,999 cases of failed compliance. All cases of failed compliance were corrected within the designated time | ✔ | ✔ | ✔ | ✔
**Emergency Response** | • Developed a mobile application version of our digitalized evacuation roll call system. People taking the roll call will receive a list of people that should be at the evacuation site and a list of people actually there to give them insight into roll calls across the facility. | ✔ | ✔ | ✔ | ✔
 | • To enhance fab safety in response to our growing number of fabs, we are working with fire brigades for fire drills, helping them gain more insight into the fire, and optimizing incident reports to accelerate authority transfer to the fire brigade | ✔ | ✔ | ✔ | ✔
**Occupational Injury Prevention** | • Continued to hold investigative meetings to analyze employee injuries and issued results to all fabs for roll-out in the hopes of reducing occupational accidents | ✔ | ✔ | ✔ | ✔

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Note 1: Completion date for the regulatory update platform is extended to 2022 due to overseas fabs currently under construction.

Note 2: 2021 Training Statistics: Routines include both employees and contractors.

Note 3: See TSMC Digitalized Learning Map with 111 Professional Courses for Occupational Safety and Health Personnel for more information.

Note 4: Hazard Identification and Assessment: Foster a safety culture where employees and the company protect each other and encourage employees to speak up and offer suggestions for occupational safety. We use classification management and tracking to control, prevent, or reduce hazards to cultivate a friendly and safe workplace.

Note 5: TSMC Chemical Management Procedures.
To raise awareness for occupational safety and health, TSMC is actively cultivating occupational safety and health professionals to lead TSMC employees in fostering a friendly and healthy workplace. In 2021, TSMC created a digitalized learning map for occupational safety and health personnel and drafted three-stage tracks for both theory and practices according to job responsibilities. The learning map contained 111 required courses on safety and health, environmental protection, and emergency response. With systematic learning as well as the sharing of know-how and experiences, TSMC aims to quickly familiarize new employees with their job responsibilities, advance their professional know-how, and improve the organization’s safety performance. In 2021, 189 occupational safety and health personnel with three years of experience or less completed the learning map.

The digitalized learning map for occupational safety and health personnel separates learning targets into three stages: The first stage contains 27 courses and 123 training hours; after the first stage, trainees are capable of performing daily responsibilities. The second stage contains 50 courses and 251 training hours; after the second stage, trainees are capable of identifying hazards and managing risks. The third stage contains 34 courses and 261 hours; after the third stage, trainees are equipped with professional knowledge and know-how.

Responsibilities & Professional Skillset of Occupational Safety and Health Personnel

**Safety**
- Equipment Safety
- Chemicals
- Hazard Identification
- Change Management
- Equipment Inspection
- Personal Protective Equipment

**Environment**
- Pollution Prevention (Air/water/waste/toxins)
- Toxic Substances
- Regular Assessments
- Operational Reporting
- Green Procurement

**Health**
- Exposure Assessment
- Environmental Assessment of Workplace
- Radiation
- Protection of Expecting Mothers

**Emergency**
- Scenario Analysis
- Emergency Response Training
- Emergency Response Drill
- Equipment Maintenance
- Incident Management

**Responsibilities**
- Equipment Safety
- Chemicals
- Hazard Identification
- Change Management
- Equipment Inspection
- Personal Protective Equipment
- Contractor Operations Management
- High-Risk Operations
- Hazardous Workplace
- Hazardous Machines and Equipment
- Incident Investigation
- Performance Evaluation

**Skills**
- Occupational Diseases & Injuries
- Ergonomic
- Hearing Protection
- Precision Operations
- Infectious Disease Prevention
- Special Health Examination

**Process**
1. Establish required courses for each level of the Industrial Safety and Environmental Protection Divisions
2. Select professional deputy managers and seed teachers
3. Compile/produce professional training materials
4. Introduce a digital platform

**Case Study**
Establish required courses for each level of the Industrial Safety and Environmental Protection Divisions
Take stock of responsibilities and functions
Select professional deputy managers and seed teachers
Compile lesson plans/teach
Introduce a digital platform
Build a digital library for employees to attend classes and take tests, with comprehensive records of the learning map.
The TSMC Safety Performance Index (SPI) is classified into four levels and two subtypes - active index and passive index. The active index encourages employees to participate in health & safety programs and raise suggestions for safety improvements while the passive index shows the number of safety-related failures, false alarms, etc. In 2021, blue-light indicators (outstanding) were increased by 5.5% from 2020 to 75.9%; any facilities that failed to reach "outstanding" were given on-site support.

TSMC also plans to amend the Safety Performance Index in 2022 to add new items to both the active and passive indexes. For the active index, TSMC will give points to facilities that voluntarily suggest mitigation measures for unsafe behaviors and environments. For the passive index, TSMC will be deducting more points from facilities making the same mistakes again. In 2021, TSMC intended to issue safety culture questionnaires in selected facilities but was forced to delay safety culture experts’ trips to Taiwan for the questionnaire and interviews due to the global pandemic and local border control regulations. We plan to issue and analyze the safety culture questionnaire and enforce mitigation measures for real outcomes in 2022.

In 2021, TSMC expanded existing facilities and, despite rising numbers of on-site contractors and employees, we were able to reduce the number of false alarms from 30 cases in 2020 to 28 in 2021; incident rate per 1,000 employees also went down from 0.311 to 0.252. Upon investigation with the 3L5W (Three-legged Five Whys) tool, we discovered that the incidents included 10 false alarms of gas leaks, 11 injuries, 6 early fire warnings, and 1 chemical leak warning.

<table>
<thead>
<tr>
<th>Historical Incidents by Type</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas false alarm</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fire false alarm</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Personal injury</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chemical leakage</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Power outage</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: In 2021, the incident rate by type per thousands of individuals entering TSMC includes employees from TSMC fabs in Taiwan, TSMC (China), TSMC (Nanjing), WaferTech, and VisEra; and contractors working at TSMC fabs in Taiwan, TSMC (China), TSMC (Nanjing), and VisEra.
Improvement Highlights in 2021

Reduce Gas Alarms

In ten cases of early warnings, the specific gases were turned off immediately after the warning signals. The gases were then channeled to treatment facilities through wind ducts and therefore there were no actual gas leaks, injuries, or pollution to the environment. Analysis of historical gas warnings revealed main causes to be: failure to comply with gas tank replacement processes and using the wrong material for gaskets for strong oxidizing gases that lead to leaks from overheating during high-speed rotations.

Mitigation Measures

- Strengthen operator compliance with SOPs and increase operator proficiency: Record gas tank changes with 5G cameras to strengthen operator awareness and to give insight into the operation in the event of unusual events. Regularly conduct on-site training and certification on changing gas tanks. When conducting on-site vendor audits, check that all gas tank joints sent back to the vendor have been cleaned.
- Determine the appropriate gasket material, life cycle, and acceptable quality based on gas properties and list the information into the Chemical Procurement Regulations.
- Re-evaluate the standard process for changing gas tanks of different pressure levels and the gas leaks.

Reduce Fire Alarms

Of the six fire alarms, four were caused by cast resin transformers with old components and one was caused by pump leaks on a tool using pyrophoric gases, i.e., hazardous gases were leaked from cracks on old components.

Mitigation Measures

- To enhance management protocols, starting from 2022, TSMC will be replacing 363 old cast resin transformers within the next five years.
- In 2021, to mitigate gas leakages, TSMC introduced the use of handheld acoustic imaging cameras.

Reduce Chemical Leaks

One case of chemical leak due to careless handling by a forklift contractor.

Mitigation Measures

- Strengthen contractor training and safety awareness.

Use Handheld Acoustic Imaging Cameras to Effectively Reduce Fire Alarms

TSMC is actively seeking appropriate technologies, equipment, and methods as better options for the time-consuming ultrasonic leak detector that is easily affected by background noise interference. In 2021, TSMC collaborated with experts from the Safety and Health Technology Center (SAHTECH) to perfect methodologies for measurement by introducing a new industrial acoustic imaging camera to check for pipeline airtightness after installation and confirm that there are no leaks. With this methodology, TSMC uncovered 152 deficiencies and made the necessary corrections early on. The methodology is now listed into standard procedures to prevent false alarms from gas/fire alarms.

Case Study

Use Handheld Acoustic Imaging Cameras to Effectively Reduce Fire Alarms

TSMC is actively seeking appropriate technologies, equipment, and methods as better options for the time-consuming ultrasonic leak detector that is easily affected by background noise interference. In 2021, TSMC collaborated with experts from the Safety and Health Technology Center (SAHTECH) to perfect methodologies for measurement by introducing a new industrial acoustic imaging camera to check for pipeline airtightness after installation and confirm that there are no leaks. With this methodology, TSMC uncovered 152 deficiencies and made the necessary corrections early on. The methodology is now listed into standard procedures to prevent false alarms from gas/fire alarms.
All Contractors Completed Digital Contractor Training Program

With the large increase in number of contractors came the increase in high-risk operations as well, rising from 28,758 operations in 2020 to 32,880 operations in 2021. To reduce incident rates and ensure contractors entering TSMC premises are fully aware of operational risks, TSMC has been facilitating the digital transformation of occupational safety and health training by introducing new online interactive courses about occupational safety and health, high-risk operational rules training, and introduction to high-risk operations on the TSMC Supplier Sustainability Academy. All contractors are asked to take refresher courses annually and training records will be added to the access control system and work order application system to maintain a full understanding of contractor eligibility. Pilot testing for contractor training ends in December 2021 and will be formally launched in 2022.

For contractors engaging in high-risk operations, TSMC will be bringing all high-risk operation training courses online and simplifying the contractor license application process so that new contractors do not have to wait in line but will receive the contractor license directly after completing their training. In December 2021, TSMC selected three facilities: Fab 2 & Fab 5, and Fab 6 for testing. A total of 592 contractors completed high-risk operation training courses online and TSMC was able to reduce 15 offline courses.
Statistical Analysis of Disabling Injuries

Disclosure of occupational accidents is in accordance with the Occupational Safety and Health Act and important disabling injury indicators issued by the Global Reporting Initiative which uses Disabling Severity Rate (SR) and Disabling Injury Frequency Rate (FR) as primary indicators. In 2021, there were 44 disabling injuries among employees with 826 working days lost. Of the 44 disabling injuries, 25 were men with 417 working days lost and 19 were women with 409 working days lost. Men suffered from a higher number of work-related disabling injuries and working days lost than women. The highest percentage of male injuries were crush injuries from failure to comply with SOPs when performing equipment maintenance. See Improvement Highlights in 2021 for details on preventing crush injuries in the future.

In 2021, the majority of female injuries were from falling or collisions that mainly occurred while transporting cleanroom trolleys at 6" and 8" fabs due to poor trolley route designs or accidental collision for failure to notify people ahead.

Collision Mitigation Measures

1. Design fixed and mobile shelf locations and design fixed trolley routes to reduce collisions from unclear route conditions. Trolley storage location is also listed as an important inspection item for safety and health enforcement.

2. Occupational physicians visited on-site to point out areas at risk of collision and TSMC has made the necessary corrections.

3. Each quarter, promote crush injury prevention at the coordination meeting with the Production Division.

4. Continue the Smooth Road Project and reward employees for reporting unsafe environments.

5. Continue installing mirrors at collision-prone areas or areas reported by employees as unsafe.

Total Working Hours, Injuries, and Working Days Lost

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Working Hours</th>
<th>Injuries</th>
<th>Working Days Lost</th>
<th>Disabling Injury Frequency Rate (FR)</th>
<th>Disabling Severity Rate (SR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>82,115,207</td>
<td>29</td>
<td>285</td>
<td>0.35</td>
<td>3</td>
</tr>
<tr>
<td>2018</td>
<td>90,837,537</td>
<td>44</td>
<td>659</td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td>2019</td>
<td>92,608,573</td>
<td>44</td>
<td>762</td>
<td>0.48</td>
<td>0.42</td>
</tr>
<tr>
<td>2020</td>
<td>102,139,494</td>
<td>43</td>
<td>422</td>
<td>0.42</td>
<td>0.7</td>
</tr>
<tr>
<td>2021</td>
<td>115,093,160</td>
<td>44</td>
<td>826</td>
<td>0.38</td>
<td>7</td>
</tr>
</tbody>
</table>

Note 1: According to the Occupational Safety and Health Act, Disabling Injury Frequency Rate (FR) and Disabling Severity Rate (SR) are defined as any diseases, injuries, disabilities, or deaths of workers caused by buildings, machinery, equipment, raw materials, materials, chemicals, gases, vapors, dust, etc., at the place of duty, or as a result of work activities, or due to other occupational causes. Other unrelated injuries in the workplace such as falling in the cafeteria or parking lot due to various reasons are not considered as work injuries.

Disabled Injury Frequency Rate by Gender

<table>
<thead>
<tr>
<th>Year</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>0.16</td>
<td>0.43</td>
</tr>
<tr>
<td>2018</td>
<td>0.67</td>
<td>0.53</td>
</tr>
<tr>
<td>2019</td>
<td>0.49</td>
<td>0.58</td>
</tr>
<tr>
<td>2020</td>
<td>0.45</td>
<td>0.37</td>
</tr>
<tr>
<td>2021</td>
<td>0.46</td>
<td>0.42</td>
</tr>
</tbody>
</table>

Disabled Severity Rate by Gender

<table>
<thead>
<tr>
<th>Year</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2018</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>2019</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>2020</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2021</td>
<td>5</td>
<td>7</td>
</tr>
</tbody>
</table>
In 2022, there were 30 non-work-related injuries. The majority, 17 injuries, were from falling and accounted for 443 working days lost. The second highest injury was sprains, 6 injuries, and accounted for 57 working days lost.

**Cause Analysis and Prevention for Falls**

**Mitigation Measures**

1. **Immediately report any wet floors to cleaning staff for professional treatment to reduce risks of employees falling.**

2. Raise awareness and remind employees to pay attention to personal safety.

**From Personal Reasons**

- From personal reasons: misstep in the stairways, not paying attention when walking, tripping when getting out of a car, or tripping over chairs or others, etc.

**At Work**

- From wet floors in the workplace
Comprehensive Health Management

TSMC’s comprehensive health management plan strives to prevent occupational diseases, facilitate personal health among employees, and achieve work-life balance by controlling health risks in the workplace and safeguarding our employees’ physical and psychological health.

Prevent Occupational Diseases

TSMC has remained committed to building a safe and healthy workplace where each task is assessed with risk identification to uncover five major potential risks: chemical, physical, ergonomic, biological, and social/psychological, and to design preventive measures accordingly.

Prevention Measures against Occupational Diseases & Achievements

Ergonomic

- On-site visits with occupational physicians
- Arranged occupational physicians to visit loading sites at TSMC fabs in Taiwan and requested feedback
- Streamlined ergonomic risk assessment form for employees to quickly identify risk levels
- Used computerized ergonomic risk assessment systems to identify operations with high ergonomics risks
- Helped health centers conduct health surveys and track employees who applied for pain relief patches, and reached out to and arranged meetings with occupational physicians for employees on leave for musculoskeletal pains

Chemical

- Establish exposure assessment model to manage the use of chemicals
- Upgraded system for reviewing chemical safety information from vendors. As TSMC is building facilities abroad, we compiled differences between hazard classifications and chemical safety information charts from Taiwan, China, the U.S., and Japan so that employees around the world have access to information safety charts at all times
- Re-evaluated chemical work stations involving manual labor at 144 laboratories to confirm that there are zero risks of chemical exposure
- Established the Upgrade Program for Cleanroom Glove Allergy Surveys and a chemical-resistant standard for gloves used for different chemicals. Analyzed plausible allergens and reviewed processes and storage methods to prevent future allergies
- Chemical Management: See TSMC Chemical Management Procedures for more information
- First Taiwan semiconductor company to introduce the EU EN 14175-3 (Requirements for Fume Cupboards) and establish standards for fume cupboards inside laboratories

Existing Measures

- On-site visits from occupational physicians with 16 suggestions for a single facility, including adjusting the transport distance of wafer cassette rinsing machines, lighting for work stations, etc. All necessary changes were made with a 100% completion rate and shared with other facilities
- Computerized assessments were conducted for 18 employees with above- or below-average height. Office chairs were raised and foot mats provided to maximize comfort levels. Employee satisfaction reached 100%
- 161 employees were impacted by soreness and participated in the ergonomic risk exposure survey. Upon assessment from occupational physicians, 14 of the 161 employees were suspected to be impacted by ergonomic risk factors and received support in the form of adjusted work duties
- Employees affected by soreness were cross-checked with the computerized ergonomic risk assessment system. None were found to be working in areas or potential areas of ergonomic risks

New Measures in 2021

- 0 cases of occupational disorders caused by chemical exposure

Achievements

- Arranged occupational physicians to visit loading sites at TSMC fabs in Taiwan and requested feedback
- Streamlined ergonomic risk assessment form for employees to quickly identify risk levels
- Used computerized ergonomic risk assessment systems to identify operations with high ergonomics risks
- Helped health centers conduct health surveys and track employees who applied for pain relief patches, and reached out to and arranged meetings with occupational physicians for employees on leave for musculoskeletal pains
Social/Psychological
Advance the Cerebrovascular and Cardiovascular Disease Prevention and Management Program

New Measures in 2021
- Offered occupational leave to employees with medium/high health risks in Taiwan facilities for free advanced imaging examinations, to help them prevent cerebrovascular or cardiovascular diseases.

Existing Measures
- Used health management system integrated with latest employee health check-ups and working hours to evaluate health risks; in addition to informing employees, TSMC also reminded supervisors and HR reps to adjust workload for said employees.
- Combined with the working hour system for risk control, if the employee's working hours are abnormally overtime, the system will automatically remind employees, supervisors and HR representatives.

Achievements
- 2,138 employees from Taiwan facilities completed advanced imaging examinations; 44 employees require medical attention for further treatment.
- Managed 4,168 employees and tracked monthly for cases of excessive workloads or workloads over doctor recommendations.

Biological
Track CDC updates to provide employees with the latest health information

Existing Measures
- Continued to track communicable epidemics domestically and abroad and establish preventive/response measures for notifiable epidemics; Disease Prevention Committee continued to develop COVID-19 countermeasures and reporting mechanisms based on changes in the COVID-19 pandemic.
- Continued to enforce reporting mechanism for non-notifiable diseases and provided up-to-date information on seasonal flu and Dengue Fever.
- Briefed and provided disease prevention toolkits to employees on business trips to areas with disease outbreaks.

Achievements
- Handled 5,794 high-risk cases in compliance with COVID-19 control measures.
- Effectively managed a total of 82 cases of notifiable epidemics and non-notifiable epidemics to contain the spread.
- Distributed 576 disease prevention toolkits to employees going on business trips.

Physical
Better identification of physical hazards in the environment

New Measures in 2021
- Established baseline data and risk map for strong magnetic field and non-ionizing radiation levels for all lab equipment.

Existing Measures
- Developed measurement system for ionizing radiation levels to monitor the radiation protection of all equipment, maintain a record of non-ionizing radiation levels of all relevant equipment, ban individuals with cardiac pacemakers from operating such equipment and warn before hiring.
- Process equipment is tested for non-ionizing radiation levels every six months.

Achievements
- Conducted special eye test on one operator whose results were normal.
- No cases of radiation exposure.
- All equipment tested normal for non-ionizing radiation levels.
TSMC’s COVID-19 Protection Network Safeguards Employee’s Health & Safety in the Workplace

In response to the global COVID-19 pandemic, TSMC’s Disease Prevention Committee continued to update disease prevention measures to effectively control the pandemic at Taiwan facilities and overseas subsidiaries, ensure employee health, and maintain business as usual.

In 2021, there was a single case of cluster infection with three confirmed cases at an office in a TSMC facility. The Disease Prevention Committee immediately convened an Emergency Response Team to investigate the infection. The Team referred to NHCC suggestions and immediately initiated the four steps to control COVID-19 cluster infections, expanded the list of contact, and immediately adopted quarantine measures and rapid testing kits for all employees on the same floor. The Team also quickly started disinfecting the space and collaborating with medical institutes to test all employees and contractors working on the same floor. After that, the Team then followed up with confirmed employees for a list of people they came in contact with for future reference and offered support in the form of COVID-19 related information and daily life support. After a 14-day observation period, the Team effectively halted the pandemic from spreading without other employees contracting COVID-19. During this time, TSMC maintained business as usual and the production wasn’t interrupted.

After the cluster infection, TSMC launched large-scale drills in Taiwan facilities for confirmed cases to strengthen disease prevention awareness and capabilities in employees. TSMC also established a COVID-19 survey which asks employees to report their temperatures each day. The records are then linked to their personal information, e.g., office floor, seating, roommates or cohabitants, transportation, meetings attended, and dining. The time it takes to complete the COVID-19 survey was reduced from an average of two hours in 2020 to 15 minutes in 2021 and it allows us to quickly compile a list of close contacts to more effectively carry out subsequent prevention plans.
Health Indicators and Health Risk Management

TSMC’s occupational health risk management plan covers both occupational hazards and personal health. TSMC complies with legal regulations on occupational safety and health as well as job characteristics and health risk matrices to regularly analyze employee health risks. The top three issues in 2021 were special health examination management, cerebrovascular and cardiovascular disease prevention and management, and high stress Support Plan.

In terms of special health examination management, we analyzed employee health examination results and found no individuals with unusual work-related conditions. As for the cerebrovascular and cardiovascular disease prevention and management program and high stress support plan, TSMC has referred to the WHO’s top ten causes of death and discovered that cerebrovascular and cardiovascular diseases are one of the top causes of death and disabilities. High blood lipids, high blood pressure, and high blood sugar are highly related to cerebrovascular and cardiovascular diseases. When combined with long-term stress, fatigue from work, or sleep disorders, patients may be more susceptible to cerebrovascular and cardiovascular diseases. After discussions with occupational physicians, TSMC decided that starting from 2022, the health program participation rate, an existing indicator in our comprehensive health management plan, will be replaced with two indicators: the physiological indicators are the abnormal rate of blood lipids, blood pressure, and blood sugar of employees; the psychological indicator is percentage of employees with reported high stress levels. The two new indicators will serve as important bases for monitoring employees in the long run and planning mitigation measures. TSMC also referred to the incident rate of high blood lipids, high blood pressure, and high blood sugar levels in Taiwan, issued by the Ministry of Health and Welfare, as well as the age of TSMC employees and health examination data over the past three years to set 2022 targets and 2030 goals, the abnormal rates of blood lipid, blood pressure, and blood sugar should not exceed 11%, 13.5%, and 2.5%, respectively. The other new target is to contain percentage of employees with reported high stress levels to <9%. TSMC continues to make rolling changes to sustainable development goals to further take care of our employees’ physical and psychological health.

Occupational Health Risk

![Occupational Health Risk Diagram]

- **6,107** Employees Special Health Examination Management: In accordance with legal regulations on occupational safety and health, all employees involved in hazardous operations completed special health examinations; and 2,402 of these are being closely monitored.
- **4,183** Employees Cerebrovascular and Cardiovascular Disease Prevention and Management Program: Mid/high-risk employees will receive medical assistance and work hour management.
- **905** Employees High Stress Support Plan: Employees with reported high stress levels were offered psychological counseling.
- **1,311** Employees Maternal Health Protection and Management: Conducted evaluations for expecting mothers on their physical health, mental health, and workplace environment and helped make work adjustments necessary.
- **249** Employees Occupational Musculoskeletal Disorder Prevention Plan: Employees who were absent for more than four days due to musculoskeletal pain were assessed to determine whether adjustments to work were necessary.
- **15,493** Employees Medical Evaluation for the Use of RPE (Respiratory Protective Equipment): In compliance with the Respiratory Protection Program and Management Guidelines, TSMC is conducting medical evaluations to determine respiratory protection needs.
- **48,999** Employees General Employee Healthcare: A total of 9,724 employees received moderately and highly abnormal health check results, and all of them were closely monitored.

Relevance to Work
Comprehensive Health Care

TSMC offers employees a supportive environment, a variety of health care programs, and events to promote and maintain employee health.

<table>
<thead>
<tr>
<th>Health and Wellness Programs in 2021</th>
<th>114,406 Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cancer Screening:</strong></td>
<td>21,080 employees received fecal occult blood test, mammography, breast ultrasound/gynecologic ultrasounds, or Pap smears</td>
</tr>
<tr>
<td><strong>Clinics Services:</strong></td>
<td>17,893 outpatients, including employees, family members, vendors, and visitors</td>
</tr>
<tr>
<td><strong>Health Promotion Programs:</strong></td>
<td>75,433 participants joined online health speeches, Health Quiz, the Weight Control Competition, consultations, health lectures, virtual walking challenge, health check-ups, healthy diets, etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sports Center</th>
<th>175,357 Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees are encouraged to exercise regularly. TSMC Sports Centers and all TSMC facilities come with gyms, aerobics classrooms, and multifunctional ball courts to provide employees and dependents with swimming, yoga, and spinning exercise classes</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assistance for Employees</th>
<th>3,316 Users of the free consulting service</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSMC has a long-term partnership with professional psychologists, lawyers, and accountants to provide employees with free consulting services and help employees deal with mental and physical stress</td>
<td></td>
</tr>
</tbody>
</table>

Case Study

Virtual Walking Challenge - 14,550 Employees Walked 1,029,825 kilometers

TSMC cares about employee health and promotes a lifestyle where ‘every day is sports day.’ As such, we decided to host a one-month virtual walking challenge where we used applications to design competitions, allowing us to bypass pandemic restrictions. We also worked with health centers and the Service Integration Department to launch health quiz, healthy lunch boxes, live-streamed lectures on healthy diets/working out, and other events promoting health that were well received by our colleagues.

We carefully designed progressive milestones from 10km to 18km for the virtual walking challenge to make it easy for employees to complete the challenge during breaks, allowing less active employees to also join in the fun, experience the sense of accomplishment from working out, and subsequently develop regular habits of working out. In 2021, the virtual walking challenge attracted 1,455 teams comprised of 14,550 employees. They completed a total of 1,029,825km, which is around 1,373,100,000 steps and the equivalent of 26 laps around Earth and 2,004 laps around Taiwan. The total number of walking hours was 205,965 hours and participants burned a total of 64,014 kcal.

"The challenge motivated me to get active and encouraged me to run my heart out after work. The best incentive is health itself."

Chu Yih-Chin
TSMC Employee

Members from the TSMC Jogging Club assembled their own team: 99% - Mr. Guan No. 1 to participate in the Virtual Walking Challenge.
Internal-External Alliance

As a leader in the global semiconductor industry, TSMC recognizes its obligations of creating a healthy workplace together with its vendors and contractors. In 2021, TSMC largely used online meetings to collaborate with business partners, other industries, the government, and academia because of the COVID-19 pandemic. We hoped to share our experiences in promoting safety and health as well as reducing risks in the workplace with vendors and contractors even under the persisting pandemic.

Work with External Parties to Optimize Work Environment

TSMC regularly attends the Joint Steering Committee ESH Working Group of the World Semiconductor Council on behalf of the Taiwan semiconductor industry to conduct exchanges with overseas peers on occupational safety and health as well as risk control measures. In 2021, the ESH Working Group was held online to reduce risks from public gatherings, overcome space and time limitations, and share experiences on managing a safe and healthy workplace.

TSMC also collaborated with the Occupational Safety and Health Administration, MOL and Institute of Environmental and Occupational Health Sciences, NYCU to compile materials for advanced in-service education on introduction to risk assessment and management theories and practices. In 2022, we plan to conduct training and drills in Northern, Central, and Southern Taiwan to advance hazard identification and problem-solving abilities among occupational health managers to build a safe and healthy workplace.

Raise Contractor’s Hazard and Health Risk Awareness

Contractors under high risk of chemical exposure were identified through analyses of chemical exposure risk and the frequency/nature of their operations. 3% of contractors were identified as high risk bearers and TSMC has been committed to reducing their risks of occupational diseases from chemical exposure. In 2021, contractors registered a higher Disabling Injury Frequency Rate (FR) and Disabling Severity Rate (SR) than in 2020. See Safety Performance Index for information on mitigation measures.

Outcomes of Contractor Training Programs

Disabling Injuries in Contractors

Note 1: Figures from TSMC labs in Taiwan, TSMC (China), TSMC (Nanjing), and VisEra
Note 2: Due to the pandemic, training was held in groups to reduce the number of emergency drills

Existing Measures

- Dispatched TSMC’s occupational physicians to inspect on-site contractor operations and analyze chemical exposure risks
- Asked contractors to report any unusual results uncovered by the special health examination

Achievements

- Guaranteed zero chemical exposure risks to contractors working at TSMC
- Received 0 cases of unusual health examination results
Enforce "Safety First" Responsibilities and Culture at Construction Sites

To ensure construction workers’ safety during fab construction and strengthen functions of construction safety and management organizations, contractors, construction site safety committees, and TSMC are collaborating in a three-level management system to guarantee construction site safety and safeguard the safety of workers. TSMC enforces construction site safety through the PDCA management framework across three dimensions of risk identification, management support, and on-site audits. TSMC also works with third-party construction safety experts to review workplace safety, analyze information, conduct on-site audits in areas we can improve on, and optimize practices for safe operations. TSMC also established a mechanism for contractor companies to practice autonomous safety management, asking their central unit for environmental protection and safety to conduct monthly on-site audits to ensure safety, adopting a top-down approach to strengthen management and ensure the contractor’s frontline supervisors are personally in control of construction site safety.

Construction Site Safety Measures

On-site Contractor Support Program Benefits 60,000 Drivers

Continuing the 2020 On-site Contractor Support Program, which targets three different on-site contractors: cleaning staff, cafeteria staff, and security personnel, TSMC further expanded the program in 2021 to optimize the workflow of tank truck and truck drivers by redesigning transportation routes, confirming truck schedules, and increasing parking spaces to reduce waiting times for truck drivers and increase wafer transportation efficiency by 95%. We also optimized the quality control process for incoming materials from tank trucks to reduce tank truck operation times by 50%. As of December 2021, more than 60,000 people have been benefited from this program, ensuring driver health and public transportation safety. See TSMC Optimizes Tank Truck Filling Process, Reducing Driver Duty Time by 50% and Improving Transportation Safety for more information.

Case Study

TSMC actively improves the efficiency of tank truck operations, reducing driver duty time by 50%. Management from TSMC and Contractors Promises and authorizes safety officials to supervise and make decisions. Safety Supervisor Commissioned by Safety Committee Supervise all construction workers. Contractors must establish management and certification system for occupational safety and health. Contractors must ensure effective on-site supervision by increasing the professionalism and training efficacy of safety officials. Contractors must fix deficiencies uncovered by on-site audits and implement preventive measures.
Construction Site Safety Efforts

**Safety Management**
- Risk Identification

**Safe Behaviors**
- Management Guidance

**Safe Workspace**
- On-site Evaluation

**Existing Measures**
- In continuation of the 170 Job Safety Analysis (JSA) items, TSMC continued to observe on-site operations and optimize safe working practices.
- TSMC continued to counsel contractors in Job Safety Analysis (JSA) to familiarize contractors with safety methodology for applications to risk management at the construction site.
- TSMC invited outside experts and contractor management to report and review achievements in construction risk analysis at work safety meetings.
- Heat stress prevention in summers.
- Enforced pandemic preventive measures at construction sites.
- Used infrared thermal imaging for early detection of abnormal switchboard activity to ensure electrical safety.
- As there were many construction tasks each day, the construction flow coordination meeting can reduce hazards from overlapping operations and ensure safe operations and environment.
- Added high-risk operation audits where work safety personnel must audit all high-risk operations including operations in confined spaces, opening switchboards, erecting and disassembling scaffolds over five meters, lifting operations, above-ceiling work, etc. Work safety personnel must confirm that the environment is safe before workers proceed with operations.

**Existing Guidance**
- TSMC built VR and offline training facilities and required all construction workers to complete the training to strengthen their understanding of the hazards of high-risk operations. Those in violation of safety regulations must pass the drill and tests again.
- TSMC used daily Toolbox meeting to remind safe practices and hold second Toolbox meeting to explain operational risks for high-risk operations.
- TSMC reviewed safety practices at the end to ensure comprehensive management over safe practices.
- At construction sites, TSMC also put up safety posters to remind contractors to remain safe in the workplace.

**New in 2021**
- To standardize health and safety protocols for construction sites, TSMC has been compiling the ESH Bluebook on Fab Construction, which covers five major dimensions: management, safety, fire prevention, health, and environmental protection and 85 management protocols. The Bluebook will be completed in 2023.
- For the 13 high-risk operations, TSMC has conducted risk evaluations based on Job Safety Analysis (JSA) and will be working with contractors to amend protection plans for high-risk operations and construction sites.
- TSMC required all contractors to submit a Construction Site Safety and Protection Plan and reviewed all safe construction practices during meetings between the construction site safety committee and contractors to ensure construction site safety.

**Establish Construction Site Safety Management Processes through Risk Identification**

TSMC requires all contractors to submit a Construction Site Safety and Protection Plan and review all safe construction practices during meetings between the construction site safety committee and contractors to ensure construction site safety. In 2021, TSMC will be compiling an ESH Bluebook on Fab Construction to standardize safety and health management processes for construction sites. We plan to require contractors to comply with Bluebook regulations after the Bluebook is announced in 2023.
Ensure Safe Practices through Management Support

In 2021, TSMC continued to drive construction site safety culture - care, communication, awareness, and behavior change. For workers in violation of safety regulations, TSMC will adopt two major measures: firstly, immediate counseling in place of compulsory punishment as we aim to apply reasonable and mutual communication to help construction workers take a new look at safety guidelines on construction sites, thereby heightening their awareness in construction safety so the same violations do not happen again. Secondly, in addition to immediate counseling, practical and VR training has also been strengthened for those in violation of safety guidelines while working on one of the 13 high-risk operations.

Enforce Audits to Ensure Safe Construction Sites

In 2021, TSMC introduced smart disaster prevention technology, established smart construction site management, and developed smart AI image recognition technology to issue real-time alerts for unsafe behaviors and environments so that construction site supervisors can make immediate changes. Construction sites can continue with construction after confirmation from on-site inspections. We are still developing some of the system functions and we estimate that they will be completed and launched in 2022.

Natural Environment

- **Heat Stress Prevention in Summer**: As construction sites are exposed under the sun, TSMC has introduced the Wet Bulb Globe Temperature (WGBT) to measure indoor and outdoor temperatures, set up heat stress risk level signs at construction sites, and offer cooling drinks and foods such as ice water and preserved plums to remind outdoor construction workers to take breaks and drink water as necessary. In 2021, TSMC reduced heat stress by 144 cases from the previous year.
- **Disease Prevention at Construction Sites**: In compliance with COVID-19 prevention measures, before entering construction sites, contractors must report their temperatures and submit a declaration of health online first. Professional contractors are also hired to perform at least three full disinfections inside and outside the construction site and check for any residual virus, monitor if disinfection processes are compliant, and ensure personnel safety.

Construction Site Environment

- **Fire Early Warning System**: Used infrared scanner (IR scanner) for early detection of abnormal switchboard activity to ensure electrical safety.
- **New Safety Early Warning & Detection Facilities and Safety Equipment**: Added visual light signals and auditory alarm signals to 55 forklifts in 2021. There were no more forklift-related crush injuries.
- **Established Construction Site Safety Facility Task Force**: Shorten process lead time from seven days to one day for accelerating mitigation efforts of unsafe environments and clean-up of massive waste at construction sites. In 2021, TSMC completed a total of 131 missions and 230 inspections.
- **Increased Personnel for Construction Site Safety Patrols**: In 2021, there were 715 construction site safety personnel, which is 91 more than the previous year. There is also an increased focus on inspecting high-risk operations to confirm that the workplace is safe before starting construction work.
With a sustainable vision to "better society," the TSMC Education and Culture Foundation and the TSMC Charity Foundation have galvanized internal and external resources to spotlight the following areas: cultivate our youth, rural education, and support arts, culture, and the environment. We also care for the disadvantaged as well as seniors living alone to build a strong foundation for society through common good.

Collaborated with 15 medical and care centers, providing 14,083 services to seniors through the Network of Compassion Program.

122 organizations supporting the disadvantaged regularly benefit from the Cherish Food Program, with a total of 58,862 beneficiaries.

203,814 Beneficiaries of the Youth Cultivation Program

14,083 Services
Collaborated with 15 medical and care centers, providing 14,083 services to seniors through the Network of Compassion Program.

58,862 Beneficiaries
122 organizations supporting the disadvantaged regularly benefit from the Cherish Food Program, with a total of 58,862 beneficiaries.
Social Impact

In line with the TSMC ESG Policy, TSMC listens to the needs of society and responds to the United Nations Sustainable Development Goals (SDGs) by taking concrete actions to close the resource gap and achieve common good. TSMC also refers to the London Benchmark Group’s (LBG) Impact Principles to examine and analyze the impact of each project from the extent of its impact (connection, improvement, change) and the type of impact (behavioral or attitudinal change, skills or personal effectiveness, quality of life or well-being) in the hopes of creating real and positive change.

Inputs

2021 Resource Investments

966 million
Total Investment (NT$)

25.1% Community Investments
$498
$268
$200
55.7% Commercial Initiatives

65.7% In-kind Giving
$635
$217
$86
$28

19.2% Charitable Donations

2.9% Management Overheads

8.9% Time

Unit: NT$ million

Outputs

2021 Social Impact Projects KPI

Note: Principle of KPI Selection: Focusing on the seven major public welfare pillars, the results will present homogenous data. The KPI will also prioritize target achievement and long-term commitment.

- 14,083 Seniors Benefited from Care for Elders
- 82 Recipients of Underprivileged Student Scholarships
- 64 Schools Promoting Filial Piety
- 2,064 Participants of Young Generation Cultivation
- 25.1% Community Investments
- 19.2% Charitable Donations
- 65.7% In-kind Giving
- 8.9% Time
- 2.9% Management Overheads

Total Investment (NT$)
Behavioral or Attitudinal Change: Help people change their behaviors to improve their personal lives, such as changing attitudes and making better choices.

Skills or Personal Effectiveness: Help people develop new skills or advance existing ones to open up more opportunities.

Quality of Life or Well-being: Help people live healthier, happier, and more comfortable life can help improve emotional health, social relationships, and health.
Over the years, TSMC has been investing in University Programs and providing timely assistance and resources for emergency relief, such as assistance for earthquake victims, vaccine donation, etc. TSMC has also integrated the TSMC Education and Culture Foundation and the TSMC Charity Foundation to form a social welfare network to address social problems in collaboration with stakeholders and partners.

Founded in 1987, the TSMC Education and Culture Foundation is dedicated to fostering youth development and opening up infinite possibilities for the next generation of students. TSMC collaborates with like-minded educational institutions to make the whole greater than the sum of its parts. The Foundation is also promoting arts and cultures and cultivating an appreciation for arts in Taiwan’s society.

The TSMC Charity Foundation, with a mission for "long-term services," connects internal and external charity partners and galvanizes colleagues to dedicate themselves to volunteer services as well as caring for the disadvantaged, elderly people living alone, filial piety, and environmental conservation to strengthen our positive influences in society.

In 2021, TSMC and the two Foundations invested more than NT$5.92 billion in charitable activities. Due to the COVID-19 pandemic, NT$4.126 billion was used to purchase and donate vaccines to alleviate the urgent domestic demand for vaccines.

In the same year, TSMC also invested more than NT$966 million into seven major public welfare pillars, mainly in the form of "In-kind Giving," through which TSMC provides resources and services, which accounts for 65.7% of total donations. In terms of public welfare activities, TSMC continues to strengthen contributions to Commercial Initiatives.

TSMC also analyzed resources invested into achieving UN SDGs, revealing that 48.8% was invested in promoting SDG 9 (Industry, Innovation and Infrastructure), 27.7% and 17% were invested in advancing SDG 3 (Good Health and Well-being) and SDG 4 (Quality Education), respectively.

<table>
<thead>
<tr>
<th>Core Services</th>
<th>Target Groups</th>
<th>Vision: Build a Society of Common Good</th>
<th>2021 Resource Investments by SDGs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivate Young Generation</td>
<td>High School/University Students and Professors</td>
<td></td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>Educational Collaboration</td>
<td>Educationally Disadvantaged Students</td>
<td></td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Promote Arts and Culture</td>
<td>Schools in Rural Areas or Educational Institutions</td>
<td></td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>Care for the Disadvantaged</td>
<td>Arts and Cultural Groups and Local Residents</td>
<td></td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>Care for Elders Living Alone</td>
<td>Disadvantaged Groups</td>
<td></td>
<td><img src="image5.png" alt="Image" /></td>
</tr>
<tr>
<td>Promote Filial Piety</td>
<td>Elders Living Alone with Low Income</td>
<td></td>
<td><img src="image6.png" alt="Image" /></td>
</tr>
<tr>
<td>Environmental Protection</td>
<td>Care Centers for Seniors Living Alone</td>
<td></td>
<td><img src="image7.png" alt="Image" /></td>
</tr>
<tr>
<td></td>
<td>NPOs</td>
<td></td>
<td><img src="image8.png" alt="Image" /></td>
</tr>
<tr>
<td></td>
<td>The Public</td>
<td></td>
<td><img src="image9.png" alt="Image" /></td>
</tr>
</tbody>
</table>

Total Amount

NT$966 million
TSMC Education and Culture Foundation

Cultivate Young Generation
Hold educational events, provide diversified educational platforms

- Ensure the number of overall youth competition events participants is higher than that of the previous year
- Hold $\geq 10$ popular semiconductor science activities with $\geq 1,000$ participants annually
- Invest $\geq NT$30 million in resources annually

The number of overall youth competition events participants is higher than that of the previous year
Hold $\geq 10$ popular semiconductor activities with $\geq 600$ participants
Invest $\geq NT$30 million in resources annually

Youth competition events attracted a total of 1,614 participants, up by 63 participants from 2020
Target: The number of youth event participants is higher than that of the previous year
Held 6 TSMC Journeys of Female Scientist Lectures, with 450 participants
Target: Hold at least 6 popular semiconductor science activities

Educational Collaboration
Cooperate with educational organizations to narrow the gap in educational resources

- Continue to cooperate with educational organizations and invest $\geq NT$20 million in resources annually
- Invest $\geq NT$15 million in resources annually

- Continued to offer scholarships at 5 universities; invested NT$8.2 million in 82 underprivileged students
- Donated NT$1.1 million in 2021 and NT$2.2 million in total between 2020-2021

Note: The long-term goals have been revised as the TSMC Education and Culture Foundation expects that the investment and the growth rate of participants could reach over 30% in 2030 according to the implementation results in recent years
<table>
<thead>
<tr>
<th>Strategies &amp; 2030 Goals</th>
<th>2022 Targets</th>
<th>2021 Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Promote Arts and Culture</strong></td>
<td>Hold art festivals to foster local art groups</td>
<td>Continuously organize the TSMC Hsin-Chu Art Festivals and sponsor ≥ 10 talented local artists or groups annually</td>
</tr>
<tr>
<td>Sponsor 10 local talented artists or art groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ensure the annual number of beneficiaries for arts and cultural events is ≥ 15,000 people&lt;sup&gt;<strong>new</strong>&lt;/sup&gt;</td>
<td>Organize ≥ 15 humanities lectures in college</td>
<td>Exclusively sponsored 17 Kenneth Hsien-Yung Pai Literature Lectures with a total of 2,302 participants. Target: Organize ≥ 15 humanities lectures in college.</td>
</tr>
<tr>
<td></td>
<td>Continuously organize ≥ 4 TSMC Lectures</td>
<td>Held TSMC Lectures and invited Dr. Ming-ke Wang, an academician from Academia Sinica, to give 4 lectures, with a total of 550 participants. Target: Continuously organize ≥ 4 TSMC Lectures.</td>
</tr>
<tr>
<td></td>
<td>Hold in-person arts and cultural activities and benefit more than 20,000 people &lt;sup&gt;<strong>NEW</strong>&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

Note: The long-term goals have been revised as the TSMC Education and Culture Foundation expects that the investment and the growth rate of participants could reach over 30% in 2030 according to the implementation results in recent years.

Exceeded ✓ Achieved — Missed Target
The TSMC Education and Culture Foundation, established in 1998, contributed NT$87.79 million to fulfill corporate social responsibility in 2021. Based on the three pillars of "Cultivate Young Generation," "Educational Collaboration," and "Promote Arts and Culture," the Foundation held educational activities and provided diversified platforms for youth; collaborated with educational organizations from public and private sectors to narrow the urban-rural education gap; held the Art Festival and sponsored local art groups. Due to the COVID-19 pandemic, the Foundation’s contributions decreased by 12% compared with that of the previous year.

Focusing on younger generations, the TSMC Education and Culture Foundation continued to hold humanities and science competitions in 2021. In addition to cultivating literacy, these competitions led the youth to explore themselves and pursue their dreams. The Foundation also promoted high-quality artistic activities, introduced resources to local art groups, and provided platforms so that people could watch performances and enrich their appreciation for the arts. Despite the impact of the pandemic, many art events were held online but remain well-received. The Foundation continues to inject resources into society to create a good positive cycle and sustainable growth in society. For more information about the events and the sponsorships, please refer to the official website of the Foundation.

Sponsorship from the TSMC Education and Culture Foundation in 2021

<table>
<thead>
<tr>
<th>Sponsorship Area</th>
<th>Financial Year</th>
<th>Amount (NT$ ten thousand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivate Young Generation</td>
<td>2017-2021</td>
<td>7,679-8,779</td>
</tr>
<tr>
<td>Educational Collaboration</td>
<td>2017-2021</td>
<td>7,681-9,985</td>
</tr>
<tr>
<td>Promote Arts and Culture</td>
<td>2017-2021</td>
<td>9,699-8,779</td>
</tr>
<tr>
<td>Others</td>
<td>2017-2021</td>
<td>12.8%</td>
</tr>
<tr>
<td>Total</td>
<td>2017-2021</td>
<td>NT$87.79 million</td>
</tr>
</tbody>
</table>
Highlight Gender Diversity and Cultivate Female Scientists

Promote the TSMC Journeys of Female Scientist Lectures

In order to inspire female students' interest in science, the Foundation worked with the National Museum of Natural Science to invite students from 12 girls’ senior high schools to attend the Lectures. The Lectures included a guided tour by TSMC female engineers to the World of Semiconductors Exhibition Hall, Semiconductor & science workshops, and dialogues between students and female scientists, which provided various opportunities for female students to learn about technology. The lectures attracted 450 females students in total.

Sponsor the Marie Curie High School Chemical Camp

Due to the pandemic, two science camps, the Wu Chien-Shiung Science Camp and the Wu Ta-You Taiwan Science Camp, long sponsored by the Foundation were suspended in 2021. The Marie Curie High School Chemical Camp was held as usual online.

To cultivate future scientist with advanced ideas and professional knowledge, the Foundation collaborated with the Chang Chao-Ting Memorial Foundation, sponsoring a 6-day-5-night science camp-the Marie Curie High School Chemical Camp- for 11 years since 2011. In addition to inviting top experts from Taiwan and abroad to introduce chemical sciences, the Foundation also invited outstanding enterprise leaders to give lectures on learning chemical sciences systematically. Due to the pandemic, the 2021 Marie Curie High School Chemical Camp was converted to three-day online courses and attracted 241 senior high school students to participate. The Foundation especially arranged a talk -The TSMC X Scientist Club Talk-during the camp and invited ten TSMC engineers under the age of 40 to share their educational backgrounds, work experiences, and the current industry status, which was well received by participating students.

I’d like to thank TSMC’s young engineers for sharing their work experiences and giving me insight to whether that’s what I want.

TSMC X Scientist Club Talk Participant

Thanks to the Lectures, I was able to know whether I am really interested in the semiconductor field, and to cross the barrier in gender and constraint to the future career path.

Student from Taichung Municipal Wen-Hua Senior High School

I didn’t expect my experience to be an inspiration for young people. I would like to thank TSMC for its dedication to cultivating young people in addition to contributing to Taiwan’s economy. It is very meaningful to be a part of this large family!

Eva Hsu
Manager, Research & Development-Special Tech. OPC, TSMC

Promote the TSMC Journeys of Female Scientist Lectures

12/450

A total of 450 female students from 12 high schools were invited to participate in the TSMC Journeys of Female Scientist Lectures, visiting the World of Semiconductors Exhibition and the Female Scientist Forum.
Establish Diversified Platforms for Youths to Undergo Self-Exploration and Deepen Humanistic Literacy

Expand TSMC Youth Dream Building Project and Encourage Youths to Focus on Environmental Sustainability

The TSMC Education and Culture Foundation has held the "TSMC Youth Dream Building Project" since 2016. In addition to inviting students from Taoyuan, Hsinchu, Miaoli, Taichung and Tainan areas, the Foundation expanded the project’s scale to students nationwide in 2021. In response to TSMC’s ESG values, the Foundation set the theme "UN SDGs" for the Sixth TSMC Youth Dream Building Project. A record high of 122 teams from 67 universities signed up for the project in 2021. In the end, 11 teams were selected and awarded a total of NT$3 million.

TSMC Youth Dream Building project has attracted more than 600 teams to participate from its first year to 2021. Among them, 46 award-winning teams made contributions in various areas such as regional revitalization, rural education, environmental protection, and indigenous culture, etc. Some of them even established their own social enterprises and continued to care about the issues raised in the project competition. A "STEAMING," shortlisted at the fifth Youth Dream Building project established their own company after graduation. Based on the core value of the 12-year Basic Education Curriculum Guidelines, the team integrated the literacy education concept to develop the first set of teaching material on "COVID-19" in Taiwan. The Daidai Rebag team, two-time winning team from the TSMC Youth Dream Building Project competition, also established a studio to promote environmental sustainability. Its founder and team project leader, Ms. Yujun Lin, was recognized by the Taiwan Academy of Corporate Sustainability and received the "2021 Outstanding Sustainability Youth Award."

The TSMC Youth Dream Building Project attracted 122 groups of students from 67 universities to participate in the competition, reaching 1,022 participants.

### Sixth TSMC Youth Dream Building Project

- **Online orientation**
  - July
- **Registration begins**
  - August
- **Press conferences and cross-border dialogues - enable students to have an in-depth understanding of SDGs and turn issues of sustainability into concrete actions**
  - September
- **Online team meeting**
  - October
- **Dream Building Workshop - invite professionals in related fields to share experiences**
  - November
- **Registration deadline**
  - December
- **Intensive workshops and TSMC visits - assist the team to optimize proposals and understand TSMC’s green manufacturing and environmental sustainability practices**
  - January
- **Final trial**
  - February
- **Initial interview**
  - March
- **Midterm sharing session**
  - April
- **Results presentation**
  - May

The judges and participient students of the Sixth TSMC Youth Dream Building Project

"ibu Indigenous Youth House," the award winning team of the sixth TSMC Youth Dream Building Project

"Steaming," award winning team of the fifth TSMC Youth Dream Building Project; and their teaching materials on "COVID-19"
Continue to Hold Calligraphy and Literature Contests

The Foundation encourages youth to study literature and calligraphy and offers a stage for them to shine with various artistic and cultural literacy competitions.

- Literature Competitions

The Foundation has held the TSMC Youth Literature Award for 18 consecutive years. With the theme of "Adult Formula in 2021" to symbolize becoming an adult, the competition has attracted a dedicated platform of students. Young people work to write novels in Mandarin, and to uncover new talents in literature writing. In 2021, the sixth TSMC Literature Award "Old School Writing" attracted more than 11,342 young writers to participate to receive a total of 171 submissions.

- Invited 12 award-winning students to write an essay titled "From a TSMC Superstar to the Next Literature Breakthrough" and published their essays on the UDN Supplement.

- To raise the public's interest in literature, the Foundation sponsored the "UDN Supplement - Under the Starry Sky of Literature" to organize five online TSMC Youth Literature Forums, attracting a total of 542,945 views.

In addition to the TSMC Youth Literature Award for high school students, the Foundation has held the biannual "TSMC Literature Award" since 2011 to encourage young people to write novels in Mandarin and to uncover new talents in literature writing. In 2021, the sixth "TSMC Literature Award" attracted more than 11,342 young writers to participate from Taiwan, China, Hong Kong, Malaysia, the United States and Canada, and received a record high of 171 submissions.

542,945

Hosted five online TSMC Youth Literature Forums, attracting a total of 542,945 views

- TSMC Calligraphy and Seal-carving Competition

The mission of the TSMC Calligraphy and Seal-Carving Competition is to promote Chinese characters, education, and their beauty. This competition is the only program that promotes calligraphy and seal-carving to high school students in Taiwan. With the theme of "Old School Writing," the 14th competition encouraged youth to experience the fun of writing in calligraphy brushes. It was also the first time that the Foundation collaborated with the Institute of History and Philology, Academia Sinica to provide teacher training courses. The training, customized Chinese character courses, middle school teachers, and solicited creative calligraphy teaching proposals from junior and senior high school teachers. It was hoped that calligraphy can therefore be promoted to the campus. In 2021, there were 422 submissions in competition, 40 teachers participating in the training, and 18 submissions of innovative teaching proposals.

Exclusively Sponsor Kenneth Hsien-Yung Pai Literature Lectures in NTHU

The Foundation has long dedicated itself to humanities education by launching diverse educational projects that aim to improve young students' cultural literacy. In 2021, the Foundation invited Hsien-Yung Pai, a literary giant in Taiwanese Literature, and several scholars to give 17 classes on Selected Classics of Chinese Culture at the Center of General Education at National Tsinghua University. The classes were well received with 2,302 participants. Meanwhile, in response to the 12-year Basic Education Curriculum Guidelines, the lectures were open to 100 sit-in students from senior high schools and could be accessed on the NTHU OpenCourseWare, and the TSMC Education and Culture Foundation's official website. In addition, the Foundation has completed and uploaded the video of Kenneth Hsien-Yung Pai Literature Lectures: Dream of the Red Chamber, sponsored in 2020 to the above two platforms. As of the end of December 2021, the number of viewers had reached 46,465.

"Tradition is a river that needs to flow. Only when you inject the water of culture will the river have life. When I can, I will pass the traditions on."

A Sit-in Student from Hsinchu Chien Kung Senior High School
Educational Collaboration

What We Want to Solve
Education inequality affecting underprivileged children and skipped-generation families in rural and less accessible areas due to a lack of digital learning resource and stable source of diversified and suitable educational resource.

How We Respond
The Foundation has long cared about education since its establishment. In 2021, the Foundation contributed NT$20.6 million and collaborated with educational organizations from both the private and public sectors, aiming to increase learning motivation of educationally disadvantaged students by providing suitable learning resource to improve their studies. In addition, in hopes of narrowing gaps in educational resources, and to respond to the New K-12 Compulsory Education Curriculum, the Foundation assisted with the development of online literacy courses and the teacher training program. Moreover, scholarships were provided to help lessen the financial burden of disadvantaged college students when pursuing higher education.

Our Actions
- Launch the Teach and Learn Program to Support Teachers to Improve the Literacy of Rural Children
- Continue to Provide Scholarship and Digital Learning Equipment to Disadvantaged College Students
- Sponsor Experimental Education at Emei Junior High School in Hsinchu County to Inject Educational Resources for Arts & Culture

Launch the Teach and Learn Program to Support Teachers to Improve the Literacy of Rural Children
The Foundation collaborated with the Common Wealth Education Foundation and the Hwawei Ko Professor Reading Research Center at NTHU to jointly launch a five-year Teach and Learn Program in 2021. Based on the long-sponsored Hope Reading Program, 51 rural elementary schools were selected. With the profession of the Hwawei Ko Professor Reading Research Center and its integration of technology, the program provided physical workshops, proposal writing training, online consulting and systems to evaluate students' reading ability. The program helps teachers build an effective teaching system, so as to improve their teaching in reading and students' learning performance. With the program, students in rural areas can gain the confidence and ability to change their lives. In 2021, the oral comprehension and reading ability of 1,573 first grade students from 51 rural elementary schools had been tested. The results showed that up to 80% of the students are significantly behind. The Foundation will continue to implement the program by tracking the learning status of students every year.

Continue to Provide Scholarship and Digital Learning Equipment to Disadvantaged College Students
Dedicated to assisting outstanding yet economically disadvantaged students, the TSMC Education and Culture Foundation continues to sponsor four years scholarships to 82 disadvantaged students at five universities including Sunrise Program Scholarship (National Tsing Hua University), Sunflower Program Scholarship (National Central University), Star Program Scholarship (National Cheng Kung University), South Star Program Scholarship (National Sun Yat-sen University), and Chia Star Program Scholarship (National Chung Cheng University). In 2021, TSMC contributed a total of NT$8.2 million and donated 25 laptop computers freshman recipients in the hopes of helping students focus on their studies. In addition, the Founder provided summer internship opportunities at TSMC for scholarship recipients to broaden their horizons and have experiences in the workplace.

The scholarship from the Foundation gives me relief from the financial pressures in college. It is a kind of gentleness bestowed on me by God!

Star Program Scholarship Recipient
Sponsor Experimental Education at Emei Junior High School in Hsinchu County to Inject Educational Resources for Arts & Culture

Caring about remote education in Taiwan as its long-term goal, the Foundation collaborated with the Cheng Zhi Foundation to realize a shared vision of providing remote areas with equal access to educational resources. A three-year education funding sponsorship was provided to Emei Junior High School, the first KIST (Knowledge-Is-Power-Program Inspired Schools in Taiwan) school in Hsinchu County in 2020. In the second year of funding, the Foundation provided more art and cultural resources to foster literature and music literacy of Emei’s students. Their score performance on the Comprehensive Assessment Program for Junior High School Students were improved in 2021. The percentage of grade "C" in subjects of Chinese, English, Social & Science decreased significantly. Recognized by the innovation on the teaching development, the school’s student number increased from 39 to 52 in total.

Emei Junior High School’s Comprehensive Assessment Program for Junior High School Students Scores in 2021

<table>
<thead>
<tr>
<th>Subject</th>
<th>2021 C-graded in Emei</th>
<th>2021 C-graded in Taiwan</th>
<th>2020 C-graded in Emei</th>
<th>2020 C-graded in Taiwan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandarin</td>
<td>15%</td>
<td>22%</td>
<td>22%</td>
<td>33%</td>
</tr>
<tr>
<td>English</td>
<td>60%</td>
<td>60%</td>
<td>60%</td>
<td>53%</td>
</tr>
<tr>
<td>Math</td>
<td>33%</td>
<td>33%</td>
<td>27%</td>
<td>15%</td>
</tr>
<tr>
<td>Social Studies</td>
<td>31%</td>
<td>31%</td>
<td>31%</td>
<td>38%</td>
</tr>
<tr>
<td>Science</td>
<td>24%</td>
<td>24%</td>
<td>28%</td>
<td>32%</td>
</tr>
</tbody>
</table>

5 universities/NT$8.2 million
- Sponsored five universities with scholarship of NT$8.2 million and 50 laptop computers; assisted 82 economically disadvantaged students with educational pursuits

Teachers and students from the Emei Junior High School visit the National Taichung Theatre
Promote Art and Culture

What We Want to Solve
Taiwan local art groups, without sufficient resources, need more stages to perform and more support from the public; meanwhile, impacted by internet entertainment media, traditional arts and culture inheritance both face critical challenges.

How We Respond
To continue to provide more resources in art and cultural education, the Foundation contributed NT$217.4 million in 2021 to organize high-quality arts and culture exhibitions and performances to support art and culture groups. Though many events were canceled or held online due to the COVID-19 pandemic, the Foundation strived to support educational, artistic, and cultural events with help from technology.

Our Actions
- Promote Art and Cultural Events
- Promote Humanities Classics

Promote Art and Cultural Events
Continue the Hsin-Chu Art Festival
Since 2003, the TSMC Education and Culture Foundation has held the Hsin-Chu Art Festival for 17 years, with a different theme for each year. Major art events are also held regularly in Hsinchu, Taichung, and Tainan. In 2021, the theme of the Hsin-Chu Art Festival was "Her Stage," the successes and life stories of female artists were introduced to the public. Various exhibitions and performances were held successfully including "A Thousand Stages, Yet I Have Never Quite Lived" and a special exhibition on Wei Haimin that uses diverse and interactive audiovisuals to bring the audience into the six roles of Peking opera singer-actress Wei Hai-min, explore the story of her life, and trace back to Taiwan's social history time flow; the play "The Man with the Compound Eyes" adapted by the National Taichung Theater from the eponymous novel by renowned author, Wu Ming-yi utilized theatre, puppetry, symphonic music, and innovative multi-media stage technologies to replicate the realistic yet magical literary landscape, inviting the audience to learn more about the diverse peoples and culture of the island of Taiwan from different angles.

Newly Added Online Classical Music Concerts
The Eric Lu piano recital was originally scheduled to perform at the Tainan Municipal Culture Center. Due to the COVID-19 pandemic, the recital was pre-recorded at the Culture Center and presented to the audience later online. The concert attracted 1,446 online viewers in total.

To continuously promote arts and culture events during the pandemic period, the Foundation put special efforts into action by sponsoring the online concert "The Legend of Mahler" held by the National Symphony Orchestra. The concert was livestreamed and broadcasted on OPENTIX Live, the National Concert Hall’s online streaming system, for 72 hours. Meanwhile, a special free access to the online concert was provided to TSMC employees for them to enjoy Mahler's music of life during the Moon Festival. The concert attracted 1,271 online viewers in total.
Promote Classical Humanities

New Broadcasting Program on Air to Innovate and Inherit the Culture of Chinese Traditional Opera

To deepen the younger generation's knowledge of Chinese traditional opera, the Foundation collaborated with IC Broadcasting company to launch a new 52-week program on Chinese opera - "Tales from Chinese Opera." The program is co-hosted by Dr. Anqi Wang, artistic director of GuoGuang Opera Company, and Dr. Shih-Lung Lo, Associate Professor of the Department of Chinese Literature at National Tsing Hua University. Each week, the program shares the story of a classic Chinese opera and also invites renowned Chinese opera actors for interviews. The program is available on the radio but also on diverse platforms such as Podcast and Spotify. As of the end of December 2021, the program has attracted 1.106 million listeners.

TSMC & GuoGuang Opera Promote Chinese Opera in Colleges

To pass down the legacy of Chinese opera, the Foundation sponsored the GuoGuang Opera’s Chinese Opera on Campus program to offer courses on Chinese opera at the National Tsing Hua University and National Tunghai University for three consecutive years, starting from 2021. The courses introduce basic principles and histories of Chinese opera and also teach students how to perform on stage. We hope that our younger generations may resonate with Chinese opera and allow the art of Chinese opera to take root. The Foundation also held the "TSMC Theatre" at the National Yang Ming Chiao Tung University. Four classic Peking opera performances were held. In addition, a special guided introduction was arranged for students to understand more about the beauty of Peking opera. The performances attracted over 450 participants.

TSMC Lectures

The Foundation has held TSMC Lectures since 2014, and every year, invited renowned lecturers in culture and history to guide Hsinchu communities closer to culture and history, and experience the charm of philosophy. In 2021, we invited Dr. Ming-ke Wang, a research fellow from the Institute of History and Philology, Academia Sinica, for the third time. Dr. Wang gave four lectures on the topic of "Ideals, Policies, and Realities: Minorities in China," sharing his experiences conducting field research on minorities in China for over two decades, giving examples to support the significance of minorities on how human ecosystems have been shaped, and guiding the audience through the realities of minorities living under China’s policies from different perspectives. The lectures drew 550 participants.

Kao Chen-Lin
Associate Professor of Chinese Literature at National Tunghai University

Without the incredible support from the TSMC Education and Culture Foundation, GuoGuang Opera would not have had the opportunity to offer practicum credit courses on Peking opera at universities, and a performing program for these enrolled students to perform on stage in three years.

Chang Yu-Hua
Head of the GuoGuang Opera Company
<table>
<thead>
<tr>
<th>Strategies &amp; 2030 Goals</th>
<th>2022 Targets</th>
<th>2021 Achievements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Care for the Disadvantaged</strong>&lt;br&gt;We care about inequality of educational resources &amp; emergency aid in Taiwan and offer support when necessary through story telling, community and fab volunteer support.</td>
<td>More than 10,000 hours in volunteer storytelling services each year</td>
<td>Volunteer storytelling services exceeded 4,910 hours&lt;sup&gt;Note 1&lt;/sup&gt; Target: 9,000 hours</td>
</tr>
<tr>
<td></td>
<td>More than NT$18 million in annual donations to the disadvantaged each year</td>
<td>Donated NT$22.63 million&lt;sup&gt;Note 2&lt;/sup&gt; to the disadvantaged Target: NT$13 million</td>
</tr>
<tr>
<td></td>
<td>Help over 10,000 children in remote areas</td>
<td>Help over 5,000 children with the remote education programs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5,287 children benefitted from the rural education programs Target: 4,000 children</td>
</tr>
<tr>
<td><strong>Care for the Elderly</strong>&lt;br&gt;We work with hospitals across Taiwan through the Network of Compassion&lt;sup&gt;Note 3&lt;/sup&gt; partnership and provide a variety of medical and social welfare resources to care for senior citizens living alone</td>
<td>Offer 12,000 services to senior citizens each year through Network of Compassion</td>
<td>Offered 15,719 services to senior citizens Target: 11,000 services</td>
</tr>
<tr>
<td></td>
<td>Deliver 400,000 meal services to senior citizens through Network of Compassion</td>
<td>Delivered 304,477 meal services to senior citizens living alone through Network of Compassion&lt;sup&gt;Note 4&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exceeded Achieved Missed Target</td>
</tr>
</tbody>
</table>

Note 1: In response to the COVID-19 pandemic, volunteer activities were suspended in accordance with related policies in the first half of 2020.

Note 2: The amount included donations from TSMC volunteers and the Sending Love Forward project, which included cash donations but excluded goods donations, repair services or other donations.

Note 3: The partnership “Networking of Love” was renamed as “Network of Compassion” in 2021.

Note 4: Network of Compassion to deliver meals for the solitary elders.
**Promote Filial Piety**

We create filial piety volunteer program and collaborate with the Ministry of Education, schools, media, and other enterprises to promote filial piety education at schools.

- Promote filial piety education in 120 educational institutions
- Promote filial piety education at 65 educational institutions
- Promoted filial piety education at 64 educational institutions

**Environmental Protection**

We aim to reduce waste through the Cherish Food Program. We also promote environmental protection and energy conservation through our energy-saving volunteers, eco-volunteers, and corporate volunteers.

- Over 50,000 beneficiaries from the Cherish Food Program each year
- More than 42,000 beneficiaries from the Cherish Food Program
- The beneficiaries of the Cherish Food Program reached 58,862 beneficiaries.

- Environment protection volunteers provide services of at least 1,200 times each year
- Environment protection volunteers provide services of 1,000 times each year
- Environment protection volunteers served 794 times.

**Note 4:** In response to the COVID-19 pandemic, volunteer activities were suspended in accordance with related polices in the first half of 2020.
The TSMC Charity Foundation was established in 2017 and has since dedicated itself to four major areas: Care for the Disadvantaged, Take Care of Elderly People Living Alone, Promote Filial Piety, and Environmental Protection. In 2021, with caring for the disadvantaged and environmental protection as its main goals, TSMC’s Charity Foundation worked with enterprises that share the same beliefs of uplifting society to provide students in remote areas with job training and employment opportunities. In terms of environmental protection, the TSMC Charity Foundation installed solar power generation equipment and LED light tubes for social welfare groups, responding to renewable energy and reducing the monthly electrical cost of social welfare groups. Any excess power can also be sold to fund the social welfare groups.

As the COVID-19 pandemic continued to ravage Taiwan, the TSMC Charity Foundation called on TSMC employees to join the donation project, which provided zero-contact test stations, oxygen generators, and industrial-grade protective equipment for domestic medical hospitals, supporting healthcare workers to work safely in quarantined areas. The TSMC Charity Foundation also invited other enterprises to support efforts against the COVID-19 pandemic.

### Core Engagement

- **Care for the Disadvantaged**
  - Close the urban/rural divide for education in remote areas through empowerment projects
  - Offer financial support and better living spaces for higher quality of life

- **Care for the Elderly**
  - The Foundation focuses on caring for seniors living alone by organizing volunteers and resources
  - Work with the K-12 Education Administration, Ministry of Education, to let the seeds of filial piety sprout

- **Promote Filial Piety**
  - Green Charity & Cherish Food Programs - Save/create energy
  - Environmental education to deepen sustainability spirits

### Social Investment (NT$)

- >$236.98 million
- 26,357 Service Hours
- 10,664 Volunteers
- 4,932 Volunteer Service Times
- 45,939 Donations
- 120,157 Beneficiaries

Note: Included cash donations, goods donations, repair services or other indirect donations, but excluded cash donations or goods from fundraising initiated by TSMC employees.
Donations by the TSMC Charity Foundation

Total (NT$) $236.98 million

Note 1: TSMC has categorized activities into cash, time, and in-kind giving (include management) according to the Dow Jones Sustainability Index and then converted all forms of donations into a monetary unit (NT$) in order to calculate their percentage; time = volunteered hours*average wages; goods & services = the monetary amount of the goods, services, and management provided by TSMC.

Note 2: TSMC has categorized donations based on the Dow Jones Sustainability Index into charitable donations, community investments, and commercial initiatives, converting all contributions into a monetary amount (NT$) in order to calculate their percentage.

Note 3: In response to global COVID-19 prevention measures, the amounts above covered an investment of NT$98,276,000 related to emergency assistance for Covid-19 testing and medical supplies in Taiwan and abroad, accounting for 41.5% of the total annual amount.

Note 4: The number of volunteers included: TSMC employees, former employees, retired employees, family members of employees, and employees of companies who are engaged in volunteer service activities organized by the TSMC Charity Foundation.

Note 5: In the second half of 2021, TSMC suspended all on-site volunteer activities in compliance with COVID-19 prevention measures set forth by the Ministry of Health and Welfare.

### What We Donated

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount (NT$)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>$180,060</td>
<td>76.0%</td>
</tr>
<tr>
<td>$34,290</td>
<td>14.5%</td>
<td></td>
</tr>
<tr>
<td>$22,635</td>
<td>9.5%</td>
<td></td>
</tr>
<tr>
<td>In-kind giving</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and service</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### How We Donated

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount (NT$)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>$119,185</td>
<td>50.3%</td>
</tr>
<tr>
<td>Initiatives</td>
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<td></td>
</tr>
<tr>
<td>$113,425</td>
<td>16.4%</td>
<td></td>
</tr>
<tr>
<td>$4,375</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td>Promote Filial Piety</td>
<td>$105,428</td>
<td>44.5%</td>
</tr>
<tr>
<td>Care for the Elderly</td>
<td>$92,219</td>
<td></td>
</tr>
<tr>
<td>Care for the Disadvantaged</td>
<td>$38,879</td>
<td>38.9%</td>
</tr>
</tbody>
</table>

### Projects We Supported

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount (NT$)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promote Filial Piety</td>
<td>$105,428</td>
<td>44.5%</td>
</tr>
<tr>
<td>Care for the Elderly</td>
<td>$92,219</td>
<td></td>
</tr>
<tr>
<td>Care for the Disadvantaged</td>
<td>$38,879</td>
<td>38.9%</td>
</tr>
</tbody>
</table>

### Accumulated Volunteer Headcount

<table>
<thead>
<tr>
<th>Year</th>
<th>Volunteers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>8,776</td>
</tr>
<tr>
<td>2018</td>
<td>10,266</td>
</tr>
<tr>
<td>2019</td>
<td>8,174</td>
</tr>
<tr>
<td>2020</td>
<td>10,451</td>
</tr>
<tr>
<td>2021</td>
<td>10,644</td>
</tr>
</tbody>
</table>

### Accumulated Service Times

<table>
<thead>
<tr>
<th>Year</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>24,612</td>
</tr>
<tr>
<td>2018</td>
<td>27,590</td>
</tr>
<tr>
<td>2019</td>
<td>17,593</td>
</tr>
<tr>
<td>2020</td>
<td>12,177</td>
</tr>
<tr>
<td>2021</td>
<td>4,932</td>
</tr>
</tbody>
</table>

### Accumulated Volunteer Service Hours

<table>
<thead>
<tr>
<th>Year</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>106,176</td>
</tr>
<tr>
<td>2018</td>
<td>109,059</td>
</tr>
<tr>
<td>2019</td>
<td>83,797</td>
</tr>
<tr>
<td>2020</td>
<td>64,779</td>
</tr>
<tr>
<td>2021</td>
<td>26,357</td>
</tr>
</tbody>
</table>
Cultivate Young Generation

What We Want to Solve
According to statistics from the Ministry of Education in 2021, there are approximately 100,000 students and 1,172 schools in remote areas, accounting for nearly 30% of total schools in Taiwan. The TSMC Charity Foundation is committed to supporting rural students with targeted learning, comprehensive remote learning equipment, various career exploration and training courses, and ample resources for rural teachers empowerment.

How We Respond
The two core objectives of the “Care for the Disadvantaged” are rural education and improving the quality of life of economically disadvantaged. In the field of rural education, the TSMC Charity Foundation joins hands with other enterprises to support students in exploring their potential and developing professional abilities through three major pillars of “Interdisciplinary Education,” “Subject-based Education,” and “Vocational Education.” To enhance the quality of life of the economically disadvantaged, TSMC volunteers help marginalized families and families suffering from financial shock through the projects of Ten Thousand Dollar Per Household, Emergency Aid for the Disadvantaged, and Scholarship for the Disadvantaged.

Our Actions
- Close the Urban/Rural Divide for Education in Remote Areas through Empowerment Projects
- Offer Financial Support and Better Living Spaces for Higher Quality of Life

Close the Urban/Rural Divide for Education in Remote Areas through Empowerment Projects
Three Countermeasures for Rural Education

1. Family Support
   - Ten Thousand Dollar Per Household and Emergency Aid for the Disadvantaged

2. Character Multicultural Education
   - Reading
   - Photography Programs
   - Ecological Environment

3. Knowledge Subject-based Education
   - After-school Class
   - Math and English
   - Popular Science Education (Science, AI, computer program)

4. Skill Vocational Education
   - Air-conditioning Repair
   - Hair Design
   - Career Exploration

Learning Accompany
Combine University Social Responsibility (USR) resources to be teachers & volunteers

Food Support
Supply excess food with manufacturers and food banks

Equipment
- Solar panels, LED lights, cars, air-conditioning, Internet, repairs, freezers, computer tablets

Appendix
ESG Feature Stories
Overview Sustainable Business Practices Operations and Governance
An Innovation Pioneer A Responsible Purchaser A Practitioner of Green Power An Admired Employer
Power to Change Society
In 2021, TSMC volunteers served at remote primary schools and non-profit after-school institutes to offer diversified learning resources and companionship such as storytelling and teaching photography. The activities aim to increase learning motivation and enjoyment from learning as well as boost their academic confidence. Volunteers also encourage students to pursue extra-curricular activities by supporting their participation in major competitions. TSMC also provides business opportunities and invites children to participate in team-oriented activities in order to develop their teamwork skills. In addition, TSMC employees make monthly donations through the TSMC i-Charity Platform, providing long-term support for non-profit organizations. Charity concerts are held every year and students in remote areas are invited to join. The proceeds from the concerts go to non-profit organizations targeting rural education.

**TSMC Participating Units**
TSMC Charity Foundation, Advanced Packaging Technology and Service, Central PIE Department, Special Technology Product Development Division, Quality & Reliability, Intelligent Manufacturing Center, Fab 2 & Fab 5, Analog Power & Specialty Technology Division and Storytelling Volunteers

**Institutional Beneficiaries**
Ruei Yuan Elementary School in Taoyuan City, Han Si Elementary School in Yilan County, 11 elementary schools in Hsinchu County, Si Wei Elementary School in Taichung City, three elementary schools in Tainan City, Holy Family for Special Education, Junyi Academy Foundation and Teach for Taiwan Education Foundation

**Cooperating Units**
National Tsing Hua University and National Yang Ming Chiao Tung University

**Reading services**

<table>
<thead>
<tr>
<th>Year</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>4,910</td>
</tr>
<tr>
<td>2020</td>
<td>5,060</td>
</tr>
<tr>
<td>2019</td>
<td>8,480</td>
</tr>
</tbody>
</table>

**Children benefitted**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>79</td>
</tr>
<tr>
<td>2020</td>
<td>5,287</td>
</tr>
<tr>
<td>2019</td>
<td>960</td>
</tr>
</tbody>
</table>

**Storytelling volunteers**

- Volunteers from Fab 2 & Fab 5 taught children photography and graphic designing

Thanks to TSMC, students at Datong Elementary School were able to experience such a fun way of learning through board games and were inspired to learn.

Yan-Hua Jhu
Datong Elementary School baseball team coach

Thanks to TSMC, DIY activities can immerse children in learning and inspire creativity. I was touched to see the kids have so much fun!

Steven Sze Hang Poon
a volunteer from the Quality & Reliability Organization arranged various after-school programs to foster imagination and creativity in children
Subject-based Education — Paving the Way

When Taiwan raised the epidemic alert, schools and kindergartens were closed to reduce the risk of cluster infection. Before schools were closed, the TSMC Charity Foundation teamed up with a number of enterprises to deploy digital learning resources in rural schools to reduce the pandemic’s impact on student learning. In addition, TSMC volunteers arranged remedial teaching by recording engaging science teaching videos and developing science materials for students to learn at home. The TSMC Charity Foundation has also worked with students from Fu Jen Catholic University and National Yang Ming Chiao Tung University to introduce AI courses and science experiments to elementary schools in remote areas. By doing so, students can learn about trends in technology and be motivated to learn more.

### TSMC Participating Units

TSMC Charity Foundation, Fab 12B, Fab 15B, C PIE, Quality & Reliability and Storytelling Volunteers

### Institutional Beneficiaries

Han Si Elementary School in Yilan, Jaudung Elementary School in Hsinchu County, Nan-Liao Primary School in Hsinchu City, Si Wei Elementary School in Taichung City, Ma Sing After-school Class in Changhua County, ShuangLong Elementary School in Nantou City, Shulin Elementary School in Tainan City and Songlin Elementary School, etc.

### Cooperating Units

Microsoft Taiwan, LENOVO TECHNOLOGY B.V. TAIWAN BRANCH (NETHERLANDS), Alpha Networks Inc., TAIWAN MOBILE CO., LTD., MyGrain Educational Company Limited, Fu Jen Catholic University and National Yang Ming Chiao Tung University

<table>
<thead>
<tr>
<th>50</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed 50 classrooms with online remote equipment</td>
<td>Created science videos</td>
</tr>
<tr>
<td>400</td>
<td>2,000</td>
</tr>
<tr>
<td>Accounts for teachers to access self-empowerment learning platform</td>
<td>Provided boxes of science materials</td>
</tr>
</tbody>
</table>

1,600/1,000/80

Provided more than 1,600 second-hand computers, 1000 networking devices, and 80 tablet PCs

Storytelling volunteers hold an online science laboratory during the pandemic for children to understand science.

"With online courses and volunteers’ help, students in remote schools can keep learning."

Tsui-Lien Shen
headmaster of Si Wei Elementary School

"Science experiments program allow children to explore principles from hands-on experiences which achieve better learning performances."

W.P. Chen
TSMC Storytelling Volunteer
In 2021, the TSMC Charity Foundation worked with Ho Tai Development Co., Ltd. and Happy Recome Co., Ltd. to foster vocational skills, provide students in remote areas with job opportunities and career training, and help students get jobs in schools and welfare institutions, creating a win-win situation for companies, students, and welfare institutions.

In 2022, the TSMC Charity Foundation expects to invite Ikea and Lohas Biotech Development Corp. to participate in its vocational education plan. In order to tap into the potential of rural students, TSMC has also partnered with the 104 Corporation to call for more than 100 professionals from different fields to share their careers in videos and set up a website called The World of Work: The Guide to Careers, empowering students to explore a wider range of careers.

The TSMC Charity Foundation helped students interested in becoming hair stylists and strengthened their skills to earn a living through training courses and with practice tools.

Ying-Nu Hung
Counseling director of National Tung Kang Maritime and Fishery Vocational High School

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Vocational Education - Develop Skills for Livelihood

In 2021, the TSMC Charity Foundation worked with Ho Tai Development Co., Ltd. and Happy Recome Co., Ltd. to foster vocational skills, provide students in remote areas with job opportunities and career training, and help students get jobs in schools and welfare institutions, creating a win-win situation for companies, students, and welfare institutions.

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The TSMC Charity Foundation helped students interested in becoming hair stylists and strengthened their skills to earn a living through training courses and with practice tools.

Ying-Nu Hung
Counseling director of National Tung Kang Maritime and Fishery Vocational High School
Offer Financial Support and Better Living Spaces for Higher Quality of Life

The TSMC Charity Foundation worked with social welfare departments of the local governments to continue the Ten Thousand Dollar Per Household and Emergency Aid for the Disadvantaged projects by providing financial support to disadvantaged families and families facing big challenges. In 2021, the Foundation collaborated with local educational bureaus and schools, helping 95 economically disadvantaged students receive education through the Scholarship for the Disadvantaged program. In addition, the Foundation called for people and companies to donate through the charity fundraising platform of Sending Love Forward. In response to the pandemic, in addition to complying with the pandemic prevention norms and caring for support institutions, TSMC volunteers met disadvantaged elderly online and launched group purchases that supports non-profit organizations affected by the pandemic. In the event of natural disasters, TSMC volunteers have assisted in housing repairs by using their profession at utility services.

TSMC Participating Units
TSMC Charity Foundation, CPO, Fab 6, Advanced Packaging Technology and Service, Fab 12A, Fab 8, Quality & Reliability, Special Technology Product Development Division, Human Resources and Community Volunteers

Institutional Beneficiaries
Green Light of I-Link Community Care Association in Hsinchu County, Mental Disability Care Association in Tainan, Taiwan Family Care Foundation in Hsinchu County, Charity Foundation of Children in Hsinchu County, Camillus Organization, Holy Family for Special Education, Teresa Children Center, SynLu Social Welfare Foundation, Children Are Us Foundation, Sundoor in Pingtung County, World Vision Taiwan, Earthquake-Affected households in Fuli Township and Hualien County

Cooperating Units
Social Welfare Departments at Local Governments
Local Educational Bureaus

95
Scholarship for the Disadvantaged program helped 95 economically disadvantaged students

917
Community Volunteer participants provided 917 hours in service

68
Ten Thousand Dollar Per Household program helped 68 families

Food offerings in temples was the main source of food for after-school programs, but this has stopped as the pandemic worsened. We are grateful to TSMC for providing food as substitute support our after-school class programs and children.

Hsiao Ya
Priest of Xushui After-school Class in Changhua County

The pandemic has been hard on everyone. However, we still hope that society can support public welfare activities and help disadvantaged groups to go through the pandemic.

Syue-Hua Lin
Fab 12A Volunteer
What We Want to Solve

According to information from the Ministry of the Interior, R.O.C., the number of households with elderly people living alone in 2021 was 477,000 households. By 2025, Taiwan may become a super-aged society. The number and needs of disadvantaged seniors and those living alone will continue to grow. Therefore, how to meet the needs of long-term care and provide transportation resources to caretakers and volunteers will be a focus issue.

How We Respond

The TSMC Charity Foundation works with our medical and healthcare partners to improve medical information sharing through the Network of Compassion. We offer quality and comprehensive care in an attempt to meet the demands of disadvantaged seniors.

Our Actions

- The Foundation focuses on caring for seniors living alone by organizing volunteers and resources.

The Foundation Focuses on Caring for Seniors Living Alone by Organizing Volunteers and Resources

In 2021, the TSMC Charity Foundation provided vehicles for the vulnerable elderly to enhance the accessibility of medical resources in the countryside. By utilizing the Network of Compassion system during the COVID outbreak, the Foundation provided and delivered a total of 3,000 prepared frozen meals, along with warm clothing to care for the elderly. Due to this pandemic, instead of holding the annual Network of Compassion Sharing Event, the Foundation published a special magazine issue to share information between medical and nursing institutions, deploying digitalization to combat the pandemic. TSMC volunteers have been taking care of the elderly by giving daily necessities and holding outdoor activities in compliance with pandemic prevention measures. This allows the elderly living alone to connect with society and enrich their lives.

"Joining the TSMC Network of Compassion makes us more welcoming. Our staff is more enthusiastic now because of charitable activities."

Yang Cho
Superintendent of China Medical University Hospital

"Although I can’t serve at agencies during the pandemic, the planning of video activities beforehand allows us to be in contact with the elders. It’s great!"

Ya-Ju Kuo
Fab 12B Volunteer
What We Want to Solve
The TSMC Charity Foundation encourages young people to express respect for their elders through real action. By doing so, the connections among family members and society will be strengthened.

How We Respond
The TSMC Charity Foundation works with the government, enterprises, and schools to promote filial piety by holding filial piety workshops and charity contests. These events aim to build generational mutual respect and understanding between parents and children.

Our Actions
- Work with the K-12 Education Administration to Let the Seeds of Filial Piety Sprout

Work with the K-12 Education Administration to Sprout the Seeds of Filial Piety

The TSMC Charity Foundation strives to promote filial piety and continues to host filial piety workshops and painting contests with the K-12 Education Administration, Ministry of Education in 2021. The TSMC Charity Foundation also transforms filial piety workshop contents and videos created by volunteers into public resources for educational institutes to download and use. In addition, TSMC filial piety volunteers visited schools to read related books and hold Mother’s Day activities to emphasize the concept of filial piety and strengthen parent-child relationships.

It was my first time participating in filial piety reading. I encouraged children to write what they wanted to say on their Mother’s Day cards. I realized that this is how love should be vocalized!

Y.C. Chang
Volunteer from Fab 15B

Promoted filial piety education in 64 educational institutions

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>64</td>
</tr>
<tr>
<td>2020</td>
<td>57</td>
</tr>
<tr>
<td>2019</td>
<td>37</td>
</tr>
</tbody>
</table>

Hosted 2 Filial Piety workshops for 64 participants

Collected a total of 1,069 outstanding works such as paintings, comics, stories and micro-movies on filial piety
What We Want to Solve

Climate change has brought on environmental issues and food inequality. Enterprises should take action and help reduce the negative impacts of climate change.

How We Respond

The TSMC Charity Foundation works with local governments to help institutions aiding the disadvantaged install solar panels and energy-efficient light bulbs. Through volunteer programs of energy savings and ecological, the Foundation hopes to promote the education of ecological restoration and carbon reduction in schools, as well as the aforementioned welfare institutions could exchange solar power for annual operating budgets by NT$2.5 million.

Green Charity & Cherish Food Programs - Save/Create Energy

The TSMC Charity Foundation supports green energy and works with local governments to prioritize social welfare institutions requiring assistance. The Foundation provides construction funds to build solar panels on the roofs of those institutions. In 2021, a total of two solar power plants were built in Tainan City, Yunlin County, and Pingtung County, which reduced the monthly electrical expenditure of social welfare institutions. Also, the aforementioned welfare institutions could exchange solar power for annual operating budgets by NT$2.5 million.

Our Actions

- Green Charity & Cherish Food Programs - Save/Create Energy
- Environmental Education Deepens

I would like to thank TSMC for equipping new LED lights for us. Compared to last year, the new lights saved us 400 kWh of electricity. TSMC also helped us build solar panels. Now, everyone is excited about sunny days — As the sun comes out, help is coming.

Hsueh-Ying Li
Director of St Raphael Opportunity Center

Green Energy for Social Welfare Institutes

Solar Power Rebates as Stable Financial Support Model

Built two solar power plants for disadvantaged institutions
Equipped 62 schools with LED energy-saving light tubes
122 centers that care for the disadvantaged regularly benefit from the Cherish Food Program

I would like to thank TSMC for equipping new LED lights for us. Compared to last year, the new lights saved us 400 kWh of electricity. TSMC also helped us build solar panels. Now, everyone is excited about sunny days — As the sun comes out, help is coming.

Hsueh-Ying Li
Director of St Raphael Opportunity Center

Environmental Protection
In addition, in order to provide students with better lighting at schools, the TSMC Charity Foundation hired disadvantaged students from Kun Shan University to install LED energy saving light tubes at a total of 62 schools in Hsinchu City, Taichung City, Yunlin County and Tainan City. The annual energy saving is NT$1.6 million, which can provide about 40,000 additional lunches.

In 2021, LAO XIE ZHEN CO., LTD. became the seventh company of the TSMC Cherish Food Program, joining the existing six food companies of the TSMC Cherish Food Program to send goodwill foods to 122 agencies that serve the disadvantaged in 13 cities and counties in Taiwan, benefitting 58,862 people. During the pandemic, the Cherish Food Program expanded its services to partner with 1919 Food Banks to distribute 1,500 boxes of food to 160 after-school programs.

58,862
Cherish Food Program helped 58,862 people in 2021

Ms. Sophie Chang, the chairperson of the TSMC Charity Foundation, installs LED energy-saving light tubes with students from Kun Shan University.
Environmental Education Deepens Sustainability

In 2021, through ecological tours and DIY activities, TSMC ecological volunteers introduced students and tourists to biodiversity and raised awareness for ecological areas near TSMC fabs and the Tainan Jacana Ecological Education Park. In addition, TSMC volunteers used their expertise in energy saving and safety to help rural schools improve energy use efficiency on campus. The volunteers also designed games for students to learn the concepts of energy and water savings.

The TSMC Charity Foundation works with TSMC volunteers to develop diverse guided tours and environmental courses. In addition to providing semiconductor science tours, TSMC promoted eco-friendly plays for rural primary schools. During the pandemic, TSMC has developed online educational activities and has been committed to deepening the spirit of sustainability.

TSMC Participating Units
TSMC Charity Foundation, Fab-12A, Fab-12B, Fab-15A, Fab-14, Ecological Preservation Volunteers, Fab Projects Volunteers, Giving Guided Tours Volunteers and Storytelling Volunteers

Institutional Beneficiaries
Jilai Elementary School in Tainan City, Baoshan Elementary School in Hsinchu County, Si Wei Elementary School in Taichung City and Jaudung Elementary School in Hsinchu County

Cooperating Units
Jacana Ecological Education Park, National Museum of Nature Science, TSMC Museum of Innovation, WALK in TAIWAN and Old Tree Yard Environmental Protection Foundation

Through thematic learning, the TSMC Charity Foundation enables environmental education to take root and expand.

Chu-Feng Liu
Headmaster of Jaudung Elementary School in Hsinchu County

Through themed environmental education, learning becomes a part of life, helping children to grow and thrive.

Mh Hsu
TSMC Storytelling Volunteer

Volunteers from Fab 6 conduct a safe energy inspection on campus and prepare materials to teach children about energy-efficient light bulbs.
Operations and Governance

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Information Security  207
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, the Audit Committee and the 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 of overseeing and providing guidance to the Company’s comprehensive sustainable management strategies. TSMC’s Chairman chairs the ESG Steering Committee, and the Chairperson of the ESG Committee serves as its Executive Secretary and reports quarterly to the Board of Directors on the implementation results and the future work plan.

<table>
<thead>
<tr>
<th>Title/Name</th>
<th>Board of Directors</th>
<th>Audit Committee</th>
<th>Compensation Committee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chairman</td>
<td>Mark Liu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vice Chairman</td>
<td>C.C. Wei</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Director</td>
<td>F.C. Tseng</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Director</td>
<td>Ming-Hsin Kung</td>
<td>Independent</td>
<td>Independent</td>
</tr>
<tr>
<td></td>
<td>(Representative of National Development Fund, Executive Yuan)</td>
<td>Directors</td>
<td>Directors</td>
</tr>
<tr>
<td>Independent Director</td>
<td>Sir Peter L. Bonfield</td>
<td>Chair</td>
<td></td>
</tr>
<tr>
<td>Independent Director</td>
<td>Kok-Choo Chen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent Director</td>
<td>Michael R. Splinter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent Director</td>
<td>Moshe N. Gavrielov</td>
<td></td>
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</tr>
<tr>
<td>Independent Director</td>
<td>Yancey Hai</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent Director</td>
<td>L. Rafael Reif</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jan C. Lobbezoo</td>
<td>Financial Expert Consultant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Board of Directors and Committees

Inheriting the spirit of TSMC’s Founder, Dr. Morris Chang’s philosophy on corporate governance, under the leadership of Chairman Dr. Mark Liu and CEO & Vice Chairman Dr. C.C. Wei, TSMC’s Board of Directors takes a serious and forthright approach to its duties and is a dedicated, competent and independent Board.
Nomination and Election of Directors

TSMC establishes the Guidelines for Nomination of Directors that set out the procedures and criteria for the nomination, qualification and evaluation of candidates for Directors. The members of TSMC Board of Directors are nominated via rigorous selection processes. It not only considers background diversity, professional competence and experience, but also attaches great importance to his/her personal reputation on ethics and leadership. Directors shall be elected pursuant to the candidate nomination system specified in Article 192-1 of the R.O.C. Company Law. The tenure of office for Directors shall be three years. The average tenure of current TSMC Board of Directors is 8.1 years. The Company aims to have at least 50% independent directors and at least one female director to serve on the Board.

Board Diversity and Independence

TSMC’s Board is comprised of a diverse group of professionals from different background in industry, academia, law, etc. These professionals include citizens from Taiwan, Europe, and the U.S. with world-class business operating experience, one of whom is female. The six Independent Directors constitute 60% of the Board, and there is no marital or is within the second degree of kinship relationship between or among the Directors. As such, the Board of Directors carries independence.

Board and Audit Committee Performance Evaluations

TSMC implemented Board performance evaluations in 2021. Through self-assessment surveys via questionnaire, performance evaluations are completed annually by the Board as a whole, by individual directors and by the Audit Committee. For the results of the 2021 performance evaluations, please refer to the 2021 Annual Report.

Board Tenure

Unit: Year

<table>
<thead>
<tr>
<th>Year Range</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>0-3</td>
<td>40%</td>
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<tr>
<td>4-6</td>
<td>20%</td>
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<tr>
<td>7-9</td>
<td>10%</td>
</tr>
<tr>
<td>≥10</td>
<td>30%</td>
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Directors’ Professional Knowledge and Expertise

Unit: Person

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<tr>
<th>Field</th>
<th>Professionals</th>
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</thead>
<tbody>
<tr>
<td>Business</td>
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<tr>
<td>Technology</td>
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</tr>
<tr>
<td>Finance/Accounting</td>
<td>8</td>
</tr>
<tr>
<td>Legal</td>
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<tr>
<td>Sales and Marketing</td>
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</tr>
<tr>
<td>Quality/Security</td>
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</table>

Directors' Skills and Experience

Unit: Person

<table>
<thead>
<tr>
<th>Skill</th>
<th>Professionals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership Skill</td>
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</tr>
<tr>
<td>Industry Experience</td>
<td>10</td>
</tr>
<tr>
<td>Global Market Perspective</td>
<td>8</td>
</tr>
<tr>
<td>Financial Management</td>
<td>8</td>
</tr>
<tr>
<td>Industry Analysis</td>
<td>9</td>
</tr>
<tr>
<td>Talent Management</td>
<td>7</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>8</td>
</tr>
<tr>
<td>Business Development</td>
<td>10</td>
</tr>
<tr>
<td>Risk/Crisis Management</td>
<td>10</td>
</tr>
<tr>
<td>Sustainability</td>
<td>10</td>
</tr>
<tr>
<td>Social Engagement</td>
<td>10</td>
</tr>
</tbody>
</table>

Note 1: Experience in understanding or addressing strategic environmental sustainability issues, including but not limited to critical issues such as energy management, climate change, air pollution control, waste management, and water stewardship.

Note 2: Experience in understanding or addressing strategic social engagement issues, including but not limited to critical issues such as participation in associations, human right, and human capital.
Risk Management

Based on corporate vision and long-term sustainable responsibility, TSMC’s risk management organization is composed of the RM Steering Committee, RM Executive Council, RM Program and RM Task Force. Through cross-functional collaborations, TSMC established a comprehensive enterprise risk management (ERM) program, as well as applying ERM framework and risk map to integrate and manage potential sustainability risks including strategic, operational, financial and hazardous risks (climate change, utility supply, earthquake, fire, chemical spill, etc.) and assessing the risk levels by defining likelihood and impact severity of events on TSMC’s operations, and to prioritize controls and implement corresponding mitigation measures. The risk management organization briefs the audit committee each year on the ever-changing risk environment facing TSMC, the focus of TSMC’s ERM, and risk assessment and mitigation efforts. The Audit Committee’s Chairperson also reports to the Board of Directors on the risk environment and risk mitigation measures to be taken. For more details of Risk Management, please refer to TSMC’s 2021 Annual Report 6.3 Risk Management.

Enterprise Risk Management Framework

- **Risk Identification and Assessment**
  - RM Steering Committee and Audit Committee of the Board of Directors review and approve implementation of risk management strategy and prioritization of risk controls
  - RM Executive Council adopts risk map which assesses likelihood and impact of risk events on operations

- **Risk Control and Mitigation**
  - RM Program conducts cross-functional risk communication to facilitate each function for enhancing risk prevention and mitigation controls
  - RM Executive Council implements risk control and improves continuously
  - Each department includes the effectiveness of risk controls into annual self-assessment

- **Risk Response**
  - RM task forces establish crisis management and business continuity plan
  - RM Program plans and implements the response and exercise for material crisis events
  - Each department implements the planning and execution of business continuity plan

- **Risk Monitoring and Reporting**
  - Risk management organization reports to RM Steering Committee and Audit Committee on the focus of enterprise risk management, risk assessment, and mitigation efforts

Risk Management Organization Chart

- **RM Steering Committee**
  - Consist of functional heads, with internal audit head sitting in as an observer
  - Report to the Audit Committee of the Board
  - Advise and approve risk control prioritization
  - Supervise continuous improvement for risk management

- **RM Executive Council**
  - Consist of director-level representatives from each function
  - Identify and implement risk control plans
  - Continuously improve risk management practice and effectiveness

- **RM Task Force**
  - Identify potential scenarios and business impacts
  - Plan and execute risk prevention and mitigation actions in accordance with various scenarios
  - Establish crisis management procedures and conducts exercises

- **Board of Directors/ Audit Committee**
  - MM&RM - RM Program
  - Consolidate ERM reports and update to the RM Steering Committee
  - Coordinate and facilitate the RM Executive Council’s risk management activities
  - Facilitate RM task forces to enhance the effectiveness of risk controls
Ethics and Regulatory Compliance

Ethics

“Integrity” is the cornerstone of TSMC’s business philosophy. TSMC established the TSMC Ethics and Business Conduct Policy (Ethics Code) to be the guide for operating TSMC’s business with integrity, and for forming a robust culture of integrity within TSMC. TSMC realizes that suppliers are key partners in the regulatory compliance and implementation of the Ethics Code, leading to TSMC establishing the Supplier Code of Conduct and Supplier Sustainability Standards to extend TSMC’s core values of integrity into its supply chains and to enable suppliers to demonstrate business with integrity behavior. In addition, TSMC publishes its TSMC Anti-Corruption Commitment on the TSMC website to emphasize TSMC’s commitment to its core values of integrity.

TSMC established and published the Complaint Policy and Procedure for Certain Accounting & Legal Matters, making multiple reporting channels available for internal and external voices, and accepting anonymous reports, to protect the rights and interests of the company and its constituencies. All reported incidents collected from these reporting channels are properly recorded, confidentially investigated, well traced, and enhancements to TSMC practices are made where applicable. TSMC keeps individual identities confidential and prohibits retaliation on any individual who in good faith reports a suspected violation or participates in an investigation. Furthermore, TSMC has an Ethics Committee that oversees the implementation of the Ethics Code and investigations and disciplinary actions for reported incidents. The Ethics Committee meets quarterly or whenever necessary. In 2021, the Ethics Committee met seven times to examine major reported incidents under investigation.

Ethics Compliance Activities

Prevention

- Conflict of interest declaration
- Training
- Continuous promotion
- Supplier promotion

Detection

- Internal self-examination
- External verification
- Internal/external reporting channels
- Administrative discipline/legal action

Continuous

- Review and analyze corruption risk assessment
- Propose improvement program
- Implement improvement program

Continuous

Enhancement

Regulatory Compliance

TSMC operates in many countries. To ensure that every business activity in compliance with applicable governing legislation, laws, regulations and regulatory expectations, TSMC has established a complete regulatory compliance system, including a sequence of regulatory identification, compliance policy and procedure formulation, implementation and execution, compliance training program, to closely monitor domestic and foreign government policies and regulatory developments that could materially impact TSMC’s business and financial operations.

Ethics Compliance Activities

- New employees declare at their first day of joining TSMC
- Annual declaration: the designated managers or employees according to the Ethics Code
- New employees: Ethics Training Course for Newcomers
- All employees: Annual Ethics and Compliance Training Course
- Posters, emails, internal news articles, face-to-face communication
- TSMC Sustainable Supply Chain ESH Forum: face-to-face communication and experience sharing
- Online courses available on TSMC Supplier Sustainability Academy: Supplier Code of Conduct – Ethics, How to formulate your own code of ethics
- Annual Control Self-Assessment (CSA)
- RBA Validated Assessment Program (VAP)
- Annual Self-Assessment Questionnaire (SAQ) from three dimensions of risk, control, and management to comply with Responsible Business Alliance (RBA) requirement
- Internal: Whistleblower System, Ombudsman System
- External: Irregular Business Conduct Reporting
- The Ethics Committee investigates the reported incidents and determines the disciplinary actions, up to and including immediate dismissal, termination of business relationship, and legal action as appropriate
- The Ethics Committee will evaluate the violation cases to enhance TSMC practices where applicable
Regulatory Compliance and Policy Formulation

2021 Achievements

- Regulatory Compliance: In 2021, TSMC did not receive any reports related to finance, accounting or antitrust matters, nor did we receive any complaints concerning breach of customer privacy and loss of customer data, or any material regulatory violations (where a fine exceeds NT$one million).
- More information related to TSMC ethics and regulatory compliance, please refer to 3.5 Ethics and 3.6 Regulatory Compliance of TSMC’s 2021 Annual Report.

Training

Ethics Training Course for Newcomers
- Online program
- New employees in Taiwan sites (including contractors)

Annual Ethics and Compliance Training Course
- Online program
- All employees

Conflict of interest declaration/Declaration of Compliance with the Ethics Code
- New employees, the designated managers or employees according to the Ethics Code

Suppliers’ Feedback on TSMC’s Ethics Related Activities
- Source: 2021 Supplier Survey Questionnaire
- Supplier coverage (The transaction amount with TSMC reached NT$1,000,000 or above within 18 months since 2020): 1,942 suppliers, including tier 1 suppliers and critical suppliers
Financial Performance

TSMC believes prudent business plans, disciplined capital management and good financial performance can help create long-term economic value and build a solid financial foundation, which allows the company to give back to all its stakeholders, including shareholders/investors, employees, customers, suppliers, government, society, and others. Therefore, good financial performance is the key to corporate sustainability.

In the aspect of communicating financial performance with investors, TSMC strives to ensure information transparency. Not only does the company regularly disclose historical financial information, it also sets clear strategic financial objectives that enhance investors’ confidence in TSMC’s long-term investment value so that they are willing to grow with the company. As the multi-year megatrends of 5G and HPC-related applications are expected to fuel the demand for more computation power, TSMC sees strong growth potential in its advanced and specialty technologies in the next several years. Thus, the Company expects from 2021 to 2026 (1) its long-term revenue growth, in US dollar terms, to be 15% to 20% CAGR, with (2) long-term gross margin to be 53% and higher, and (3) ROE to be 25% and higher across the cycle.

Given the funding requirement of the growth opportunities and the need to maintain a solid financial foundation, TSMC issued a total of NT$234.6 billion in NT dollar denominated and US$13 billion in US dollar denominated corporate bonds with favorable pricing terms. After the bond issuances, TSMC continues to maintain the semiconductor industry’s highest credit ratings.

Four Strategies to Increase Long-term Investment Value

- **Continue to invest in technology leadership**
  - 14.5% R&D investment increased at 14.5% CAGR
  - TSMC produced 26% of the world semiconductor value (excluding memory output) in 2021

- **Provide excellent manufacturing services and capacity support**
  - 1,300 million 12”-equivalent wafers in 2021
  - Capital expenditures increased at 15.2% CAGR

- **Pursue revenue and market share growth**
  - 14.6% Net revenue increased at 14.6% CAGR
  - TSMC produced 26% of the world semiconductor value (excluding memory output) in 2021

- **Maintain or improve profitability and investment returns**
  - 16.7% Net income increased at 16.7% CAGR
  - 25.5% Average ROE
  - 2.2 Trillion Cumulative cash dividends from 2004 to 2021 (NTS)

Note: From 2012 to 2021
Supported by the Company’s strengthening industry position, growth potential and solid operating performance, TSMC’s share price, adjusted for cash dividends, increased 18.1% in 2021, marking 13 consecutive years of annual growth. Since the Company went public in 1994, TSMC has been profitable every year and TSMC’s market capitalization has been growing steadily. As of December 31, 2021, TSMC’s market capitalization reached NT$16.2 trillion, or US$584.9 billion.

TSMC’s solid financial performance enables the Company to distribute profits to shareholders in the form of cash dividends. In June 2021, TSMC’s Board of Directors approved quarterly cash dividend of NT$2.75 per share per quarter to be paid in the fourth quarter of 2021, an increase from NT$2.5 per share for the previous three quarters. TSMC’s shareholders received a total of NT$10.25 per share in cash dividends in 2021. From 2004 to 2021, TSMC has paid out a total of NT$2.2 trillion, or US$71.8 billion, in cash dividends.

In the future, TSMC intends to maintain a sustainable quarterly cash dividend, and to distribute the cash dividend each year at a level not lower than the year before.

**Financial Performance**

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue (NT$ Billion)</th>
<th>Net Income (NT$ Billion)</th>
<th>ROE %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>506</td>
<td>166</td>
<td>25%</td>
</tr>
<tr>
<td>2013</td>
<td>597</td>
<td>188</td>
<td>24%</td>
</tr>
<tr>
<td>2014</td>
<td>763</td>
<td>264</td>
<td>28%</td>
</tr>
<tr>
<td>2015</td>
<td>843</td>
<td>307</td>
<td>27%</td>
</tr>
<tr>
<td>2016</td>
<td>948</td>
<td>334</td>
<td>26%</td>
</tr>
<tr>
<td>2017</td>
<td>997</td>
<td>343</td>
<td>24%</td>
</tr>
<tr>
<td>2018</td>
<td>1,031</td>
<td>351</td>
<td>22%</td>
</tr>
<tr>
<td>2019</td>
<td>1,070</td>
<td>345</td>
<td>21%</td>
</tr>
<tr>
<td>2020</td>
<td>1,339</td>
<td>516</td>
<td>30%</td>
</tr>
<tr>
<td>2021</td>
<td>1,587</td>
<td>597</td>
<td>30%</td>
</tr>
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</table>

**Cash Dividend**

<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Dividend per Share (NT$)</th>
<th>Total Dividend Paid (NT$ billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>0.6</td>
<td>12</td>
</tr>
<tr>
<td>2004</td>
<td>2.0</td>
<td>46</td>
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<tr>
<td>2005</td>
<td>2.5</td>
<td>62</td>
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<tr>
<td>2006</td>
<td>3.0</td>
<td>77</td>
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<tr>
<td>2007</td>
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<td>2008</td>
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<td>2010</td>
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<td>2012</td>
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<td>2013</td>
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<td>2014</td>
<td>6.0</td>
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<td>2015</td>
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<td>2016</td>
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<td>2017</td>
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<td>2018</td>
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<td>2020</td>
<td>10.0</td>
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</tr>
<tr>
<td>2021</td>
<td>10.25</td>
<td>266</td>
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</tbody>
</table>

A complete dividend history can be found on TSMC’s website.
Tax

TSMC supports tax policies and incentives that encourage enterprise innovation and foster economic growth. The Company aims for its tax approach and disclosure to be transparent and sustainable in the long term.

**Tax Policy**

1. Act at all times in compliance with the spirit and the letter of all applicable tax laws and regulations in the jurisdictions in which we operate.
2. Inter-company transactions are based on the arm's length principle, in compliance with internationally accepted transfer pricing guidance published by the OECD.
3. Be transparent in financial reporting. Disclosures are made in accordance with applicable regulations and reporting requirements.
4. Do not use tax havens or tax structures whose sole purpose is for tax avoidance.
5. Do not transfer value created to low-tax jurisdictions.
6. Develop strong, mutually respectful relationships with tax authorities based on transparency and trust.
7. Always consider tax as part of major business decisions.
8. Analyze the operating environment and assess tax risk through a corporate management mechanism.

**Tax Risk Management**

TSMC is subject to tax laws and regulations in various jurisdictions in which it operates or conducts business. Any unfavorable changes in tax laws and regulations in these jurisdictions could increase the Company’s effective tax rate and have an adverse effect on its operating results. In order to effectively manage tax risks, TSMC follows internal control processes, identifies, assesses, and manages tax risks from regulatory changes and its business transactions, accounts for them appropriately, and implements and monitors controls over them.

Tax risk management is incorporated in TSMC’s enterprise risk management (ERM) program. The risk management organization regularly briefs TSMC’s Audit Committee on the ever-changing risk environment facing TSMC, the focus of the Company’s enterprise risk management, and risk assessment and mitigation efforts. For more details on risk management, please refer to the Risk Management section in TSMC’s 2021 Annual Report.

**Effective Tax Rate**

TSMC’s effective tax rate and cash tax rate in 2021 were 10.0% and 12.6%, respectively, both of which were lower than the industry average effective tax rate of 15.26% and the industry average cash tax rate of 14.12% based on SAM CSA Companion in Semiconductors and Semiconductor Equipment industry group, and also lower than Taiwan R.O.C. statutory tax rate of 20%. This was primarily due to a five-year tax exemption for capital investments made in previous years, and tax credit for research and development expenditures according to regulations under the R.O.C. Statute for Upgrading Industries and the Statute for Industrial Innovation.

**Tax Governance**

The ultimate responsibility for taxation management for TSMC and its subsidiaries rests with the Chief Financial Officer, who delegates day-to-day responsibilities to the Controller. A team of qualified and experienced tax professionals support the Controller to meet TSMC’s tax obligations. In addition, TSMC also leverages external tax service providers for complementary expertise.

TSMC’s Audit Committee is delegated by the Board to oversee the quality and integrity of the accounting, auditing, reporting, and financial control practices of the Company through periodic review of certain major matters, including accounting policies and procedures, internal control systems, legal compliance, and corporate risk management, etc. Among these, tax compliance is included as part of the Company’s legal compliance.

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**2021 Tax Breakdown**

- **95.3%** Taiwan R.O.C.
- **2.4%** Asia (excluding R.O.C)
- **2.3%** North America
- **8.8%** Labor and Health Insurance, Social Security
- **2.0%** Others

**Income Tax Paid**
- **83.5 Billion (NT$)**
- **Taiwan R.O.C.** 98.2%
- **Asia (excluding R.O.C)** 1.1%
- **North America** 0.7%

**Profit Before Tax**
- **663.1 Billion (NT$)**
- **Taiwan R.O.C.** 96.8%
- **Asia (excluding R.O.C)** 3.3%
- **North America** -0.3%
- **Others** 0.2%

**Income Tax Accrued**
- **88.8 Billion (NT$)**
- **Taiwan R.O.C.** 98.2%
- **Asia (excluding R.O.C)** 1.3%
- **North America** 0.5%

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Note 1: TSMC categorizes its profit before tax, income tax accrued, and taxes paid geographically based on the country in which TSMC and subsidiaries are located.


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<table>
<thead>
<tr>
<th>Region</th>
<th>Tax Breakdown</th>
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</thead>
<tbody>
<tr>
<td>Asia (excluding R.O.C)</td>
<td>2.4%</td>
</tr>
<tr>
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<td>Others</td>
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**2021 Tax Breakdown**

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<td>Others</td>
<td>2.0%</td>
</tr>
</tbody>
</table>

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In 2021, TSMC’s total tax payments on a cash basis worldwide were NT$93.6 billion.

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Note: Source: National Statistics, R.O.C. (Taiwan).
Information Security

As the world’s leading IC foundry, TSMC is actively strengthening the information security and proprietary information protection mechanisms, as stated in the TSMC Information Security Declaration. TSMC has successfully passed information security requirements of customers and third-party audits over the years. In 2021, TSMC furthered the promotion of information security management to the semiconductor supply chain. TSMC initiated and assisted SEMI (Semiconductor Equipment and Materials International Organization) to establish a Cybersecurity Committee and Specification for Cybersecurity of Fab Equipment. TSMC strives to further enhance supply chain information security.

Information Security Management Strategy

TSMC leverages four management mechanisms to enforce information security: dedicated information security organization, board of directors’ supervision, executive level participation and employee level participation. TSMC standardizes information security management and imposes policies and guidelines to maintain competitiveness and protect the interests of customers and partners.

Build up information security culture and implement management mechanism

To enhance the resilience of corporate information security, TSMC actively implements information security measures through professional talent cultivation and certification, information security education/training and social engineering drills as well as diversified communication channels. The company adopts international information security standards to improve defense and adaptability to build an information security culture.

<table>
<thead>
<tr>
<th>Information security management channels</th>
<th>Professional training and certification for information security employees</th>
<th>Information security training and social engineering walkthrough</th>
<th>Deploy the latest international information security standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diversified information security</td>
<td>TSMC cultivates a professional information security team and continues to encourage personnel to obtain international information security certifications.</td>
<td>All new employees and suppliers must attend training courses containing the latest information security policy.</td>
<td>Establish automated information security management system and obtain the ISO/IEC 27001 information security certification.</td>
</tr>
<tr>
<td>communication channels</td>
<td>Corporate Information Security planned 6 courses by experts from other organizations/fields at TSMC to understand the characteristics of different organizations and determine the information security operation and management.</td>
<td>TSMC imports the most well-known test tools and question banks in the world, and randomly selects employees for different phishing email simulations on threat identification.</td>
<td>Continuously achieve ISO/IEC 15408 security certification.</td>
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<tr>
<td></td>
<td>Employee punishment will be imposed based on non-compliance with information security and the degree of impact on the company.</td>
<td>TSMC set up the TSMC Proprietary Information Protection Committee organized by the senior executives of each function. Quarterly meetings are held to review and decide on information security and information protection guidelines and implemented measures.</td>
<td>TSMC continues to adopt new information security international standards, such as SKT CSF - SANS CSC, information security maturity standards, and risk assessment mechanisms to ensure effective physical security, information security, system operation, and product protection and controls.</td>
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<tr>
<td></td>
<td>Hold an internal review meeting and award ceremony every year as well as conduct a comprehensive review and discussion on the policy implementation results of the year in order to formulate annual implementation goals.</td>
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</tbody>
</table>
TSMC implemented the Business Continuity Management Policy to support the company's continuous operation management. In addition to daily information security management, it holds an information security accident emergency response and recovery exercise every year, to ensure continuous operation. According to the script, when an information security incident occurs in the simulation plant, the 24-hour Cyber Incident Response Center (CIRC) directs and coordinates the response. In order to ensure the disaster response capability at critical moments and the continuous operation of information systems without interruption, TSMC established an internal information security evaluation team. This team conducts continuous security risk assessments to confirm that the internal security operation control points are effective. An automated evaluation mechanism was also established so that if a loophole is found in the inspection result, the repair will be completed within the specified time limit. Every year, TSMC continues to conduct Red Team Assessments with external professional teams simulating intrusion attacks without affecting operations. Through the drill process, the detection and response capability of TSMC's information security defense are verified, and potential risks discovered.
Strengthen Supplier Information Security Management and Performance

TSMC is not only deepening the connotation of its own information security management but also striving to promote information security measures and standards to supply chain-related industries. TSMC drives the overall supply chain to improve and establish information security standards using the information security risk assessment platform as an indicator of effectiveness.

Initiate and Lead the Information Security of the Semiconductor Industry Supply Chain

TSMC continues to provide excellent semiconductor manufacturing services to global customers, meeting all information security requirements and international standards. TSMC initiated cooperation with SEMI (Semiconductor Equipment and Materials International Organization) to formulate a global Specification for Cybersecurity of Fab Equipment, which defines general specifications in four areas: computer operating system, network security, endpoint device protection and security monitoring, as well as information security auditing. To provide consistent guidelines for semiconductor equipment suppliers, Specification for Cybersecurity of Fab Equipment was officially announced at the International Semiconductor Exhibition (SEMICON TAIWAN) in December 2021. TSMC initiated the process to assist SEMI to establish the SEMI Cybersecurity Committee. The director of TSMC Corporate Information Security, Tu Zhen, served as the inaugural chairman of the SEMI Cybersecurity Committee, working together with industry players to solve the semiconductor industry’s information security protection problems and improve the overall information security level.

Achievements of Supplier Information Security Management in 2021

- Established and integrated the management and announcement mechanism of TSMC Supplier Proprietary Information Protection and Information Security (PIP & IT Security) Specifications
- Developed Supplier information security management requirements which has 12 categories covering 135 items according to TSMC’s needs and international standards
- Established an online work permit application reservation and authority management mechanism to strengthen the management of suppliers entering the factory

- TSMC conducted an information security assessment by surveying more than 1,200 suppliers and contracting a third-party information security assessment.
  - Of the 417 TSMC assessed suppliers with scores lower than 80, 198 improved their scores to above 80. TSMC will continue to monitor the improvement plans of the other 219 suppliers.
  - Of the 179 third party assessed suppliers with scores lower than 80, 155 improved their scores to above 80, a total of more than 3,000 key security weaknesses have been improved
  - Cooperated with 1 key supplier in improving information security through the TSMC Supplier Information Security Alliance channel

- Published 4 issues of Supply Chain Security Newsletter with over 200,000 recipients
- Developed supplier-friendly information security training courses and developed 2 online information security courses in the TSMC Supplier Sustainability Academy

- Established TS M C Supply Chain Information Security Incident Management and Reporting Mechanism
- Established Real-time Notification Risk Handling Procedure to share industry experiences raise information security alerts
### 2021 Information Security Measures Enforcement Result

#### Policies
- **11 Regulations**
  - Newly created or revised 11 information security regulations
  - 2021: 11
  - 2020: 10
  - 2019: 10

#### Violations
- **0.04%**
  - 0.04% of employees were found violating information security protection and PIP procedures and penalized consistent to the severity of damage caused by their violations.

#### Training/Promotion programs
- **100%**
  - 100% of new employees completed information security and protection training courses
  - 2021: 100%
  - 2020: 100%
  - 2019: 100%

#### Information Security Certification
- **300 mm Fab Obtained ISO/IEC 27001 Certification**
  - Areas include: Client Silicon IP merge, mask manufacturing and production, inventory management and related IT management applied to support 12-inch wafer manufacturing (Tainan)
- **1 Backend Fab Obtained ISO/IEC 15408 Certification**
  - Fab 14B and Advanced Backend Fab 2 were successfully certified by the German Federal Office for Information Security (BSI) for ISO/IEC 15408: EAL6 under Common Criteria (Site Certification)

#### Information Security Team Professional Certificate
- **51**
  - In 2021, TSMC information security team has obtained 51 international top-level information security certifications (including CISSP, CISA, EH, CHFI, ISO 27001 Lead Auditor, etc.).

#### Information Security Assessment
- **99 Points**
  - The third-party evaluation on TSMC’s information security resulted in a score of 99 in 2021

#### Surveys
- **94 Points**
  - Average a score of 94 for employee approval of information protection-related policies
  - Conducted an information protection engagement survey in 2021, collected over 55,000 surveys with over 89% response rate

#### Note:
2021 indicators cover TSMC’s Taiwan fabs and overseas subsidiaries
About this Report

To drive positive change towards a better society, TSMC has been issuing non-financial reports for 23 consecutive years. In addition to complying with Sustainability Information Disclosure Framework, the report also heeds expectations and suggestions from various stakeholders regarding the Company’s daily operations and uses materiality analysis to adjust sustainable management practices and align with international sustainability standards. We hope that the annual Sustainability Report can become an important tool for managing ESG practices internally and a way to disclose mid- and long-term strategies, practices, and progress. We collaborate with employees, shareholders/investors, customers, vendors/contractors, the government and public associations, and society to strive for a sustainable future.

Reporting Period

The reporting period is between January 1, 2021, and December 31, 2021. The report is published in June 2022 in both English and Chinese and is available on TSMC’s ESG website. The report covers major topics of interest to stakeholders as well as TSMC practices in the economic, environmental, social, and governance dimensions. Visit the following links for more historical data and information:

- ESG Performance Summary/ Video
- ESG Website
- ESG Newsletter
- TSMC LinkedIn
- TSMC TCFD Report
- TSMC UN SDGs Actions Report

Reporting Scope

The reporting scope includes all TSMC fabs in Taiwan (HQ and all wafer fabs and backend fabs in Taiwan), TSMC (China), TSMC (Nanjing), WaferTech, VisEra, and other subsidiaries. Changes from last year include an expansion to Fab 18 Phase 4 in Taiwan which has begun volume production. If the scope of reporting is different from the above statement, a note will be added to explain any differences in this paragraph.

Primary Changes in the 2021 ESG Disclosures

<table>
<thead>
<tr>
<th>Name of Report</th>
<th>Materiality Analysis</th>
<th>Disclosure Boundaries</th>
<th>Updates</th>
</tr>
</thead>
<tbody>
<tr>
<td>In compliance with the Taiwan Stock Exchange Corporation Rules Governing the Preparation and Filing of Sustainability Reports by TWSE Listed Companies, the name of the report has been officially changed to Sustainability Report</td>
<td>Materiality analysis will be conducted once every three years and we have issued our first TSMC Materiality Analysis Report</td>
<td>Disclosure boundaries for sustainability topics have now been expanded to include new fabs</td>
<td>TSMC introduces its first UN SDGs Actions Report and updates the TCFD Report and the EP&amp;L Report</td>
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<tr>
<td>Publish a new case study on corporate sustainability to provide real-time updates on the Company’s progress toward sustainability; added a new section on ESG FAQs</td>
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<table>
<thead>
<tr>
<th>Theme Reports</th>
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<tbody>
<tr>
<td>TSMC UN SDGs Actions Report</td>
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</tbody>
</table>

Appendix

2021 Sustainability Report
ESG Feature Stories
Overview Sustainable Business Practices Operations and Governance
An Innovation Pioneer A Responsible Purchaser A Practitioner of Green Power An Admired Employer Power to Change Society
Appendix
### Data Collection Boundaries for Sustainable Development Issues

<table>
<thead>
<tr>
<th>Issue</th>
<th>Taiwan Facilities(^\text{Note 1})</th>
<th>WaferTech</th>
<th>TSMC (China)</th>
<th>TSMC (Nanjing)</th>
<th>VisEra</th>
<th>Other Subsidiaries(^\text{Note 2})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation Management</td>
<td>●</td>
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<td>Product Quality and Safety</td>
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<tr>
<td>Customer Relations</td>
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<td>Sustainable Supply Chain</td>
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<td>Climate and Energy</td>
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<td>Water Stewardship</td>
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<td>Circular Resources</td>
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<td>Air Pollution Control</td>
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<td>Diversity and Inclusion</td>
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<td>Talent Attraction and Retention</td>
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<td>Talent Development</td>
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<td>Human Rights</td>
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<tr>
<td>Occupational Safety and Health</td>
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<tr>
<td>Social Impact</td>
<td>●</td>
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</table>

- ● Collect complete data
- ◐ Collect partial data
- The issue lacks materiality to the institution and is not included in the boundary of data collection

\(^\text{Note 1}\): TSMC’s fabs in Taiwan include corporate headquarters, wafer fabs, testing and assembly facilities.

\(^\text{Note 2}\): TSMC subsidiaries or offices in North America, Europe, Japan, South Korea, and other countries.
Report Writing and Quality Management Process

**Engagement**
- **Inclusivity**
  - Communicate with stakeholders to identify reasonable expectations

- **Materiality**
  - Analyze and identify issues that concern and significantly impact TSMC and stakeholders

- **Comprehensiveness**
  - Define the boundaries of material issues and data collection

**Planning**
- **Launch Kick-off Meeting**
  - Deliver a comprehensive plan proposal
  - Define the main theme and content of the report
  - Establish Editing and revision guidelines
  - Verify matters requiring collaboration

- **Inter-departmental Meetings**
  - Share new trends and approaches
  - Share the annual plan for improvements
  - Report case studies
  - Plan the ESG Newsletter

**Editing**
- **Compile, edit, and revise** in compliance with the SMART principle and six quality indicators set forth by the GRI

- **Long-term Sustainability Goals**
  - Review the 2030 Sustainability Goals in accordance with the SMART principles
    - Specific
    - Measurable
    - Achievable
    - Realistic
    - Time-bound

**Review**
- **Confirm sustainable activities and performances** by the organization
- **Audit information accuracy**

- **Verify information and data**

- **Preliminary and on-site paperwork review** by third parties
- **Raise matters requiring attention** revealed from the reviews

**Communication**
- **Communication channels to external parties**
  - TSMC Website and ESG Website
  - TSMC ESG Newsletter
  - Reach out to stakeholders through newsletters
  - TSMC ESG Facebook page
  - TSMC LinkedIn
  - Supply Online 360
  - Customer newsletter
  - Reporting on government platforms

- **Internal communication channels**
  - Hand out EDM to all employees
  - myTSMC internal Website
  - ESG AWARD Website
  - ESG Steering Committee
  - ESG Committee
  - Inter-departmental ESG communication meetings
Report Writing Guidelines and Principles

**Standards**

- GRI Standards: Comprehensive Option
- AA1000 AccountAbility Principles Standard
- The International Integrated Reporting Framework
- SASB Index for the Semiconductor Industry
- TCFD Framework
- CDP Climate Change/ Water Security
- The United Nations Global Compact (UNGC)
- The United Nations Sustainable Development Goals (UN SDGs)
- WEF IBC Stakeholder Capitalism Metrics

**Certification Organization**

- DNV GL Business Assurance Co. Ltd.
- Deloitte & Touche

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**Feedback**

If you have any feedback, advice, or suggestion on this report or TSMC’s sustainable development, please feel free to contact us. For more information about TSMC’s latest sustainability practices, please subscribe to the TSMC ESG Newsletter.

Responsible Unit: ESG Committee
ESG Website: [https://esg.tsmc.com/en/](https://esg.tsmc.com/en/)
Email: ESG@tsmc.com
Phone: +886-3-5636688
Address: 8, Li-Hsin Rd. 6, Hsinchu Science Park, Hsinchu 300-78, Taiwan, R.O.C.
The TSMC Sustainability Report follows the editorial standards of the Global Reporting Initiative (GRI), AccountAbility (AA), United Nations (UN), Carbon Disclosure Project (CDP), International Integrated Reporting Council (IIRC), Sustainability Accounting Standards Board (SASB), Financial Stability Board (FSB), World Economic Forum International Business Council (WEF IBC) and refers to their principles of reporting disclosure (to establish a systematic management process for reports) and indicators (environmental, social and governance indicators) to report TSMC’s sustainability information and data. In addition, TSMC utilizes sustainability information disclosure as a proactive management tool to serve as a guide for organizations to improve.
Participation in Industry Associations and Non-Profit Organizations

Based on a foundation of healthy corporate governance, TSMC actively carries out its three missions of Acting with Integrity, Strengthening Environmental Protection, and Caring for the Disadvantaged, meeting our commitments to society and the environment to drive more beautiful changes in the world. TSMC participates in a variety of industry associations and public policy related 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. With the impact brought by climate change and extreme weather, TSMC is not only committed to reaching net zero emissions by 2050 but also actively participates in international and domestic organizations for climate actions. Together with our supply chain partners, TSMC is committed to environmental sustainability. In 2021, TSMC participated in more than 80 industry associations and non-profit organizations at home and abroad, with expenditures of over NT$44.37 million. Total expenditures in the past five years (2017–2021) were about NT$147.82 million.

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 semiconductor industry. Through participating in industry associations, the Company forges consensus, facilitates collaboration, defines standards, develops talents, and 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 to steer industry development include:

1. **Taiwan Semiconductor Industry Association (TSIA)**
2. **Semiconductor Industry Association (SIA)**
3. **Semiconductor Equipment and Materials International (SEMI)**
4. **Global Semiconductor Alliance (GSA)**
5. **The Allied Association for Science Park Industries**
6. **Chinese National Association of Industry and Commerce, Taiwan (CNAIC)**
7. **Monte Jade Science & Technology Association of Taiwan**
8. **Taiwan Electrical and Electronics Manufacturers’ Association (TEEMA)**
9. **Information Technology Industry Council (ITI)**
10. **National Committee on United States-China Relations**
11. **Cleveland currently serves as director of ITI.**
12. **Vice President J.K. Lin currently serves as director of TEEMA.**
13. **Senior Vice President Peter McVey currently serves as director of SEMI Taiwan’s Consumer Electronics Committee.**
14. **Senior Vice President Rick Cassidy currently serves on the board of GSA.**
15. **Senior Vice President Y.P. Chin currently serves as executive director of The Allied Association for Science Park Industries.**
16. **Chairman Dr. Mark Liu currently serves as director of CNAIC.**
17. **Senior Vice President J.K. Lin currently serves as director of ITI.**

TSMC supports efforts to promote the development of the semiconductor industry in Taiwan and promotes competition and cooperation among companies. TSMC participates in the SIA to join other industry members to collectively communicate with the U.S. government and highlight the importance of the semiconductor industry to U.S. economic development, national security, and global competitiveness.

TSMC Chairman Dr. Mark Liu has served as Chairman of TSIA since 2019, and in 2021 chairs the World Semiconductor Council. Senior Vice President Y.P. Chin currently serves as chairperson of TSIA’s Energy Committee, Vice President Dr. Y.L. Wang currently serves as chairperson of TSIA’s Industry and University Committee, Director Han-Wen Fung currently serves as chairperson of TSIA’s Environmental, Safety and Health Committee, and Director Dr. Cheng-Ming Lin currently serves as chairperson of TSIA’s JSTC Committee. Vice President Dr. Douglas Yu currently serves as co-chair of SEMI Taiwan’s Packaging & Testing Committee, Senior Director Hsiao-Chin Tuan currently serves as chairperson of SEMI Taiwan’s MEMS & Sensors Committee, Director Dr. John Lin currently serves as chairperson of SEMI Taiwan’s IC Committee, Director M.D. Chen currently serves as chairperson of SEMI Taiwan’s Materials Committee, and Director Dr. James Tu currently serves as chairperson of SEMI Taiwan’s Cyber Security Committee. Senior Vice President Rick Cassidy currently serves on the board of GSA. Senior Vice President Y.P. Chin currently serves as executive director of The Allied Association for Science Park Industries, and Vice President Connie Ma currently serves as executive controller of The Allied Association for Science Park Industries. Chairman Dr. Mark Liu currently serves as director of CNAIC. Senior Vice President J.K. Lin currently serves as director of ITI.

Note 1: Non-profit organizations in the areas of charity and education are not included here.

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 communicated with the U.S. and global governments on the importance of technology to the global economy.

Note 3: The five largest membership fees paid or donations made by TSMC in 2021, in descending order, are:
1. **Information Technology Industry Council (ITIC)/NT$1,174,800**
2. **Semiconductor Industry Association (SIA)/NT$4,472,800**
3. **Global Semiconductor Alliance (GSA)/NT$2,400,000**
4. **Taiwan Association for Net Zero Emissions/NT$1,785,059**
5. **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.

Note 4: TSMC’s expenditures of membership and donation for industry associations and non-profit organizations between 2017 and 2021 were NT$21,176,571, NT$21,735,168, NT$20,338,992, NT$40,197,059, and NT$44,367,765, respectively.

Note 5: In addition to the expenditures disclosed in Note 4, TSMC’s government relations expenses in 2021 amounted to NT$39,191,979, with the primary expense being employee payroll. TSMC did not make any political donations in the reporting period. In the past five years (from 2017 to 2021), TSMC did not make any political donations or other spending related to ballot measures or referendums.
Corporate Governance

TSMC advocates and acts upon the principles of operational transparency and respects shareholder rights. Based on strong governance foundation, TSMC believes in leadership integrity and adopts ethics, regulatory compliance, and risk management mechanisms into daily business operations. TSMC participates in industry associations in the area of corporate governance including:
- Asia Business Council
- Asian Corporate Governance Association (ACGA)
- Chinese Professional Management Association
- Association of Certified Fraud Examiners, Taiwan Chapter

Environmental Sustainability

Responding to climate change and mitigating climate impact to protect our shared global environment, TSMC integrates green management into daily operations and continues to enhance climate and energy, water stewardship, circular resources, and air pollution control through introducing innovative green technologies. The Company's goal is to become the global standard of eco-friendly corporations. To achieve the commitment of Net Zero Emissions by 2050, TSMC mobilizes supply chain partners to reduce carbon footprint, creating a green supply chain for the semiconductor industry. TSMC participates in industry associations and non-profit organizations in the area of environmental sustainability including:
- Taiwan Alliance for Net Zero Emissions/Taiwan Climate Partnership
- Taiwan Institute for Sustainable Energy/Taiwan Center for Corporate Sustainability
- Science and Technology in Society Forum
- RE100
- Business Council for Sustainable Development of Taiwan
- CommonWealth Sustainability Council

TSMC is among the first members of Taiwan Alliance for Net Zero Emissions, Taiwan Climate Partnership, and CommonWealth Sustainability Council. Senior Vice President J.K. Lin currently serves as vice chairman of Taiwan Alliance for Net Zero Emissions. Senior Vice President Lora Ho currently serves as director at the Taiwan Center for Corporate Sustainability.

Human Rights and Supply Chain Management

Respecting human rights and creating a respectful workplace are critical to TSMC and our suppliers. TSMC is a full member of the Responsible Business Alliance, and in addition to meeting the alliance’s requirements in auditing suppliers, we have also asked our suppliers to strictly comply with local regulations to safeguard human rights. TSMC requires all suppliers to commit to the Assurance to Comply with TSMC’s Code of Ethics and Business Conduct and in July 2021, TSMC issued a statement titled Supply Chain Partners Should Ensure Protection of Human Rights During the COVID-19 Pandemic to ensure a dignified work environment. TSMC participates in industry associations in the area of human rights and supply chain management including:
- Responsible Business Alliance (RBA)
- Responsible Minerals Initiative
## ESG Performance Summary

### Key Indicators

<table>
<thead>
<tr>
<th>Operational &amp; Economics</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue (NT$ billion)</td>
<td>1,070</td>
<td>1,339</td>
<td>1,587</td>
</tr>
<tr>
<td>Net income attributable to shareholders of the parent company (NT$ billion)</td>
<td>345</td>
<td>518</td>
<td>597</td>
</tr>
<tr>
<td>Income tax expense (NT$ billion)</td>
<td>45</td>
<td>67</td>
<td>66</td>
</tr>
<tr>
<td>Cash dividend (NT$ billion)</td>
<td>259</td>
<td>259</td>
<td>266</td>
</tr>
<tr>
<td>R&amp;D expenditures (NT$ billion)</td>
<td>91</td>
<td>109</td>
<td>125</td>
</tr>
<tr>
<td>Capital expenditures (NT$ billion)</td>
<td>460</td>
<td>507</td>
<td>839</td>
</tr>
<tr>
<td>R&amp;D expenses to revenue (%)</td>
<td>8.5</td>
<td>8.2</td>
<td>7.9</td>
</tr>
<tr>
<td>Global patents granted</td>
<td>39,118</td>
<td>45,162</td>
<td>50,506</td>
</tr>
<tr>
<td>Registered trade secrets</td>
<td>88,000</td>
<td>100,000</td>
<td>120,000</td>
</tr>
<tr>
<td>Value generated from improvement projects (NT$/ billion)</td>
<td>15</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>Encourage all major local raw materials suppliers to participate in the Taiwan Continuous Improvement Competition (%)</td>
<td>100</td>
<td>79</td>
<td>64</td>
</tr>
<tr>
<td>Encourage back-end packaging materials suppliers to participate in the Taiwan Continuous Improvement Competition (%)</td>
<td>-</td>
<td>46</td>
<td>67</td>
</tr>
<tr>
<td>Local and back-end packaging materials suppliers that advanced to the finals of the Taiwan Continuous Improvement Award (%)</td>
<td>-</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td>New innovative testing methods for product quality and reliability</td>
<td>-</td>
<td>-</td>
<td>254</td>
</tr>
<tr>
<td>Complete quality and reliability certification during the design stage for advanced processes, specialty processes, and wafer-level packaging processes in compliance with the TSMC technological roadmap</td>
<td>Completed</td>
<td>Completed</td>
<td>Completed</td>
</tr>
<tr>
<td>Develop analytical abilities for carcinogenic, mutagenic, and reprotoxic substances and assist the suppliers that supply materials with potential risks in developing such abilities (%)</td>
<td>83</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>NMP replacement rate (%) (Base year: 2016)</td>
<td>38</td>
<td>59</td>
<td>75</td>
</tr>
<tr>
<td>Ensure that manufacturing processes are free from PFASs with more than 4 carbon atoms</td>
<td>Replaced 86% of PFOA-related matters</td>
<td>Ensured that all 3nm process and beyond are free from PFASs with more than 4 carbon atoms</td>
<td>Selected PFHxA substitutes and launched production line testing</td>
</tr>
<tr>
<td>Diversify facilities and assess new suppliers in compliance with the multi-source program (Base year: 2018)</td>
<td>56</td>
<td>70</td>
<td>109</td>
</tr>
</tbody>
</table>

### An Innovation Pioneer

- **Encourage all major local raw materials suppliers to participate in the Taiwan Continuous Improvement Competition (%)**
  - 100 in 2019
  - 79 in 2020
  - 64 in 2021

- **Encourage back-end packaging materials suppliers to participate in the Taiwan Continuous Improvement Competition (%)**
  - - in 2019
  - 46 in 2020
  - 67 in 2021

- **Local and back-end packaging materials suppliers that advanced to the finals of the Taiwan Continuous Improvement Award (%)**
  - - in 2019
  - - in 2020
  - 16 in 2021

- **New innovative testing methods for product quality and reliability**
  - - in 2019
  - - in 2020
  - 254 in 2021

- **Complete quality and reliability certification during the design stage for advanced processes, specialty processes, and wafer-level packaging processes in compliance with the TSMC technological roadmap**
  - Completed in 2019
  - Completed in 2020
  - Completed in 2021

- **Develop analytical abilities for carcinogenic, mutagenic, and reprotoxic substances and assist the suppliers that supply materials with potential risks in developing such abilities (%)**
  - 83 in 2019
  - 100 in 2020
  - 100 in 2021

- **NMP replacement rate (%) (Base year: 2016)**
  - 38 in 2019
  - 59 in 2020
  - 75 in 2021

- **Ensure that manufacturing processes are free from PFASs with more than 4 carbon atoms**
  - Replaced 86% of PFOA-related matters in 2019
  - Ensured that all 3nm process and beyond are free from PFASs with more than 4 carbon atoms in 2020
  - Selected PFHxA substitutes and launched production line testing in 2021

- **Diversify facilities and assess new suppliers in compliance with the multi-source program (Base year: 2018)**
  - 56 in 2019
  - 70 in 2020
  - 109 in 2021
### Key Indicators

<table>
<thead>
<tr>
<th>Key Indicators</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tier 1 suppliers' completion rate of the Sustainability Management Self-Assessment Questionnaire (%)</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Critical suppliers' completion rate for receiving third-party audits (by RBA-certified auditing institutions) every three years (%)</td>
<td>102</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Total number of critical high-risk suppliers that have received audits for the S.H.A.R.P. Program</td>
<td>-</td>
<td>-</td>
<td>86</td>
</tr>
<tr>
<td>Requires suppliers to conduct due diligence for responsible mining; % of legally compliant mines</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Audit at least three suppliers for due diligence in responsible mining each year</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Total number of suppliers audited for due diligence in responsible mining</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Raw materials suppliers invited to observe the annual emergency response drill (Base year: 2016)</td>
<td>90</td>
<td>111</td>
<td>132</td>
</tr>
<tr>
<td>Total number of suppliers that participated in the ESH training program (Base year: 2016)</td>
<td>411</td>
<td>558</td>
<td>759</td>
</tr>
<tr>
<td>Critical high-risk suppliers that received safety and health support (%)</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Increase local sourcing of indirect raw materials (%)</td>
<td>59</td>
<td>60</td>
<td>60.4</td>
</tr>
<tr>
<td>Increase local sourcing of parts and components (%)</td>
<td>50</td>
<td>45</td>
<td>46.4</td>
</tr>
<tr>
<td>Total energy conserved by helping suppliers (GWh) (Base year: 2018)</td>
<td>0.97</td>
<td>2.1</td>
<td>3.4</td>
</tr>
<tr>
<td>Total water conserved by helping suppliers (metric tons) (Base year: 2020)</td>
<td>-</td>
<td>2,130,000</td>
<td>19,710,000</td>
</tr>
<tr>
<td>High-energy-consumption suppliers that have received ISO14064 certification for GHG emissions (%)</td>
<td>-</td>
<td>-</td>
<td>51</td>
</tr>
<tr>
<td>Waste reduction in major waste-generating suppliers (%) (Base year: 2014)</td>
<td>28.5</td>
<td>29.4</td>
<td>31</td>
</tr>
</tbody>
</table>

(continued on the next page)
<table>
<thead>
<tr>
<th>Key Indicators</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenhouse gas emission (metric ton-CO$_2$ equivalent) (Scope 1 and Scope 2 market-based)</td>
<td>8,769,614</td>
<td>9,464,696</td>
<td>10,304,344</td>
</tr>
<tr>
<td>Scope 1 (metric ton-CO$_2$ equivalent) Note 1</td>
<td>2,071,743</td>
<td>2,004,841</td>
<td>2,151,937</td>
</tr>
<tr>
<td>Taiwan sites</td>
<td>1,678,754</td>
<td>1,710,677</td>
<td>1,808,427</td>
</tr>
<tr>
<td>Subsidiaries Note 2</td>
<td>392,989</td>
<td>294,164</td>
<td>343,510</td>
</tr>
<tr>
<td>Scope 2 (metric ton-CO$_2$ equivalent) (market-based)</td>
<td>6,697,872</td>
<td>7,459,856</td>
<td>8,152,497</td>
</tr>
<tr>
<td>Taiwan sites</td>
<td>6,673,235</td>
<td>7,429,951</td>
<td>8,116,440</td>
</tr>
<tr>
<td>Subsidiaries Note 2</td>
<td>24,637</td>
<td>29,905</td>
<td>36,057</td>
</tr>
<tr>
<td>Scope 2 (metric ton-CO$_2$ equivalent) (location-based)</td>
<td>7,350,195</td>
<td>8,282,509</td>
<td>9,196,964</td>
</tr>
<tr>
<td>Scope 3 (metric ton-CO$_2$ equivalent) Note 3</td>
<td>5,307,028</td>
<td>5,511,486</td>
<td>6,049,256</td>
</tr>
<tr>
<td>Carbon offset (metric ton-CO$_2$ equivalent)</td>
<td>15,376</td>
<td>4,125</td>
<td>241,577</td>
</tr>
<tr>
<td>Fluorinated greenhouse gas emission (metric ton-CO$_2$ equivalent)</td>
<td>1,081,212</td>
<td>1,311,530</td>
<td>1,369,478</td>
</tr>
<tr>
<td>Reduction rate of GHG emissions per unit product compared to the base year (metric ton-CO$_2$ equivalent - 12-inch equivalent wafer mask layer) (%)</td>
<td>17</td>
<td>23</td>
<td>27</td>
</tr>
<tr>
<td>Energy consumption (GWh) (including electricity, natural gas and diesel)</td>
<td>14,323</td>
<td>16,919</td>
<td>19,192</td>
</tr>
<tr>
<td>Direct energy consumption (GWh) (including natural gas and diesel)</td>
<td>747</td>
<td>861</td>
<td>1,112</td>
</tr>
<tr>
<td>Indirect energy consumption (GWh) (non-renewable energy)</td>
<td>12,658</td>
<td>14,828</td>
<td>16,409</td>
</tr>
<tr>
<td>Indirect energy consumption (GWh) (renewable energy)</td>
<td>918</td>
<td>1,230</td>
<td>1,671</td>
</tr>
<tr>
<td>Renewable energy used at all TSMC fab operation sites (%)</td>
<td>6.7</td>
<td>7.6</td>
<td>9.2</td>
</tr>
<tr>
<td>Renewable energy used at overseas subsidiaries (%)</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

(continued on the next page)
## Key Indicators

<table>
<thead>
<tr>
<th>Metric</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total energy conserved from new energy saving measures since 2016 (GWh/y)</td>
<td>12</td>
<td>17</td>
<td>24</td>
</tr>
<tr>
<td>Energy efficiency after volume production - 16nm technology</td>
<td>1.4 (5th year)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Energy efficiency after volume production - 10nm &amp; 7nm technology</td>
<td>0.7 (3rd year)</td>
<td>1.4 (4th year)</td>
<td>1.5 (5th year)</td>
</tr>
<tr>
<td>Energy efficiency after volume production - 5nm technology</td>
<td>-</td>
<td>-</td>
<td>0.2 (2nd year)</td>
</tr>
<tr>
<td>Days of production interrupted due to climate disasters</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NOx emissions (metric tons)</td>
<td>116.67</td>
<td>170.36</td>
<td>205.57</td>
</tr>
<tr>
<td>SOx emissions (metric tons)</td>
<td>32.18</td>
<td>38.13</td>
<td>39.48</td>
</tr>
<tr>
<td>VOC emissions (metric tons)</td>
<td>102.1</td>
<td>106.8</td>
<td>107.7</td>
</tr>
<tr>
<td>Reduction in air pollutant emissions per unit of production (%)</td>
<td>30</td>
<td>45</td>
<td>54</td>
</tr>
<tr>
<td>Reduction rate of volatile organic gases (%)</td>
<td>97.8</td>
<td>98.3</td>
<td>98.4</td>
</tr>
<tr>
<td>Number of unusual events reported in air pollution prevention equipment</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ISO 14001 certified sites number</td>
<td>22</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>ISO 14001 certified sites percentage (%)</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Water consumption (million metric tons)</td>
<td>64.3</td>
<td>77.3</td>
<td>82.8</td>
</tr>
<tr>
<td>Taiwan sites</td>
<td>58</td>
<td>70.6</td>
<td>76.1</td>
</tr>
<tr>
<td>Subsidiaries [Note 2]</td>
<td>6.3</td>
<td>6.7</td>
<td>6.7</td>
</tr>
<tr>
<td>Process water recycling rate (%) [Note 3]</td>
<td>86.7</td>
<td>86.4</td>
<td>85.4</td>
</tr>
<tr>
<td>Total water saving (million metric tons) [Note 3]</td>
<td>133.6</td>
<td>173</td>
<td>186.3</td>
</tr>
</tbody>
</table>

(continued on the next page)
### Key Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ultra-pure water usage (million metric Tons)</td>
<td>90.1</td>
<td>102.4</td>
<td>109.5</td>
</tr>
<tr>
<td>Tetramethylammonium hydroxide (TMAH)</td>
<td>7.9</td>
<td>6.3</td>
<td>5.5</td>
</tr>
<tr>
<td>Copper ion (Cu²⁺)</td>
<td>0.09</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td>Reduction % in unit water consumption (liter/12-inch equivalent wafer mask layer) (Base year: 2010)</td>
<td>5.2</td>
<td>8.9</td>
<td>14.9</td>
</tr>
<tr>
<td>% of water pollution composite indicator above effluent standards</td>
<td>43.8</td>
<td>42.4</td>
<td>42.5</td>
</tr>
<tr>
<td>Waste generated (metric tons)</td>
<td>416,715</td>
<td>575,740</td>
<td>674,703</td>
</tr>
<tr>
<td>General waste generated (metric tons)</td>
<td>219,584</td>
<td>277,340</td>
<td>335,080</td>
</tr>
<tr>
<td>Taiwan sites</td>
<td>212,465</td>
<td>269,640</td>
<td>326,069</td>
</tr>
<tr>
<td>Subsidiaries</td>
<td>7,119</td>
<td>7,700</td>
<td>9,011</td>
</tr>
<tr>
<td>Hazardous waste generated</td>
<td>197,131</td>
<td>298,400</td>
<td>339,623</td>
</tr>
<tr>
<td>Taiwan sites</td>
<td>183,015</td>
<td>280,635</td>
<td>319,763</td>
</tr>
<tr>
<td>Subsidiaries</td>
<td>14,116</td>
<td>17,765</td>
<td>19,860</td>
</tr>
<tr>
<td>Waste recycling rate (%)</td>
<td>96</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>Taiwan sites</td>
<td>96</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>Subsidiaries</td>
<td>74</td>
<td>77</td>
<td>85</td>
</tr>
<tr>
<td>Outsourced unit waste disposal per wafer (kg/12-inch equivalent wafer mask layer)</td>
<td>0.89</td>
<td>1.01</td>
<td>0.99</td>
</tr>
<tr>
<td>Develop multiple types of electronic-grade chemicals for resource recycling within TSMC - % of resource recycling within facilities</td>
<td>22</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Waste treatment vendors that have obtained ISO14001 or other international EHS Management certifications (%)</td>
<td>70</td>
<td>80</td>
<td>82</td>
</tr>
</tbody>
</table>

(continued on the next page)
## Key Indicators

<table>
<thead>
<tr>
<th></th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of employee</td>
<td>51,297</td>
<td>56,831</td>
<td>65,152</td>
</tr>
<tr>
<td>Employee training hours</td>
<td>74,178</td>
<td>926,379</td>
<td>3,185,784</td>
</tr>
<tr>
<td>Females in all employees (%)</td>
<td>37.8</td>
<td>37.1</td>
<td>35.4</td>
</tr>
<tr>
<td>Females in management (%)</td>
<td>12.7</td>
<td>12.5</td>
<td>13</td>
</tr>
<tr>
<td>Females in junior management (%)</td>
<td>13.6</td>
<td>13</td>
<td>13.4</td>
</tr>
<tr>
<td>Females in top management (%)</td>
<td>11.1</td>
<td>10</td>
<td>8.3</td>
</tr>
<tr>
<td>Females in newly hired technical professionals (%)</td>
<td>-</td>
<td>-</td>
<td>21.3</td>
</tr>
<tr>
<td>Turnover rate (%)</td>
<td>4.9</td>
<td>5.3</td>
<td>6.8</td>
</tr>
<tr>
<td>New hire (&lt; 1 year) turnover rate (%)</td>
<td>13.4</td>
<td>15.7</td>
<td>17.6</td>
</tr>
<tr>
<td>Voluntary turnover rate (%)</td>
<td>4.8</td>
<td>5.1</td>
<td>6.7</td>
</tr>
<tr>
<td>Total compensation amongst industry peers</td>
<td>Top 25%</td>
<td>Top 25%</td>
<td>Top 25%</td>
</tr>
<tr>
<td>Management positions filled through internal promotions (%)</td>
<td>-</td>
<td>79.3</td>
<td>82.5</td>
</tr>
<tr>
<td>Positions are filled through internal transfers (%)</td>
<td>50.8</td>
<td>45.2</td>
<td>57.6</td>
</tr>
<tr>
<td>Employees are fully committed to their work (%)</td>
<td>-</td>
<td>96</td>
<td>-</td>
</tr>
<tr>
<td>Employees are willing to continue working for TSMC in the next five years (%)</td>
<td>-</td>
<td>95</td>
<td>-</td>
</tr>
<tr>
<td>Goals for the issue of sustainably engaged from the Engagement Survey in comparison to the WTW Global High Performance Norm</td>
<td>-</td>
<td>-</td>
<td>Top 25%</td>
</tr>
<tr>
<td>Injury frequency rate</td>
<td>0.52</td>
<td>0.42</td>
<td>0.38</td>
</tr>
<tr>
<td>Injury severity rate</td>
<td>9</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Occupational fatalities - employees</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

(continued on the next page)
### Key Indicators

<table>
<thead>
<tr>
<th>An Admired Employer</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupational fatalities - contractors</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>RBA Self-Assessment Questionnaire (SAQ) scores in all facilities</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>Incident rate per 1,000 employees</td>
<td>0.425</td>
<td>0.311</td>
<td>0.252</td>
</tr>
<tr>
<td>Cases of occupational disorders caused by exposure to chemicals</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Contractors that have obtained ISO 45001 certification for occupational safety and health management system with help from TSMC (%)</td>
<td>50</td>
<td>60</td>
<td>65</td>
</tr>
<tr>
<td>Total participants in youth competitions</td>
<td>-</td>
<td>1,551</td>
<td>1,614</td>
</tr>
<tr>
<td>Promotional events on semiconductor sciences</td>
<td>-</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Sponsor outstanding local artists or groups</td>
<td>7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hours in reading services</td>
<td>8,400</td>
<td>5,060</td>
<td>4,910</td>
</tr>
<tr>
<td>Annual cash donations to the disadvantaged (NT$ million)</td>
<td>13.21</td>
<td>12.1</td>
<td>22.63</td>
</tr>
<tr>
<td>Children in remote areas that have benefited from TSMC programs</td>
<td>1,400</td>
<td>3,279</td>
<td>5,287</td>
</tr>
<tr>
<td>Service visits to seniors living alone by Network of Compassion</td>
<td>9,527</td>
<td>10,855</td>
<td>15,719</td>
</tr>
<tr>
<td>Meals delivered by Network of Compassion</td>
<td>-</td>
<td>-</td>
<td>304,477</td>
</tr>
<tr>
<td>Promote filial piety education</td>
<td>37</td>
<td>57</td>
<td>64</td>
</tr>
<tr>
<td>Annual beneficiaries of the Cherish Food Program</td>
<td>21,791</td>
<td>37,071</td>
<td>58,862</td>
</tr>
<tr>
<td>Volunteer service from environmental protection volunteers</td>
<td>770</td>
<td>1,044</td>
<td>794</td>
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</tbody>
</table>

#### Note:
- Figures from all Taiwan fabs and subsidiaries of TSMC
- **Note 1**: To ensure consistent data in GHG inventory and reduction goals after 2020, inventory data for Scope 1 will comply with the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gases Inventories starting from 2020 and the base year also change from 2010 to 2020.
- **Note 2**: The scope of subsidiaries in Environmental parts includes WaferTech, TSMC China Company Limited, TSMC Nanjing Company Limited and VisEra.
- **Note 3**: Figures from all Taiwan fabs of TSMC
- **Note 4**: Safety – Injury Frequency Rate = Injury Number x 1,000,000/Total hours worked
- **Note 5**: Safety – Injury Severity Rate = Lost Work Days x 1,000,000/Total hours worked

According to the Occupational Safety and Health Act, Disabling Injury Frequency Rate (FR)/Disabling Severity Rate (SR) are defined as any diseases, injuries, disabilities, or deaths of workers caused by buildings, machinery, equipment, raw materials, materials, chemicals, gases, vapors, dusts, etc., at the place of duty, or as a result of work activities, or due to other occupational causes. Other unrelated injuries in the workplace such as falling in the cafeteria or parking lot due to various reasons are not considered as work injuries. Target has been amended according to new definition. See Statistical Analysis of Disabling Injuries for detailed information.
Independent Third Party Assurance Statement

Scope and approach

We performed our work using DMV’s assurance methodology Veritasyne3, which is based on our professional expertise in assurance services best practice, including International Standard on Auditing (ISA) performance standards and GRI Sustainability Reporting Standards.

We evaluated the performance data using the methodology provided together with TSNC’s data protocols for how the data were measured, assessed, and reported. The performance data was against TSNC’s significant Environmental, Social and Governance (ESG) issues and the 2021 sustainability commitment and the best practices set forth in the GRI Standards.

We understand that the reported financial and non-financial data are based on data from TSNC’s Annual Report and Accounts, which are subject to independent verification processes. The relevant financial data taken from the Annual Report and Accounts is not within the scope of our work.

We planned and performed our work to establish the information we considered necessary to provide a basis for our assurance opinion. We are providing a "moderate/limited level of assurance" as stated.

Responsibilities of the Directors of TSNC and of the assurance provider

The Directors of TSNC have responsibilities for the preparation of the Report. In performing our assurance work, our responsibility is to the management of TSNC in our report on the basis of the design and implementation of all TSNC’s sustainability activities. DMV was not involved in the preparation of any statements included in the Report or for this Assurance Statement.

DMV provides other services to TSNC on which a conflict of interest with this assurance work does not exist.

DMV’s assurance engagement was based on the assumption that the data and information provided by the client is true and complete. The results of our work will be in accordance with the GRI Standards.

Based on our work, we report as follows:

- Review of the current sustainability practices that are measured in the Report.
- Review of TSNC’s assurance form for engagement and non-financial.

We verify the following elements:

- Independent Verification of the TSNC’s assurance form and results.
- Review of the TSNC’s assurance and sustainability practices performed at headquarters and site level.

We conclude that the following elements:

- The sustainability practices are measured in the TSNC’s assurance form and results.

We recommend that the TSNC’s assurance form and results are verified and detailed in the TSNC’s assurance report.

Mandatory

The mandatory determination process was modified based on a review by key stakeholders including employees, customers, investors, contractors, NGOs, governments, shareholders, investors, regulatory bodies, local communities and other concerns of TSNC and has not missed out on any critical and reported issues.

Third Party Verification Services

The third party verification services provided the necessary level of assurance to ensure that the TSNC’s sustainability practices are verified and detailed in the TSNC’s assurance report.
### Contact Information

#### Taiwan Facilities

| Fab 14A | 1-1, Nan-Ke North Rd., Southern Taiwan Science Park, Taiwan 741-014, Taiwan, R.O.C. Tel: +886-6-5056688 Fax: +886-6-5051262 |
| Fab 14B | 17, Nan-Ke 9th Rd., Southern Taiwan Science Park, Taiwan 741-014, Taiwan, R.O.C. Tel: +886-6-5056688 Fax: +886-6-5055217 |
| Fab 15A | 1, Keya Rd. 6, Central Taiwan Science Park, Taichung 428-303, Taiwan, R. O. C. Tel: +886-4-27026688 Fax: +886-4-25607548 |
| Fab 15B | 1, Xinke Rd., Central Taiwan Science Park, Taichung 407-728, Taiwan, R. O. C. Tel: +886-4-27026688 Fax: +886-4-24630372 |
| Fab 18A | 8, Beiyuan Rd. 2, Southern Taiwan Science Park, Taiwan 745-093, Taiwan, R.O.C. Tel: +886-6-5056688 Fax: +886-6-5050363 |
| Fab 18B | 8, Beiyuan Rd. 2, Southern Taiwan Science Park, Taiwan 745-093, Taiwan, R.O.C. Tel: +886-6-5056688 |

#### Advanced Backend Fab 1

<table>
<thead>
<tr>
<th>Fabrication Facility</th>
<th>Address</th>
<th>Tel:</th>
<th>Fax:</th>
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<tbody>
<tr>
<td>Advanced Backend Fab 1</td>
<td>6, Creation Rd. 2, Hsinchu Science Park, Hsinchu 300-093, Taiwan, R.O.C.</td>
<td>+886-3-5636688</td>
<td>+886-3-5773628</td>
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#### Advanced Backend Fab 2

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<td>Advanced Backend Fab 2</td>
<td>1-1, Nan-Ke North Rd., Southern Taiwan Science Park, Taiwan 741-014, Taiwan, R.O.C.</td>
<td>+886-6-5056688</td>
<td>+886-6-5051262</td>
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#### Advanced Backend Fab 3

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<tr>
<td>Advanced Backend Fab 3</td>
<td>101, Longyan 6th Rd., Longtan Dist., Taoyuan City 325-002, Taiwan, R.O.C.</td>
<td>+886-3-5636688</td>
<td>+886-3-4804250</td>
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#### Subsidiaries

<table>
<thead>
<tr>
<th>Subsidiary Name</th>
<th>Address</th>
<th>Tel:</th>
<th>Fax:</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSMC North America</td>
<td>2851 Junction Avenue, San Jose, CA 95134, U.S.A</td>
<td>+1-408-3828000</td>
<td>+1-408-3828000</td>
</tr>
<tr>
<td>TSMC Europe B.V.</td>
<td>World Trade Center, Zuiderplein 60, 1077 XV Amsterdam, The Netherlands</td>
<td>+31-20-3059900</td>
<td></td>
</tr>
<tr>
<td>TSMC Japan Limited</td>
<td>2F, Queen’s Tower C, 2-3-5, Minatomirai, Nishi-ku, Yokohama, Kanagawa, 220-6221, Japan</td>
<td>+81-45-6820670</td>
<td></td>
</tr>
<tr>
<td>TSMC China Company Limited</td>
<td>440, Wen Xiang Road, Songjiang, Shanghai, China Postcode: 201616</td>
<td>+86-21-57768000</td>
<td>+86-21-57762525</td>
</tr>
<tr>
<td>TSMC Nanjing Company Limited</td>
<td>16, Zhongguancun, Pudong Economy Development Zone, Nanjing, Jiangsu Province, China Postcode: 211806</td>
<td>+86-25-57688000</td>
<td>+86-25-57712395</td>
</tr>
<tr>
<td>TSMC Korea Limited</td>
<td>381, 2104-2105 west, 10th floor, Hanwha Inter Valley 24 Building, 322, Teheran-ro, Gangnam-gu, Seoul 06211, Korea</td>
<td>+82-2-2051688</td>
<td></td>
</tr>
<tr>
<td>TSMC Design Technology Japan, Inc.</td>
<td>10F, Minatomirai Grand Central Tower, 4-6-2, Minatomirai, Nishi-ku, Yokohama, Kanagawa 220-0012, Japan</td>
<td>+81-45-6644500</td>
<td></td>
</tr>
<tr>
<td>TSMC Japan 3DIC R&amp;D Center, Inc.</td>
<td>2F, 70 Rd, West 16, 16-1 Orito-cho, Tsukuba, Ibaraki, 305-8569, Japan</td>
<td>+81-45-6820670</td>
<td></td>
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<tr>
<td>TSMC Design Technology Canada Inc.</td>
<td>100 Innovation Drive, Suite 401, Kanata, ON K2K 3X7, Canada</td>
<td>+613-576-1990</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>VisEra Technologies Company Limited</td>
<td>6F, 126, W. Dunlap Avenue, #85021, Phoenix, AZ 85021, U.S.A. Tel: +1-602-567-1688</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TSMC Technology, Inc</td>
<td>132, Dunlap Rd., 1 Hsinchu Science Park, Hsinchu 300-096, Taiwan, R.O.C. Tel: +886-3-666-8788</td>
<td>+886-3-666-2858</td>
<td></td>
</tr>
<tr>
<td>TSMC Arizona Corporation</td>
<td>2510 W. Dunlap Avenue, #600, Phoenix, AZ 85021, U.S.A. Tel: +1-602-567-1688</td>
<td></td>
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