

**INDUSTRY 3.5 AS HYBRID STRATEGY EMPOWERED BY AI & BIG DATA ANALYTICS
AND COLLABORATIVE RESEARCH WITH MICRON TAIWAN FOR SMART
MANUFACTURING**

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ABSTRACT

The paradigm of global manufacturing is shifting as leading nations proposing next phase of industrial revolution for Industry 4.0 by Germany and reemphasizing the importance of advanced manufacturing such as AMP in USA. Driven by Moore's Law, semiconductor manufacturing is one of the most complex industries for continuous migration of advanced technologies for manufacturing excellence. Micron Technology is a world leading producer of semiconductor memory and computer data storage that has established one of her largest manufacturing bases in Taiwan through a number of acquisitions of local fabs as well as investments of new fabs. Industry 3.5 was proposed as a hybrid strategy between the best practice of the existing Industry 3.0 and to-be Industry 4.0 to address fundamental objectives for smart manufacturing while employing artificial intelligence and big data analytics as means objectives for manufacturing intelligence solutions. This speech will introduce Industry 3.5 and use a number of empirical studies under the existing infrastructure for validation. Furthermore, collaborative research with Micron for smart manufacturing will be used to illustrate our continuous efforts employing artificial intelligence, big data analytics, optimization, and intelligent decision for smart manufacturing and digital transformation. This talk will conclude with discussions of the implications of Industry 3.5 as alternative for Industry 4.0 to empower humanity in the ongoing industrial revolution.

AUTHOR BIOGRAPHY

CHEN-FU CHIEN is Tsinghua Chair Professor in the Department of Industrial Engineering & Engineering Management, National Tsing Hua University (NTHU), Hsinchu, Taiwan. He is also a Micron Chair Professor sponsored by Micron Foundation, USA. Dr. Chien is the Director of Artificial Intelligence for Intelligent Manufacturing Systems (AIMS) Research Center, which is one of four national AI centers sponsored by Ministry of Science & Technology (MOST), Taiwan. He is the founder and chairing professor for the Decision Analysis Laboratory (DALab), the NTHU-TSMC Center for Manufacturing Excellence, and the Semiconductor Technologies Empowerment Partners Consortium (STEP Consortium), Taiwan. He received B.S. with double majors in Industrial Engineering and Electrical Engineering with the Phi Tau Phi Honor from NTHU in 1990. He received M.S. in Industrial Engineering and Ph.D. of Decision Sciences and Operations Research at UW-Madison, in 1994 and 1996, respectively. He was a Fulbright Scholar in the Department of Industrial Engineering and Operations Research, UC Berkeley, from 2002 to 2003. From 2005 to 2008, he had been on-leave as the Deputy Director of Industrial Engineering Division in Taiwan Semiconductor Manufacturing Company (TSMC). He received the Executive Training of PCMPCL from Harvard Business School in 2007. He was a Visiting Professor at the Institute for Manufacturing, Cambridge University (sponsored by Royal Society, UK), Visiting Professor in Beijing Tsinghua University (sponsored by Chinese Development Foundation), Visiting Professor in Waseda University (sponsored by Japan Interchange Association Young Scholar Fellowship), and Visiting Professor in Tianjin University and Zhejiang University, China. His research efforts center on decision analysis, big data analytics, modeling and analysis for

Chien

semiconductor manufacturing, manufacturing strategy, and manufacturing intelligence. Dr. Chien and his DALab Associates have conducted in-depth university-industry collaborative research projects with the leaders of different industrial segments to validate developed solutions and served as senior consultant for leading companies including TSMC, MediaTek, Delta, and AUO. Dr. Chien has received 12 USA invention patents on intelligent manufacturing and published 6 books, more than 170 journal papers (1 HiCi) and 12 case studies in Harvard Business School. He has been invited to give keynote speech in various conferences including APIEMS, C&IE, FAIM, IEEE, IEEM, IML, ISMI, ISSM, leading universities and international companies worldwide. He is a Fellow of APIEMS, CIIE, and CSMOT. Dr. Chien received the National Quality Award, the Executive Yuan Award for Outstanding Science & Technology, three Distinguished Research Awards and Tier 1 Principal Investigator (Top 3%) from MOST, Distinguished University-Industry Collaborative Research Award from the Ministry of Education, University Industrial Contribution Awards from the Ministry of Economic Affairs, the TECO Award, the 2011 Best Paper Award of IEEE Transactions on Automation Science and Engineering, and the 2015 Best Paper Award of IEEE Transactions on Semiconductor Manufacturing. He is a member of the Board of Directors for BoardTek (TWSE: 5349) and Uniflex (TWSE: 3321) and Just College UNISON Foundation.