Applied Science Group

Chenming Hu

Academician

A Key Figure in the Advancement of Taiwan's Semiconductor Industry

Breaking Through Transistor Bottlenecks to Extend Moore's Law for Decades

Taiwan's semiconductor industry leads the world, and the contributions of Academician Chenming Hu to technology research and development cannot be overstated. Academician Hu, who previously served as the inaugural Chief Technology Officer of TSMC (Taiwan Semiconductor Manufacturing Company), also devoted an extensive period to teaching at the University of California, Berkeley. Under his leadership, his research team pioneered the development of the "FinFET" in the late 1990s, a groundbreaking innovation that successfully resolved the issues of chip overheating and miniaturization—challenges that even Intel struggled to conquer at the time. This significant advancement enabled Moore's Law to extend its influence for several more decades.

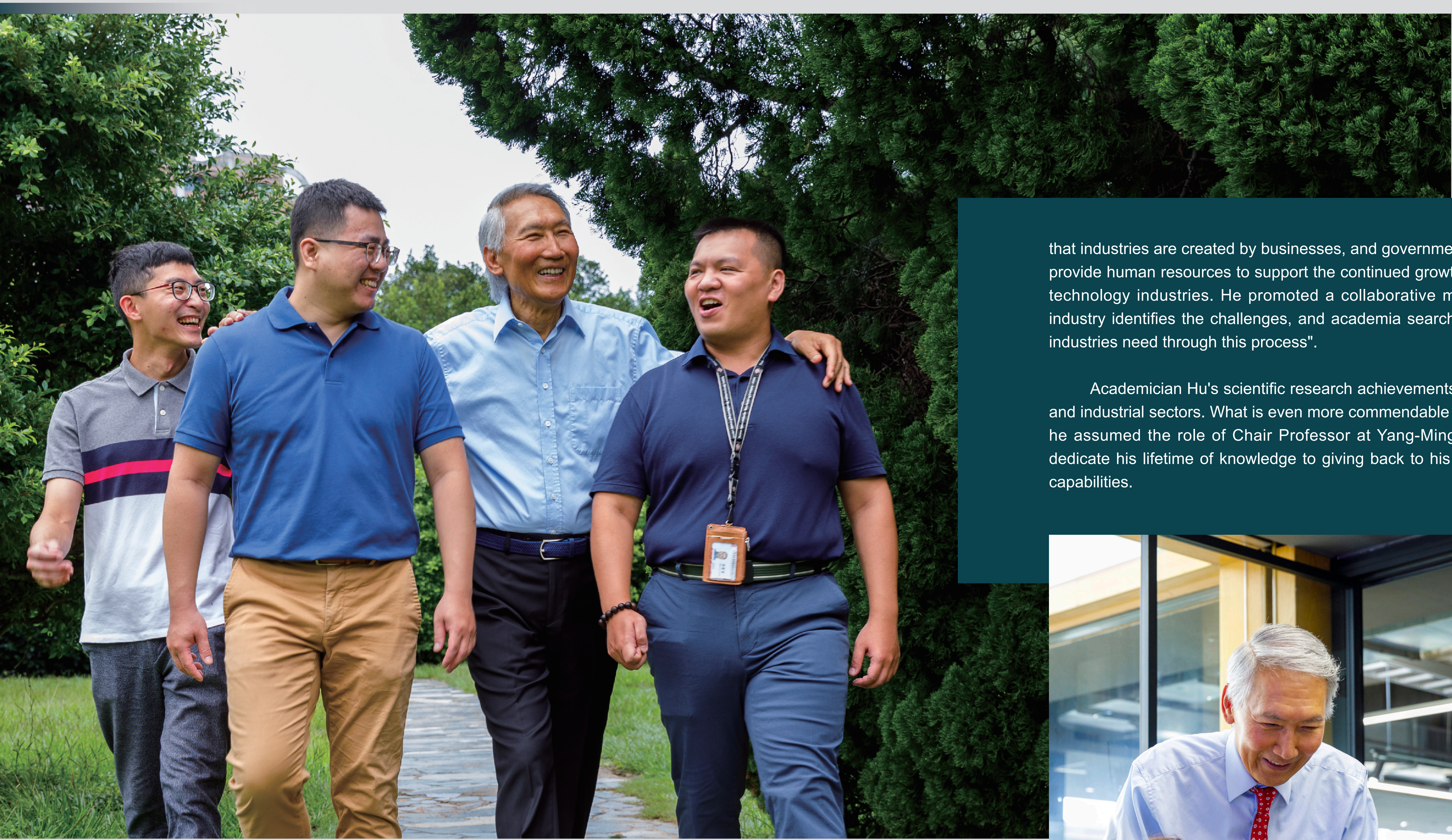
According to Hu, the key to their breakthrough was hard work, thinking deeply before solving a problem, and having innovative ideas. They then proposed two different approaches while maintaining confidence that they would find a solution. Both approaches succeeded.

Breaking away from conventional thinking, Hu revolutionized the 50-year-old planar transistor design by transitioning it into a three-dimensional structure, thereby allowing significant augmentation of transistor density. This involved an etching process to create vertical, thin, fin-like crystals, endowing FinFET with the capacity to combine high-speed performance with low power consumption. In 2001, Hu returned to Taiwan, where he pioneered the development of FinFET technology. Under his leadership, TSMC's research and development team continuously released leading-edge FinFET prototypes, surpassing international semiconductor giants like Intel and Samsung Electronics, establishing a foundation for Taiwan's future ascent to prominent position in the semiconductor industry.

After Intel took the lead in using FinFET technology in 2011, TSMC and Samsung followed suit. Today, electronic products such as the internet, computers, and smartphones rely on FinFET chips. Academician Hu transformed laboratory research into commercially valuable cutting-edge technology, significantly improving the quality of human life.

In recognition of his innovative contributions to the world, Academician Hu received the "National Medal of Technology and Innovation" from former U. S. President Barack Obama. In 2020, he was awarded the highest honor, the "IEEE Medal of Honor" by the Institute of Electrical and Electronics Engineers, and was hailed a "microelectronics visionary".

With his long-standing dedication to academic education, and his enthusiasm for technological research and cultivating talents, Hu authored five semiconductor textbooks, published over 1000 research papers, and received 150 U. S. patents. This earned him awards such as the IEEE Education Award, SRC Aristotle Award, and Berkeley Distinguished Teaching Award.



Over the past forty years, Hu nurtured many outstanding talents who excelled in their respective industries. He consistently encouraged young people to cultivate problem-solving skills and focus on research aimed at addressing real-world problems. He developed the BSIM software 30 years ago, an international standard transistor model, and has been continuously updating it and providing it royalty free for the semiconductor industry to design chips with cumulative value of a trillion US dollars.

Despite living abroad for many years, Hu tirelessly worked to advance Taiwan's semiconductor technology and nurture research talents. He contributed to the "Submicron Project" steering committee, which established Taiwan's first 8-inch wafer laboratory, provided long-term guidance to the National Nano Device Laboratory (NDL) of Taiwan's National Applied Research Laboratories, and assisted in leading collaborative project between the University of California and National Chiao Tung University. He advocated that industries are created by businesses, and governments should draw upon limited education resources to provide human resources to support the continued growth of the competitive information and communication technology industries. He promoted a collaborative model in which "government provides the funding, industry identifies the challenges, and academia searches for the solutions and cultivates the talents that industries need through this process".

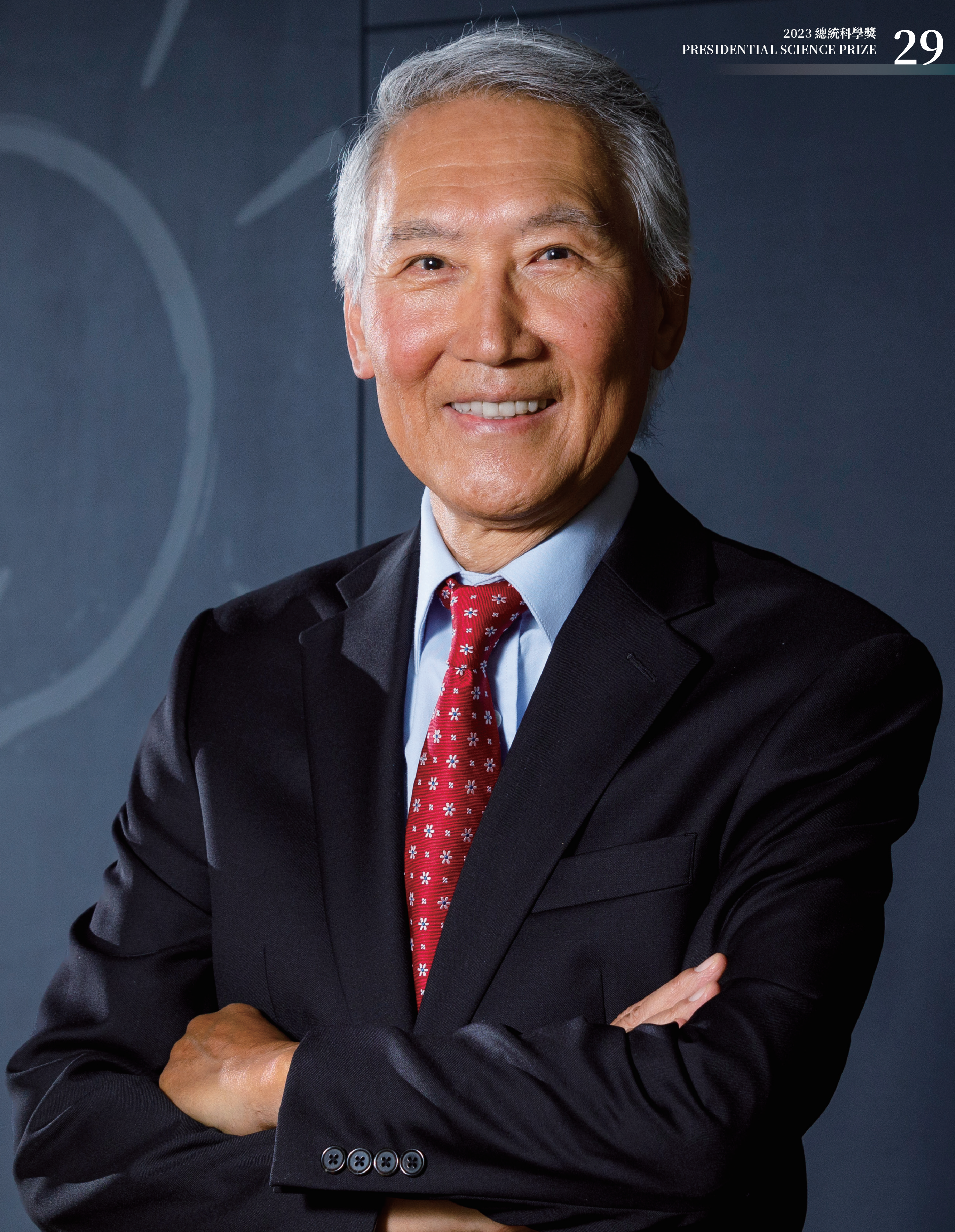
Academician Hu's scientific research achievements have had a profound impact on Taiwan's academic and industrial sectors. What is even more commendable is that, after retiring from the University of California, he assumed the role of Chair Professor at Yang-Ming Chiao Tung University in 2017. He continued to dedicate his lifetime of knowledge to giving back to his homeland and strengthening the nation's industrial capabilities.

Inventor of FinFET – Overcoming The Limits Of Semiconductors

Advancing Cutting-Edge Technology Research and Assisting Taiwan's Semiconductor Industry

Academician Hu, who grew up and was educated in Taiwan, came into contact with semiconductors in his senior year in college, and turned it into his lifelong passion. He invented the "FinFET" transistor, which successfully addressed the challenges of chip overheating and miniaturization, enabling the production of smaller and more efficient chips. Today's smartphones, the internet, artificial intelligence, etc. all use FinFET chips, which have a huge impact on human life.

Despite his long tenure as a professor at the University of California, Berkeley, Hu remained connected to his homeland. In 2001, he made a resolute decision to return to Taiwan and joined TSMC as its first Chief Technology Officer. During this period, he led his team to publish numerous advanced FinFET prototypes and patents, establishing TSMC's leading position in the international semiconductor industry. He is not only a leading figure in technology research but also an essential member of the academic community. He collaborated closely with Taiwan's industry and academia to enhance the country's research capabilities and international academic standing. He also participated in various national programs, and was a driving force behind Taiwan's semiconductor industry's innovative development.



胡正明院士後排右邊第二，
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Hu was born in Beijing in 1947. He relocated to Taiwan with his family during the war. In 1968, he graduated from National Taiwan University with a degree in electrical engineering. Subsequently, he pursued further studies in the United States, specializing in semiconductor technology.

Hu mentioned that his initial choice to enter the semiconductor field was somewhat serendipitous. During his senior year in college, the school invited Dr. Fang Fu, who was working at IBM in the United States and conducting research in semiconductor physics and devices, to serve as a visiting professor for a semester, during which he taught an introductory semiconductor course. Prior to this, there was no semiconductor course on campus. "I remember a professor lamenting that it took him decades to finally understand the 'vacuum tube', and now there is something called a 'transistor ' that seems even harder to figure out." said Hu with a smile.

Hu's curiosity and good performance in the course drew encouragement and praise from Dr. Fang. Consequently, when applying for scholarships to American universities, he decided to focus on the field of semiconductors. In 1970 and 1973, Hu earned his master's and doctoral degrees in electrical and computer engineering from the University of California, Berkeley. After graduating, he became an assistant professor at the Massachusetts Institute of Technology (MIT) and later returned to his alma mater, the University of California, Berkeley, in 1976, where he served until his retirement in 2010. He cultivated countless outstanding talents during this period and won the "Berkeley Distinguished Teaching Award" from the University of California, Berkeley for his exceptional teaching methods.

Forty Years of Teaching at Berkeley, Abundant Achievements in Research Papers and Patents

Throughout his four-decade career as an educator, Academician Hu authored five semiconductor textbooks, published over 1000 research papers, and secured 150 U. S. patents. His dedication to education earned him prestigious awards such as the IEEE Education Award, the SRC Aristotle Award, and the Berkeley Distinguished Teaching Award. His contributions to the industry were equally profound. Notably, the transistor computer model series he developed, known as the BSIM series, was selected as the international standard in 1996, serves as a communication tool between the semiconductor manufacturing sectors and the computer-based chip design sector. He generously made his research results freely available, and continues to release new versions annually. This contribution has generated over a trillion dollars in value for the semiconductor chip industry.

Among his extensive research achievements, his successful development of the "FinFET transistor" in 1999 garnered the most attention. Hu shared his original motivation for undertaking the research, saying, "I am a person who enjoys problem-solving. Conducting research is all about addressing real-world issues, and I take great pleasure in tackling these difficult challenges."

At the time, the biggest challenge faced by the semiconductor industry was excessive energy consumption t hat led to high chip temperatures. Intel's Chief Technology Officer issued a public warning, stating that "in the near future, the heat generated per unit area by semiconductor chips may surpass that of a nuclear reactor core." The reason was that transistor miniaturization had reached its physical limits, causing industry-wide panic with no apparent solutions. This prompted Hu to boldly venture in this direction.

Research funding is an essential component that enables scientific research to proceed. Academician Hu's research project obtained research funding from the "Defense Advanced Research Projects Agency (DARPA)" of the United States. At the same time, IBM and the United States Air Force Research Laboratory also received research funding. DARPA is an agency under the jurisdiction of the U. S. Department of Defense, responsible for developing advanced technologies. They have a long history of funding disruptive technology breakthroughs, including projects such as computer networks (Internet) and NLS (the first hypertext system).

Be bold in try to solve difficult real-need problems

In 1999, Hu and his research team developed the FinFET, which received a U. S. patent in 2000. He would go on to transform the traditional planar transistors, used for 50 years, into a three-dimensional structure, overcoming the physical limits of semiconductors. This innovation allowed for increased transistor density while raising speed and lowering power consumption. Hu candidly expressed, "The time spent in acquiring knowledge and skills far exceeded the time dedicated to actual problem-solving. It took less than three years from receiving the funding and commencing our research. The success can be attributed to having the right skills and opportunity and the collective effort of our team."

Academician Hu shared two factors that enabled him to perceive innovative directions that had escaped others' attention. ,"Firstly, it involves putting in hard work and thoroughly understand the subject matter. Sometimes, we need to provide alternative explanations or ask alternative questions instead of just following the herd. This allows us to generate fresh ideas while exploring all possible solutions in our minds. Secondly, it requires self-confidence, which allows us to take on challenges that even large corporations couldn't tackle."

"Confidence is accumulated over time." Hu believed that accumulating confidence is best achieved through small successes. Small achievements, recognition and praise build self-confidence, allowing individuals to tackle more significant challenges and accumulate more confidence.

Academician Hu strongly encourages young people to venture into problem-solving and to refrain from self-doubt before trying. "Many students believe their math skills are lacking, leading them to assume they cannot become good engineers or scientists. However, the reality is that as long as you possess curiosity and a willingness to learn, you can contribute to science and engineering and contribute to addressing global challenges. The key is recognizing your passion for problem-solving, being open to acquiring scientific and engineering knowledge, and cultivating confidence, as these are the pivotal elements in becoming a problem solver."

Academician Hu recounted, "My math skills were just average, yet I have always harbored a curiosity for unraveling the mysteries of things. For instance, when my father told me that the alarm clock rang because little people lived inside it, I remained skeptical. I opened up the alarm clock and figured out its inner workings." Academician Hu used his own experiences to exemplify that true ingenuity emerges from a blend of knowledge and a thirst for exploration.

He emphasized the importance of self-confidence and advised young individuals that while external praise is welcome, self-affirmation becomes crucial in the absence of such validation, as it provides the necessary motivation to progress.

Changing the Paradigm: From Planar to 3D

After the publication of the "FinFET" paper in December 1999, it immediately garnered significant attention from the semiconductor industry. Many companies, including Intel, invited Academician Hu to speak on the topic.

So, what is the "FinFET" (Fin Field-Effect Transistor)? In simple terms, it transformed the original 2D transistor structure into a 3D structure, resembling fish fins, hence the name "FinFET". Academician Hu and his team achieved this feat, earning him the title of the "Father of 3D Transistors".

The difference between horizontal and vertical can be likened to building houses in a city. Initially, you build flat houses (horizontal). However, as the city develops, you can't keep building flat houses; you need to construct tall buildings (vertical). Similarly, FinFET technology used an upward stacking approach to overcome the physical limits of semiconductors, allowing for increased transistor density.

The design of FinFET also addressed other limitations of traditional planar transistors. The fin-like structure improved current control, reducing leakage current and solving the problem of excessive chip power consumption and high temperatures. These advantages enabled semiconductor miniaturization, extending Moore's Law. It's worth noting that the FinFET 3D architecture also became the foundation for subsequent developments such as Gate-All-Around (GAA) nanowire transistors and nanosheet transistors, significantly impacting the semiconductor industry's long-term future.

Speaking of Moore's Law, Academician Hu mentioned contemplating similar questions during his elementary school days, "When a piece of paper is cut in half repeatedly, how small can it get? There must be a point where it can't be cut further."Perhaps, it was this curiosity that led him into the field of scientific research and ultimately to the development of microchip technology, overcoming the bottleneck of semiconductor technology.

The advent of FinFET brought significant changes to human society. Modern smartphones, regardless of the brand, use FinFET chips. Technologies like network communications, artificial intelligence (AI), and all advanced electronics require FinFET. Transistors are the fundamental building blocks of semiconductor technology, and the more transistors a chip has, the more tasks it can perform. Today, there are tens of billions of FinFET transistors in a single chip, enabling breakthroughs in AI and other fields that were once considered impossible.

TSMC's First Chief Technology Officer: Advancing Taiwan's Semiconductor Industry

Although FinFET gained international attention after its publication, it initially didn't draw the attention of the Taiwanese government or Taiwanese industries. Academician Hu, who grew up and received his education in Taiwan, made a resolute decision to return and contribute to his homeland. In the spring of 2001, after returning to Taiwan, he happened to meet TSMC's Chairman, Dr. Morris Chang. He volunteered his services and expressed his willingness to work in Taiwan for a period of two years. He mentioned, "At the time, Chairman Chang called the executive in Hsinchu to arrange an interview with me. After our discussion, the details were settled on the same day – they even created a new position for me called the 'Chief Technology Officer' of TSMC."

At that time, Taiwan's academic community was actively seeking the involvement of Academician Hu. However, he believed that while education was undoubtedly important, its effect is felt over a long-term. The most pressing concern was helping Taiwan companies to take the lead. Failing to do so would make it even more challenging for Taiwan's semiconductor industry to thrive in the future. Consequently, he made the decision to enter the industry.

Academician Hu specified that Chairman Chang entrusted him with two critical tasks. Firstly, he was charged with extending the time horizon of technological development. His mandate was not merely to catch up with foreign technologies but to surpass them. The FinFET technology emerged as a remarkable opportunity in this context. Under his guidance, TSMC's research team consistently unveiled pioneering FinFET prototypes, including 25nm (2002), 10nm (2003), and 5nm (2004). The second task was to optimize the patent portfolio. He recognized that the problem lay not in the quantity of patents but in their quality. To address this, he initiated internal educational programs, delivered lectures, and bolstered the patent acumen of the research team. Moreover, he established a patent management department entirely staffed by engineers.

Academician Hu underscored that patents should not only stand the test of legality but should also exhibit high utility. He emphasized, "FinFET patents are not restricted to singular applications.

Because FinFET is versatile, one can contemplate its integration with other technologies. This synergy is indispensable, and as long as the integration represents a non-trivial innovation, it qualifies as a valuable patent."

After over three years at TSMC, Academician Hu played a crucial role in the early adoption of FinFET technology and patents, laying a solid foundation for competition with top international semiconductor companies. He also helped establish a career advancement system for technical personnel at TSMC, one of the foundations for TSMC's long-term development. In 2011, Intel became the first to employ 22nm FinFET technology, hailing it as "the most radical change in semiconductor technology in 50 years". Subsequently, TSMC introduced 16nm and 14nm FinFET technology and maintained global leadership with 12nm, 10nm, 7nm, 5nm, and 3nm FinFET technologies.

In 2004, Academician Hu was elected the first Academician of Academia Sinica who works at the Hsinchu Science Park. Following the successful completion of his assignment at TSMC, he returned to the University of California, Berkeley, to continue his teaching career.

Even back in the United States, Academician Hu remained deeply connected to Taiwan. He continued to collaborate closely with Taiwan's academic, industry, and research sectors, co-publishing dozens of academic papers, and working tirelessly to enhance Taiwan's semiconductor research capabilities and international academic standing.

Industry-Academia Collaboration: Industry Poses Questions, Academia Provides Answers

process for someone from the academic world. He said, "Teaching and application go hand in hand. You can take your knowledge and apply it in real applications. Industry experience also benefited my teaching. Teachers who collaborate with the industry are usually the best teachers in students' eyes because students want to learn practical knowledge and do useful things. When teachers bring industry insights and experience to students, it significantly enhances their learning interest and motivation."

Regarding industry-academia collaboration, Academician Hu acknowledged that most innovation occurs in the industry. He explained, "Because the industry knows where the problems are, but they often lack the manpower to solve problems that will only become pressing three to five years later. Through industry-academia collaboration, students can access the industry knowledge about problems needing solutions, while the industry gains talent for mid to long term research."

Academician Hu believes that the best approach to industry-academia collaboration is for "the industry to pose questions, the government to provide funding, and academia to search for solutions." The process of problem-solving also serves the government's goal of supporting education and nurturing talent. "Nurturing talent is not just about studying; it's also about learning how to solve problems, and industry-academic collaboration is the best training ground."

"Industry and academia are interdependent. People often say that the reason why the San Francisco Bay Area's electronics and information technology industry developed well was because of prestigious schools like Stanford and Berkeley. In fact, it might be the other way around. Why are Stanford and Berkeley top universities? Because there is a good industry presence there."Hu went on to point out that the University of Washington was not initially a top-ranking school, but due to the presence of the headquarters of Microsoft and Amazon in Seattle, the University of Washington's computer science department rose to the top four in the United States. Similarly, the University of California, San Diego, gained global recognition in high-frequency electronics because Qualcomm was located in the city. Taiwan's engineering universities can certainly become world-class, by focusing on closer collaboration with local industries. The government should also recognize that education directly influences future economic development, and should seize the favorable opportunities rather than insisting on uniform development across different departments or even taking resources from strength to prop up the weak.

Market demand to determine the cultivation of industry

Academician Hu, who has long resided in Silicon Valley, consistently provided service to Taiwan. This includes serving as the inaugural Executive Yuan National Chair Professor in 1985, where he taught advanced semiconductor courses at the Industrial Technology Research Institute. In 1992, he served as a steering committee member of the National Submicron Project, playing a role in establishing Taiwan's first 8-inch wafer experimental factory. From 2009 to 2014, he conducted monthly remote conferences with researchers at the National Nano Device Laboratories (NDL, now named TSRI), offering guidance and mentoring to researchers to facilitate their achievements.

In 2011, Hu collaborated with Yang Ming Chiao Tung University to jointly execute a five-year plan supported by the Ministry of Science and Technology for an international top-notch R&D center, integrating researchers from the University of California, Berkeley, and the Chiao Tung University research team. After retiring from the University of California, Hu began serving as a Lifetime Chair Professor at Yang Ming Chiao Tung University in 2017. The subsequent year, he personally oversaw the Ministry of Education and National Science Council-supported research center project, known as the Center for Semiconductor Technology Research. Under Academician Hu's leadership, the Yang Ming Chiao Tung University team has dedicated itself to advanced semiconductor technology research and development, achieving numerous world-class results while nurturing many exceptional research talents.

Regarding the global shortage of semiconductor industry talent, Academician Hu believes that the semiconductor industry requires a skilled workforce. He contends that the government should refrain from disproportionately allocating limited educational resources to create new industries. Instead, he argues that industries are forged by the private sector, not the government. The government's primary responsibility should be to provide human resources to support thriving industries capable of creating jobs, foreign exchange, and economic growth.

"The U. S. government provides research universities with a lot of funding, not necessarily for breakthrough research results but to cultivate good talent for the country and industry. Everything in American schools is determined by market supply and demand. Schools can increase the number of students because of the manpower need of a particular industry," he pointed out. As an example, he cited the University of California, Berkeley, where he taught. From 2009 to 2019, the number of students taking computer science courses increased from 3,000 per year to 10,000 per year, more than tripling. Not only did the engineering students take such courses, but students from humanity and other colleges also eagerly enrolled in programming courses. The government and schools not only did not restrict this but also assisted professors in increasing the number of students in their classes several times or even tenfold.

Academician Hu also mentioned that during his tenure as Chief Technology Officer at TSMC, many in the government considered all "manufacturing" to be low-tech, and underestimated the value of the semiconductor and technology outsourcing industry. However, TSMC is a semiconductor foundry, and is TSMC not high-tech enough? Or not innovative enough? "Sometimes the government may be misled by a few terms. In fact, as long as an industry can create added value, provide high-paying job opportunities, and comply with the law to protect the environment, it is worth the government's support."

He suggests that the Taiwanese government and government research organizations need to rethink their strategies. Taiwan already possesses large, internationally competitive private enterprises. Consequently, government strategies should evolve beyond the traditional methods of doing research for industries and should concentrate on educating talent that meet the needs of current industry requirements. The responsibility for technological innovation and research development should be delegated to the industry. At the same time, large govenment research organizations should adopt a new approach. Rather than competing for talent with the industry and universities, they should focus on releasing talent into the industry. In doing so, they will infuse renewed vigor into the national economy.

'The semiconductor industry will continue to be a mainstream industry in the future. If young people are interested, they should not worry about their career prospects. ' Academician Hu pointed out that in the digital age, the world relies on semiconductors and electronics. Whether it's the internet, artificial intelligence, or other fields, all of them require digital processing, which depends on semiconductors.

He also advised young people to have confidence in themselves, cultivate curiosity, be eager to learn new things, and be willing to work hard. "One of the challenges faced by the American semiconductor industry is that young people often perceive technology as difficult or believe that they are unsuitable for careers in technology due to their lack of mathematical prowess. In reality, as long as they are willing to work hard, and enjoy problem-solving, they can contribute to the technology industry and society."

Nanomanufacturing is the Key Advancing Semiconductor Research

In 2016, former U. S. President Barack Obama awarded the 'National Medal of Technology and Innovation' to Academician Hu at the White House, recognizing his outstanding contributions to the world through technological innovation. That same year, he also received the title of Academician from the Industrial Technology Research Institute. In 2020, the Institute of Electrical and Electronics Engineers (IEEE) awarded him its highest honor, the "IEEE Medal of Honor", hailing him as a "semiconductor visionary".

Throughout his life, Academician Hu dedicated himself to research in electronic science. He acknowledged that every material has its limits, and Moore's Law (which states that the number of transistors on a chip approximately doubles every two years) would eventually reach its conclusion. Both academia and industry have been attempting to alter transistor structural designs, materials, and physical principles to prolong Moore's Law as much as possible.

"The innovation in 3D FinFET lies in the fact that whether we make the transistor thinner or stack it higher, there is still room for advancement. I firmly believe that the future of the semiconductor industry will continue to progress in these two directions", emphasized Academician Hu. He stressed that technological development is continually evolving, and semiconductor materials will evolve over time, possibly incorporating more non-semiconductor materials onto chips. However, regardless of the materials used, it is inevitable that require many intricate and complex structures. Therefore, nanomanufacturing is the core technology of the semiconductor industry, and this is one of Taiwan's strengths. Taiwan Semiconductor Manufacturing Company (TSMC) will not only continue to perform well but will also explore new stages to perform on.

Passion for Academics and Life, Commitment to Giving Back to Society

Throughout his journey, Academician Hu not only benefited humanity through scientific research but also made significant contributions in other ways. For example, Dr. Chenming Hu and his wife, Margaret Hu, donated one million dollars to establish the 'Dr. Chenming and Margaret Hu Medical Center' in the Asian Health Services (AHS) in Oakland's Chinatown. This building was renovated from the original AHS administration building and is now equipped with state-of-the-art pediatric and family care facilities. Asian Health Services was established in 1974 as a volunteer-run clinic. Over the past few decades, the center's patient population has grown to tens of thousands, with 95% being low-income children and families. The expansion of medical facilities will enable better healthcare services for more patients.

Dr. Chenming Hu's philanthropic spirit comes from a long-standing family tradition. His father had established scholarships in China. His two sons, Raymond Hu and Jason Hu, continue this tradition. Raymond has contributed many beautiful paintings to the medical center, while Jason has engaged in philanthropic medical work in Ghana, West Africa. It is worth mentioning that the City of Oakland, in appreciation of the contributions of Dr. Chenming Hu and Margaret Hu to the community, designated August 31, 2018, as 'Dr. Chenming and Margaret Hu Day. '

Academician Hu not only engages in academic research, he also has diverse interests and leads a vibrant life.

He utilizes his spare time to explore activities such as sailing, and scuba diving, and often shares these special moments with his sons. He even treked to the Mount Everest base camp. Hu's sister, Hu Haiyan, mentioned in a media interview, "My brother is not only a science expert, he multi-talented. Since childhood, he wrote speeches for his siblings when they participated in competitions. He likes poetry, music, and painting." She further recalled how her brother patiently taught and creatively explained complex problems whenever they encountered academic difficulties in their youth. "No matter how complex the problem, after his explanation, it would become simple and clear." The talent for mentoring was evident in Academician Hu from a young age.

With numerous accolades, Academician Hu looks back on his journey with deep gratitude. Every step of the way, from Dr. Fang Fu leading him into the semiconductor field, to the education he received at National Taiwan University and the University of California, and the teamwork of his students and colleagues, to his entry into the industry at TSMC, has led him to fulfill his dream of giving back to society. He is grateful for his parents' education, which included encouragement and praise, and how it helped him to build self-confidence. The support and companionship of his family allowed him to fully engage in research and innovation.

Academician Hu particularly emphasized the importance of "self-confidence" in his life, stating, "The foremost task for young people is to build self-confidence. When someone genuinely appreciates you, accept it willingly. Even if you feel that someone's praise is reserved, try to believe it. In any case, seize any opportunity to boost your self-confidence. Even if no one praises you, encourage yourself." Hu has emphasized the importance of self-affirmation on many occasions. He says, "Believe in yourself, so that you have the strength to solve more difficult challenges."

Academician Hu, who has achieved numerous world-class accomplishments, passionately stated, "Take from society and give back to society. As long as there is an opportunity, I will continue to contribute to industry and academia."

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