

# SINGAPORE SEMICONDUCTOR VOICE

 **SSIA**  
Singapore Semiconductor Industry Association

Volume 32 • T05SS0291A

## SEMICONDUCTOR WOMEN'S FORUM 2024 RECAP

Relive the inspiring moments from SSIA's prestigious flagship event, celebrating women's contributions and advancing unity and equality in the semiconductor industry.

## SEMICONDUCTOR BUSINESS CONNECT 2024: 23 JULY 2024

Showcasing cutting-edge innovations, address supply chain disruptions, and promote sustainability in manufacturing, all aimed at enhancing global competitiveness and resilience. Sponsorships open!

## CELEBRATING SMES AND EMPOWERING THEIR JOURNEYS

Celebrating and empowering SMEs like ELH, Factorem, Innowave, Kromax, Meridionale Impianti, Secure-IC, and Sesto Robotics - innovators driving progress and excellence in the semiconductor industry.



Joining the Singapore Semiconductor Industry Association (SSIA) opens a world of business opportunities

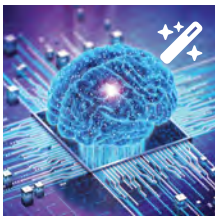
# SSIA IS YOUR GATEWAY

Blending unparalleled network access and strategic growth opportunities into a single membership



### Network Expansion:

Dive into a vast industry network through exclusive business networking and supplier development sessions, designed to forge valuable connections and partnerships.



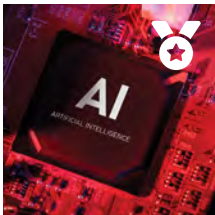
### Branding and Marketing Leverage:

Broaden your outreach and enhance your visibility through diverse marketing opportunities - such as in our top industry VOICE publication - and a complimentary listing on the SSIA website.



### Insight and Influence:

Gain access to the latest developments and government policies affecting the sector, while also having a platform to voice your feedback directly to key industry and government leaders.



### Exclusive Training Opportunities:

Enjoy priority enrolment in specialized semiconductor-focused training and courses, keeping your team at the forefront of industry advancements.



### Advocacy and Growth:

Benefit from SSIA's proactive advocacy efforts, ensuring your business's interests are represented, while also contributing to the vibrancy and growth of Singapore's semiconductor ecosystem.

## Why be an SSIA member?

For both SMEs and MNCs in the semiconductor sector, SSIA membership offers a dynamic platform for growth, influence, and strategic connections, accelerating your business's success in Singapore and beyond by fostering key industry partnerships, providing insights into policy and development, and enhancing visibility within the global semiconductor ecosystem.



## SSIA WELCOMES NEW MEMBERS



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# FOREWORD

## BY THE EXECUTIVE DIRECTOR





**W**elcome to this issue of VOICE magazine, where we delve into the heart of what makes the Singapore Semiconductor Industry Association (SSIA) thrive—our commitment to unity and collaboration. As we navigate the complexities of the semiconductor industry, it is this ethos of cooperation and partnership that drives our success and innovation.

In each edition, we aim to embody the spirit of our association, preparing the groundwork for transformative initiatives and setting the stage for events that celebrate and enhance our industry. This year has been marked by significant milestones that exemplify our community's strength and unity.

The Women's Forum 2024, held in March, was a remarkable success, celebrated for its vibrant discussions and the high engagement of both speakers and attendees. It highlighted the crucial role of diversity within our sector and the powerful impact of our collaborative spirit. This positive momentum continues as we gear up for the upcoming Leadership in Engineering course, happening from July 30 to August 1. Sponsored by E2i, this three-day program is meticulously crafted to equip high-potential managers and individual contributors with the necessary mindset, emotional competencies, tools, and strategies to lead now and in the future.

Building on these enriching experiences, we invite you to save the date for our annual Semiconductor Summit and Dinner on September 18, 2024. This year's Summit will focus on advancing technology responsibly within the semiconductor industry. We will explore pivotal strategies to balance robust industry growth with the imperative of environmental sustainability. This gathering is an exceptional opportunity to engage with industry leaders and to contribute to shaping a greener future.

Stay tuned for more details on this flagship event and prepare to be part of shaping the trajectory of our vibrant industry.

Our mission has always been rooted in empowering both small and medium-sized enterprises (SMEs) and multina-

tional corporations (MNCs) alike through mutual collaboration and continuous ecosystem development. This endeavour is not just about business growth; it's about forging a path of sustainable development and technological advancement that benefits all stakeholders. In our upcoming features and stories, you'll find a recurring theme that resonates with this mission—unity in action.

As you peruse the insightful articles and expert opinions within these pages, consider how each piece contributes to a larger narrative of cooperation and collective progress. The discussions and profiles presented here are not just informative; they are a prelude to the greater dialogue we aim to facilitate within our community and beyond.

Looking ahead, SSIA continues to champion the integration of resources, knowledge, and networks. We are setting the groundwork for not just an event but a movement towards a cohesive and resilient industry. The future is bright, and as part of this vibrant community, you are at the forefront of an exciting journey of innovation and growth.

We invite you to stay engaged, be proactive, and contribute to this ongoing conversation. Your involvement is key to our collective success and in shaping the semiconductor landscape in Singapore and globally. As we look forward to future initiatives like Business Connect 2024 and the SSIA Summit and Semiconductor Dinner 2024, we are excited about the unfolding opportunities for collaboration and partnership within our vibrant community.

Thank you for your continued support and participation. Let's continue to unite under the banner of SSIA, driving forward to new heights of achievement and innovation. Together, we can transform challenges into opportunities and aspirations into realities.

Sincerely,

**Ang Wee Seng**

Executive Director

Singapore Semiconductor Industry Association

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# SEMICONDUCTOR BUSINESS CONNECT 2024



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# SEMICONDUCTOR BUSINESS CONNECT 2024

23 July 2024 | 9am - 6pm

The Semiconductor and Systems Industry Association (SSIA) is committed to revolutionizing the semiconductor ecosystem by fostering collaboration between multinational corporations (MNCs) and small to medium-sized enterprises (SMEs). Our goal is to elevate SMEs by sharing knowledge and networks, showcasing their innovations, and highlighting their critical role in enhancing the sector’s global competitiveness and resilience. Together, we aim to create a unified and thriving semiconductor future.

**Event Focus**

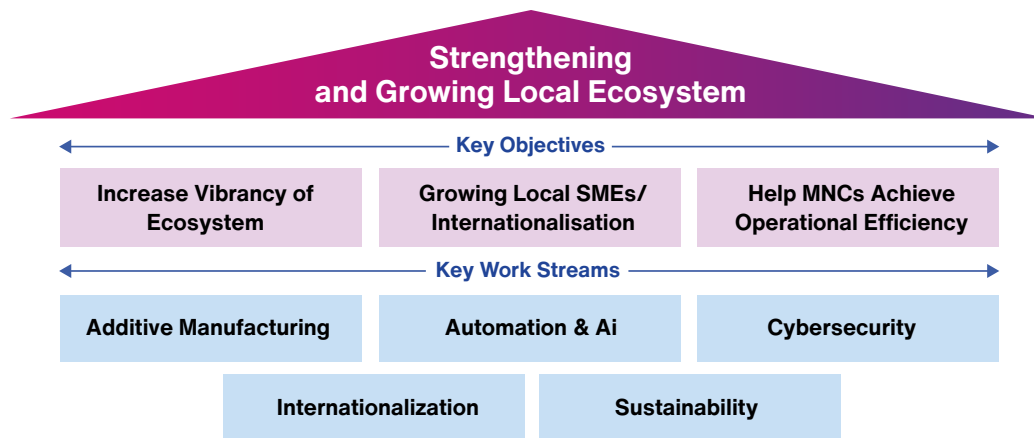
The upcoming Semiconductor Business Connect event is designed to propel this mission forward. The forum focuses on connecting the semiconductor network, innovating

**Why Attend?**

For SMEs, this event is a prime opportunity to showcase your innovations, spark partnerships, and propel your business to new heights. For MNCs, it’s a chance to join an elite assembly, bolster your industry standing through high-level networking, and actively shape the semiconductor landscape.

**Networking and Business Matching**

The event will provide extensive business matching opportunities, connecting manufacturers with solution providers. This initiative aims to foster the adoption of innovative technologies and strategies, optimizing operations and driving industry growth.



cutting-edge solutions, and fostering successful collaborations. Key topics to be discussed include supply chain disruptions and sustainability in manufacturing, critical for today’s industry landscape.

Our event will emphasize several core workstreams: additive manufacturing, automation & AI, cybersecurity, internationalization, and sustainability. These areas are crucial for staying ahead in the rapidly evolving tech world and will form the foundation of discussions and presentations.

Semiconductor Business Connect is more than just a conference; it’s a strategic platform for all industry stakeholders to learn, share, and collaborate. Whether you’re looking to enhance your strategic approach or integrate the latest technologies, this event is a key step toward maintaining competitiveness in a dynamic global market.

Scan the QR code to find out more about this event





# SEMICONDUCTOR WOMEN'S FORUM 2024



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MARCH



# #InspireInclusion



**T**he Semiconductor Women's Forum 2024, hosted at the prestigious Mandarin Oriental Hotel, represented a landmark achievement in championing inclusivity and empowerment within the semiconductor industry. Celebrating the pivotal contributions of women in this sector, the event was distinguished by its meticulously curated and relevant agenda, as attested by the enthusiastic feedback from attendees.

Each session, graced by keynote speeches from eminent industry leaders, addressed pivotal issues of gender equality and empowerment with depth and precision, deeply resonating with attendees. This harmonious alignment not only underscored the significant strides made towards a diverse and innovative future but also solidified the forum's esteemed reputation and profound impact, as widely acclaimed by participants.



# Guest of Honour

We were privileged to welcome **Minister of State Gan Siow Huang** as our Guest of Honour at the Semiconductor Women's Forum 2024. In her keynote address, Minister Gan illuminated key government strategies aimed at fostering inclusivity and agility within the workforce. She stressed the significance of flexible work arrangements (FWAs), supported by government initiatives that facilitate their adoption through grants and comprehensive guidelines. Minister Gan also underscored the importance of agility in the workforce, highlighting career health initiatives, job redesign, and reskilling programs as critical for enabling the semiconductor industry to navigate evolving business demands and seize new opportunities.



## Panel Discussion on Agile Career Movement

Moderated by a team of industry experts including representatives from SMU, WSG, STM, AMD, and AMAT, this panel shed light on personal journeys of individuals transitioning into the semiconductor field from various sectors, offering insights into the agility required for such moves.



### Bridging Sectors, Embracing Diversity

In an enlightening session by **Ms. Yeo Wan Ling** from NTUC, attendees explored the strategic approach to dynamic career transitions across different sectors. Her extensive cross-industry experience provided valuable insights into navigating these shifts, emphasizing personal and professional growth.



### Navigating Career Transitions for Mid-Career Professionals

ST Microelectronics' **Kuo Yang** addressed the challenges faced by mid-career professionals entering the semiconductor industry. His talk highlighted the importance of upskilling and networking, supported by success stories of women who have made impactful transitions.



### Empowering Women in Semiconductor

Global Foundries' **Clare Yong** delivered a compelling analysis on gender diversity, discussing successful strategies like flexible working hours and mentorship programs that have boosted female participation and leadership in the industry.



### Shaping the Future with Female Researchers

A\*STAR IME's **Karen Chong** discussed the significant contributions and growing influence of female researchers in semiconductor innovation. Her session covered the trajectory of women in R&D and their pivotal roles in academia-industry collaborations.



### Future Trends and Opportunities for Women

Micron's **Adeline Tay** explored future trends such as AI, IoT, and sustainable manufacturing, discussing the new opportunities these areas present for women in the semiconductor industry.





### Empowering the Next Generation

A session by SAY Ambassador **Yuan Kun** highlighted the experiences and insights of emerging talent in the semiconductor field, underscoring the role of initiatives like the Semiconductor Active Youth Ambassador Programme in nurturing future leaders.



### Diversity and Inclusivity: Beyond Gender

AMD's **Jocelyn Teo** emphasized the broader benefits of a diverse workforce, exploring strategies for fostering an inclusive culture that enhances creativity and drives technological advancement.



Networking was a highlight of the forum, with attendees praising the vibrant exchange of ideas and the potential for impactful collaborations. The sessions facilitated more than just professional connections; they fostered personal relationships and camaraderie among participants from various backgrounds.

This strong engagement highlighted the forum's significance as a key platform for both professional and personal growth in the semiconductor industry. It demonstrated the enjoyment and unity that can be achieved at an industry event with the right mix of motivated and dedicated individuals.

SSIA LEADERSHIP IN ENGINEERING 2024:

# EMPOWER YOUR ENGINEERING TEAM FOR TOMORROW'S CHALLENGES



**Duration:** 3 Days  
(30<sup>th</sup> July to 1<sup>st</sup> August, 2024)

**Target Audience:**  
High potential individual contributors, team leaders, supervisors, and managers

This premier programme is tailored to foster leadership skills within Singapore's semiconductor industry. This three-day intensive program is crafted to transform your high-potential engineers into visionary leaders who are equipped to navigate and shape the future of technology.

Elevate your team's potential by investing in their transformation from skilled engineers to inspirational leaders. This program not only boosts leadership capabilities but also instills a proactive and innovative mind-set critical for sustaining growth and competitive advantage in the rapidly evolving semiconductor industry.

### **Benefits of Enrolling Your Team:**

- Cultivate a leadership mind-set that drives innovation and operational excellence.
- Equip your team with emotional intelligence to enhance interpersonal relationships and team cohesion.
- Transition your high performers into roles where they can have a broader impact on project and organizational goals.
- Strengthen decision-making skills across all levels of your team, fostering a culture of confidence and strategic insight.
- Create a network of peers and leaders, building a supportive community for post-program collaboration and growth.

The semiconductor industry's rapid pace of change requires a leadership approach that transcends traditional management. This program offers your team the necessary 'heartware' to complement the 'hardware' and 'software' of their technical skills, enabling them to lead with courage and creativity. By developing leaders at every level, you enhance your organization's capacity for innovation and resilience in facing future challenges.

Position your team for success in an industry defined by constant innovation and change. By empowering your engineers with leadership skills, you are investing in your future leaders who will drive your organization forward.

To secure your team's place in the **SSIA Leadership in Engineering 2024** program now and watch them transform into leaders who inspire, innovate, and excel, reach out to [secretariat@ssia.org.sg](mailto:secretariat@ssia.org.sg).





MEET MORITZ SUM:

# SHAPING THE FUTURE OF HUMAN CAPITAL IN THE SEMICONDUCTOR INDUSTRY

As the Director of Human Capital Development at the Semiconductor Industry Association of Singapore (SSIA), Moritz Sum has been pivotal in driving workforce initiatives that cater to the evolving needs of the semiconductor sector. With a career that spans over two decades, starting from a technical role to leading global teams, Moritz brings a rich blend of experience and insight into his role at SSIA. We had the opportunity to sit down with him to discuss his journey, motivations, and the impact of his work.

**Can you share a brief overview of your background and career journey before joining SSIA?**

I started my career in 2001 as an equipment technologist, conducting both preventive and corrective maintenance on key semiconductor equipment. As I gained proficiency, I progressed to roles such as equipment and process manager, where I led teams across Singapore and the United States. Before joining SSIA, I expanded into roles involving procurement and supplier quality, leading a global team to negotiate with strategic suppliers on capital investments and improvements in quality management systems.



Moritz and his wife Wenling, and 14-month old son June Yung.



Moritz and his wife are active volunteers with the Singapore Red Cross.

**What pivotal moments or influences shaped your early professional life?**

Early in my career, I focused heavily on improving my hardware knowledge. As I transitioned into management, I realized that the technical skills, while important, were less relevant than being able to motivate, influence, and provide clear guidance to my team. Learning to manage large teams effectively became crucial in achieving our goals.

**What motivated you to join SSIA, and how did you first hear about our organization?**

I was aware of SSIA's impactful outreach through its various programs advancing the semiconductor industry. Beyond my personal volunteering, I sought a way to contribute more significantly to the industry that shaped my career. SSIA presented the perfect opportunity.



Moritz Sum

**Since joining SSIA, what have been some of the most impactful experiences or projects you've been involved with?**

One of the key roles I've embraced at SSIA is overseeing Human Capital Workforce Development. In 2023 alone, we collaborated with the Ministry of Education and various Institutes of Higher Learning to run over 50 school outreach events. These initiatives are not just about promoting STEM education but also about guiding students throughout their educational journey into the workforce.

**What aspects of your role at SSIA do you find most engaging and why?**

Working with the WSG's Career Conversion Program has been incredibly fulfilling. This program allows us to assist mid-career professionals in transitioning to the semiconductor industry through skill conversion, which is immensely rewarding. Being part of someone's journey to a more promising career path is what I find most engaging.

**Can you describe a project or challenge at SSIA that you found particularly rewarding or that has been a significant learning experience for you?**

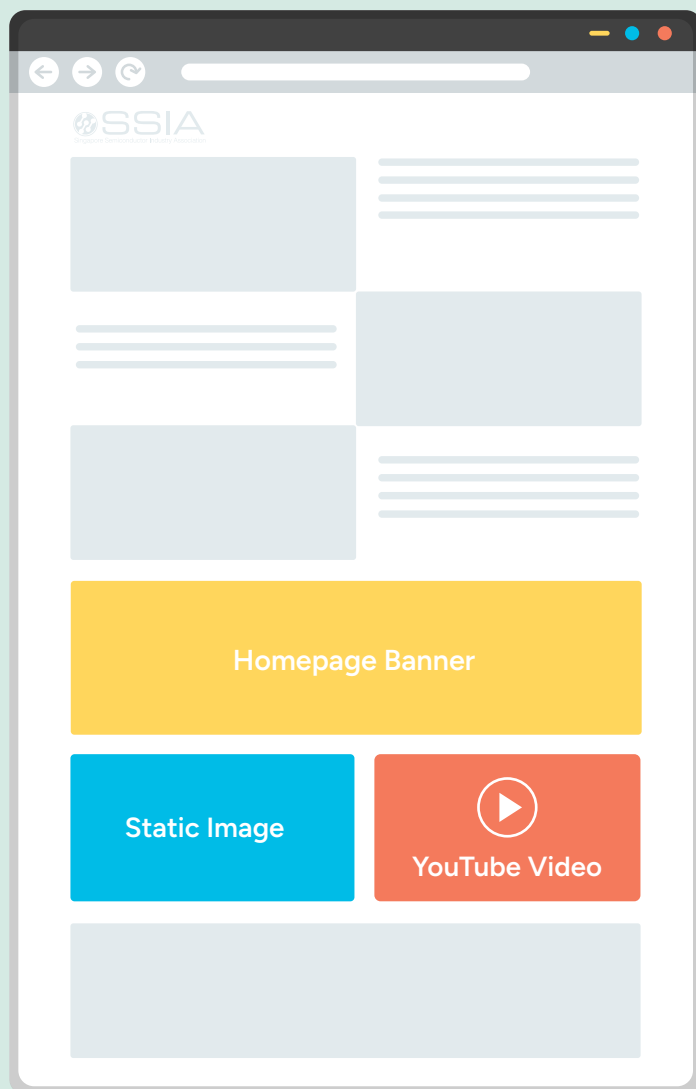
Stepping outside my comfort zone into event planning and hosting was initially challenging. However, it has been a significant learning curve. The support from my colleagues at SSIA has been instrumental in helping me adapt and improve in these new areas.

# DIGITAL RATE CARD

Note: Digital Advertisements will be displayed for 2 months

PROMOTE YOUR BUSINESS  
AND REACH A WIDER AUDIENCE  
WITH A PROFESSIONAL 50-100  
WORD POST AND IMAGE.

Members: S\$1200 per post  
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(high-resolution image to be provided)

Members: S\$3000  
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## STATIC IMAGE

(high-resolution image to be provided)

Members: S\$2000  
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## EMBEDDED YOUTUBE VIDEO

(No longer than 3m)

Members: S\$3000  
Non-members: S\$5000

# VOICE RATE CARD

INTERNATIONAL READERSHIP OF  
OVER 8000 SEMICONDUCTOR  
INDUSTRY LEADERS, PARTNERS,  
AND ECOSYSTEM MEMBERS



## DOUBLE-PAGE SPREAD

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Non-members: S\$6000



## SINGLE-PAGE SPREAD

Members: S\$2000

Non-members: S\$3000

## 360 COMMUNICATIONS PACKAGE WITH SSIA: S\$8500

- 1 Full Speciality Page - choose between front inside cover or back inside cover (subject to availability) [worth S\$3000]
- Double-page Spread [worth S\$6000]
- Company Banner on SSIA Homepage for 2 months [worth S\$5000]

For bespoke advertisement or advertorial space, contact us at:

[secretariat@ssia.org.sg](mailto:secretariat@ssia.org.sg)



# INNOVATIVE MOBILE MANIPULATOR SOLUTION

SESTO ROBOTICS  
TRAILBLAZING  
ROBOTIC APPLICATION

In the fast-paced world of semiconductor manufacturing, where precision and efficiency are paramount, the integration of cutting-edge automation technologies has become increasingly vital. At the forefront of this technological revolution stands SESTO Robotics, a pioneering force in delivering innovative autonomous mobile robot (AMR) solutions tailored to the semiconductor industry's unique challenges and demands.

With a deep understanding of the sector's intricacies, SESTO Robotics provides AMR solutions that streamline WIP handling processes, optimize resource utilization and enhance operational efficiency.

In a leading American global semiconductor company with a significant presence in Singapore, SESTO Robotics' AMRs have revolutionized their manufacturing processes, offering unparalleled efficiency, precision and safety.

The handling and delivery of FOUPs to tools involved operators walking significant distances across the production floor and required a team of workers working around the clock to fulfil the manual loading and delivery tasks. The customer also faced the constraint of limited floor height which made traditional Overhead Hoist Transport (OHT) systems not feasible.

The adoption of SESTO Robotics mobile manipulators in this pioneering semiconductor fab revolutionized the entire lot transfer and delivery process and eliminated the need for operators, thereby reducing labor costs while still achieving the required throughput in deliveries.

The integration of a 7-axis robot arm to the SESTO AMR resulted in a mobile manipulator that is able to operate within the limited real estate on the probe floor. The 7-axis arm is highly dexterous and able to interact with the smart 3-tired racks that are arranged less than 1m apart. SESTO was able to overcome this spatial challenge by programming the 7-axis arms to pick and place the FOUPs from a sideways position which allows the fab to maximize storage capacity while maintaining operational efficiency.

The automated lot delivery team has also become a reference model for other departments in the fab and the team shares their insights about AMR deployment with other colleagues.

### **One Base, Limitless Solutions**

The team continues to work with SESTO on various Continuous Improvement Projects to further enhance operational efficiency and productivity and one of the key successes includes the introduction of task pairing which involves the development of algorithms in SESTO fleet management system that enables the AMR to deliver lots that are located on similar routes. This optimization allows the mobile manipulator to decrease the time needed to achieve the same number of delivery tasks which leads to more FOUPs being handled in the same time window.

Furthermore, SESTO advanced Smartflow traffic control system optimizes the flow of AMRs in a constrained environment by directing AMRs away from paths occupied by other AMRs to prevent path blocks. The Smartflow system also intelligently plans the shortest traveling routes to optimize the output of robots.

The partnership between SESTO and the American Semiconductor fab has yielded multiple benefits, including consistency in FOUP handling and deliveries, minimized errors caused by humans and operational safety in the probe floor.

Man-hour savings through SESTO AMR automation have empowered operators to focus on value-added tasks, enhancing job satisfaction and skill development.

But that's not all. Driven by a commitment to innovation, SESTO Robotics continually pushes the boundaries of the possibilities in semiconductor automation.

Through ongoing research and development, we are ready to release a new mobile manipulator with a smaller footprint in response to market demands.

It will also be able to transport more lots per delivery which leads to even higher output and efficiency.

As the industry continues to evolve, SESTO Robotics remains dedicated to empower our customers with AMR solutions that enable them to thrive in a rapidly changing landscape with less reliance on manual workforce. SESTO also offers intelligent AMR solutions that automate the picking and transportation of roll cages to ease the burden of moving heavy payloads from store to the production line.

Our Magnus Lifter series autonomously identifies roll cages parked at certain locations and delivers the roll cages containing tools or parts to the designation drop off locations on an ad-hoc or scheduled basis.

By embracing automation and innovation such as the AMR solutions from SESTO Robotics, semiconductor plants will unlock new levels of efficiency, agility and scalability, positioning themselves for long-term success in an increasingly competitive market.



NAVIGATING THE  
QUANTUM REVOLUTION:

# CHALLENGES & SOLUTIONS IN POST-QUANTUM CRYPTOGRAPHY

In the annals of cryptographic history, the late 1970s marked a pivotal era with the emergence of two seminal algorithms: McEliece and RSA. At that juncture, quantum threats remained theoretical specters, and the selection criteria for cryptographic algorithms prioritized factors such as public key length and execution time. RSA swiftly ascended to prominence as the standardized choice, relegating McEliece, despite its quantum-resistant properties, to relative obscurity.

The landscape underwent a shift in 1994 when Peter Shor's algorithm exposed the vulnerabilities of both RSA and ECC to quantum attacks, catalyzing a quest for cryptographic solutions impervious to quantum threats. Since the early 2000s, the cryptographic community has fervently pursued candidate algorithms poised to supplant conventional standards. Recognizing the urgency, the National Institute of Standards and Technology (NIST) initiated a call for proposals in 2016, heralding a new chapter in the quest for Post-Quantum cryptography (PQC) standards.

## Why is PQC Important?

The impetus for PQC is multifaceted, anchored in the imminent reality of quantum computing. Unlike classical computers, quantum counterparts exhibit exponential growth in computational power, accelerating the the poten-



tial breach of traditional cryptographic algorithms. PQC assumes paramount importance in safeguarding long-term confidentiality, preempting the specter of adversaries armed with powerful quantum computers poised to unravel encrypted communications. Standardization efforts, epitomized by initiatives like CNSA 2.0, underscore the strategic imperative of strengthening as soon as possible and even today cryptographic infrastructure against quantum adversaries of tomorrow.

### The Challenges of the PQC Transition

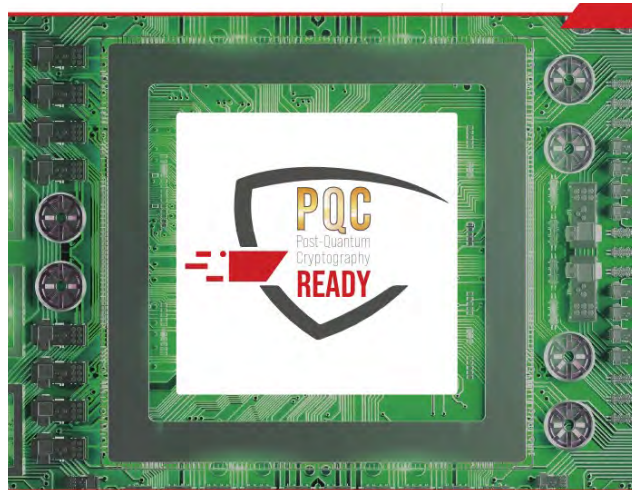
Transitioning to PQC presents a labyrinth of challenges, spanning performance, security, and regulatory domains. In embedded systems, reconciling cryptographic robustness with performance efficiency remains a Herculean task, exacerbated by resource constraints and the overhead of physical attack countermeasures. PQC schemes, while resilient against cryptanalytic attacks, introduce novel security challenges, notably susceptibility to side-channel attacks and fault injections. The adoption of new primitives, exemplified by lattice-based algorithms, entails grappling with unfamiliarity, performance bottlenecks, patent concerns, and interoperability issues.

Certification poses another formidable hurdle, particularly in safety-critical industries like aeronautics and automotive. Navigating the labyrinthine certification landscape demands meticulous planning, resources, and expertise to ensure compliance with stringent specifications across diverse regulatory regimes.

### Secure-IC: Pioneering PQC Solutions

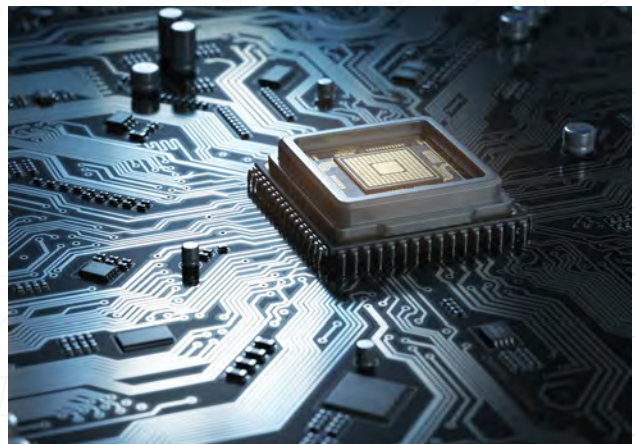
Amidst these challenges, Secure-IC emerges as a pivotal partner for Singapore's semiconductor industry, offering tailored solutions to navigate the quantum revolution securely. Leveraging its unique expertise in hardware security and cryptographic technologies, Secure-IC is committed to empowering semiconductor manufacturers with PQC-ready solutions from chip to cloud. Secure-IC's Securyzr™ integrated Secure Element, reinforced with PQC capabilities, exemplifies the company's dedication to fortifying cryptographic infrastructures and enabling seamless transitions to quantum-resistant architectures.

As Singapore's semiconductor industry embarks on this transformative journey, cooperation and innovation will be paramount. Secure-IC stands ready to partner with industry



stakeholders, offering cutting-edge solutions, expertise, and support to navigate the complexities of Post-Quantum Cryptography and safeguard Singapore's position as a global leader in semiconductor innovation.

In conclusion, the transition to Post-Quantum cryptography heralds a new frontier in cybersecurity resilience, fraught with challenges yet brimming with opportunities for innovation and collaboration. As stakeholders in the Singapore Semiconductor Industry Association, let us embark on this journey together, fortified by a shared commitment to safeguarding the integrity and confidentiality of digital communications in an era of quantum uncertainty.



**SECURE-IC**  
THE SECURITY SCIENCE COMPANY



# SUSTAINABILITY & EFFICIENCY THROUGH TECHNOLOGY

For over 20 years, **Kromax South Asia** has been at the forefront of technology acquisition, engaging with best-in-class partners internationally. Through our strategic collaborations, we deliver pivotal competitive edges to clients, boosting operational efficiency and achieving sustainability goals.

## Energy Management Systems



## IoT & Digitalisation



## Predictive Maintenance



## Green Technologies



奇裕

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A DISCUSSION ON

# DIGITALISATION & SUSTAINABILITY

TRENDS IN SOUTH EAST ASIA 2024

**Reports indicate a shortfall in the adopting of automation and digitalization systems. What would you say are some barriers for the SEA region?**

Understandably, they might be unsure of which technologies to adopt in a rapidly changing landscape. The fear of high upfront costs also makes it even tougher, especially when returns aren't guaranteed. They also worry about disruptions to their current workflows. To overcome these barriers, SEA companies need clear tech advice, cost efficient options, and solid plans for managing change.

**What is KSA's position on the topic of Sustainability and ESG excellence?**



KSA's ESNB APAC Green Badge

Sustainability is one of the core values of KSA. Pollution and global warming is a critical issue and businesses need to consider beyond short term returns, and into the long term on issues such as carbon emissions, reporting and taxes, and ensuring a better future for coming generations.

Hence, for over 20 years, KSA has specialized in assisting our clients align their business goals with sustainability and ESG objectives through innovative technology that benefits both businesses and the planet.

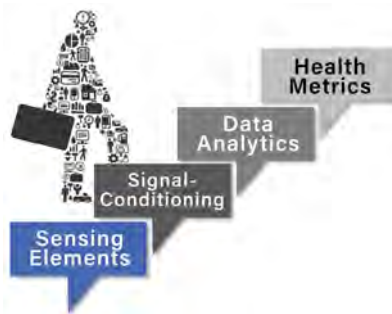
**What key deliverables have KSA achieved and success rates?**

Key deliverables varies between systems, but for KSA, operational efficiency is the common theme. We have attained for our clients:

- 50% energy savings,
- 3x maintenance extension,
- Reduced downtime,
- 50% waste reduction.

The return on investment (ROI) of the solution is important, as it determines its viability from a corporate standpoint. We firmly believe KPIs and sustainability goals can be achieved together.

**What is an example of technology that provides high ROI?**



Turnkey Predictive Maintenance

Predictive maintenance yields a high ROI as we help clients evolve from the conventional run-to-fail or time-based to condition-based maintenance. This change significantly reduces unscheduled downtimes and in turn, optimize machine uptime.

Further savings is also achieved when repair and maintenance services are structured by tiers backed by actual machine health data instead of scheduled full rebuild packages.

**Q&A** with



**Chen Lin, Lee**  
Vice President

Kromax South Asia Pte Ltd  
Kromax Malaysia Sdn Bhd  
PT U-SUN International

With advanced edge computing right at the data source, we have many proven cases of accurate and timely abnormality detection in mechanical systems, furnaces, and heaters.

**How does KSA leverage technology to achieve higher Sustainability excellence?**

The products we carry are all proven to conserve resources such as energy, fuel, water and chemicals. One way is through ,agnetic technology that treats fuel and water, creating more efficient fuel combustion and water boiler processes.



Smartflower at Austrian University

Our green technology lineup also includes next-gen solar energy systems with intelligent features such as sun tracking and self cleaning for maximum power output. The Smartflower has been an international symbol of technology, sustainability and corporate responsibility.

At KSA, we are committed to equipping our clients with globally sourced state-of-the-art solutions. Through adopting the latest technologies, we support businesses with transitioning from Industry 4.0 through to 6.0, enhancing their competitive edge on the international stage.



INNOWAVE TECH:

# TRANSFORM SEMICONDUCTOR MANUFACTURING WITH AI AUTOMATION

## manufActuring sImplified

Innowave Tech is proud to share our groundbreaking Industrial AI Automation solution specifically designed to automate and simplify complex human-centric processes, optimizing workflows and increasing productivity. This solution represents a key step forward in our commitment to helping semiconductor manufacturers be truly best-in-class.

### Proven Impact on People, Process, and Productivity

Our Industrial AI Automation solutions are domain-specific products that use computer vision AI to automate the complex manual assisting processes. One key application is on a CDSEM (Critical Dimension Scanning Electron Microscope).

The AI simplifies and streamlines the operation of the CDSEM by automatically adjusting the focus, magnification, alignment, and contrast of the images captured by the CDSEM. It also provides real-time adjustment on the tool to perfect measurement accuracy and repeatability. This solution is user-friendly and efficient, enhancing productivity and quality.

By fully automating complex yet repetitive tasks (zero operators on shift), engineers were able to move away from time-consuming, routine tasks to more critical roles. The utilization of AI contributed to improved operational efficiency but also the opportunity to upskill and re-allocate resources.

As our AI software is linked to our single point of access dashboard, engineers can remotely control and monitor the status of the AI, viewing logs and error handling data. This information is then consolidated and used to identify problematic recipes and equipment issues that are typically hidden in the massive amounts of tool data, resulting in an overall reduction of machine downtime.

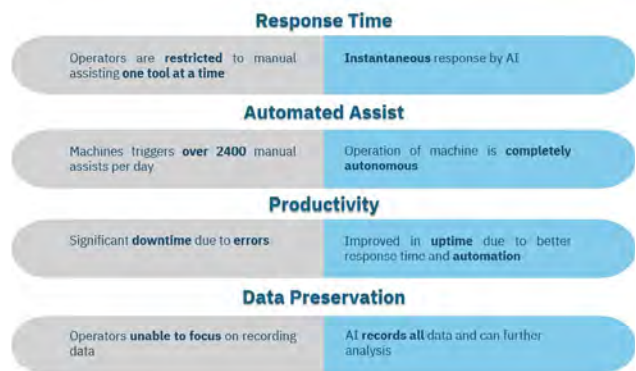


Figure 1: Outcomes of CDSEM AI Automation

### AI Orchestrator

Within our AI Automation solution, our AI Orchestrator serves as the bedrock, able to make snap judgements beyond the limits of humans. The AI Orchestrator can collate big data during its 24/7 operations to further learn and enhance its decision-making capabilities. This not only streamlines processes but also optimizes workflow, reducing errors and increasing throughput.

By ingesting vast datasets encompassing production metrics, equipment performance, and environmental variables, our AI engine generates actionable intelligence in real-time, empowering the industry to anticipate operational challenges, preemptively mitigate risks, and optimize resource allocation with precision.

### Tackling the Complexities of Integrating AI

Whilst AI advancements are occurring at an accelerated pace, the semiconductor industry faces a multitude of

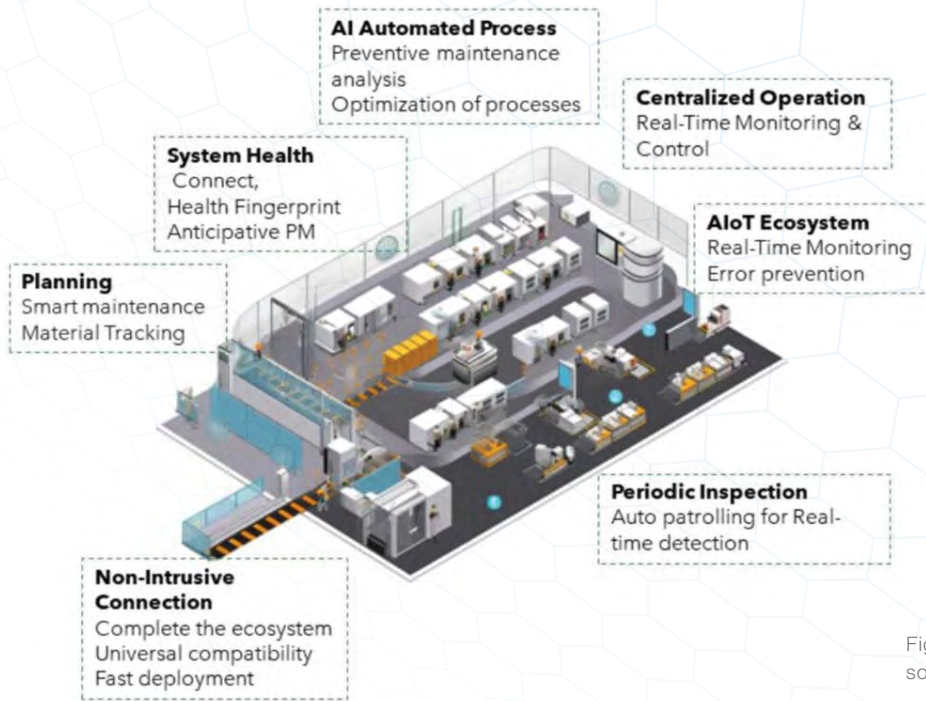


Figure 2: Overview of Innovave Tech's solutions at various levels in a Fab

restrictions in adopting AI. Manufacturers often have an amalgamation of various systems; each requiring expert knowledge to operate and manage.

However, much of this knowledge can be lost or requires time to train other individuals to become well-versed in, much less translating it into AI-readable workflows.

### Scaling AI Automation Accessibility

Recognizing the gaps in AI accessibility within the semiconductor manufacturing space, Innovave serves as the bridge for pioneering manufacturers eager to embrace innovative technology to lead the industry towards their objectives.

In our determination to craft a suitable and specialized solution, our Industrial AI – developed using the combined insights and experiences of both our partners and our people – ensures continuity and the continual improvement of equipment intelligence operations.

### Your Partner in AI Automation Solutions

As part of our resolve to aid manufacturers in integrating AI, Innovave Tech offers an array of cutting-edge automation technologies designed to streamline and enhance various manufacturing processes. From computer vision and smart

sensors to connectivity and Internet of Things (IoT) devices, our solutions augment human capabilities to unlock greater operational efficiency and scalability.

### The Future of AI Automation

The development and integration of AI brings countless opportunities for smart factories, where machines communicate and make decisions autonomously to optimize production.

We remain dedicated to nurturing a culture of innovation and excellence. We truly envision a future of zero defects made possible by AI.



Written by



**Charlyn Ip,**  
Business Development Executive



**Lauren Khoo,**  
Data Science Engineer

We would like to extend our heartfelt gratitude to the Singapore Semiconductor Industry Association for this opportunity to showcase our achievements in this issue of Singapore Semiconductor VOICE magazine. We hope that our story inspires and motivates our industry peers in this next evolution of semiconductor manufacturing.

MERIDIONALE IMPIANTI:

# EMPOWERING SUSTAINABILITY AND INNOVATION IN SEMICONDUCTOR MANUFACTURING



these industry pressures. Their core competencies include the design and manufacturing of high purity specialty gases, which are critical in semiconductor manufacturing for processes like etching and deposition. By providing these essential materials alongside advanced technological solutions, Meridionale Impianti supports manufacturers in enhancing operational efficiency, maintaining production quality, and reducing environmental impact.

In the dynamic field of semiconductor manufacturing, Meridionale Impianti has established itself as a leader not only through automation but also through its expertise in high purity specialty gases, crucial for various semiconductor processes. Their core competency lies in the design and manufacture of these gases, which are essential for etching and deposition—processes that define the functionality and efficiency of semiconductor devices. By ensuring the purity and availability of these gases, Meridionale Impianti provides a foundational component that semiconductor manufacturers rely on to produce high-quality, reliable products. This expertise in gas production helps clients maintain stringent controls over their manufacturing environments, reducing contaminants and enhancing overall yield.

Meridionale Impianti's automation solutions, particularly in robotics, exemplify their commitment to advancing semiconductor manufacturing. The company's robotics are designed to handle sensitive processes such as wafer transport and placement with precision and efficiency. This reduces human error and increases throughput, crucial for meeting the high demand and quality standards of the semiconductor industry. Automation extends beyond simple task execution to include the integration of advanced sensing and control technologies, ensuring that



**T**he semiconductor industry, a cornerstone of modern technology, faces the dual challenges of rapid technological evolution and increasing environmental regulations. Meridionale Impianti, established in 1975, has evolved from a provider of industrial electrical and mechanical services to a leader in semiconductor manufacturing technology, adept at addressing



each step of the semiconductor fabrication process is optimized for speed and accuracy.

Sustainability is a growing priority, especially in energy-intensive industries like semiconductor manufacturing. Meridionale Impianti addresses this through initiatives such as the green hydrogen GenSys project, utilizing PEM fuel cells to promote cleaner energy solutions. This effort not only reduces the carbon footprint of manufacturing processes but also aligns with broader global sustainability goals. By implementing renewable energy solutions, Meridionale Impianti helps the industry transition towards greener manufacturing practices, meeting stringent environmental standards and reducing overall ecological impact.

Meridionale Impianti further enhances workplace safety and operational efficiency by automating critical and hazardous tasks within semiconductor fabs. Their robotic systems manage sensitive processes such as wafer transport and handling, reducing the risk of contamination and accidents associated with manual operations. This automation not only streamlines production but also significantly enhances safety, addressing growing industry concerns over labor conditions and operational safety standards.

Looking forward, Meridionale Impianti is integrating AI into their systems to better anticipate industry needs and refine their technological offerings. AI enables predictive maintenance, enhanced process optimization, and smarter resource management, ensuring that semiconductor

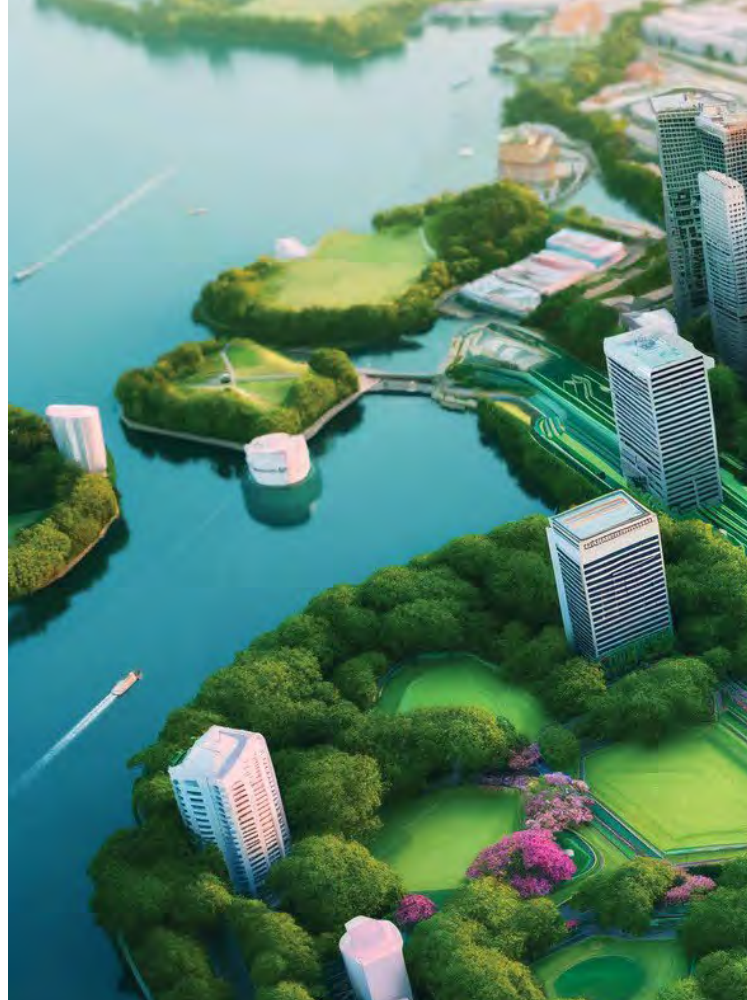
manufacturers can maintain a competitive edge in a rapidly evolving market. This proactive approach underlines Meridionale Impianti's commitment to continuous innovation and excellence, essential for driving future growth and sustainability in the semiconductor industry.

In conclusion, Meridionale Impianti is a critical partner for the semiconductor industry, providing not only essential materials like high purity specialty gases but also advanced manufacturing solutions. Their dedication to innovation, efficiency, and sustainability is setting new industry standards, paving the way for the future of semiconductor manufacturing.



INNOVATING FOR  
A GREENER FUTURE:

# THE PIONEERING EFFORTS OF SHENGJIAN ENVIRONMENT



**S**hengjian Environment, established in 2005, stands at the forefront of China's green technology service industry. Known for its high-tech facility system solutions and semiconductor process support equipment, Shengjian has solidified its role as a leader in environmental innovation. The company made a significant leap forward with its IPO on the Shanghai Stock Exchange in April 2021, underlining its growth and commitment to ecological betterment.

Shengjian's expertise also extends to wet chemicals, which play a critical role in semiconductor manufacturing and various high-tech processes. Wet chemicals, including etchants, cleaners, and solvents, are essential for processes such as wafer cleaning, etching, and photoresist stripping. Shengjian provides a comprehensive range of these high-purity chemicals, ensuring they meet stringent industry standards and environmental regulations. This not only enhances the efficiency and quality of semiconductor production but also aligns with Shengjian's commitment to sustainability by minimizing the environmental impact of chemical use.



Facing challenges like high operational costs and technological barriers, Shengjian has strategically invested in overcoming these obstacles. In 2023, it allocated USD 14 million towards research and development to enhance technology and reduce costs. Collaborative efforts with global giants like Solvay and Nagase have also accelerated its innovation, highlighting Shengjian's commitment to advancing green technology through partnerships.

Professional development is a priority at Shengjian, with regular training programs to ensure its team meets industry demands. The company also contributes to regulatory standards, participating in the creation of emission controls that benefit the industry at large.

Shengjian's market expansion strategies are robust, focusing on promoting green technology applications. Notable projects include providing process exhaust solutions for fabrication plants and a Chemical Dispense and Recycle System, which emphasize resource efficiency and compliance with environmental standards.

Client relationships are nurtured through high-quality products, effective communication, and a keen understanding of client needs. Shengjian's approach to customer service—characterized by reliability, responsiveness, and long-term partnership focus—further cements its reputation as a trusted industry leader.

Looking ahead, Shengjian remains committed to driving innovation and expanding its product range to support sustainable practices in the semiconductor and high-tech industries. Its proactive stance on environmental responsibility continues to inspire industry-wide progress and ensures its place at the helm of green technology advancements.

Shengjian Environment not only leads in technological innovation but also in fostering a sustainable future, demonstrating an unwavering commitment to ecological and corporate excellence.





TRANSFORMING MANUFACTURING:

# THE ELH TECH STORY



**F**ounded in 2009, ELH Tech embarked on a journey to revolutionize the manufacturing landscape through additive techniques. At its inception, ELH Tech was driven by the immense potential of additive manufacturing to redefine traditional manufacturing methods. With a focus on 3D printing, the company has since been at the forefront of creating innovative solutions that are tailored to meet the intricate demands of industries, ranging from semiconductor components to sub-assembly devices. ELH Tech's commitment to innovation is not just about adapting to changes but setting new benchmarks in the manufacturing sector.

## Innovation and Technology

At the heart of ELH Tech's success is its proprietary technology that enhances the efficiency and precision of additive manufacturing processes, especially tailored for semiconductor applications. By concentrating on materials science and process optimization, ELH Tech ensures its components satisfy the rigorous standards of semiconductor manufacturing. The company's dedication to staying ahead of technological trends is evident through substantial investments in research and development, strategic industry collaborations, and active participation in technological forums. This proactive approach allows ELH Tech to stay at the cutting edge of 3D printing technologies for semiconductors.

## Market and Industry Impact

ELH Tech's innovative solutions have made it a pivotal player in the semiconductor industry. The company's main clientele includes key semiconductor manufacturers and suppliers who rely on ELH Tech's advanced additive manufacturing capabilities to enhance their production processes. By streamlining supply chains and enabling on-demand manufacturing, ELH Tech not only reduces lead times and material waste but also facilitates the creation of complex geometries essential for semiconductor applications. This transformative impact is reshaping how semiconductor companies approach production and design.

## Challenges and Solutions

One of the most significant hurdles in additive manufacturing is balancing consistent quality and reliability with cost-effectiveness. ELH Tech tackles this challenge head-on with stringent quality control measures, continuous improvements in process and productivity, and close collaborations with clients to refine and perfect manufacturing solutions. A testament to their problem-solving prowess, ELH Tech recently eliminated a critical production bottleneck for a semiconductor client by developing lightweight, high-strength components that surpassed the required performance metrics.

## Future Directions

Looking ahead, ELH Tech envisions a future where additive manufacturing is deeply integrated with digital technologies such as artificial intelligence and machine learning. These integrations are expected to further optimize design processes, materials selection, and production workflows. Over the next decade, ELH Tech aims to expand its market presence, advance the capabilities of additive manufacturing, and cultivate strategic partnerships to foster global adoption of 3D printing technologies.

ELH Tech stands as a beacon of innovation and excellence in the additive manufacturing industry. With a clear vision for the future and a robust strategy to navigate the evolving technological landscape, ELH Tech is poised to continue its legacy of transforming the manufacturing sector. We are thrilled to feature ELH Tech in Singapore Semiconductor VOICE Magazine and look forward to witnessing their ongoing contributions to the industry.



**Powering  
Semiconductor  
Excellence,**

**Shaping Global  
Futures.**

# DIGITAL MANUFACTURING ACCESSIBILITY REDEFINED BY AN INNOVATIVE STARTUP

**F**actorem, established in 2020, is a pioneering cloud platform reshaping custom manufacturing within Southeast Asia. This cutting-edge platform specializes in comprehensive fulfillment services designed for on-demand, low-volume production without a minimum order quantity requirement. Factorem employs Artificial Intelligence to optimize the entire manufacturing process, reducing sourcing lead times by half.

## The Importance Factorem Places on Manufacturing Ease

The arduous journey of developing hardware innovations and the manufacture of components present significant challenges. Such challenges encompass extended lead times, the necessity to interact with a plethora of suppliers across diverse cultural and linguistic landscapes, and the assurance of timely delivery of high-quality parts. These complexities can lead to delays in product launches and impose considerable costs on organizations.

Factorem's founding principle is to facilitate a frictionless and effortless experience for businesses seeking custom and intricate parts, enabling them to accelerate their market presence and foster rapid development economically. Factorem's clientele spans essential industries including Semiconductors, Robotics & Automation, IoT, Defense, and Aerospace.

## Technological Advancements by Factorem

Factorem addresses longstanding industry challenges

through sophisticated algorithms that refine the pricing and fulfillment process for custom part orders, revolutionizing on-demand manufacturing services. Factorem's AI-infused platform innovates in several critical domains:

### Instantaneous Quotation Delivery

Through its unique AI-powered predictive models, Factorem delivers immediate cost estimations for custom part designs, transforming a procedure that traditionally took days.

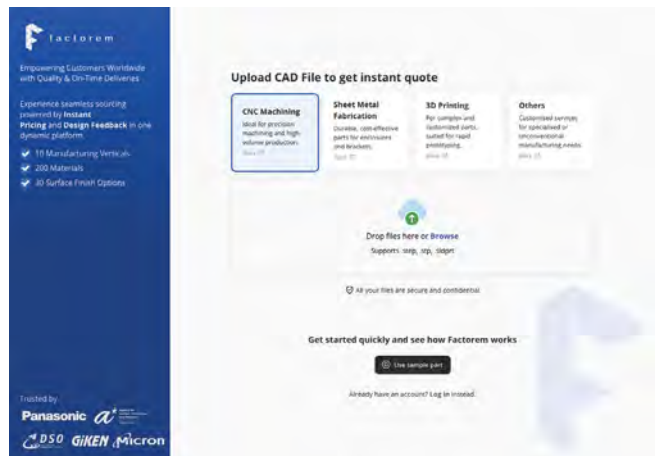
- **Advanced Categorisation:** Neural networks discern past orders, enhancing pricing precision with features such as the ability to distinguish between the use of cylindrical and rectangular stock materials for fabrication.
- **Price Predictions:** Utilizing past data and trend analysis, Factorem forecasts prices for new designs with remarkable accuracy in half a second.
- **Dynamic and Real Time Pricing Updates:** Clients benefit from competitive, transparent pricing updated in real-time based on material costs and market rates.

### Precise Manufacturing from the Outset

Factorem's technology is pivotal in ensuring accurate production from inception, promptly identifying potential design issues and thereby diminishing communication overheads with manufacturers and expediting iterations.

The AI algorithms at Factorem automate the extraction of crucial details from 2D technical drawings, such as dimensions, tolerances, and material specifications. This reduces errors and manual data entry inconsistencies, leading to a cost reduction of 20-30%.

The synergy of technology with professional acumen enables Factorem to complete orders with consistent quality efficiently.



Factorem's platform delivers instant quotes for CAD models



Factorem is broadening its network of vetted factories throughout Southeast Asia to meet worldwide demand.

### Intelligent Fulfillment Matching

The intelligent algorithm developed in-house by Factorem effortlessly aligns new queries with the most appropriate manufacturers within its expansive network of certified factories in Southeast Asia. The algorithm weighs various factors, including the factory's capability, capacity, and geographical positioning, to optimally tailor each job for the production of high-caliber parts.

Factorem's platform applies unsupervised learning techniques to assess project specifics and rates the top manufacturers for each job, ensuring an optimal pairing overseen by Factorem's system. This optimizes factory capacity utilization and minimizes idle machine time.

Continuous monitoring and feedback are integral throughout the fulfillment cycle to guarantee dependable delivery. Post-production, the system evaluates comprehensive quality metrics for each order, identifying trends to hone processes and reduce defects.

### Continuous, On-Demand Support

Factorem enhances client support with FactoremGPT, an AI-enabled customer service interface that provides prompt, personalized responses using natural language processing. This service is available across various communication platforms, ensuring support is always at hand.

### Case Study: Phaos Technology

Phaos Technology, a frontrunner in advanced microscopy technology for manufacturing, biomedical, and research applications, encountered several obstacles such as exorbitant costs for low volumes, the necessity for rework, and prolonged lead times.

Prior to Factorem, Phaos Technology experienced 1-2 weeks of waiting for quotations, variable part quality, and significant lead times. Utilizing services like CNC Machining and 3D Printing, Factorem revolutionized their experience with rapid 24-hour quotes, competitive pricing, and consistent quality.

Phaos Technology has occasionally required CNC machined parts within tight timeframes. Before engaging with Factorem, finding suppliers capable of meeting these stringent deadlines proved challenging. Factorem stood out by effectively navigating through multiple suppliers to identify those who could fulfill the required lead times without compromising on quality. Despite the accelerated production, all finished machined components met the quality standards and were priced reasonably.

This level of efficiency has established Factorem as Phaos Technology's preferred provider for on-demand machined parts, and they express their gratitude for the exceptional service provided.

### Factorem's Commitment to Innovation in Parts Sourcing

Factorem is redefining the custom parts sourcing paradigm through digitalization, automation, and agile supply chains, presenting an end-to-end fulfillment platform that heralds the future of manufacturing. Factorem's system invites clients to experience the convenience of ordering in moments and receiving parts in days, effectively eradicating protracted waiting.

Streamline your manufacturing today at [factorem.co](https://factorem.co)!



Semiconductor component crafted with precision by Factorem's trusted network of partners.





# Sustainability as our culture

## For us, and the generations to come

Sustainability at Infineon goes beyond just environmental sustainability, it includes social and economic values as well. We believe sustainability to be the symbiosis between economy, ecology and social engagement, continuously respecting and recognizing the importance of cultural diversity.

We understand how technical systems can be made increasingly efficient through the use of semiconductors, providing sustainable solutions for the world of today and the world of tomorrow. This makes our customers more successful and is an important contribution to society.

We are committed to making life easier, greener and safer -with technology that achieves more, consumes less and is accessible to everyone. Join us in driving decarbonization and digitalization for you and me, and the generations to come.

Scan to find out more



PARTNERS IN PROGRESS:

# EXPLORING TEMASEK POLYTECHNIC'S COLLABORATIVE PATHWAYS FOR INDUSTRY GROWTH

**A**s a leading institution of higher learning in Singapore, Temasek Polytechnic (TP) is proud to be at the forefront of nurturing a strong talent pipeline with industry-relevant skills, ready to contribute to the workforce of the future. With 6 Academic Schools offering 36 full-time and more than 40 part-time diploma courses, and Centres of Excellence developed in collaboration with the industry, TP hopes to contribute skills and value across different sectors in Singapore's economy, from advanced manufacturing to business process engineering amongst others.

More than just equipping our students with skills, TP strives to establish collaborations with industry partners. From curated internships to access our brightest talents, collaborative projects to tackle industry challenges, sharing of technology solutions, and industry-relevant courses for adult learners to be future ready, we hope to work with industry partners to add value and generate positive outcomes.

In particular, TP stands as a pivotal bridge between technological advancements and the practical needs of Small and Medium Enterprises (SMEs). Through our academic schools and specialised research centers, we are ideally positioned to foster innovation tailored to enhance productivity. By collaborating with TP, you can gain access to a wealth of cutting-edge research and development resources, tapping into innovative solutions developed by students and faculty members. Our commitment to real-world applications ensures that solutions provided are pragmatic and applicable for the industry. Such partnerships can focus on relevant areas in the semiconductor industry such as automation, business process engineering or data analytics, ultimately translating to enhanced productivity and reduced operational costs.

Some opportunities for SMEs in the semiconductor industry to generate value through collaborative projects with TP are illustrated below.

## COLLABORATIVE PARTNERSHIPS FOR TRANSFORMATION AND PRODUCTIVITY GAINS

### Automation Solutions with the TP Robotics and Automation Centre

A key cornerstone of TP's educational philosophy is preparing students to be industry relevant. Our Centres of Excellence are developed in collaboration with industry partners to simulate up-to-date industry operations. Besides providing our students the opportunity for hands-on learning, these facilities also enable us to provide consultancy services and collaborate on joint projects with industry partners.

In particular, the Temasek Polytechnic Robotics and Automation Centre (TP-RAC) has been working with industry partners such as SSMC and Lumileds to develop customised autonomous mobile robots (AMRs) solutions for materials transport since 2016.



TP AMR integrated with Collaborative Robotic Arm



SSMC AMR

The AMRs developed by TP-RAC are customisable according to the industry partners' needs, are fully autonomous and can navigate narrow spaces with a position accuracy of  $\pm 35\text{mm}$ . The AMRs can also be integrated with lift systems for inter-floor operations and integrated with collaborative robotic arms to perform autonomous movement and pick and place operations. In addition, TP-RAC's capabilities

also include developing and deploying robotics and automation solutions at manufacturing plants e.g. using collaborative robotic arms to automate polishing operations and automating manufacturing workcell for materials handling and packing.

### Improving Productivity through Process Optimisation



Apart from equipping our students with applicable skills, our diploma courses also strive to work with industry partners on joint projects to tackle real-world problem statements.

This provides mutual benefits of crowdsourcing innovative solutions for these challenges, while allowing valuable industry exposure and experience for students.

The Diploma in Business Process and Systems Engineering is one such programme. A unique blend of engineering and business concepts, students gain knowledge in Business Analytics tools, Decision Analysis techniques, Statistics, and Computer Programming. These skills empower students to offer insights and solutions for optimising processes and improving productivity. As such, collaborative student projects often benefit industry partners in areas such as Process Improvement, Process Mapping, Market Research, Data Analysis and Customer Service Gap Analysis.

### INTEGRATED TALENT PIPELINE READY FOR THE INDUSTRY

The Internship to Career Integrated Programme (ICIP) is a unique year-long internship programme created to lend a seamless integration between internship and full-time employment. Through ICIP, our final year students will be

**“ I am glad to see companies like Micron working together with the polytechnics to nurture local talent. Strong industry partnerships are crucial for our institutes of higher learning to continue equipping students with the latest skills and knowledge, and contribute meaningfully to industry once they graduate. I look forward to Micron’s efforts to inspire students and train the next generation of tech leaders. This partnership also enables the development of a skilled and nimble workforce that contributes to Singapore’s technological success and global competitiveness.**

**Mr Chan Chun Sing**, Minister for Education

given a headstart in their career, and participating industry partners gain early access to talents.

In particular, TP was proud to facilitate a collaboration between Micron and all five polytechnics in Singapore for such an internship programme, which aims to strengthen and scale the talent pipeline joining the company’s workforce, while allowing students valuable industry exposure and experience leading to career opportunities.

### TAILORED SOLUTIONS FOR BUSINESS TRANSFORMATION

TP’s role in upskilling the workforce presents significant value-add for SMEs striving to stay competitive in a world of rapid advancements. A key player in the national drive for lifelong learning, the Temasek Skills Future Academy offers numerous opportunities for enterprises to transform, and for adult learners to upskill with industry-relevant programmes.

The Enterprise Transformation Project is one such initiative aimed at boosting productivity for companies through workforce development and operational redesign. As a strategic initiative by SkillsFuture Singapore in collaboration with TP, projects are eligible for the Mentorship Support Grant, with funding support of up to \$30,000 to address business challenges through tailored consultancy services and practical training for your workforce.

If your company is keen to explore collaboration opportunities with Temasek Polytechnic, we invite you to contact us via email at [industrypartnerships@tp.edu.sg](mailto:industrypartnerships@tp.edu.sg).





# SUPPORTING THE FLOURISHING SOUTHEAST ASIAN SEMICONDUCTOR MARKET

MATERIALS AND EXPERTISE  
THAT MAKE NEW PACKAGE  
DESIGNS POSSIBLE



**T**he semiconductor market in Southeast Asia is exploding as supply chain diversification and fortification continue. Current figures put regional chip

export revenues at US \$200 billion, making the sector a primary driver of investment and job expansion. Among the most prevalent products and technologies fueling the growth are automotive electronics, artificial intelligence, and high-performance computing (HPC). As quickly as the market is developing, however, new IC designs are coming online just as fast and are pushing the limits of die and package thermal capability, stability, size constraints, and reliability.

Henkel, a vital member of the Southeast Asian electronic market for over 40 years, is helping semiconductor manufacturers address these challenges with new material innovation, well-resourced application and engineering centers, an expert technical team, and substantive R&D investment. With a broad offering of next-generation die attach, sintering, and advanced packaging adhesives, Henkel is facilitating package design ingenuity in Southeast Asia, particularly for automotive and HPC technologies.

## **Automotive Device Ingenuity**

The electronics content value of a vehicle today is approaching 50%, according to some estimates, with that figure increasing substantially year over year. Often termed 'semiconductors on wheels', the modern vehicle depends on electronics for continuous innovation in safety features, electrification, entertainment, comfort, and enduring performance within an incredibly demanding environment. The requirements for high thermal capability, cost-efficiency, and automotive grade reliability are immense.

Henkel's semiconductor materials for wirebond and advanced packaging devices are key to automotive package innovation, delivering processability and reliable performance. Engineered to meet the most rigorous standards, the company's die attach pastes and films, encapsulants, and sintering materials are integrated throughout the automobile – from image sensors to analog and logic ICs to processors, and power semiconductor devices. Some of Henkel's most recent formulations include pressure-less and pressure-assisted sintering materials with thermal capability up to 200 W/m-K; high thermal electrically conductive die attach adhesives that address the cost and performance demands of bare copper leadframe MCUs and other high I/O packages; and conductive die attach films that provide automotive grade reliability within challenging footprints for devices like PMICs and MCUs.



### **Demanding AI and HPC Packages**

Advanced packaging designs have seen noteworthy evolution in the last decade and are, in large part, the primary contributor to today's artificial intelligence (AI) and high-performance computing (HPC) capability. High-density fan-out (HD-FO)/2.5D devices, on which many AI and HPC packages are built, have witnessed significant progress in terms of increased I/O, performance, and cost efficiencies and, consequently, are projected to see 35% CAGR over the next five years. While these innovations have empowered the rise of high-bandwidth AI and HPC devices, they also present significant stress and warpage control challenges due to large die with higher I/O counts, tighter pitches, and lower gap heights. For example, some of the newest-generation designs have interposer dies as large as 2500mm<sup>2</sup>. Fully encapsulating bump interconnects across such a large surface area is the foundation of reliability enhancement for these complex designs, and Henkel has developed several new materials with proven results. Among the latest advanced packaging formulations are anhydride-free low warpage liquid compression molding underfills (LC-MUFs) that achieve fine gap filling and low wafer-level warpage; high fracture toughness, fast flow, low CTE capillary underfills designed for large die (> 50 mm x 50 mm), high-density I/O thorough bump protection; and low stress, high elongation lid attach materials that prevent warpage for enhanced reliability.

### **Expansive Regional Support**

Henkel has teams and resources positioned across Southeast Asia to ensure personalized, local support for regional semiconductor customers. Our application engineering and technical support centers in Southeast Asia and globally, bolstered by Henkel's corporate financial strength and global resources, provides the technical expertise, customized solutions, and proven track record to help Southeast Asian semiconductor manufacturers achieve ambitious technology roadmaps with confidence.





# HOW AMD IS SHAPING THE FUTURE OF AI

## Global innovation, grassroots contributions

The latest AMD Instinct™ MI300 Series accelerators are uniquely well-suited to power even the most demanding AI and HPC workloads, offering exceptional compute performance, large memory density, high bandwidth memory, and support for specialized data formats.

The AMD Instinct™ MI300X accelerators are designed to deliver leadership performance for Generative AI workloads and HPC applications especially as today's LLMs (Large Language Models) increase rapidly in size and complexity, requiring massive amounts of memory and compute. At the same time, the AMD Instinct™ MI300A APUs, the world's first data centre APU for HPC and AI, leverage 3D packaging and the 4th Gen AMD Infinity Architecture to deliver leadership performance on critical workloads sitting at the convergence of HPC and AI.

**A**I is the defining technology shaping the next generation of computing as a new wave of AI applications evolve at a rapid pace. From creating realistic virtual environments for gaming and entertainment to helping scientists treat and cure diseases or helping humanity better prepare for climate change, AI has the potential to solve some of the world's most important challenges.

At AMD, our mission is to push the limits of innovation as the leader in high-performance and adaptive computing. As AI transforms every aspect of our lives, AMD is uniquely positioned to deliver leadership computing solutions to enable that transformation. We believe the technology is the single most important innovation of the last 50 years.

The company is investing in AI at every level and powering the new era of AI PCs. Succeeding in AI requires investing in every part of the business – from strategic partnerships with leading ISVs (Independent Software Vendors) to software investments in toolchains, platforms, and libraries – and that's exactly what AMD has done.

In 2023 alone, we took the following giant strides towards this vision – from the acquisition of Nod.AI and the release of the Ryzen™ AI software stack, to the introduction of the first NPU (Neural Processing Unit), AMD Ryzen™ AI in an x86 processor and the integration of Xilinx's hardware into AMD processors such as the AMD Ryzen™ 8040 Series, and 8000G series. Beyond these, we also unveiled our AMD Instinct™ MI300X GPU and MI300A accelerators that deliver breakthrough performance for HPC and AI workloads.





Innovation is never a solo endeavour, but one that thrives when diverse minds come together. The AMD Instinct™ MI300 Series was the fruit of unwavering dedication and countless hours of going above and beyond from thousands of AMD engineers across the world, including **Chen Lan, Director of Product Development Engineering**, and over 200 Silicon Core Team (SCT) engineers in Singapore.

Achieving tape delivery was a surreal moment for the team. The AMD Instinct™ MI300 was a complex challenge – the accelerators not only have nearly triple the transistors count at 146 billion compared to its predecessor, but also require the use of advanced packaging technology like SOIC (System on Integrated Chips) and CoWoS (Chip on Wafers on Substrate). For Chen Lan, the MI300 project is a definitive testament to the AMD’s spirit of striving for execution excellence and inclusive collaboration, representing the pinnacle of the team’s ability to overcome technological barriers and the fullest potential of the company whenever it comes together as one.

Throughout the course of this momentous project, the SCT members were constantly pushing the boundaries of existing processes and innovation – working with cutting-edge technologies while ensuring the product meets the highest standards of quality. In fact, some of the major milestone achievements from the team include introduction of breakthrough industry testing standards for

ATE Exascale Tester configuration, and System Level Test (SLT) thermal solution that can remove 1 Kilowatts of power.

### **A laser focus on the future**

We remain committed to accelerating AI innovation, and we intend to realise this ambition through our three-pronged AI strategy. First, deliver a broad portfolio and multi-generation roadmap of leadership GPUs, CPUs and adaptive computing solutions for AI inferring and training. Second, extend the open and proven software platform we have established that enables our AI hardware to be deployed broadly and easily. And third, expand the deep and collaborative partnerships we have established across the ecosystem to accelerate deployments of AMD-based AI solutions at scale.

Through these, we look towards making the benefits of AI pervasive by enabling customers to tackle AI deployment with ease, as well as delivering solutions that scale across a wide range of applications, from processors and adaptive SoCs using AI engines, to edge inferring, to large-scale AI inference and training in data centres.



# FROM SILICON WAFERS TO STRATEGIC LEADERSHIP

## ZERLINDA TAN'S JOURNEY TO INSPIRING THE NEXT WAVE OF SEMICONDUCTOR INNOVATORS

**F**rom an engineer to a regional talent acquisition director at Micron Technology, Zerlinda Tan is dedicated to inspiring the next generation to join and grow their careers in the semiconductor industry. Join us to hear her sharing her career journey, insights on mentorship and talent development.

**You started working in Micron as an engineer and now you are a regional talent acquisition director. Could you share with us your career journey?**

Zerlinda: Reflecting on my early engineering career, I vividly recall being captivated by the intricate process of building nanostructures on silicon wafers. This early fascination wasn't just about the technical process required but also about how meticulous observation leads to monumental discoveries. Boundless curiosity, passion, tenacity, and teamwork have propelled innovation. These qualities fuel my work enthusiasm but also empower me to take on new challenges. Over recent years, I've had the honor of spearheading new projects for Micron in support of our talent strategies, affirming the industry's immense potential. It's a journey of endless possibilities and personal growth.

**You are a strong advocate of mentorship and such programs at Micron. How has mentorship shaped your career, and how do you pay it forward?**

Zerlinda: Throughout my career, I've been blessed with mentors who have inspired my curiosity and cared deeply for me. Their guidance shaped my professional path and personal growth. I've been privileged with strong women role models, and their invaluable tips have helped me navigate leadership, motherhood, and work-family integration.

Committed to paying it forward, I mentor young professionals in the industry. This mentorship journey is rewarding as it's a two-way street; I also learn from their fresh insights.

**As a seasoned leader with nearly two decades of experience in the semiconductor industry, how would you inspire our young people, especially young women to join this dynamic field?**

Zerlinda: Technological advancement drives semiconductor demand and smart manufacturing progress. I am proud that Micron has been recognized by the World Economic Forum as a beacon, a lighthouse for Industry 4.0 and sustainability. At Micron, our culture of innovation fuels the pursuit of technological excellence, where we create opportunities to not only enhance digital and automation skills but also cultivate leadership, adaptability, and creativity. We foster an equitable environment for women and younger generations to grow and thrive.



Zerlinda attended the Electronics Industry Day event supporting the team in connecting with potential talents, aligning with Micron's commitment to grow the early talent pipeline in the semiconductor industry.



Zerlinda, a committed member of the Micron Women's Leadership Network (MWLN) and the lead for the Micron Global Women Mentoring platform, encourages female leaders and inspires students to pursue careers in the semiconductor industry.

**How does Micron collaborate with various institutes of higher learning (IHLs) in Singapore to attract talent to the semiconductor industry?**

Zerlinda: Micron partners with educational institutions to expose students to industry developments that equip them with future-ready skills. By showing students the latest advancements and demonstrating how their academic learning can be applied to real-world problems, we bridge the gap between theoretical knowledge and practical application. At Micron, we offer learning experiences for students and educators, collaborate on curriculum development, and provide internship and mentorship opportunities. "Together with Singapore Semiconductor Industry Association (SSIA), we showcase the depth and breadth of the semiconductor industry in Singapore, which celebrated its 55th anniversary last year." Initiatives like the SSIA Semiconductor Active Youth (SAY) Ambassador Programme connect us with young talents, inspiring the next generation of engineers. Through these programs, we ensure continuous growth and innovation in our industry.

**Outside work, what are your interests and how do they influence your professional life?**

Zerlinda: Away from work, I cherish family time as my family is my support system and biggest cheerleader. They enjoy hearing about my travels abroad and cultures I experience. Most recently, the dynamics of learning have shifted; my teenagers, who are naturally skilled in navigating the digital realm, have started to teach me new digital skills. These skills benefit my professional endeavors and strengthen our family bond. Indeed, we are excited about the future, convinced that it's bright for the aspiring talents who will drive innovation in our industry.



# UNLOCKING THE POTENTIAL TO LEADERSHIP

A CONVERSATION WITH SUE ANN TENG, DIRECTOR FINANCE AND CONTROL AT ASM



**A**t ASM, growth is powered by our people, who make every innovation possible. By gathering the brightest minds worldwide, we are driving advancements in cutting-edge technologies, such as AI and electric vehicles, to improve people's lives.

Throughout Sue Ann's four-year journey with ASM, Sue Ann has adeptly navigated the rapidly-evolving and fast-paced semiconductor industry with a growth mindset, ascending from a business partner to the global procurement team to Director Finance and Control. She has been supported along the way by her colleagues at all levels and was part of ASM's Women Mentoring Program, where she was mentored by the CFO.

ASM's Women Mentoring Program is designed to expedite the readiness of future women leaders. Sue Ann has benefited from this program where senior executives actively mentor female talents, focusing on sharing knowledge and insights on career growth, skill development, and providing networking opportunities.

In this interview, Sue Ann shares her journey to leadership within the semiconductor industry and discuss how the mentorship program has been instrumental in her development.

## What is the key influence on your leadership development?

Sue Ann: The Women Mentoring Program has played a huge role, especially being mentored by the CFO who comes from a similar background. Our monthly one-on-one sessions focuses not only on identifying areas to grow but also setting very specific objectives and action plans for my development. These sessions were also a safe space where I could open up about any struggles I was facing. The perspectives I gained help me view challenges through the lens of a senior executive, which has been invaluable in shaping my leadership approach and solving problems under pressure.





### How did you successfully transition into a different role?

Sue Ann: I started my career in an accounting consulting firm and a bank before moving into the supply chain sector in the mining industry. Transitioning from a procurement business partner to a leadership role in financial controlling at ASM was smoother than expected, thanks to my mentor. Having transitioned several times in his career, he has guided me through the emotional and mental aspects of shifting roles at this stage of my career. He also expanded my network within the company, connecting me with key stakeholders. Additionally, my diverse background allowed me to speak the same business language with colleagues from different departments, ensuring I can effectively support their needs.

### What challenges have you faced as a female leader in the semiconductor industry?

Sue Ann: I often attended meetings where I was the only woman, which can be intimidating. But I'm inspired to see that the environment is changing with the rise of more female leaders, including our Site Leader in Singapore, Yvonne Lee, who's also the VP of Global Product Delivery, and many other female colleagues in manufacturing and engineering leadership roles. ASM aims for 20% female employees by 2025, a target we've already exceeded in Singapore, signalling a real change. With a gender pay ratio of 98% and a Supervisory Board composed of 50% women, the voices of women are increasingly heard and valued.

### Is there any support system for women at ASM?

Sue Ann: Joining the Women's Initiative Network (WIN) was an important move for me. It hosts events, such as panel discussion and speed networking, that connect me with inspiring female leaders, who share common challenges yet possess the experience to overcome them. This has not only inspired me to take on bigger roles and responsibilities but also helped me build my confidence as a leader. Furthermore, I am currently one of the chairpersons of the We Care club in Singapore, where we bring people of every gender, religion, age, and colleagues from 20 nationalities together, making a positive impact on society and the planet.

### What is your advice for women who aspire to become leaders?

Sue Ann: We should avoid seeing any industry as gender-leaning. Such a mindset only limits your aspirations and potential. Instead, we should focus on developing our knowledge and expertise; that's where you win respect. Do not be afraid to ask questions and be ready to learn from everyone. Asking questions across all levels and functions is key to broadening your skills.







**Improving  
lives**









**Advancing  
technology**



**Unlocking  
potential**

ASM is a leading, global supplier of semiconductor wafer processing equipment. Our smart and ambitious team is dedicated to delivering innovative technology solutions to the world's leading semiconductor manufacturers.

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# LEVERAGING TEST TO DRIVE ENGINEERING EFFICIENCY



In today's digital landscape, the speed of change is relentless. Technologies once seen as futuristic are now part of everyday life, driving a constant evolution in semiconductor development. Though innovation pushes us toward new realities, change creates new challenges, especially for test and measurement, where the pressure continues to mount for semiconductor companies to keep up with the rate of change. However, shorter development cycles and increasingly complex designs mean that now more than ever, engineering teams are assigned a significantly more complex task with even less time to complete it.

Small inefficiencies, like the time it takes to set up non-automated systems and the manual effort to organize complex data, have a significant impact on time-to-market. Additionally, disjointed design and testing phases across the semiconductor product lifecycle lead to delays and a misuse of resources in many organizations. But even making minor

improvements can have a big impact, helping teams keep up with tight deadlines.

Companies that prioritize addressing these issues now will become market leaders. To do so, semiconductor companies should rethink their approach to test by assessing each stage of product development. Standardizing test and measurement tools and fostering communication between engineering functions can streamline operations. However, leveraging expertise, tools, and software from a trusted source is crucial. At NI, we strive to help drive engineering efficiency with user-friendly automation tools and versatile testing systems that enable engineers to focus on key competencies and improve their products.

In the dynamic semiconductor landscape, collaboration and insights are key to driving innovation. Achieving a connected and intelligent world will require taking a closer look at how companies develop, test, and drive data from their products. NI's mission is to help engineers develop the technology that will redefine the industry. Together we can unlock the complete potential of semiconductor technology to shape a brighter, smarter, and more sustainable future.



Written by **Robert Manion**, VP & GM Semiconductor and Electronics Business Unit

# INNOVATORS AT THE FOREFRONT

## PIONEERING WOMEN OF KLA SINGAPORE



Hou Dongxia

**H**ou Dongxia serves as the mechanical design team manager within the Chief Technology Officer (CTO) Group at global technology leader KLA's Singapore branch. With 18 years of R&D design experience, she plays a pivotal role in advancing technological innovation at KLA, spearheading efforts to introduce new tools to the market.

"Compared to my previous jobs, being part of a multidisciplinary early research and development group sets KLA apart because interactions within the team and our processes greatly nurture my knowledge and broaden my view - it's a wonderful work environment," she says.

Her typical day involves intense collaborative sessions.

"Members of our multidisciplinary team within the CTO are from many different backgrounds, each bringing their own unique talents. Our discussions spark ideas and inspire solutions," she says.

Following these dynamic engagements, some "quiet work" is essential to transform ideas into tangible actions.

The effectiveness of this approach is clear. Shortly after joining KLA, Hou collaborated with her team members to devise an innovative solution for a laser source, known as the argon-ion replacement (AIR) laser design.

"I'm proud of our team's collaboration to successfully complete the work - the resulting laser design was also a great technical learning experience," she adds.

Hou believes a key benefit of working at KLA is the emphasis on employee development. In addition to training opportunities available online through the company's Corporate Learning Center, she values direct engagement with group leadership.

"I'm very thankful for my manager's guidance and 1:1 mentorship from CTO senior management," she says. "I've learned a service mindset and management skills that are crucial for effectively handling my daily responsibilities."

When not immersed in work, Hou enjoys walking outdoors. "It brings me freshness and energy and gives me time to recharge," she says.



Janet Lim

**Janet Lim**, an optics manufacturing design engineer at KLA Singapore, joined the company in 2022 to focus on laser scanning inspection products. She plays a critical role in leading optics integration throughout the toolmaking process, adeptly coordinating the assembly of individual lenses into a cohesive system to optimize the optical performance of inspection systems.

She acknowledges the steep learning curve associated with her position but finds it rewarding, as each tool developed significantly contributes to the growth of the semiconductor industry.

"As part of the manufacturing engineering team, we engage with numerous stakeholders and frequently make rapid decisions at each stage to efficiently manufacture the tools," Janet explains. "Optics integration is crucial in my daily work, and possessing this rare skill facilitates quick and precise troubleshooting actions."

Janet views her role as both innovator and gatekeeper. Her team collaborates closely with design engineers to refine systems based on real-world production experiences. They ensure each system's manufacturability meets specific requirements and explore improvements to enhance future models. Janet frequently works alongside test engineers to address tool nonconformities and coordinates with suppliers to ensure component standards and timely delivery.

"Occasionally, we also provide technical support for urgent issues at customer sites," Janet adds.

She is particularly proud of her involvement in the development of KLA's first blank reticle inspection tool, a market that demands high throughput and low cost. "This tool optimally balances wavelength, sensitivity, and throughput, minimizing costs for our customers and enabling high-efficiency inspection of blank reticles," she notes.

Outside of work, Janet is an avid badminton player, having played throughout school and college, and currently co-chairs the KLA badminton group. She is also a passionate foodie. "I love exploring new cuisines and restaurants,

and I maintain an Instagram account to share my culinary adventures," she says.

**Siew Khim Tay**, Senior Materials Director at KLA Singapore, navigates the complexities of a highly specialized global supply chain daily, ensuring the timely delivery of cutting-edge KLA products to customers. As semiconductor manufacturing evolves, the rapid advancement of technologies necessitates continuous enhancements to both processes and systems and resolving supply chain issues is vital for effective strategic planning and organizational resilience.

"The collaboration and co-development with our high-tech level suppliers are distinctive to KLA, our suppliers, and the semiconductor industry leaders," Tay explains.

A major challenge Tay faces is the rapidly decreasing lifecycle of parts due to technological advancements. Extensive global planning with supply chain and design engineering teams is crucial to manage the extended lead times required to develop complex new products.

"We strive to secure a reliable supply of critical components before launching a new KLA tool," Tay says. "This includes clarifying technical specifications with our supply chain partners early and establishing contractual agreements to ensure part availability for a set period, thus providing long-term value to our customers."

According to Tay, building strong, trusting relationships with suppliers is essential for successful long-term collaboration. She plays a pivotal role in coordinating diverse stakeholders across various geographical locations to source raw materials and ensure their delivery from KLA plants to customers.

"My role is akin to an orchestra conductor," she remarks. "I keep the team synchronized, aligned, and harmonious to deliver high-value solutions that meet or exceed our customers' expectations."

Tay's extensive background supports her leadership of KLA Singapore's Materials Team, which comprises 10 business divisions. These divisions operate autonomously yet strive for standardized and optimized processes to enhance customer value.

"Ms. Tay is not only the most senior female leader at KLA Singapore but also a role model," says Ray Chua, Head of Human Resources at KLA Singapore.



Siew Khim Tay



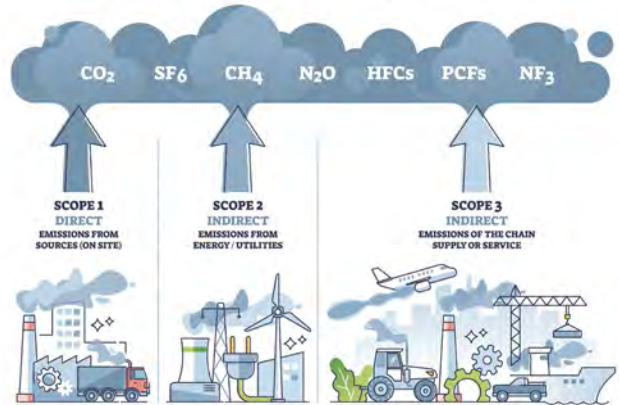
# ADVANCING ENVIRONMENTAL SUSTAINABILITY IN SEMICONDUCTOR MANUFACTURING

## INSIGHTS INTO EMISSION ABATEMENT TECHNOLOGIES AND STRATEGIES

Understanding the gases that must be treated is crucial when considering waste gas emissions from some semiconductor process tools. These hazardous gas releases can be toxic, flammable, corrosive, and contribute to global warming. Gases, such as carbon tetrafluoride (CF<sub>4</sub>), are very stable, can exist in the atmosphere for 50,000 years, and require temperatures over 1400oC for effective destruction. It is approximately 7000 times more potent greenhouse gas than carbon dioxide (CO<sub>2</sub>). Other gases in semiconductor manufacturing, such as hexafluoroethane (C<sub>2</sub>F<sub>6</sub>), trifluoro-methane (CHF<sub>3</sub>), and sulfur hexafluoride (SF<sub>6</sub>), also require significant energy input. Nitrous oxide (N<sub>2</sub>O), nitrogen trifluoride (NF<sub>3</sub>), and fluoro-methane (CH<sub>3</sub>F) can be treated using lower temperatures (~500oC). Finally, the process gases used react in the chamber; sometimes, the byproducts may be more difficult to treat than the gases provided to the chamber. Therefore, the first take way is to understand the gases that need to be treated and apply the appropriate amount of energy at the right time to treat them.

Our next question is how to reduce the hazards associated with these gases by abatement. The earliest abatement approaches used dilution and wet scrubbing. They did not

### SCOPES OF EMISSIONS



reduce greenhouse gas emissions but did manage safety and compliance by dealing with flammable gases by dilution and toxic and corrosive gases by wet scrubbing. Electrically heated adsorbers such as lime or electrically heated catalysts were then adopted. The former works with the more reactive greenhouse gases, and the latter can also treat the more difficult gases. Still, both have challenges with solids that may also be present in the waste gases from the tool or that form during the treatment of the waste gases. Both are still in use. Point-of-use and end-of-pipe options are sometimes adopted for catalysis, but both require solids mitigation to ensure an adequate catalyst lifetime. Fossil fuel burners, Direct Current (DC) plasmas, and wet scrubbers were adopted as the industry voluntarily moved to reduce greenhouse gas emissions and manage other challenges. These sources of energy and chemical conditions are needed to convert the gases, in the case of the fluorocarbons, to carbon dioxide and hydrogen fluoride (HF) – with the latter wet scrubbed and treated as wastewater. The second takeaway is that burn-wet or plasma-wet abatement methods are used and have been advancing to treat waste gases and reduce greenhouse gas emissions. Therefore, understanding how energy is provided and the implications of adopting these routes is crucial.

Looking at the greenhouse gas protocol, we consider Scope 1 greenhouse gas emissions as those from the untreated process gases, the carbon dioxide from burning any fossil fuel or any carbon compounds being treated, along with traces of nitrous oxide formed when nitrogen (N<sub>2</sub>) heating in the presence of oxygen (O<sub>2</sub>). Scope 2 emissions reference the electricity used to run the abatement product and that required to run the facilities that provide utilities such as on-site generated nitrogen, oxygen, compressed air, clean water, extract, and water treatment. Upstream Scope 3 emissions will reference those from the upstream supply chain, waste treatment, and emissions related to the provision of fuels, either to generate the electricity covered by Scope 2 or the abatement product itself. Let's look at the current state-of-the-art fossil fuel or plasma-based abatement technologies. The reduction of

Scope 1, 2, and 3 emissions achieved in moving from dilution and wet scrubbing to such abatement will be more than 90%, with the emissions avoided far exceeding those created by operating the abatement, even when using fossil fuels and electricity derived from fossil fuels. Takeaway three is that state-of-the-art abatement achieves a substantial net emissions reduction.

So, how can we reduce emissions further? If most of the emissions are associated with process gas releases, then further reduction improvement can be achieved by increasing the energy used.

However, there will be a point when emissions associated with the operation will exceed the reduction achieved by adding more energy, and there is always a concern about cost. Diluent reduction associated with purges and unreactive process gases can either reduce the energy required for abatement or increase destruction efficiency by reducing the volume to be treated and increasing the reaction time. It is important to ensure that diluent reduction does not have an unintended effect, such as increased corrosion or challenges with solids. The fourth takeaway is optimizing the system regarding flow and energy usage is important.

Can we eliminate the emissions from burning fossil fuels in the abatement? We could look at plasma-based systems, which have no fossil fuels. The concern is that generating electricity for such equipment usually involves burning fossil fuels, so Scope 2 and 3 fuel-related emissions may be significant. Carbon dioxide equivalent (CO<sub>2</sub>e) emissions breakeven for the plasma versus fossil fuel abatements depends on the fuel and energy used by the two systems and the method used for electricity generation. It is possible to estimate that the carbon intensity of the electricity needs to be between 0.15–0.3 kgCO<sub>2</sub>e/kWh to reduce emissions when using electrically based systems such as plasmas. So, a substantial component of low-carbon electricity is needed to power the abatement and the associated facility equipment. It is possible to reduce operational Scope 2 emissions to nearly zero by taking that route. However, low-carbon electricity is not universally available and is more expensive than electricity derived from fossil fuels. Challenges associated with the grid supply and internal distribution of electricity in the fab need to be accounted for when considering transitioning fabs from fossil-fuelled to electric-only abatement. The takeaway is that replacing fossil fuel abatement with electric abatement requires understanding the

availability and cost of low-carbon electricity and managing distribution to and within the fab.

What about alternative fuels? Hydrogen is considered a clean fuel, and Scope 1 emissions associated with the fuel are essentially zero. However, more than 98% of hydrogen (H<sub>2</sub>) is made using fossil fuels, and there is a significant Scope 3 fuel-related emissions from hydrogen generation. The Scope 1 & 3 emissions from an abatement when using fossil fuel-generated hydrogen is ~25% more than the Scope 1 and 3 emissions associated with natural gas. If the destruction performance is the same, then there's no benefit in using so-called grey hydrogen as a fuel. Low carbon hydrogen is rare, is more expensive, and may be difficult to supply in bulk, and hydrogen as a fuel is more challenging than natural gas to permit when distributing in the fab. The takeaway is that hydrogen can be used, even if blending is an option. However, upstream emissions, costs, availability of clean hydrogen, distribution, and permits must be considered as part of the decision-making process.

Finally, whose "Scope" is it anyway? From an environmental perspective, it doesn't matter—if you are using energy to destroy gases, do it to the best of your ability using the least amount of energy, preferably low-carbon, where feasible. From a cost viewpoint, it is also immaterial since if carbon charges are prevalent, someone will be paying for the right to emit or develop low-carbon alternatives, and those costs will be passed on.

Each abatement method presents its own set of trade-offs. Fossil fuel-based systems, while economically appealing, come with significant environmental drawbacks. Clean hydrogen, on the other hand, offers a cleaner alternative but at the cost of higher operational complexities and expenses. Electricity-powered systems hold the promise of the cleanest abatement, but their effectiveness hinges on the greening of the power grid and the ability to distribute, both off-site and on-site. As Singapore advances its renewable energy capabilities, the balance of these factors may shift, favouring more sustainable abatement solutions in the semiconductor industry. Therefore, it's crucial to consider these trade-offs when selecting the most suitable abatement method.



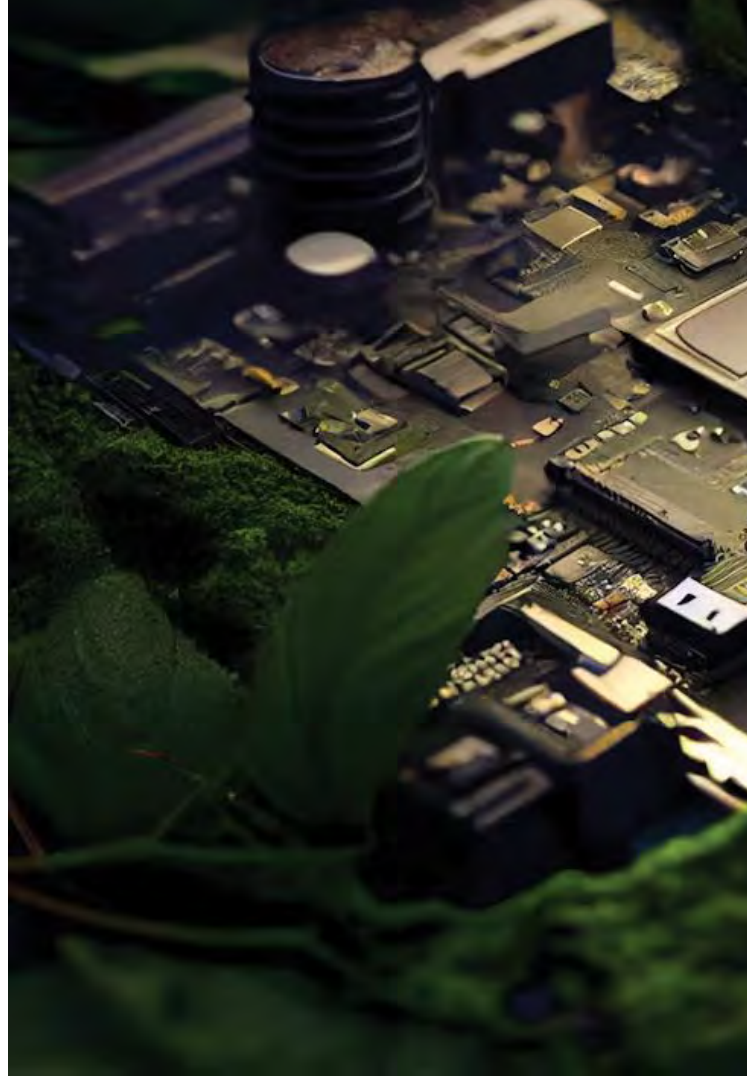
Written by **Dr Chris Jones**

Christopher Jones is a PhD qualified chemist who has focused his career on environmental sustainability within the semiconductor and other industries. At Edwards, he has applied his expertise to align products with environmental standards, leveraging his understanding of regulatory frameworks globally. Jones has actively engaged in discussions on sustainability with industry groups and regulatory bodies, and collaborates with academia and serves as the secretary of the Society of Chemical Industry's Electrochemical Technology Group.



REVOLUTIONIZING  
HYDROGEN SAFETY:

# A\*STAR'S PIONEERING SENSORS LEAD THE WAY TO A SUSTAINABLE FUTURE



**R**esearchers at A\*STAR are pioneering advanced hydrogen sensors that promise to revolutionize safety and efficiency in industries utilizing hydrogen. These sensors address critical challenges faced by existing technologies, such as low selectivity, cross-sensitivity, and susceptibility to poisoning—common issues that compromise sensor performance and reliability. The team has developed two specialized sensors: a hydrogen purity sensor and a hydrogen leakage sensor, both designed to offer higher sensitivity and immunity to poisoning compared to current market options.

The hydrogen purity sensor, equipped with a pyroelectric detector, is particularly adept at monitoring high hydrogen concentrations with impressive precision, critical for maintaining the quality of products in various manufacturing processes. This sensor enables real-time monitoring and control of hydrogen purity, which significantly enhances manufacturing yields by avoiding over or under purifica-



tion, a common issue with current technology that lacks inline monitoring capabilities.

The hydrogen leakage sensor utilizes novel materials to detect hydrogen concentrations as low as 20 ppm, ensuring early detection of leaks and enhancing safety, especially in confined spaces. This capability is vital as Singapore pursues its goal of net zero emissions, where hydrogen is envisioned to play a major role as a renewable energy source.

These innovations align with global sustainability efforts and Singapore's ambition to achieve net zero emissions, by providing essential safety measures for the broader adoption of hydrogen as a renewable energy source. Furthermore, the sensors' design mitigates the common problem of poisoning—where sensors lose sensitivity due to exposure to other gases—by using materials that exclusively react with hydrogen. This advancement not only improves

the sensors' accuracy over time but also reduces the frequency of replacements needed, offering a significant cost advantage and sustainability benefit.

In addition to technical advancements, the project addresses regulatory and market adoption challenges by collaborating with national and international bodies to develop new standards for hydrogen sensor evaluation. This proactive approach ensures that the sensors meet the highest safety and performance criteria before they reach the market.

Through strategic partnerships and rigorous testing, the IME team is setting new standards in hydrogen sensor technology, aiming to foster confidence in hydrogen technologies and drive forward the future of energy. With these developments, the researchers are not only enhancing industrial safety and efficiency but also contributing to the environmental goals of reducing reliance on fossil fuels and mitigating climate change.





Hear from the female scientists behind the hydrogen sensors project



**Doris Ng Keh Ting**

Principal Scientist  
Photonics & Sensors,  
A\*STAR's Institute of Microelectronics (IME)

**Role:** Lead project investigator in charge of the overall hydrogen sensors project



**Xu Linfang**

Principal Research Engineer  
Photonics & Sensors  
A\*STAR's Institute of Microelectronics (IME)

**Role:** Worked on the circuitry of the H<sub>2</sub> purity sensor



**Wang Huanhuan**

Scientist  
Photonics & Sensors  
A\*STAR's Institute of Microelectronics (IME)

**Role:** Worked on the fabrication of the pyroelectric detector used in the H<sub>2</sub> purity sensor

# Q&A

**Describe your path to the field of microelectronics and what motivated you to pursue this career.**

**Doris:** I majored in microelectronics during my undergraduate years and was fascinated by the wafer processes which I felt were quite 'neat'. During my PhD years, I took on more courses related to microelectronics and was working on nanowires and getting field emission response from them. I am always excited whenever I see fabricated wafers, knowing that thousands of devices/components are on these wafers and each of them has the potential to be used in our daily lives.

**Linfang:** During my undergraduate and graduate studies, my focus was on electrical and electronics engineering.

Following graduation, I embarked on a career path in various consumer electronics firms, applying my acquired knowledge and integrating commercial microelectronics chips into my design to create tangible projects and products that improve people's daily experiences. Upon joining A\*STAR's IME, I found even greater inspiration as I could work on innovative microelectronic chips for sensor development.

**Huanhuan:** I love reading novels and being inspired by books. One example is Liu Cixin's "Three Body" trilogy, which involves the development of sophons, microelectronic engineering on high-dimensional unfolded protons: small but powerful. Although it does not yet exist in the real world, it drew my attention at a young age to the importance and challenges of microelectronic devices. In addition, my background in materials science gave me a strong foundation to further pursue my career in this field and to develop innovative miniature electronic devices.

**As a leading female scientist in sustainability technology, how do you perceive your role in encouraging the next generation of women in STEM?**

**Doris:** I hope that my role can inspire women to set the stage for innovation in sustainable technology as well.

**Linfang:** I believe the next generation of women in STEM can be encouraged through sharing my experiences, and offering guidance, support, and resources to help them navigate their own paths in STEM fields, so that they can make meaningful contributions to develop technology for a more sustainable future.

**Huanhuan:** I hope that through mentorship and sharing my experiences, I can help female scientists to develop a greater passion in sensors and photonics and spur them to innovative technologies.

**How do you envision the future of microelectronics over the coming decade, especially in environmental monitoring?**

**Doris:** I envision that AI will be increasingly adopted in the development of new sensor technologies that are powered by microelectronics.

**Linfang:** With ongoing progress in miniaturisation, power efficiency, and sensor technology to detect a wider range of environmental parameters with greater precision and sensitivity, I believe that microelectronics will play an increasingly pivotal role in enhancing our ability to monitor

and understand our environment. The integration of microelectronics with other emerging technologies such as artificial intelligence and the Internet of Things (IoT) will further revolutionise environmental monitoring.

**Huanhuan:** I picture multifunctional devices that can sense various parameters and conduct in-situ analysis through the integration of artificial intelligence in the future of microelectronics, that are portable like our mobile phones and can be incorporated into wearables for convenience.

**What advice would you give to young scientists, particularly women, aspiring to enter the field of microelectronics and sustainability?**

**Doris:** Keep an open mind and always be ready to learn. There are a lot of bright minds out there and it can be very fulfilling to learn from them. You might be unsure when starting out your journey, but as you tread further it will become clearer. Be strong-minded and stay focused!

**Linfang:** Pursue your interests wholeheartedly. Passion is a powerful driving force that will take you past challenges and setbacks. Develop valuable technical skills and improve your proficiency in microelectronics, sensor technology, as well as electrical and electronic design.

**Huanhuan:** Don't worry if you feel like you're starting from scratch in a new field and don't blindly worship anyone – it will only weaken your confidence! While the basics are important, don't let that stop you from getting started. Believe in your abilities, learn as you go, and you will find the way forward.

# WE VALUE PEOPLE! WE INSPIRE INCLUSION & EQUALITY FOR A BETTER FUTURE!



The third iteration of our companywide celebration saw employees coming together to honour the achievements of SSMC women. Engaging activities such as pledge writing, balloon sculpting and a captivating photo contest (where staff proudly posed with #InspireInclusion heart signs) underscored our collective commitment to embracing diversity and driving gender parity. Amidst the celebratory atmosphere, gratitude permeated the event as employees expressed appreciation for the unwavering support in advancing gender equality. We are proud to have a well-balanced gender diversity, with 41% of our employees being female. The solidarity and dedication to inclusivity exhibited by our workforce highlight the pivotal role each individual plays in forging gender equality.



Demonstrating leadership by example, Lim Soon, CEO, led the charge, striking the #InspireInclusion pose to symbolise our unwavering commitment to fostering an inclusive workplace culture. Across social media platforms, employees demonstrated the support for the #InspireInclusion movement through the hashtag #SSMCIWD2024, showcasing their creativity, enthusiasm and team spirit.

The commendable efforts of our HR team, management and department heads culminated in a captivating photo collage, serving as a visual testament to our collective solidarity and commitment to DE&I.

As we continue our diversity, equity and inclusion journey, SSMC remains steadfast in its collaboration with industry partners to create an inclusive environment that empowers every individual. Together, let us champion positive visibility and empowerment for women, and inspire DE&I in the workplace, as we work towards a brighter and more equitable future.

In celebration of International Women's Day on 8 March, 2024, SSMC marked its commitment to diversity, equity and inclusion (DE&I) with a vibrant event themed "Inspire Inclusion." As a semiconductor industry leader, SSMC recognizes the invaluable contributions of its female workforce and is dedicated to fostering an environment where every employee feels respected, supported and valued.



LIM K.F.:

# MASTERING ADAPTABILITY IN THE SEMICONDUCTOR INDUSTRY



**L**im K.F. a 36-year-old Singaporean engineer, has carved a distinguished path through the semiconductor industry, demonstrating a strategic and resilient career evolution. A 2012 graduate of the National University of Singapore with a Bachelor's Degree in Chemical Engineering, Kai Fong's journey in the sector is both dynamic and inspiring.

Before joining SSMC as a Principal Engineer, he excelled in his career in a Test and Assembly company and IDM (Integrated Device Manufacturer) semiconductor backend environment, promoted from Senior engineer to Staff Engineer. In his last job, he had to navigate the complexities of a company-wide restructuring. Fortunately, with the right mindset, K.F. seized new opportunities offered by SSMC, and he was able to leverage his past engineering experiences and continues to thrive.

At SSMC, K.F.'s current responsibilities are critical and wide-ranging. He is deeply involved with the development and maintenance of process capabilities, manages production tool performance, and collaborates closely with cross-functional teams to investigate, troubleshoot and resolve product quality issues. This career change took on a new dimension requiring a rapid transition from a 300mm (about 11.81 in) fab backend process at his previous role to a more frontend-focused process at SSMC, a change that demanded adaptation and upskilling.

K.F.'s successful transition was supported by the Workforce Singapore's (WSG) Career Conversion Programme (CCP), a key component of SSMC's competency development framework, which ran from April to September 2023. Facilitated by SSMC's HR L&D team, the program curriculum equipped him with necessary skills, such as advanced SPC and Data Analytics, critical skills for thriving in the fast-paced semiconductor manufacturing environment.

Reflecting on his experiences, K.F. offers advice to those considering similar shifts: "Changes are always tough in the beginning. Don't give up and do your best!" His story is a testament to the power of resilience, adaptability, and continuous adult learning in successfully navigating challenging career transitions even within the industry.



The Career Conversion Programme (CCP), facilitated by Workforce Singapore (WSG), aids mid-career professionals in transitioning into new sectors with promising prospects. As a project partner, SSIA collaborates with WSG on the CCP to foster growth in Singapore's semiconductor ecosystem and industry, supporting skill development and employment opportunities in this vital sector.

JANET COLLYER:

# PIONEERING THE FUTURE OF SEMICONDUCTORS AND QUANTUM TECHNOLOGY



Janet Collyer

**J**anet Collyer stands as a formidable force in the semiconductor and quantum technology sectors, holding influential positions such as Senior Independent Director at EnSilica and Chair of the Board at Quantum Dice and Machine Discovery. Beyond her corporate roles, she shapes policy as a member of the UK government's Semiconductor Advisory Panel, guiding national strategies to enhance the semiconductor industry's resilience and innovation.

From an early age, Janet was captivated by the complexities of engineering, a passion ignited by her father, a civil engineer. "My father used to take us on his engineering site visits after school. Watching complex structures take shape was utterly fascinating," Janet recalls. Her academic journey at Girton College, Cambridge, laid a robust foundation, but it was the real-world challenges that honed her expertise.

Janet's entry into semiconductors was serendipitous, after being deemed 'unemployable' in the oil sector due to gender biases. Redirected to semiconductors, she embraced the role, carving out a niche as a leader in a male-dominated field. "I was the accidental semiconductor engineer, learning from generous colleagues who were mostly men," she shares.

At Quantum Dice, Janet oversees the development of pioneering technologies that are revolutionizing security and computation in the semiconductor industry. "Our work at Quantum Dice involves miniaturizing systems into chips using integrated photonics, which enhances the security and efficiency of embedded systems," Janet explains. Her leadership is driving the next wave of hardware accelerators that promise to reshape industries much like GPUs did for machine learning.

Janet is deeply committed to fostering diversity, equity, and inclusion (DEI) within the tech world. She actively mentors women engineers, guiding them to C-suite roles and advocating for DEI initiatives that attract and retain diverse talent. "The key is not just to attract diverse talent but to retain and nurture them into future leaders. We set clear metrics and celebrate successes to ensure our goals translate into tangible outcomes," Janet emphasizes.

Her leadership style—direct, detail-oriented, and structured—is tailored for interdisciplinary collaboration, ensuring every voice is heard during the development process.



Engineer at work in the Quantum Dice laboratory

"Diversity isn't just about fairness; it's about enriching our work and ensuring robust scrutiny before our products reach customers," Janet points out.

Reflecting on her inspirations, Janet cites Ada Lovelace as a pivotal figure, drawing parallels to her own journey in tech. "Ada Lovelace saw the potential of computers beyond mere calculation. Like her, I strive to innovate continually and persuade others to believe in unconventional paths," she says.

Janet Collyer's story is not just about overcoming barriers; it's about transforming challenges into opportunities for innovation and leadership in technology. Her enduring impact is a beacon for aspiring engineers, particularly women aiming to break new ground in the high-tech echelons of semiconductors and quantum mechanics.



Quantum Dice's QRNG product, VERTEX 1100



Quantum Dice's QRNG product, APEX 2100

