2020 ICBEM
International Conference on Business, Economics and Management in the Digital World

Proceeding

October 5-7, 2020
Taipei, Taiwan

Edited by

Fen-May Liou
Kuei-Hsien Chen

Organizer
Chihlee University of Technology

Co-Organizer
Institute of Business & Management,National Chiao Tung University
Department of Applied Economics,Fo Guang University

Sponsorship
Taiwan Association of Environmental and Resource Economics

Conference Proceeding

2020 International Conference on Business, Economics and Management in the Digital World (2020 ICBEM)

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Journal of Management and Systems

Corporate Management Review

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Assistant Professor Ming-Jia Hsu, Ph.D.

Assistant Professor Ro-Land Gau, Ph.D.

Assistant Professor Shun-Chieh Chang, Ph.D.

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2020 International Conference on Business, Economics and Management in the Digital World

SCHEDULE - DAILY PLANNER

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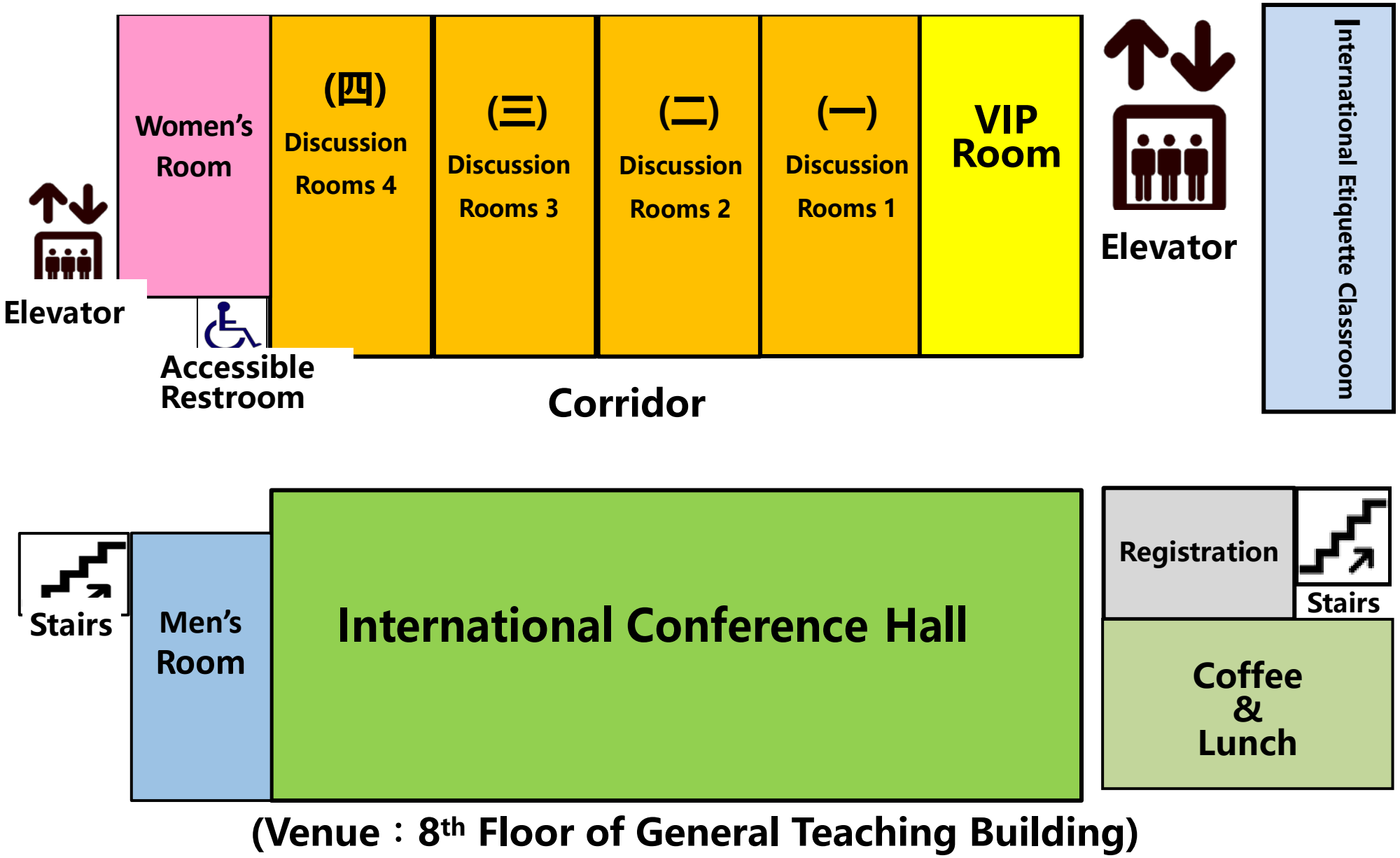
9:00~09:30 (30 minutes)		Registration **(8th Floor of General Teaching Building)**	City Tour
09:30-09:45 (15 minutes)		Opening Ceremony **(8th Floor of International Conference Hall)**	
09:45-10:30 (45 minutes)		Keynote Speech Dr. Chen-Fu Chien Industry 3.5 as a Hybrid Strategy Empowered by AI & Big Data Analytics for Smart Manufacturing and Digital Transformation **(8th Floor of International Conference Hall)**	
10:30-10:50 (20 minutes)		Coffee Break	
10:50-12:10 (80 minutes)		Session I **(8th Floor of Discussion R1,R2,R3)**	
12:10-14:00 (110 minutes)		Lunch	
14:00-16:00 (120 minutes)	Registration **(8th Floor of General Teaching Building)**	Session II **(8th Floor of Discussion R1,R2,R3)**	
16:00-16:20 (20 minutes)		Coffee Break	
16:20-16:40 (20 minutes)		Best Paper Award **(8th Floor of International Conference Hall)**	

Deployment layout



(Venue：8th Floor of General Teaching Building)

Session Schedule (R1)

Date: 10/6 Tuesday	**Time: 10:50-12:10**	**Session Room: Room 1**

Session Topic: Tourism

Session Chairs: Chia-Ning Chiu

1.	Paper Title:	The Impact of Country Image and Travel Constraints on Revisit Intention: The Case of Thai Tourists Visiting Taiwan	**Paper ID: 1038**
	Author(s):	Chin-Hsiang Tsai, Shih-Hao Liu, Su-Juan Li	
	Commentator:	Jen-Yao Lee	
2.	Paper Title:	The Disaggregate Productivity Change in Taiwan's International Tourist Hotels	**Paper ID: 1026**
	Author(s):	Chiang-Ping Chen	
	Commentator:	Chia-Ning Chiu	
3.	Paper Title:	A Study on the Trends of Global and Asian Cruise Industry Development and Challenges of COVID-19 Pandemic	**Paper ID: 1039**
	Author(s):	Li-Ying Lin, Chang-Ching Tsai, Jen-Yao Lee	
	Commentator:	Chiang-Ping Chen	
4.	Paper Title:	Do National Parks or Different levels of Scenic Areas Drive Lodging Business Performance?	**Paper ID: 1015**
	Author(s):	Chiang-Ping Chen, Chia-Ning Chiu, Ming-Chung Chang	
	Commentator:	Shih-Hao Liu	

Session Schedule (R2)

Date: 10/6 Tuesday	**Time: 10:50-12:10**	**Session Room: Room 2**

Session Topic: Sustainable Development

Session Chairs: Yung-Ho Chiu

1.	Paper Title:	Government Debt and Fiscal Execution Efficiency	**Paper ID: 1016**
	Author(s):	Yung-Ho Chiu, Kuei-Ying Huang, Tai-Yu Lin	
	Commentator:	Liang-Chun Lu	
2.	Paper Title:	Food Efficiency of European Union Countries by Considering Ammonia Emission and Food Wastes	**Paper ID: 1024**
	Author(s):	Liang-Chun Lu, Shih-Yung Chiu, Yung-Ho Chiu, Tzu-Han Chang, Kuei-Ying Huang	
	Commentator:	Kuei-Ying Huang	
3.	Paper Title:	The Assessment of Energy, Health Efficiency and Total Factor Dynamic Overall Efficiency with OECD Economies	**Paper ID: 1013**
	Author(s):	Chih-Yu Yang, I-Fang Lin, Ching-Cheng Lu	
	Commentator:	Liang-Chun Lu	
4.	Paper Title:	Dynamic linkages among Economic Development, Environmental Pollution and Human health in Chinese	**Paper ID: 1027**
	Author(s):	Ying Li, Tai-Yu Lin, Yung-Ho Chiu	
	Commentator:	Ching-Cheng Lu	

Session Schedule (R3)

Date: 10/6 Tuesday	**Time: 10:50-12:10**	**Session Room: Room 3**

Session Topic: Management

Session Chairs: Amon Lee

1.	Paper Title:	Prioritizing Value Measures on Smart Buses by AHP	**Paper ID: 1031**
	Author(s):	Chia-Hsiang Wang, Chung-Chu Liu, Yu-Han Chin	
	Commentator:	Ma Shew Lan alias Zoya	
2.	Paper Title:	The Factors of Users Trust in Online Customer Reviews on Amazon.com	**Paper ID: 1032**
	Author(s):	Li-Fang Shen, Shu-Fen Chiou	
	Commentator:	Ming-Chiang Hu	
3.	Paper Title:	Customer Loyalty: A Study on Women's Beauty Salon in Kolkata, India	**Paper ID: 1036**
	Author(s):	Ma Shew Lan alias Zoya, Amon Lee	
	Commentator:	Chia-Hsiang Wang	
4.	Paper Title:	Constructing a Smart Medical Nutrition Consultation App system -As Example C.G.M.F.	**Paper ID: 1037**
	Author(s):	Ming-Chiang Hu	
	Commentator:	Li-Fang Shen	

Session Schedule (R1)

Date: 10/6 Tuesday	**Time: 14:00-16:00**	**Session Room: Room 1**

Session Topic: Marketing

Session Chairs: Sungjun (Steven) Park

1.	Paper Title:	The Influence of Social Media Advertising on User Purchase Intention	**Paper ID: 1049**
	Author(s):	Chien-Wen Chen, Wen-Shin Liu, Shu-Fen Huang	
	Commentator:	Chih-Ming Tsai	
2.	Paper Title:	Film Tourism in Travel Decision-making: The Roles of Authenticity, Memorable Tourism Experience, and Celebrity Involvement	**Paper ID: 1025**
	Author(s):	Chi-Feng Lo, Chu-Hwa Yan, Fang-Ping Chen	
	Commentator:	Shu-Fen Huang	
3.	Paper Title:	The Effect of Perceived Quality and Brand Image on Green Purchase Intention for Tesla in Taiwan	**Paper ID: 1029**
	Author(s):	Chih-Ming Tsai, Hong-Ye Wang	
	Commentator:	Sungjun (Steven) Park	
4.	Paper Title:	More crowed? More violent? The physical factors influencing customer misbehaviors	**Paper ID: 1043**
	Author(s):	Jia-Jen Ni, Hsu-Ju Teng, Chi-Feng Lo	
	Commentator:	Chih-Ming Tsai	
5.	Paper Title:	The Effect of Perceived Quality and Customer Satisfaction on Purchase Intention in the Cinema Industry	**Paper ID:1030**
	Author(s):	Chih-Ming Tsai, Jeni Liu	
	Commentator:	Chi-Feng Lo	
6.	Paper Title:	The Importance of Perceived Consistency to Increase Consumers' Adoption toward AI Robots: Korean Case	**Paper ID: 1012**
	Author(s):	ChunTing (David) Tung, Sungjun (Steven) Park	
	Commentator:	Chih-Ming Tsai	

Session Schedule (R2)

Date: 10/6 Tuesday	**Time: 14:00-16:00**	**Session Room: Room 2**

Session Topic: Financial Markets and Regulation

Session Chairs: Jin-Li Hu

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	Author(s):	Matthew C. Chang	
	Commentator:	Kuang-Chin Chen	
2.	Paper Title:	Patent Informatics Contributes Investment In China Stock Market	**Paper ID: 1022**
	Author(s):	Yu-Jing Chiu, Kuang-Chin Chen, Hui-Chung Che	
	Commentator:	Te-Wei Chiang	
3.	Paper Title:	Quantitative Option Trading Strategies based on Fourier Transform	**Paper ID: 1028**
	Author(s):	Te-Wei Chiang, J-P Lin	
	Commentator:	Matthew C. Chang	
4.	Paper Title:	Financial Crises: Transition Drivers for Uncovering Stock Markets Instability	**Paper ID: 1011**
	Author(s):	Alessandro Spelta, Nicol`o Pecora, Andrea Flori, Fabio Pammolli	
	Commentator:	None (Virtual Presentation)	
5.	Paper Title:	An Analysis of a Feed-in Tariff in Japan’s Electricity Market	**Paper ID: 1033**
	Author(s):	Satoshi Honma, Jin-Li Hu	
	Commentator:	None (Virtual Presentation)	

Session Schedule (R3)

Date: 10/6 Tuesday	**Time:14:00 -16:00**	**Session Room: Room 3**

Session Topic: Economics

Session Chairs: Christos Michalopoulos

1.	Paper Title:	Does Good Corporate Social Responsibility Lead to Better Corporate Performance in the Global Retail Industry?	**Paper ID: 1045**
	Author(s):	Thu Huong Tran, Wen-Min Lu	
	Commentator:	Oyunchimeg Ganbaatar	
2.	Paper Title:	New avenues for brand extension: How does Apple Watch signify a change in paradigm in the way Apple engages with different industries?	**Paper ID: 1019**
	Author(s):	Nick Vasiljevic	
	Commentator:	Christos Michalopoulos	
3.	Paper Title:	Does cross culture behavior have an impact on multinational enterprise performance? Empirical Study of Mining Industry	**Paper ID: 1044**
	Author(s):	Oyunchimeg Ganbaatar, Kuo-Cheng Kuo	
	Commentator:	Thu Huong Tran	
4.	Paper Title:	Kernel Density Estimation of Bivariate Copulas: A Review and an Application to Debt and GDP Growth Dependency	**Paper ID: 1035**
	Author(s):	Christos Michalopoulos	
	Commentator:	Nick Vasiljevic	
5.	Paper Title:	The Welfare Effect of Vertical Licensing in the Presence of Complementary Inputs	**Paper ID: 1047**
	Author(s):	Yen-Ju Lin, Yan-Shu Lin, Pei-Cyuan Shih	
	Commentator:	Ming-Chung Chang	
6.	Paper Title:	The Dynamic Performance of Energy Use in ASEAN Plus Six Countries	**Paper ID: 1020**
	Author(s):	Chiang-Ping Chen, Ming-Chung Chang	
	Commentator:	Yen-Ju Lin	

Keynote Speech

Industry 3.5 as a Hybrid Strategy Empowered by AI & Big Data Analytics for Smart Manufacturing and Digital Transformation

Speaker：Chen-Fu Chien, Ph.D.

(Tsinghua Chair Professor &
Micron Chair Professor)

Industry 3.5 as Hybrid Strategy Empowered by AI & Big Data Analytics for Smart Manufacturing and Digital Transformation

Chen-Fu Chien, Ph.D.
Tsinghua Chair Professor & Micron Chair Professor
National Tsing Hua University (NTHU), Hsinchu, Taiwan
Director, Artificial Intelligence for Intelligent Manufacturing Systems (AIMS) Research Center, Ministry of Science & Technology (MOST), Taiwan
Director, AIMS Fellows Executive Master Program, NTHU
Director, Intelligent Manufacturing and Circular Economy Research Center, NTHU
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One earth is not enough!? Inter- vs Intra-country Gaps

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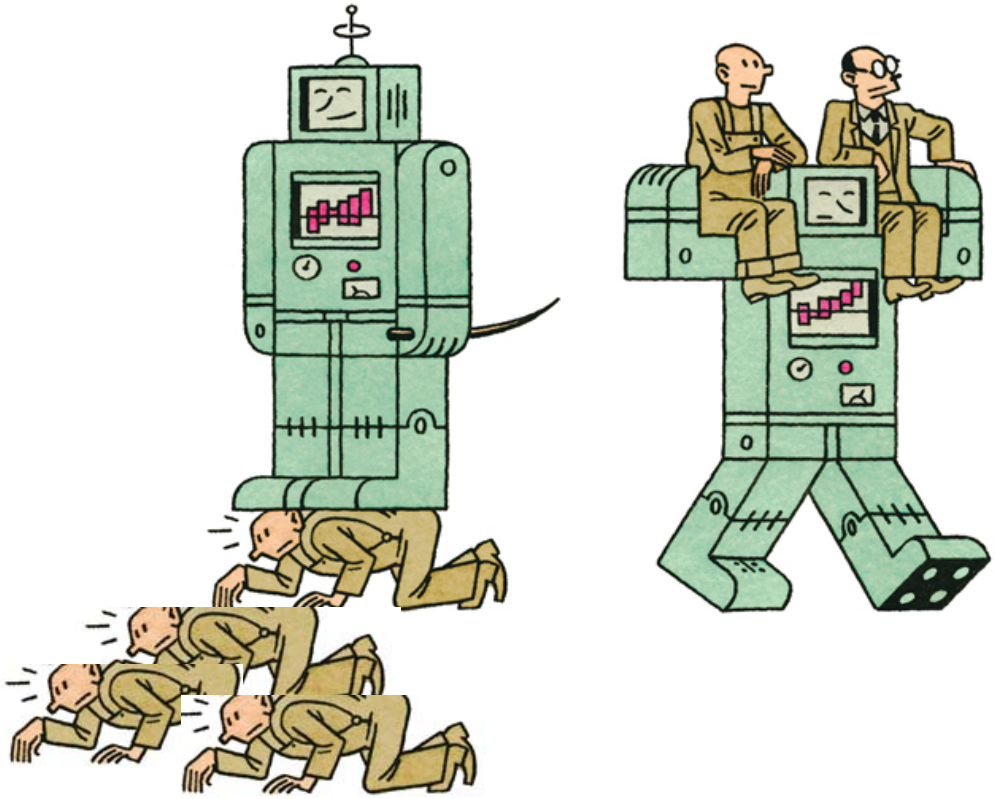
Increasing Digital Gaps owing to AI, Big Data, Computing..



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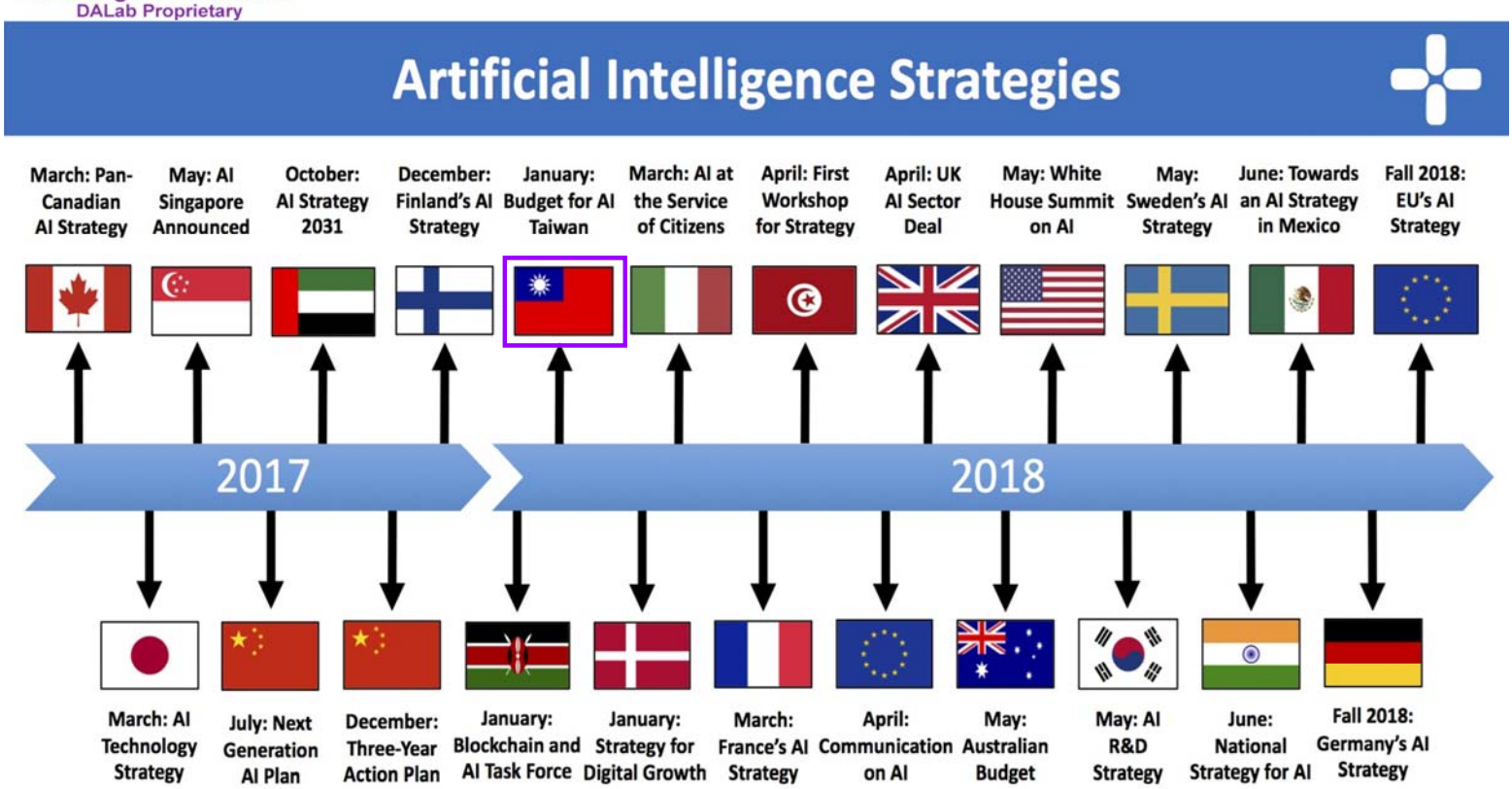
Worldwide Initiatives for AI/ Industry 4.0 for Smart Manufacturing



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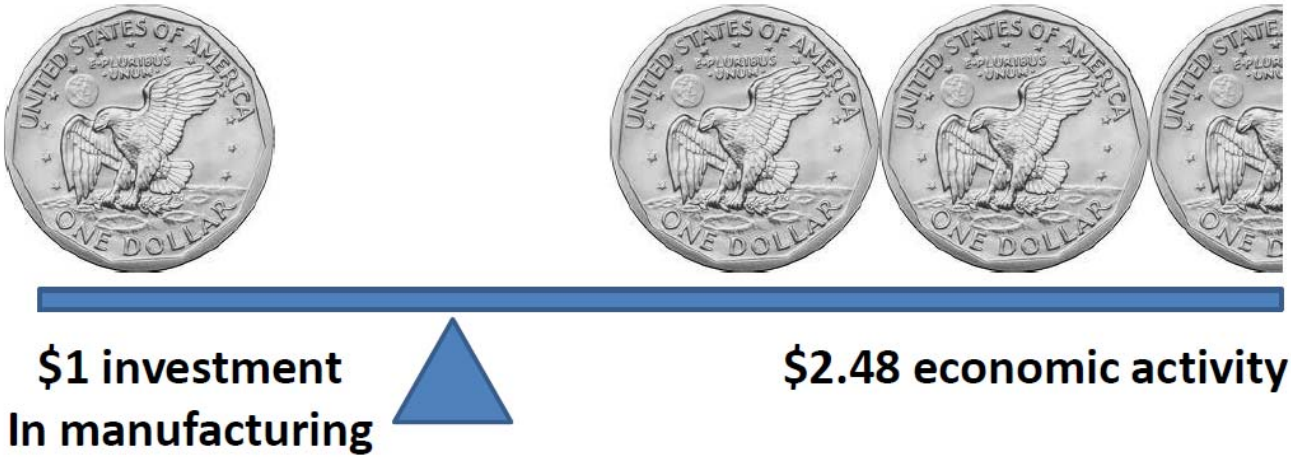
Leading Nations Return Manufacturing

Advanced Manufacturing Partnership (AMP) of USA to invest in emerging technologies to create high quality jobs and enhance USA global competitiveness.

248% ROI (Return on Investment)



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Four Phases of "Industrial Revolution"

Industrie 4.0

1st: steam-powered mechanical manufacturing facilities

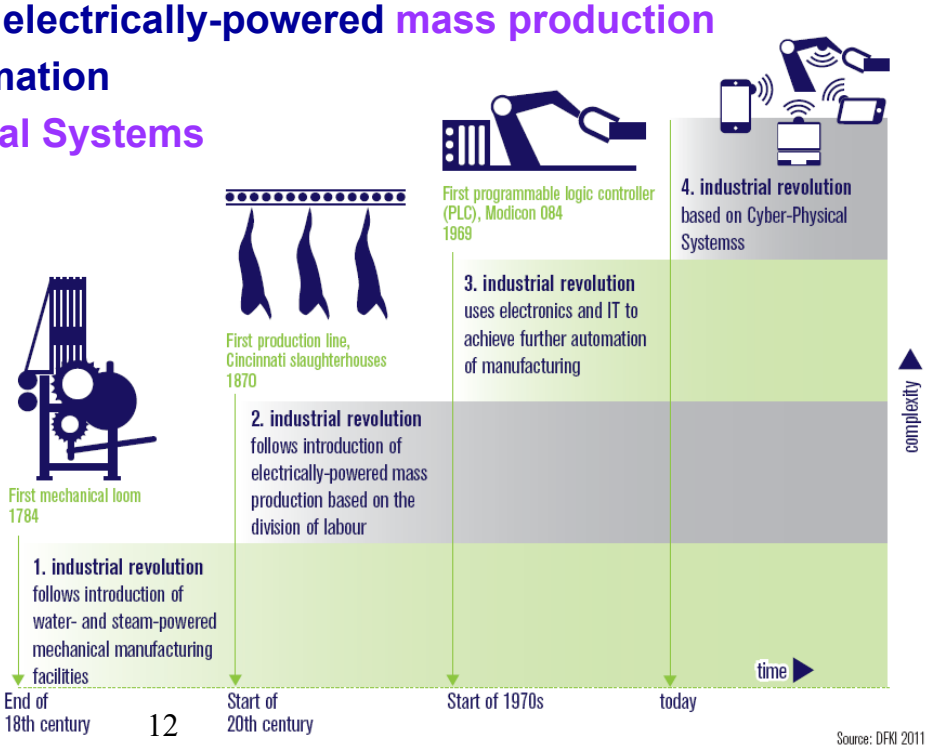
2nd: (start of 20th century)- electrically-powered mass production

3rd : IC and IT to achieve automation

4th : (today)- Cyber-Physical Systems

Enabling Technologies (0 -> 1)

- **1.0 Watt steam engine** (James von Breda Watt)
- **3.0 Transistor** (1947/ Bardeen, Brattain, and Shockley, 1956 Nobel Prize)
- **3.0 IC** (Jack Kilby, 1958/ 2000 Nobel Prize)
- **3.0 programmable logic controller (PLC) Modicon (modular digital controller)** (Dick Morley 1968)

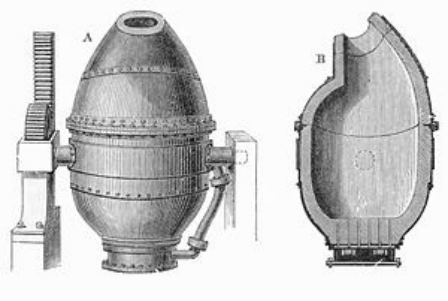


*Source: Federal Ministry of Education and Research (2013), "Securing the future of German manufacturing industry recommendation the strategic initiative INDUSTRIE 4.0 final report of the industrie 4.0 working group," *National Academy of Science and Engineering*.

Artificial Intelligence for Intelligent Manufacturing Systems (AIMS) Research Center, MOST, Taiwan

Industry 2.0 (1-> 10..0?)

The **Second Industrial Revolution**, also known as the **Technological Revolution**,[1] was a phase of the larger Industrial Revolution corresponding to the latter half of the 19th century, sometime between 1840 and 1860 until World War I. It is considered to have begun around the time of the introduction of Bessemer steel in the 1850s and culminated in early factory electrification, mass production and the production line. (Wikipedia)



Taylorism: Scientific Management (Industrial Engineering)

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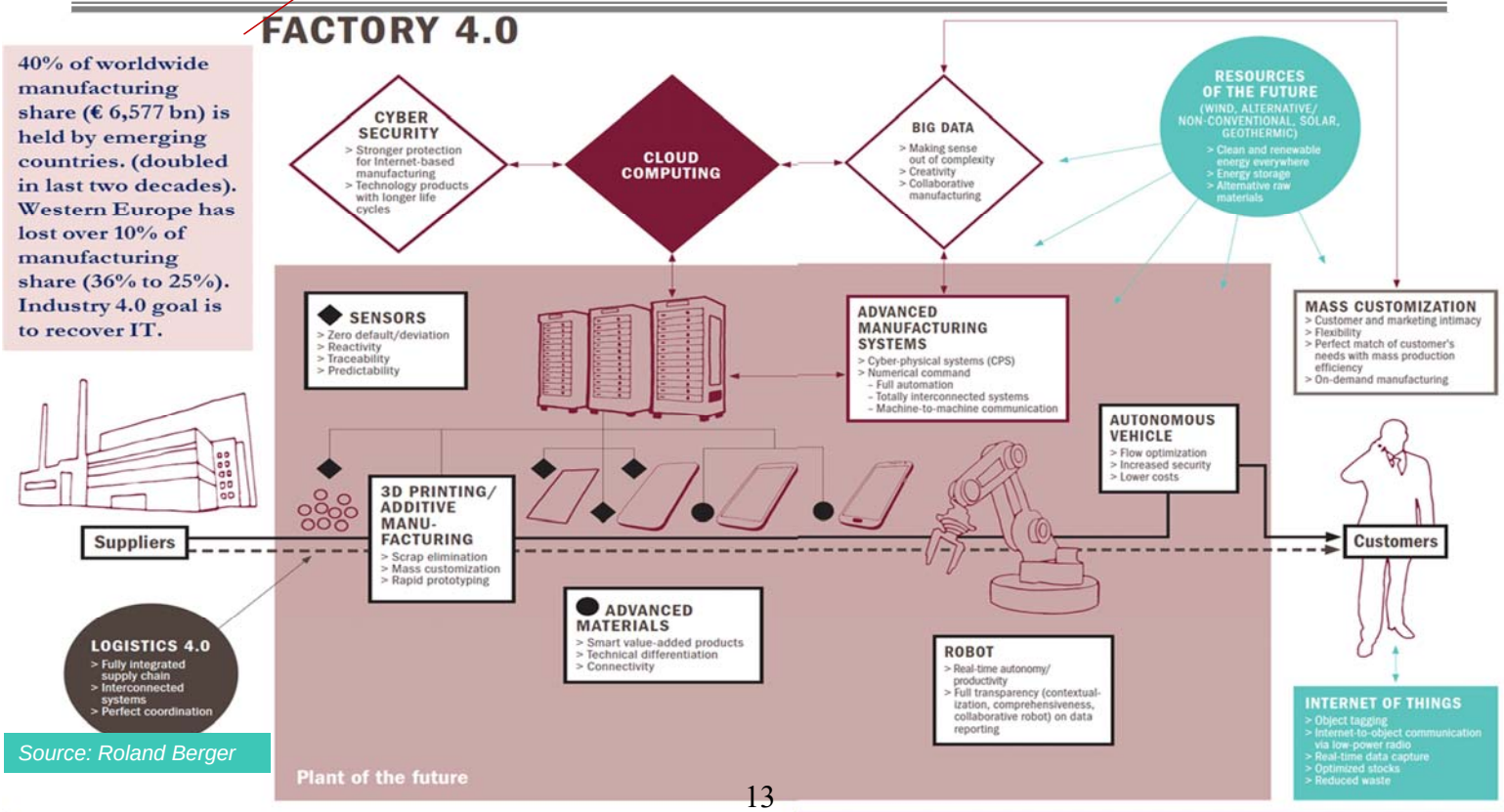
Industry 4.0 goal is to recover it (ie. 10% loss of manufacturing share)



Source: Roland Berger

Industry 3.5

Hybrid Strategy between Industry 3.0 and to-be Industry 4.0 via AI, Big Data Analytics, Computing & Digital Decision as disruptive innovations to empower smart production and Taiwan manufacturing (Chien, 2014).

DIGITIMES電子時報 觀點 2017年2月23日 星期四 15

簡禎富：工業3.5才是台灣製造的機遇和戰略

名人講堂

簡禎富

隨著物聯網(IoT)、人數據、機器人和人工智慧(AI)的發展，產業轉型升級的工業革命已經在進行中，越來越多工作機會因為自動化和智能化而消失，年輕人和弱勢族群更不容易找到好的工作。世界各國均提出自己的製造戰略，換言之，發展工業4.0提升製造的國際競爭力以搶救失業和經濟是德國的國家戰略。為了因應未來個人化、少量多樣的市場需求，工業4.0、大數據和虛實整合系統只是「工具目標」，聰明生產和彈性決策才是根本目標。台灣應該藉由組SWOT分析，思考適合台灣的製造戰略。

Cover Story 封面故事

避免被上下夾殺
簡禎富建議：台灣應獨創工業3.5

工業1.0 蒸汽機啟動機械化生產，啟起第一次工業革命

工業2.0 使用電力作為大量生產的動力來源

工業3.0 透過電子設備與資訊技術，進行自動化生產

工業4.0 透過機器人與大數據，達到生產少量多樣，兼具環保，又能在都市進行製造的智慧工廠

工業3.5 台灣無法一步到位發展工業4.0，應掌握過去製造優勢與管理經驗，打造專屬台灣的工業3.5

美國、德國搶著做！台灣製造業不能等

「這些龍頭廠商負產業發展的責任，它們都很清楚，大數據分析、智能化製造的重要性，這是它們一定要推進的趨勢。」簡禎富分析，因為這影響的不是台積電、聯發科、廣達、台塑等任一家公司，而是整體台灣製造業的競爭力。

過去這幾年，美國政府積極喊出「再工業化(reindustrialization)」，要把高階製造業搬回美國去。德國推動「工業四．〇」，將高度自動化與數據分析的技術導入德國工業，往「無人工廠」的目標發展，都是著眼於提升自家製造業的競爭力。

「美國、德國把製造業價值最高的這塊拿走，便宜勞力、大量生產的低階製造，又被中國搶走，台灣剩下什麼？」簡禎富認為，這是台灣所有製造業者不能迴避的課題。

運用過去管理經驗，先從部分自動化做起

「台灣過去總被稱為製造大國、軟體小國，如果不發展大數據，就如同我們把精良武器都賣到海外，但我們自己攻擊敵人的武器卻是弓箭與矛。所以，台灣製造業一定要升級，要用大數據的思惟來想事情，增加我們的產業競爭力。」工研院巨資中心主任余孝先說。

同樣的說法，也在對智慧工廠研究甚深的工研院機械所分析師黃仲宏口中聽到，「大數據絕對是開啟製造業往智慧化、自動化發展的一大關鍵。」

相較於歐美製造業都在升級，簡禎富從另外一種角度想：「我們不能停在工業三．〇，短期內又無法像美國、德國做到全自動化，可不可以用混合的方式，提出一個工業三．五？」簡禎富直言，台灣製造業仍未具備足夠能力，發展工業四．〇的全自動智慧化工廠，但我們可以利用過去的管理經驗與智慧，先從部分自動化做起，再搭配數據分析的力量，從根本上提升台灣製造業的競爭力，因為這一戰，台灣已沒有本錢再等下去了。

今周刊 2014.11.24 / 86

Harvard Business Review 哈佛商業評論 全球繁體中文版

迎向工業4.0挑戰

如何先打造出「工業3.5」的能力？

簡禎富（國立清華大學工業工程與工程管理系講座教授）

工業4.0智慧製造時代來臨！工業4.0的生產方式以物聯網、大數據、雲端系統、互聯網+、智慧機械等新型科技為基礎，以數據匯流串接產業價值鏈每一個環節，強調跨域虛實整合，打破生產與服務邊界和公司界線，正在重新解構價值鏈並形塑全球製造分工。

另一方面，若未能多工作機會已因無人化而消失，年輕人和弱勢族群更不容易找到好的工作，更加大貧富差距。製造業帶動經濟發展、創造就業的重要性，造經過國內生產總額（GIP）表面數字，各國政府為了救經濟、救失業，無不積極推動國家製造戰略，以重回先進製造，並爭奪第四次工業革命的主宰地位。然而，台灣如何在先進國家重回製造和新興國家替代的上下夾擊間，發展適合自身產業結構和核心競爭的製造戰略？台灣廠商如何在產業升級重構過程中，規畫適合的數位轉型和智慧製造策略？

國立清華大學工業工程與工程管理系講座教授簡禎富主張，「如果企業不能為上跨入工業4.0，不妨先做『工業3.5』！」大多數公司只是工業4.0軟硬體系統的使用者，而相關系統架構仍在演化中，當務之急，還是先發展能讓智慧製造系統發揮效能的大數據分析和彈性決策能力。也就是說，「工業3.5」是工業3.0和工業4.0之間的混合策略，企業可以先站在既有的基礎之上，盤點自身擁有的資源和長處，建立自身專屬的數位轉型策略和智慧製造技術藍圖，一面強化自身的數位能力，拉開與新興國家的差距，另一方面先迎入工業4.0之前的過渡階段，先從市場上收割部分產業升級的好處。厚植實力後，再迎入工業4.0，成功機率就會大幅提升。

他並提出「工業3.5概念架構圖」，作為製造業者盤點自身資源和決策情境、

DIGITIMES

工業3.5紮根台灣產業研究 發揮國際產學影響力

台北訊 2020-05-12

科技部部長陳良基(左)頒發「最具影響力研究專書」給蘭禎富講座教授(右)。

為表彰系統性且可長遠發展、反映時代意義的學術專書，科技部今年首次評選「最具影響力研究專書」，包含「學術影響力」、「科學影響力」、「專業貢獻度」、「社會影響力」與「獲獎紀錄」等5項評審原則，由「自然科學及永續」、「工程技術」、「生命科學」、「人文及社會科學」等四大領域分別進行，從各個學術領域推薦的188本研究專書中選出20本。

科技部部長陳良基表示，深耕的研究可能一開始看不出立即的成果，但時間拉長來看，卻可能改變世界，本次工程領域的推薦書，也跟台灣未來生向有關，包含工業3.5、結晶材料、薄膜光學與鏡頭技術、電力系統等領域，面向多元且專精。

國立清華大學清華講座教授暨美光講座教授蘭禎富執行科技部AI專案計畫的成果之一《工業3.5：台灣企業邁向智慧製造與數位決策的戰略》，融入許多產學合作的實戰經驗，以務實之角度提出混合策略，藉助AI、大數據分析及數位決策等破壞性創新技術，協助企業建立數位大腦掌握彈性決策的核心能力，並由從經營決策、資源管理、人才培育與整合四個大方向上，協助企業有效全面資源管理，優化PDCCCR經營決策。

蘭禎富講座教授指動「企業新五四運動：德先生是公司治理與決策；賽先生是科學管理與分析」，主張台灣企業應先從「掃之在我」的改革和數位轉型做起，給予台灣本地產業邁向智慧製造的階段性建議，讓企業升級轉型就算無法一步到位，也能有所依循。

蘭禎富在科技部記者會領獎感言中，也分享影響他自己的兩本書：其一是林語堂所著之《蘇東坡傳》，這是他在建中紅樓圖書館看過後從此影響其一生的書，從高中立志學習效法蘇東坡至今，因此捐出所有版稅加上其他獎金，以清華「紫」和「蘇軾」為名，在新竹市成立「財團法人紫軾書院教育基金會」以培育跨領域人才。其二是彼得．杜拉克所著之《旁觀者》(Adventures of A Bystander)，闡往他精彩人生閱歷和產學經驗，更認同彼得．杜拉克的理念：「管理重要的創新都來自實踐」，因此積極當「參與者」，透過借調、顧問和不同企業的產學合作來實踐練功，以發展紮根於台灣產業的一家之言。《工業3.5》也是累積的努力成果之一。

《工業3.5》一書發表後引起國內外產學界之巨大迴響，蘭禎富教授應邀於天下經濟論壇、哈佛商業評論高峰論壇、電子時報智慧製造論壇、遠見華人精英論壇、商業周刊論壇發表相關理念，中華卓越經營協會、台中市機械業二代協進會、台灣電路板協會、台灣區工具機暨零組件工業同業公會等公協會和企業演講，以及許多國際會議和鄰近國家的政府單位的主題演講，並應邀擔任經部設在日本的亞洲生產力中心的智慧製造「主任專家」，今年初並接受Nature和Taiwan Research Highlight、台灣評論等各大媒體的專訪，已經逐步發揮國際影響力。

Taiwan Research Highlight

Reports on research focus and innovative development of universities in Taiwan

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LIFE SCIENCES HUMANITIES & SOCIAL SCIENCES ENGINEERING & TECHNOLOGIES NATURAL SCIENCES NEWSLETTER

Are You Ready for Industry 3.5?

Industry 3.5

Principal investigator

Prof. Chen-Fu Chien

Biography

Dr. Chen-Fu Chien is Tsinghua Chair Prof. & Micron Chair Prof. at IEEM Departement, National Tsing Hua University (NTHU). He is the Director of AI for Intelligent Manufacturing Systems (AIMS) Research Center and the Convener of Industrial Engineering and Management Program, Ministry of Science & Technology (MOST).

University

National Tsing Hua University

Edited by

MOST Artificial Intelligence for Intelligent Manufacturing Systems (AIMS) Research Center, National Tsing Hua University (NTHU)

TAGS

Intelligent Manufacturing | AI | Big Data | Digital Transformation | Industry

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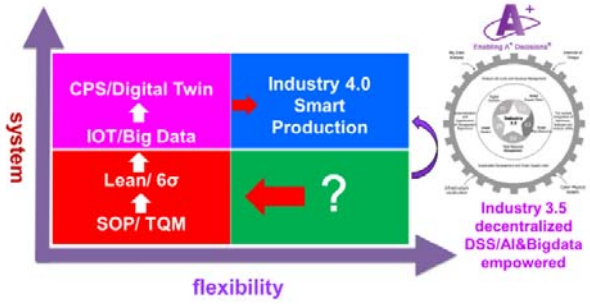
ENGINEERING & TECHNOLOGIES | Text & Image | February 26,2019

Leading nations including Germany and the USA have reemphasized manufacturing and proposed national strategies such as Industry 4.0 and AMP; China is also promoting Made in China 2025 to upgrade her industrial structure. The paradigm of global manufacturing is changing, and the increasing adoption of AI, big data analytics, cloud computing, Internet of Things (IoT), intelligent machines and robotics has empowered manufacturing intelligence for smart production and agile supply chains.

The industry structure of most emerging countries might not be ready for the migration of Industry 4.0, or for facing other challenges such as governing, promoting productivity, maintaining economic growth and creating jobs. Therefore, the AI for Intelligent Manufacturing Systems (AIMS) Research Center, one of the MOST AI centers, aims to integrate various efforts to empower intelligent manufacturing and digital transformation for Made in Taiwan to maintain its competitive advantages. The teams have proposed Industry 3.5 as a hybrid strategy between Industry 3.0 and the to-be Industry 4.0. They have developed core technologies which have validated the approaches through a number of in-depth industrial collaborations with leading companies in different fields including the high-tech manufacturing, assembly, process, and textile industries. With the innovative solutions AIMS has developed, Taiwan is able to play a leadership role in the new manufacturing paradigm of Industry 3.5 and share our experiences with other emergent countries (such as ASEAN countries) facing similar issues.



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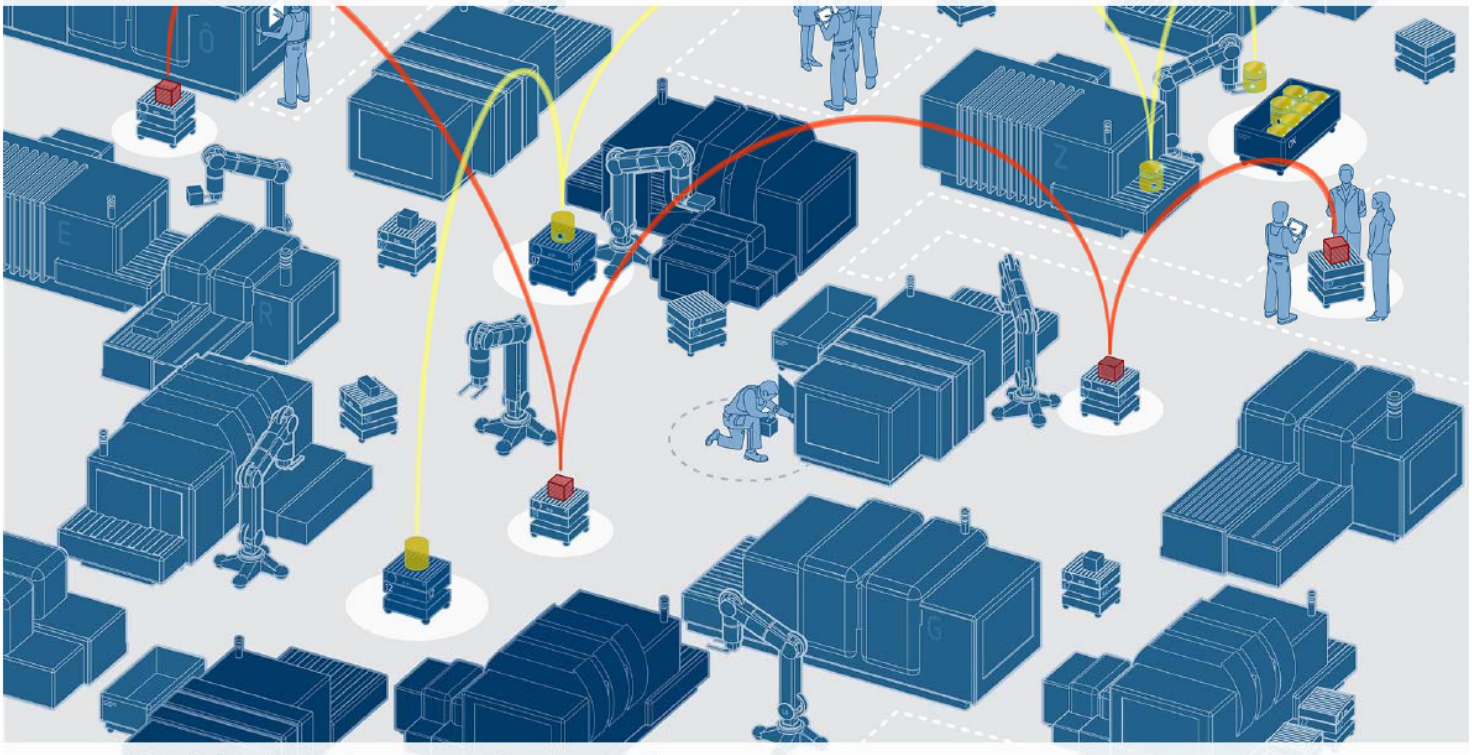
Internet of Things in Production: Industrie 4.0

Flexible Production: More Customer orientation



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Industry 3.5 in 200mm fabs

IEEE TRANSACTIONS ON AUTOMATION SCIENCE AND ENGINEERING

A Novel Route Selection and Resource Allocation Approach to Improve the Efficiency of Manual Material Handling System in 200-mm Wafer Fabs for Industry 3.5

Chen-Fu Chien, *Member, IEEE*, Che-Wei Chou, and Hui-Chun Yu

***Abstract*—Motivated by realistic needs to enhance the productivity for 200-mm wafer fabs, this paper aims to propose a novel approach for manual material handling system (MMHS) to mimic functionalities of the automated material handling system in the advanced fabs without intensive capital investment to deliver the wafer lots manually and systematically. In particular, a mathematical model is developed to optimize the routing plan with two objectives that minimize the total traveling distance in all routes or minimize the number of manpower needed in all routes. Furthermore, a route planning approach is proposed to utilize the routes that reduce the technician traveling distance and transportation time for implementation. Also, a manpower loading index was developed for evaluating the number of needed technicians in the proposed MMHS. To estimate the validity of the proposed MMHS, we developed a simulation environment based on empirical data with different transportation requirement scenarios for comparison. The results have shown practical viability of the proposed approach.**

***Note to Practitioners*—As advanced manufacturing strategies such as Industry 4.0 are proposed for smart production, 200-mm wafer fabs cannot be equipped with fully automation facilities such as the automated material handling system to enhance overall productivity. To address the needs in real settings, a disruptive innovation manual material handling system was developed, on the basis of existing 200-mm fab facility, to organize the technicians to mimic the setting of a virtual material handling system manually to enhance productivity. Indeed, the developed solution has been implemented in this case company, in which the results have validated the proposed approach that can be a hybrid between the existing Industry 3.0 and to-be Industry 4.0.**

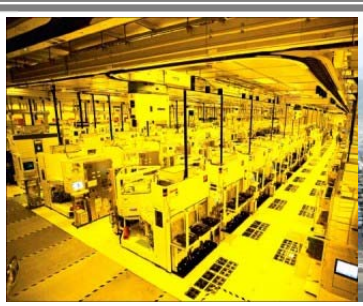
***Index Terms*—Fab economics, Industry 3.5, manpower allocation, manual material handling system (MMHS), productivity, route planning.**

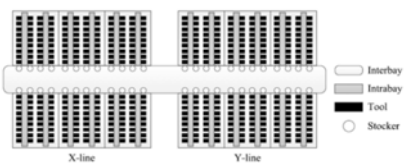
I. Introduction

SEMICONDUCTOR fabrication facilities (fabs) are the most capital-intensive and complex manufacturing plants that consists of lengthy re-entrant processes including cleaning, oxidation, deposition, metallization, lithography, etching, ion implantation, photoresist strip, inspection, and measurement [1]. The wafers pass through approximately several hundred processing steps for wafer fabrication, in which operational efficiency and productivity enhancement via maximizing the throughput and yield, while minimizing cycle time, are critical for maintaining competitive advantages [2], [3].

Automation in modern fabs enables efficient material handling between resources to reduce cycle time and manufacturing cost [4]. In particular, the advanced 300-mm fabs rely on automated material handling system (AMHS) to manage the wafer transportation in fabs [5], [6]. Furthermore, Germany has proposed a manufacturing strategy, Industry 4.0 [7], for smart factory via cyber-physical systems and decentralized decisions within a smart and networked platform. However, most existing 200-mm fabs that find it difficult or cost effective to install AMHS employ technicians maneuvering the trolleys for moving the wafer lots [8].

Motivated by realistic needs to empower 200-mm wafer fabs, this paper aims to propose a disruptive innovation via manual material handling system (MMHS) that mimics the AMHS functionalities by technicians and reduces the trolley accidents effectively. However, since the technicians may decide by themselves the wafer lots and the corresponding transportation route, some lots may be delayed causing cycle time increase, while serious trolley accidents happen causing





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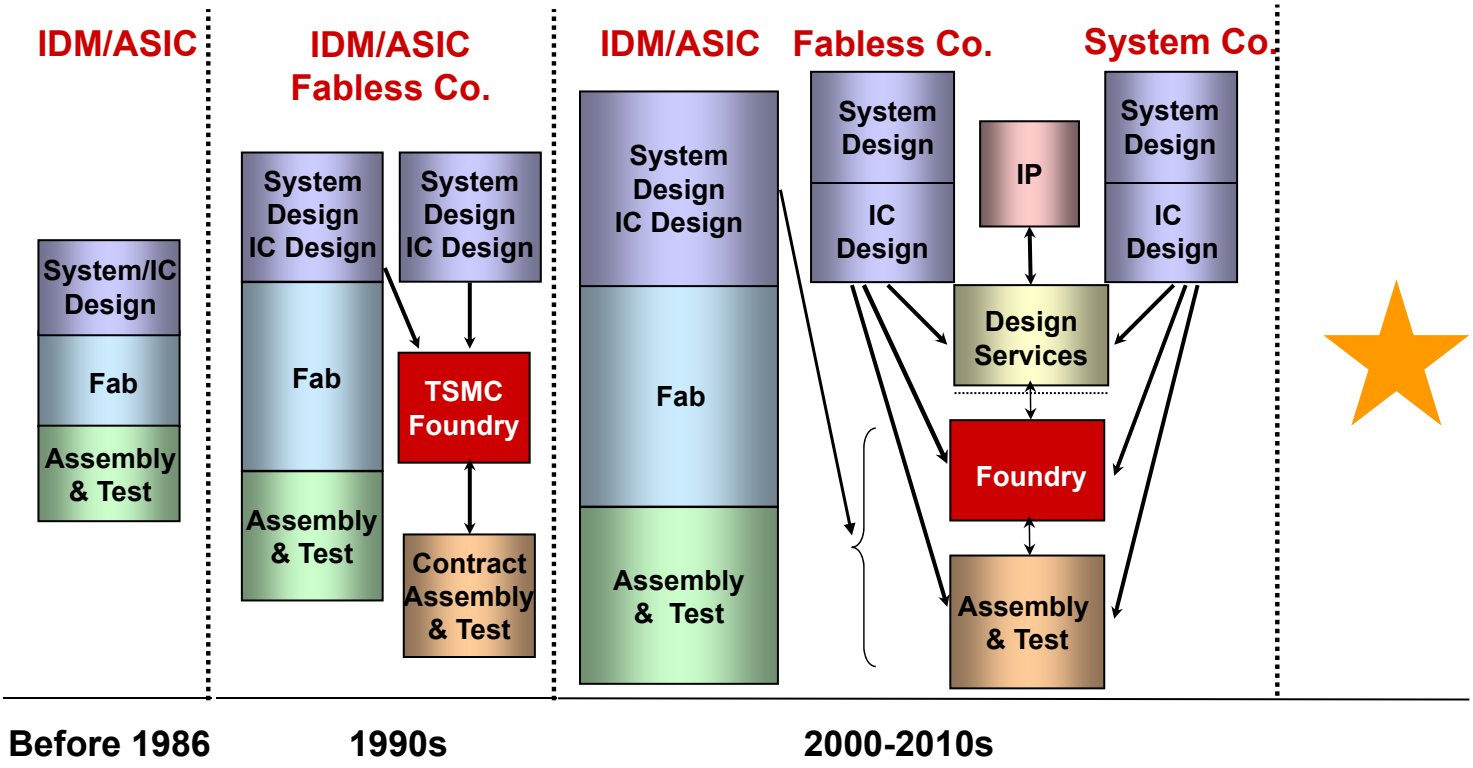

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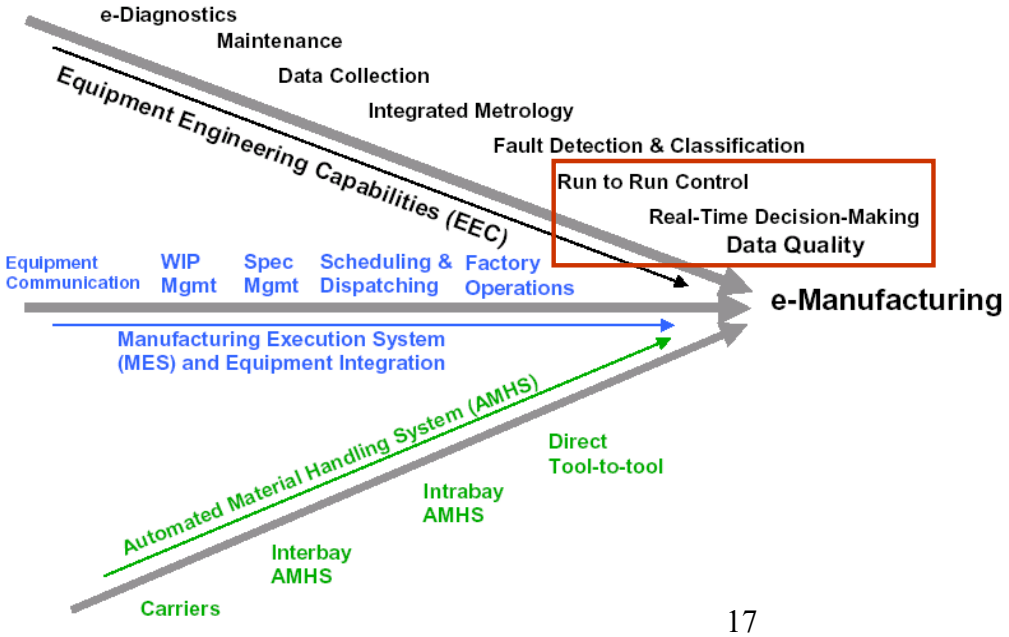


現在的競爭不是公司和公司間，而是供應鏈和供應鏈的競爭。生產基地的移動，需要整個供應鏈和生態系統一起調整，所以不論如何遷移，決策的元素很多，不能只考慮成本。

我覺得鴻海提的「無人工廠」很符合「製造智能」（Manufacturing Intelligence）的趨勢，而且每個工廠或多或少都應該做。八〇年代，日本就是因為日圓升值，人力成本提高，而積極推自動化，所以並沒有一路「逐水草而居」下去，有些製造業還可以留在日本。

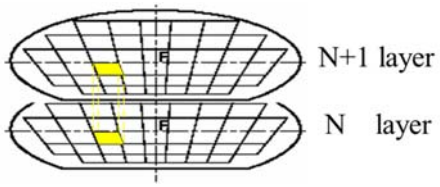
台灣過去的勞力短缺及成本議題，在大陸找到了解決方案，但現在又再度遇到缺工問題，因此更進一步的自動化需求又浮現，我認為台灣應該及早面對及思考製造策略。

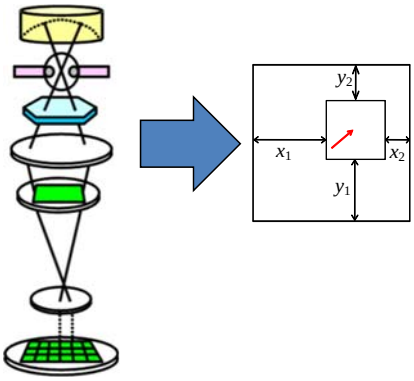
無人工廠的概念太簡化，其實是建立智慧型製造系統。有沒有智慧，差別在於有沒有辦法做「決策」。台積電曾把自動化分為三個階段，第一是擬人化，機器學習人怎麼做。再來是無人化，把例行的工作自動化。第三階段是超人化，建立集成眾人智慧的系統。

IEEE TRANSACTIONS ON AUTOMATION SCIENCE AND ENGINEERING, VOL. 11, NO. 2, APRIL 2014 473

Overlay Error Compensation Using Advanced Process Control With Dynamically Adjusted Proportional-Integral R2R Controller

Chen-Fu Chien, *Member, IEEE*, Ying-Jen Chen, Chia-Yu Hsu, and Hung-Kai Wang





Abstract—As semiconductor manufacturing reaching nanotechnology, to obtain high resolution and alignment accuracy via minimizing overlay errors within the tolerance is crucial. To address the needs of changing production and process conditions, this study aims to propose a novel dynamically adjusted proportional-integral (DAPI) run-to-run (R2R) controller to adapt equipment parameters to enhance the overlay control performance. This study evaluates the performance of controllers via the variation of each overlay factor and the variation of maximum overlay errors in real settings. To validate the effectiveness of the proposed approach, an empirical study was conducted in a leading semiconductor company in Taiwan and the results showed practical viability of the proposed DAPI controller to reduce overlay errors effectively than conventional exponentially weighted moving average controller used in this company.

Note to Practitioners—Although various APC/R2R control approaches have been proposed for specific conditions, little research has been done to deal with unknown changing production/process conditions in the real setting of semiconductor fabrication. Focusing on a realistic problem, this study is the first to develop dynamically adjusted proportional-integral R2R controller by considering future disturbance prediction to effectively reduce overlay errors. The proposed DAPI controller has only one key parameters needed to be determined like exponentially weighted moving average (EWMA) controllers. The proposed approach was validated in a leading semiconductor company in Taiwan and has been implemented on line.

Index Terms—Advanced process control (APC), manufacturing intelligence, overlay errors, proportional-integral controller, run-to-run (R2R) control, yield enhancement.

thus achieved unparalleled growth in past few decades. Thus, process control and excursion detection become increasingly difficult. However, most existing studies focus on defect diagnosis for yield enhancement [2]–[5]. To meet the demands of shrinking feature sizes and the reduced linewidth of integrated circuits (ICs), lithography has become increasingly critical for wafer fabrication [6], [7]. In particular, wafer fabrication contains multilayer wiring in which the patterned layers must overlay each other to within the tolerance to function properly. Overlay errors are the displacement of the present exposure layers relative to preceding layers [8], [9]. To enhance the process yield and to satisfy customers' need, overlay errors must be controlled within a tight tolerance.

Modern semiconductor fabrication facilities (fabs) adopted a variety of advanced process control (APC) and run-to-run (R2R) control methodologies for yield enhancement. Moyne *et al.* [10] defined R2R control as "a form of discrete process and machine control in which the product recipe with respect to a particular machine process is modified *ex-situ*, i.e., between machine runs, to minimize process drift, shift, and variability." Sachs *et al.* [11] and Ingolfsson and Sachs [12] pioneered the application of R2R controller in semiconductor fabrication processes. Conventionally, the exponentially weighted moving average (EWMA)-based controller is widely used to compensate for process shift and noise such as epitaxial growth [8], silicon epitaxy [13], chemical mechanical polishing (CMP) [14], and metal sputter deposition [15]. However, the

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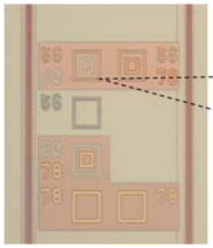
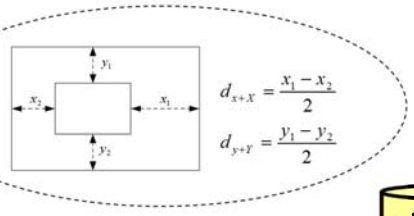
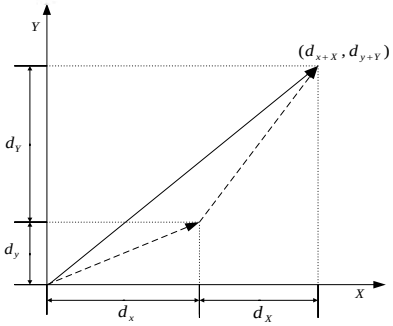
Novel Overlay Error models considering only controllable factors

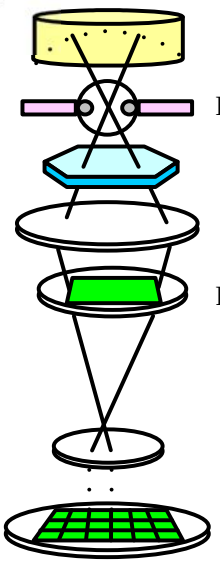


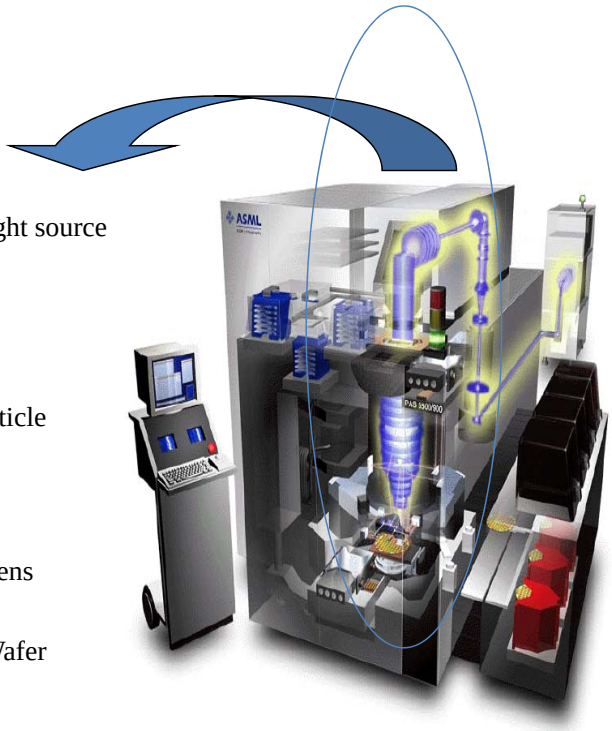




$$d_{x+X} = T_{x+X} + S_X X - (\theta_W + \phi)Y + (M_i + M_a)x - (\theta_r + \theta_a)y + \varepsilon_{x+X}$$

$$d_{y+Y} = T_{y+Y} + S_Y Y + \theta_W X + (M_i - M_a)y + (\theta_r - \theta_a)x + \varepsilon_{y+Y}$$





Artificial Intelligence for Intelligent Manufacturing Systems (AIMS) Research Center, MOST, Taiwan

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Novel Analytics for Modeling and Compensating Overlay Errors for Steppers and Scanners

(12) **United States Patent**
Lin et al.

(10) **Patent No.: US 7,586,609 B2**
(45) **Date of Patent: Sep. 8, 2009**

(54) **METHOD FOR ANALYZING OVERLAY ERRORS**

(75) Inventors: **Shun-Li Lin**, Hsinchu (TW); **Chen-Fu Chien**, Hsinchu (TW); **Chia-Yu Hsu**, Hsinchu (TW); **I-Pien Wu**, Hsinchu (TW)

(73) Assignee: **MACRONIX International Co., Ltd.**, Hsinchu (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 239 days.

(21) Appl. No.: **11/112,115**

(22) Filed: **Apr. 21, 2005**

(65) **Prior Publication Data**

US 2006/0238761 A1 Oct. 26, 2006

(51) **Int. Cl.**
G01B 11/00 (2006.01)

(52) **U.S. Cl.** **356/401**

(58) **Field of Classification Search** 356/399–401
See application file for complete search history.

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Primary Examiner—Tarifur R. Chowdhury
Assistant Examiner—Isiaka O Akanbi
(74) *Attorney, Agent, or Firm*—J.C. Patents

(57) **ABSTRACT**

A method for analyzing overlay errors in lithography is described. Interfield sampling and intrafield sampling are first conducted to sample multiple positions on each of the wafers, and then the overlay error value at each of the positions is measured. An overlay error model including coefficients of intrafield and interfield overlay errors of different types is used to fit the measured overlay error values with respect to the sampled positions. In the overlay error model, the intrafield overlay errors include intrafield translation, isotropic magnification, reticle rotation, asymmetric magnification and asymmetric rotation, and the interfield overlay errors include interfield translation, scale error, wafer rotation and orthogonality error.

11 Claims, 5 Drawing Sheets

(12) **United States Patent**
Chien et al.

(10) **Patent No.: US 6,975,974 B2**
(45) **Date of Patent: Dec. 13, 2005**

(54) **OVERLAY ERROR MODEL, SAMPLING STRATEGY AND ASSOCIATED EQUIPMENT FOR IMPLEMENTATION**

(75) Inventors: **Chen-Fu Chien**, Hsinchu (TW); **Kuo-Hao Chang**, Taichung (TW); **Chih-Ping Chen**, Hsinchu (TW); **Shun-Li Lin**, Hsinchu (TW)

(73) Assignee: **Macronix International Co., Ltd.**, Hsinchu (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 791 days.

(21) Appl. No.: **09/920,034**

(22) Filed: **Aug. 1, 2001**

(65) **Prior Publication Data**

US 2002/0183989 A1 Dec. 5, 2002

(30) **Foreign Application Priority Data**

Feb. 26, 2001 (TW) ..... 90104309 A

(51) **Int. Cl.**[7] **G06F 17/10**

(52) **U.S. Cl.** **703/2**; 700/109; 700/121; 716/20

(58) **Field of Search** 703/2; 700/109, 700/118–121; 716/19–21; 702/83, 150, 155; 250/548; 430/22; 355/53

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Arnold, Overlay Simulator for Wafer Steppers, SPIE vol. 922, Optical/Laser Microlithography, Mar. 1988, p. 94–105.*

* cited by examiner

Industry 3.5

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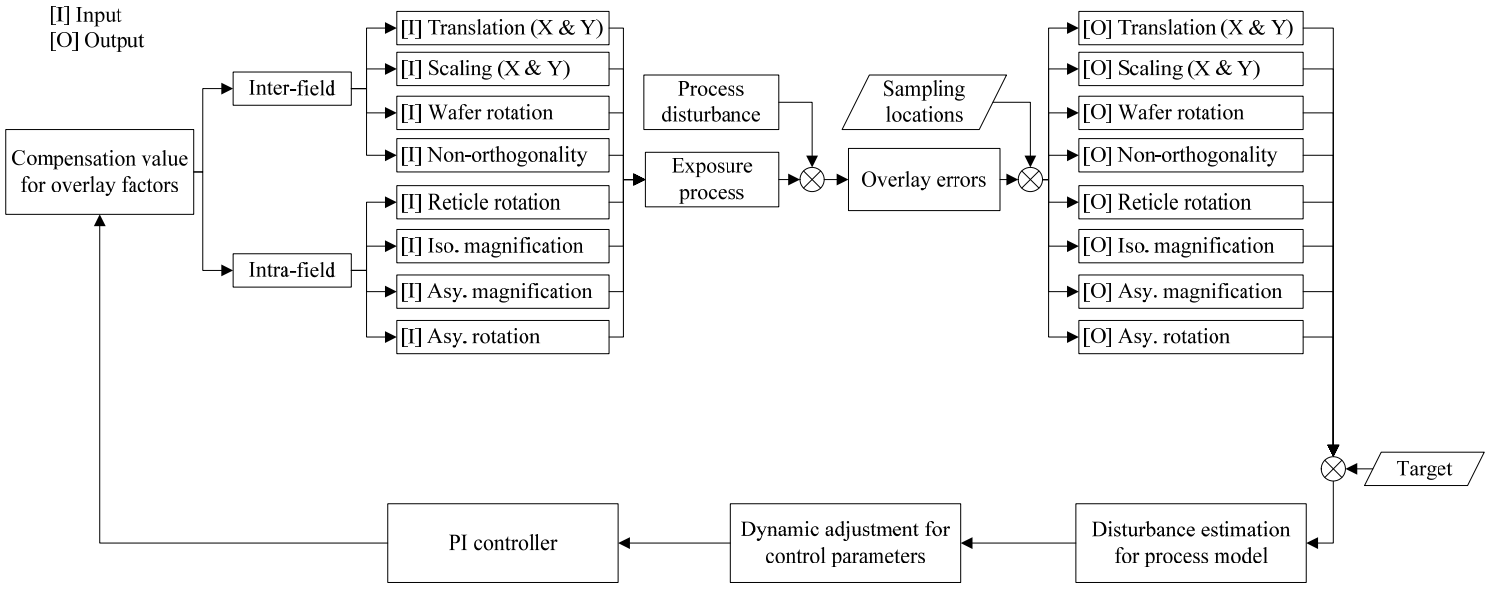
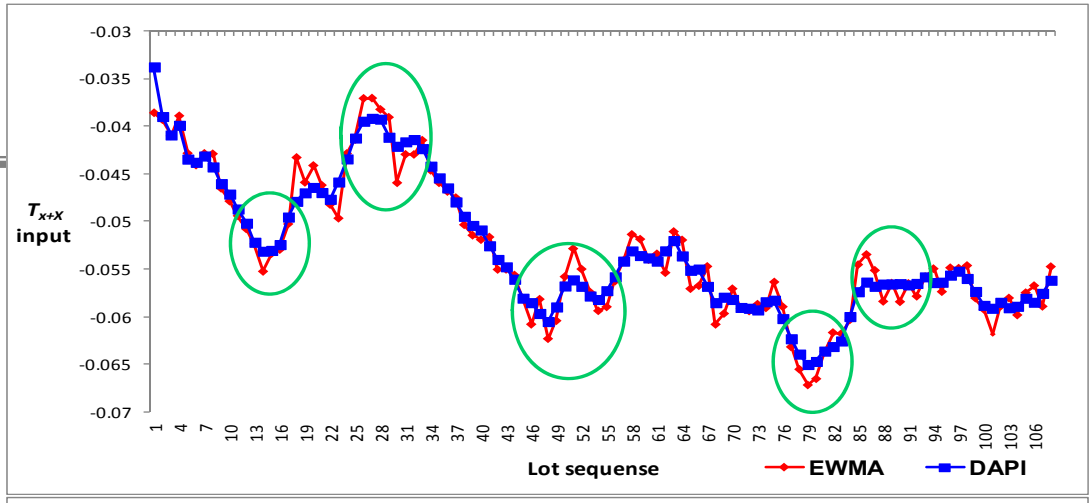
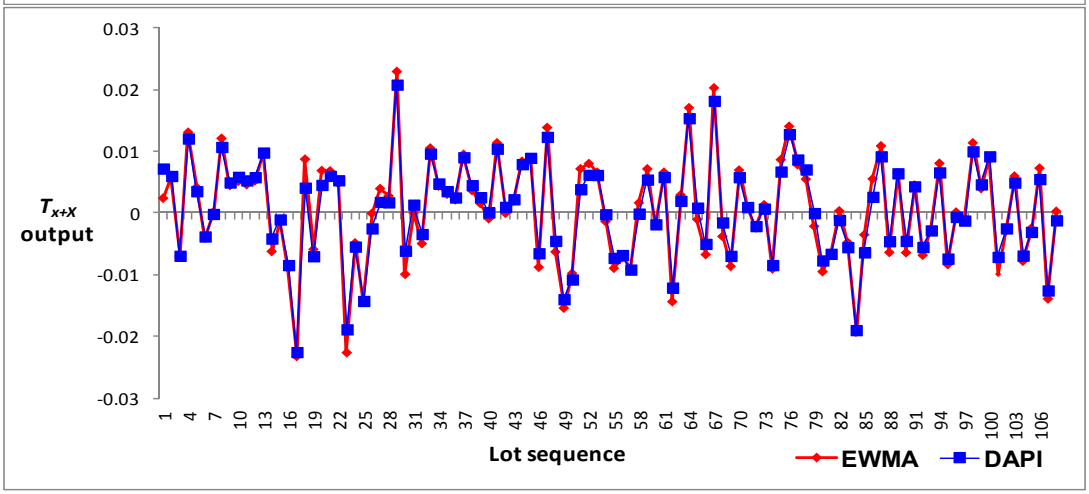
APC/AEC

(Advanced Process Control/ Advanced Equipment Control)

- **Step1. Overlay process modeling for R2R control**
- **Step2. DAPI controller design**
- **Step3. Performance monitoring and evaluation**







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PDCCCR Decision Systems for intelligent manufacturing strategies

C.-F. Chien et al. / Int. J. Production Economics 128 (2010) 496–509

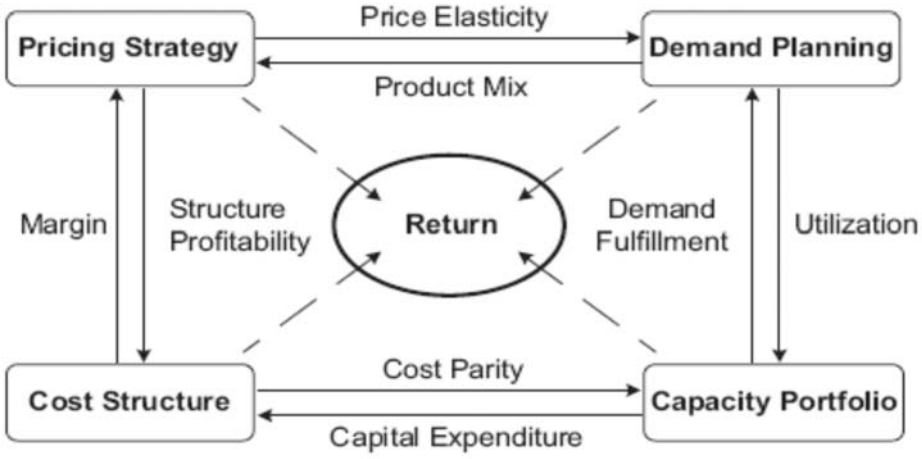

Fig. 1. Conceptual Framework of PDCCCR.

mouth communications.
models have been widely
Focusing on the first p
adopter can only buy one
making a repeat purchas
function, in which the pr
in circumstances where i

$$\frac{f(t)}{1-F(t)} = p + qF(t)$$

where $f(t)$ is the probabili
$F(t)$ the cumulative desti
coefficient of innovatio
coefficient of imitation (i

Harvard Business Review

TSMC Way

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CASE (FIELD)

The TSMC Way: Meeting Customer Needs at Taiwan Semiconductor Manufacturing Co.

by Willy Shih, Chen-Fu Chien, Chintay Shih, Jack Chang

Source: Harvard Business School

23 pages. Publication date: Aug 13, 2009. Prod. #: 610003-PDF-ENG

When L.C. Tu receives an emergency order, he is confronted with a range of production scheduling choices, each of which has unique costs and trade-offs. The case was designed to help students understand job-shop style production and the impact of disruptions and reactive scheduling. Students use two of Taiwan Semiconductor Manufacturing Company's mainstream processes as a vehicle for analysis. The case describes a real situation in which upper management accepts an emergency order. By working through the impact on the production system, students should develop a feel for how shifting demand in a large factory that is structured as a job shop alters the demands on, and utilization rates of expensive capital equipment in a complex way. As bottlenecks shift, students can explore several alternatives, each with different costs and trade-offs. Students may also reflect on the true cost of providing the extraordinary service, and whether management properly takes the impact on operations into account when it makes customer commitments.

CASE STUDY

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TSMC Way as a new paradigm of smart manufacturing for Industry 3.5+

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Taiwan manufacturing soft power/ Industry 3.5

to Optimize Human Capital in Emerging Countries

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The TSMC Way: Meeting Customer Needs at Taiwan ... - Prezi

https://prezi.com/.../the-tsmc-way-meeting-customer-needs-at-taiwan-se... 翻譯這個網頁

2013年10月15日 - The TSMC Way: Meeting Customer Needs at Taiwan Semiconductor Manufacturing Co. Group 6. Questions 7-9. Q7. Does this suggest that ...

Google Toyota Way **Toyota Way: Industry 2.0+**

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[PPT] Toyota Way 豐田模式

bm.nsysu.edu.tw/tutorial/kuo/rm/toyotaWay.ppt

Toyota Way 豐田模式. 郭倉義. 中山企管. kuo@bm.nsysu.edu.tw. www.books.com.tw. 為何導入『豐田生產系統』. Just-in-time; 自働化Jidoka. 大野耐一的兩大支柱.

The Toyota Way - Wikipedia

https://en.wikipedia.org/wiki/The_Toyota_Way 翻譯這個網頁

The Toyota Way is a set of principles and behaviors that underlie the Toyota Motor Corporation's managerial approach and production system. Toyota first ...

「Toyota way」的圖片搜尋結果 檢舉圖片

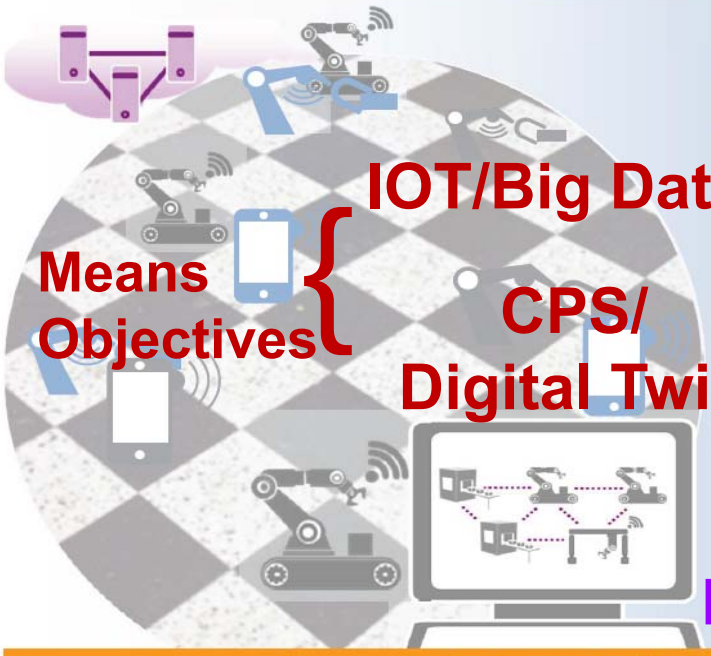
更多符合「Toyota way」的圖片

New paradigm of Industry 3.5

12 Harvard Case Studies by Chen-Fu Chien

Industry 4.0: Algorithmicized "production chess" within cyber-physical systems

SIEMENS



Vision for Industry 4.0

- The **product** to be manufactured **contains all necessary information** on its production requirements
- **Self-organization of integrated production installations** considering the entire value chain
- **Flexible decision on production process** on the basis of the current situation

Fundamental Objectives

Decentral cyber-physical systems (CPS) interact via embedded internet-based technologies

Industry 3.5

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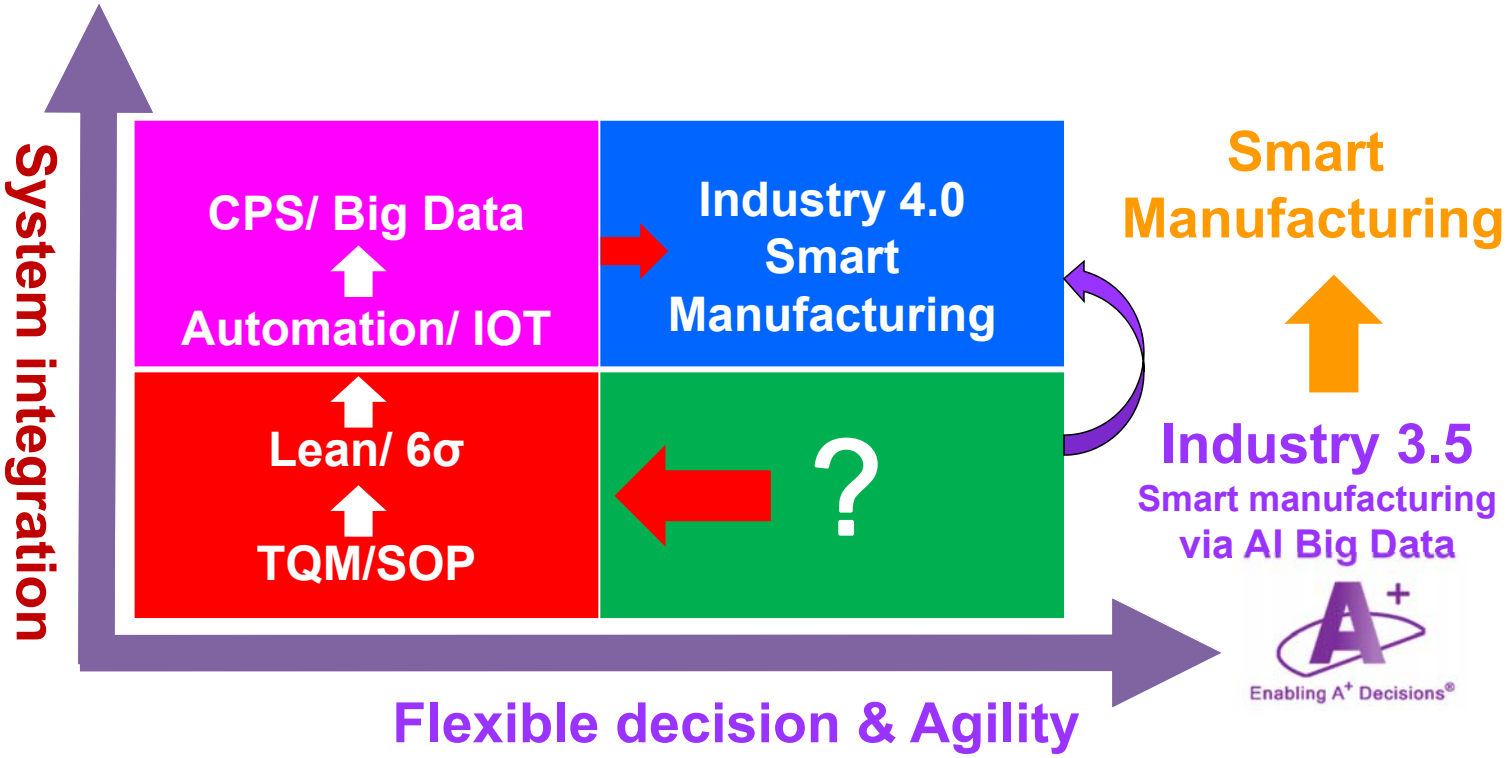
Industry 3.5 hybrid strategy via disruptive innovations to empower smart manufacturing (Chien, 2014)



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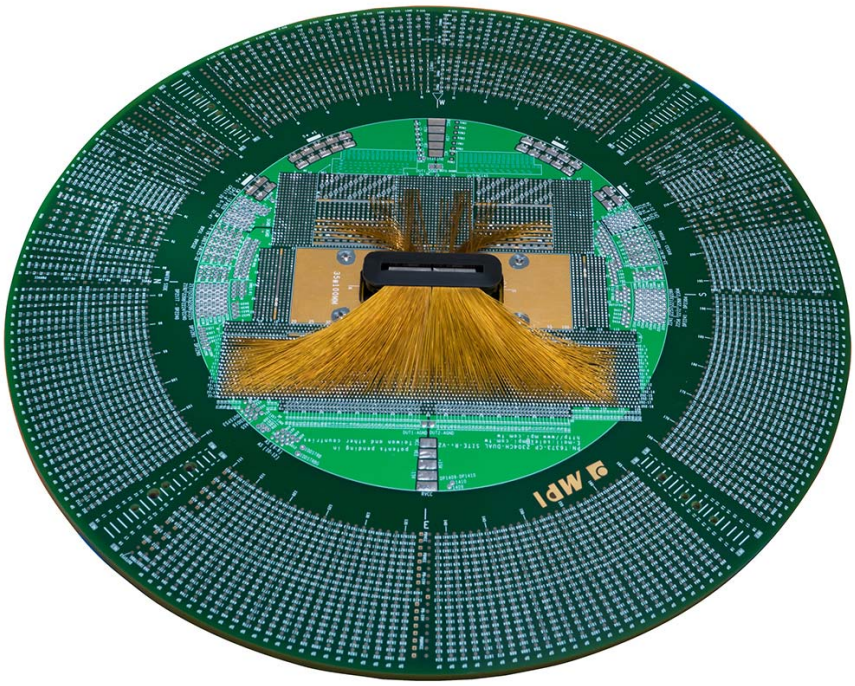
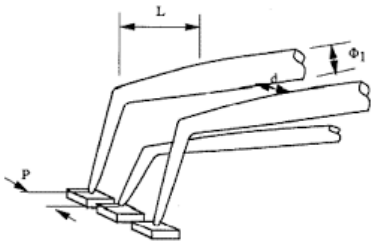
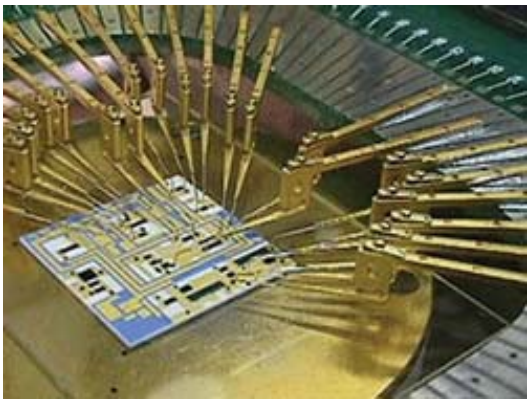
Circuit Probe (CP) test for wafer to identify "Known Good Dies"







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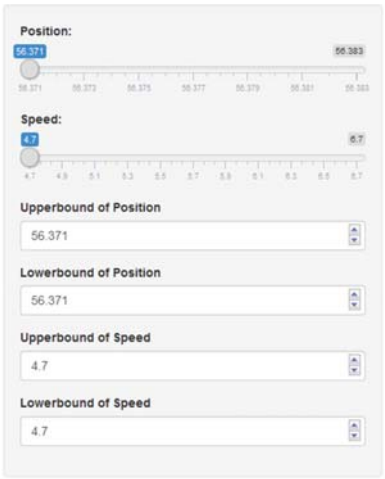
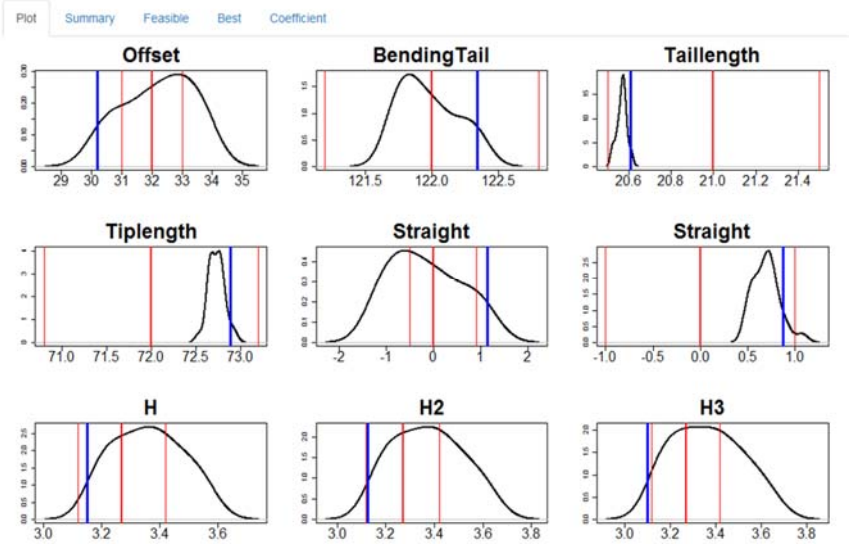
Optimizing multi-variate analytics for yield enhancement





Artificial Intelligence for Intelligent Manufacturing Systems (AIMS) Research Center, MOST, Taiwan

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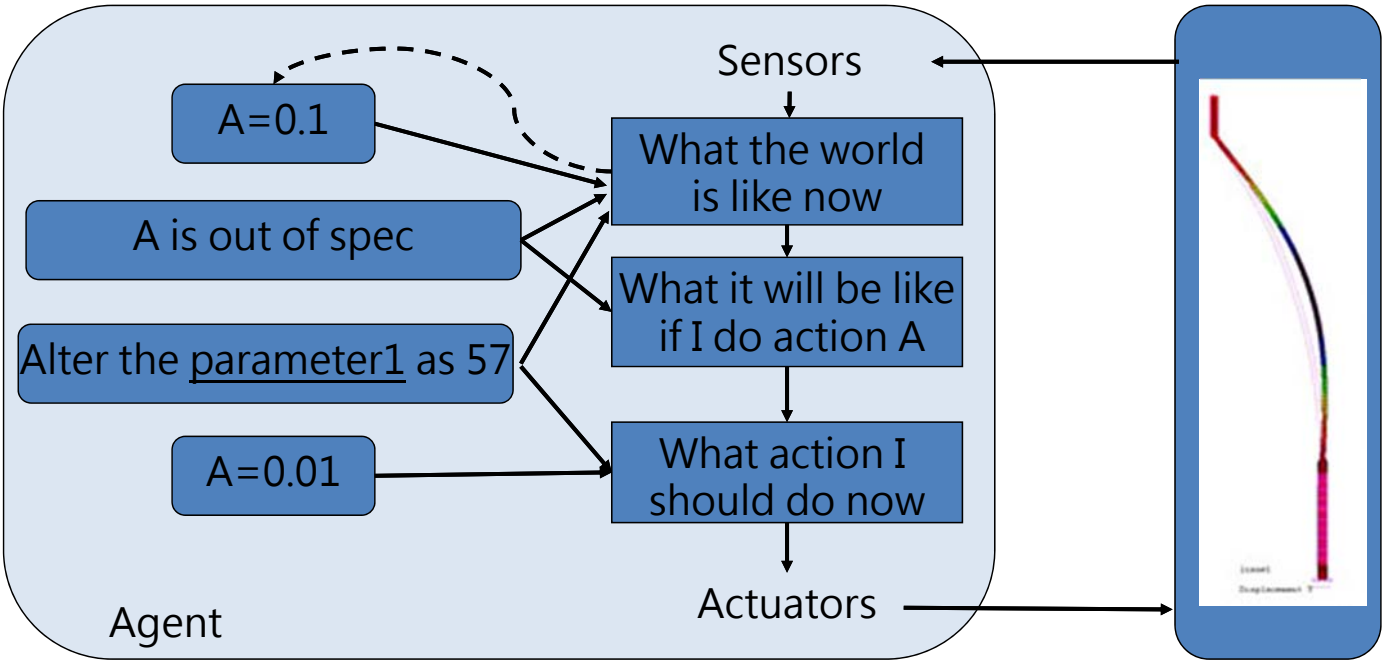
Intelligent Agents to Empower Engineers

A model-based, goal-based "intelligent agents" can perceive environment and take actions to maximize its chance of success at some goal.



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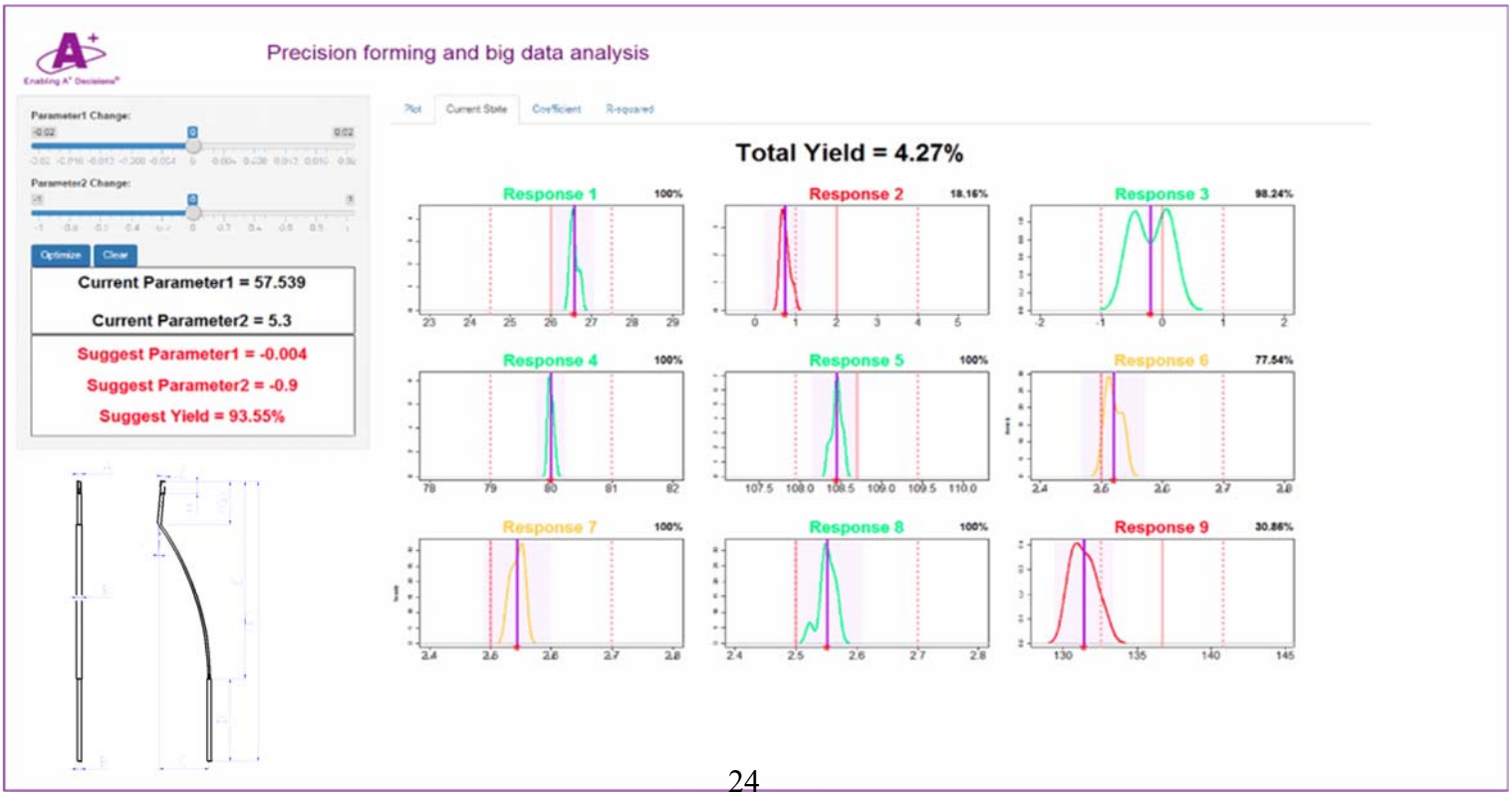
"Intelligent Agents" to support Engineers to empower smart manufacturing



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Robot for shoe making via EMS such as Flex (Flextronics)

Under Armour (UA) CEO Kevin Plank: *Chasing the Cheap is Being Lazy*

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Not easy to replace human now :)

Flex and Nike terminate business relationship

Flex and Nike has mutually agreed to wind-down the footwear manufacturing operations in Guadalajara by the end of the year.

"Regarding NIKE, we have worked hard with NIKE to make our footwear operation in Mexico technically and commercially successful. In recent weeks, however, it became clear that we are unable to reach a commercial and viable solution with NIKE and have mutually agreed to wind down our NIKE footwear manufacturing operation in Guadalajara by December 31, 2018. We are finalizing the terms and details of the wind-down and we are striving to retain many of our affected employees and to repurpose our facility", states Christopher E. Collier, CFO at Flex Ltd. in an analyst call.

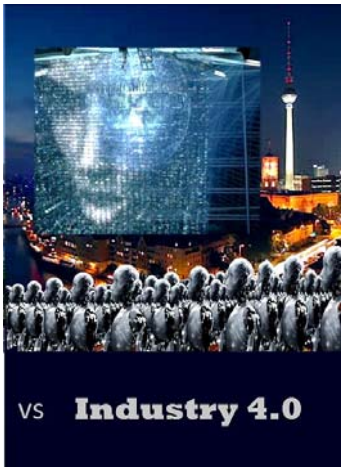
In connection with the closing of the operation, the EMS-provider recognised USD 30 million of exit costs primarily related to its estimated impairment of fixed assets. Additional costs as the wind-down is completed may be incurred.

"I would say that we are disappointed where we sit right now. I think as we step back, NIKE was extremely unique in differentiating and I think that it was an important feature that we went after and we are just being very thoughtful at this stage in terms of where we sit. And since we can't get to a commercial agreement where our shareholders can have a sustainable return, we decided to exit", Collier continues.

Industry 3.5 aims to empower human being as “Iron Man”

WPG Holdings is the world No.1 Semiconductor Distributor and the largest electronics distributor

?



Industry 3.5 “Iron Man”	Industry 4.0 “I, Robot”
Human-System Collaborations Decentralized DSS & disruptive innovations	Cyber-Physical System Closed platform led by big company with constant charge
Human empowered by AI	**human replaced by robots and AI**

Digital Transformation for WPG via Industry 3.5 “Iron Man”

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大聯大控股執行長 葉福海

面對新變革 一起共享共好 把市場做大

大數據、物聯網的出現，使得運作近百年的商業流程，將在5年內全面「顛倒」，過往大量製造銷售、壓低成本、搶佔市占率的紅海手段已面臨考驗。在面臨變革的重要時刻，大聯大領頭，邀請產業建立共識、攜手打群架，建築智慧供應鏈平台的生態圈，一起贏市場，把市場做大。

撰文者 商周數位 | 2017-09-07 | 瀏覽數：2049

讚 94 分享

清華講座教授 簡禎富

善用台灣優勢 鋼鐵人迎戰機械人

工業4.0驅動各國製造戰略競合，台灣製造業如何乘勢而起？清華講座教授簡禎富提醒，台灣必須升級轉型，但無法一步到位，工業3.5的混合策略是先當鋼鐵人，善用台灣人的管理智慧和產業利基，並整合新科技的應用，搶先卡位。

撰文者 商周數位 | 2017-09-27 | 瀏覽數：1849

讚 216 分享

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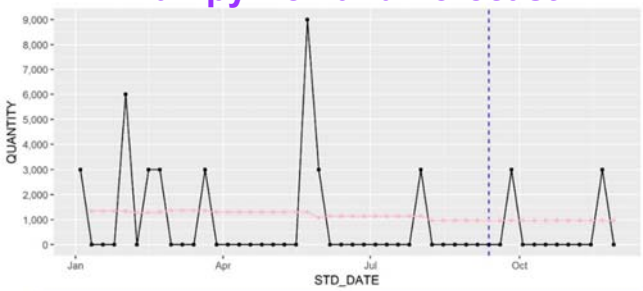
Validation & DSS to Empower Decision Makers

Lumpy Demand Forecast



As Is
Customer Prediction:
By judgments of domain experts
MASE : 1.1367

To Be
Industry 3.5 approach:
IMAPA+SARIMA+RNN
MASE : 0.5735

產品搜索、需求預測檢視及預警	公司內部預測維護及預警

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Computers & Industrial Engineering 135 (2019) 940–949

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UNISON data-driven intermittent demand forecast framework to empower supply chain resilience and an empirical study in electronics distribution

Wenhan Fu[a], Chen-Fu Chien[a,b,*]

[a] Department of Industrial Engineering and Engineering Management, National Tsing Hua University, Hsinchu 30013, Taiwan
[b] Artificial Intelligence for Intelligent Manufacturing Systems (AIMS) Research Center, Ministry of Science & Technology, Hsinchu 30013, Taiwan

ARTICLE INFO

Keywords:
Demand forecast
Intermittent demand
UNISON data-driven framework
Supply chain management
Artificial intelligence
Global manufacturing networks

ABSTRACT

The complexity involved in demand forecast for supply chain management of electronics components is exponentially increasing owing to demand fluctuations in consumer electronics, shortening of product life cycles, continuous technology migration, lengthy production cycle time, and long lead time for capacity expansion. While global manufacturing networks often suffer the risks of oversupply and shortage of key components, the distributor that is the key intermediate participator in electronics product supply chain buys components from the suppliers, warehouses them, and resells different parts to a number of electronics manufacturers with vendor-managed inventories. Thus, the component distributors forecast the demands for large assortments of stock keeping units (SKUs) with distinct dynamics for inventory control and supply chain management. To address realistic needs to enhance demand forecast performance, this study aims to develop a UNISON data-driven analytics framework that integrates machine learning technologies and temporal aggregation mechanism to forecast the demands of intermittent electronics components. An empirical study is conducted in a world-leading semiconductor distributor for validation. The results have shown practical vitality of the proposed approach with better performance than conventional approaches and the existing practice. Indeed, the developed solution has been employed in this company to support flexible decisions to empower agile logistics and supply chain resilience for smart production.

International Journal of Production Research, 2020
https://doi.org/10.1080/00207543.2020.1733125

Deep reinforcement learning for selecting demand forecast models to empower Industry 3.5 and an empirical study for a semiconductor component distributor

Chen-Fu Chien *, Yun-Siang Lin and Sheng-Kai Lin

Department of Industrial Engineering & Engineering Management, National Tsing Hua University, Hsinchu, Taiwan, R.O.C

(Received 15 December 2018; accepted 12 February 2020)

A semiconductor distributor that plays a third-party role in the supply chain will buy diverse components from different suppliers, warehouse and resell them to a number of electronics manufacturers with vendor-managed inventories, while suffering both risks of oversupply and shortage due to demand uncertainty. However, demand fluctuation and supply chain complexity are increasing due to shortening product life cycle in the consumer electronics era and long lead time for capacity expansion for high-tech manufacturing. Focusing realistic needs of a leading distributor for semiconductor components and modules, this study aims to construct a UNISON framework based on deep reinforcement learning (RL) for dynamically selecting the optimal demand forecast model for each of the products with the corresponding demand patterns to empower smart production for Industry 3.5. Deep RL that integrates deep learning architecture and RL algorithm can learn successful policies from the dynamic and complex real world. The reward function mechanism of deep RL can reduce negative impact of demand uncertainty. An empirical study was conducted for validation showing practical viability of the proposed approach. Indeed, the developed solution has been in real settings.

Keywords: deep reinforcement learning; demand forecasting; supply chain management; model selection; smart production; Industry 3.5

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隨著雲網端等資通訊科技的進步、電腦運算能力的增強，以及資料儲存技術持續改進的影響，大數據分析（big data analytics）可以發掘先前未知且潛在有用的資訊樣型或規則，進而轉化為有價值的資訊，制定出有效的解決方案，協助決策者迅速做出適當的決策。清華大學簡禎富講座教授領導的 IC 產業同盟，深耕高科技製造大數據，以協助智能製造和數位決策，與會員廠商有許多成功的合作研究案例，「產業要升級，大數據和工業 3.5 是台灣製造的機遇和戰略。」

▲ IC 產業同盟主持人簡禎富教授（右）榮獲 2016 行政院傑出科技貢獻獎。（攝影 / 蔡世豪）

Taiwan
spotlight

nature

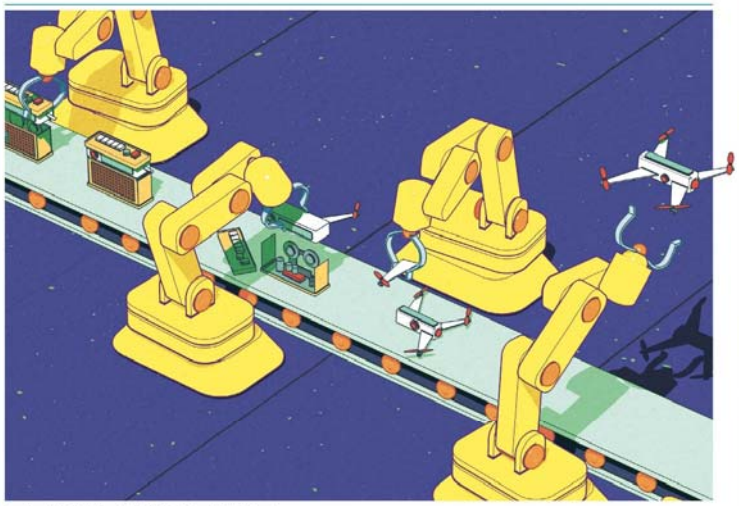


ILLUSTRATION BY GEORGINA GOODLEY

TAIWAN'S TIME TO TRANSFORM

The government is betting its manufacturing future on smart machinery and artificial intelligence to improve product quality and flexibility. **By Sarah O'Meara**

In 2016, industrial engineer Chen-Fu Chien was asked to lead a university research centre in Taiwan that would develop new manufacturing technologies using artificial intelligence (AI).

Rather than aiming to publish academic papers, his brief was to produce ideas that could be quickly transferred into industrial settings, says Chien. His research at the National Tsing Hua University (NTHU) in Hsinchu City uses big-data analytics to make machines smarter through AI that lets them take decisions without human control. It is one of several approaches to creating 'smart factories' that use an interconnected, digital network of supply systems – part of Taiwan's push to improve the flexibility, quality and efficiency of its manufacturing.

"I am one of the few senior scientists in Taiwan who's worked extensively with business, as well as in public research. It's one of the reasons the government asked me to lead the project," says Chien, whose position at the NTHU is endowed by the US firm Micron Technology in Boise, Idaho, which develops computer memory and storage technologies.

Chien's mission is a sign of how Taiwan's government wants its manufacturing industry to change using technologies such as cloud computing, big data, the Internet of Things and smart robots – a shift in industrial practices that has been dubbed Industry 4.0. Once known as a hub for mass-produced cheap goods, such as toys and electronics carrying the ubiquitous 'Made in Taiwan' stamp, the island is looking to science to upgrade its image so it can become a destination for international companies searching for futuristic manufacturing solutions.

In 2018, Chien and his team opened the Artificial Intelligence for Intelligent

Taiwanese government around US$33 million over 5 years, starting in 2018.

"The Ministry of Science and Technology wanted our centre to help create the next generation of intelligent manufacturing systems that could only be found in Taiwan," Chien says. The ministry's aim is "to use the region's strength in electronics manufacturing to its best advantage and establish Taiwan as a key high-tech manufacturing hub."

Taiwan's efforts to change its manufacturing model are timely. A global slowdown in trade since 2011 and a tariff war on goods traded between mainland China and the United States have pushed companies to look for alternative manufacturing options that are flexible, efficient and unaffected by such economic tussles.

Diverse development

Taiwan has been a leading manufacturer of electronic components since the 1990s. Its economy remains reliant on an industry that is led by the world's largest contract electronic chipmaker, Taiwan Semiconductor Manufacturing Company (TSMC), which supplies technology companies such as Apple and Huawei and contributed more than 4% to the region's gross domestic product in 2018.

However, the growth of consumer electronics has slowed across the world in the past few years as smartphone sales have dipped as a result of market saturation. In 2016, Taiwan's newly inaugurated president, Tsai Ing-wen, announced that the government would promote a new model of economic development. The idea was to encourage local technology firms to diversify their products and to become more innovative and self-sufficient to boost technology ties with the United States and Japan. Taiwan also wants to reduce its reliance on mainland China, with which it shares strong economic ties (see 'Moving money').

Tsai's 2016 strategy was followed by a breakneck series of policy announcements to encourage investment in smart machinery – equipment that can work with less input from an expensive human controller – and in other manufacturing technologies (see 'Non-stop reforms').

When Taiwanese manufacturers began moving factories to mainland China in the 2000s, it harmed the development of smart manufacturing technology on the island, explains Stephen Su, vice-president of a centre at Taiwan's Industrial Technology Research Institute, a government-funded research and development centre in Hsinchu. The institute, founded in 1973, has acted as an incubator for several Taiwanese companies, including the TSMC.

Now the government is "pouring resources" into smart manufacturing "because it's the future of production," Su says.

> "Pull quote on a four lines saying something cool and exciting and most probably amazing."

A conventional moving assembly line – many people using tools to complete small tasks in a much larger, complex process – was pioneered by Henry Ford to manufacture automobiles in the United States in 1913. Invented at the end of the 'second industrial revolution' that saw the global spread of technologies such as the widespread used of electrical power, the assembly line is still used in many factories today, says Chien.

Machines have largely replaced workers since the advent of the computer age, which saw a third revolution in industry involving robotics and greater automation. The next development, known as the fourth industrial revolution or Industry 4.0, will use advances in cyber-physical systems, such as biological sensors on machines. These will collect and exchange data that can be processed by big-data analytics and AI technologies, enabling manufacturers to make flexible decisions about how they operate and to allocate resources efficiently to empower smart production. Taiwan is betting that the products of the future will be made by such intelligent machinery.

Smart focus

More companies across the world are re-evaluating where and how they make their products, says Jason Ho, general manager of Avectec in Zhubei City near Hsinchu, which offers conventional manufacturers a software platform to help create smart factories. In these, networked machines can detect their own faults, work more efficiently and achieve lower production costs.

"Particularly in high-tech areas such as the computer industry, information and communications technology and consumer electronics, companies don't need to focus on making more products more quickly. They need to make manufacturing more intelligent so it can be more flexible. That way, companies can quickly adjust the product to meet the demands of each customer," Ho says.

Chien says his centre is already in demand from large companies that want it to develop new processes and that are headquartered in Taiwan and abroad, such as IT equipment producers. Many plan to try out new manufacturing solutions and want to move more of their operations outside mainland China as it becomes more expensive to work in and as its trade war with the United States rumbles on.

Talent base

Now that Taiwan is remaking itself as a destination for the next generation of manufacturers, there's one thing missing: talent.

It is in urgent need of experienced engineers, both to design smart manufacturing technologies and to create the high-tech products of the future, says Su. "We must invest in our scientists and engineers. There are many countries in southeast Asia that are also becoming more sophisticated in terms of manufacturing, and to stay competitive, it's important to make

NON-STOP REFORMS
TAIWAN'S POLICIES AIM TO BOOST TECH-BASED INDUSTRIES

May 2016
Taiwan's government announces its 'five plus two' policy – a plan to innovate the fields of biotechnology, defence, green energy, intelligent machinery and the Internet of Things.

November 2016
Launch of the Digital Nation and Innovative Economic Development Program (DIGI+), an initiative to make Taiwan a smart digital region by 2025. Policies include investment in start-up firms and development of the cybersecurity industry.

February 2017
The Smart Machinery Promotion Program is introduced. It aims to develop smart machinery applications by combining manufacturing expertise with that from information and communications technologies.

July 2017
The Ministry of Science and Technology (MOST) unveils plans to establish four research centres in artificial intelligence (AI). The initiative will cost US$33 million annually over five years.

August 2017
MOST announces a 4-year, $132-million semiconductor programme to speed up the development of AI processor chips, and a 5-year, $517.5-million strategy to cultivate AI talent and research (2017 to 2021).

AiMS 人工智慧製造系統研究中心
AIMS, Taiwan, R.O.C.
Artificial Intelligence for Intelligent Manufacturing Systems Research Center

MOST 科技部
Ministry of Science and Technology

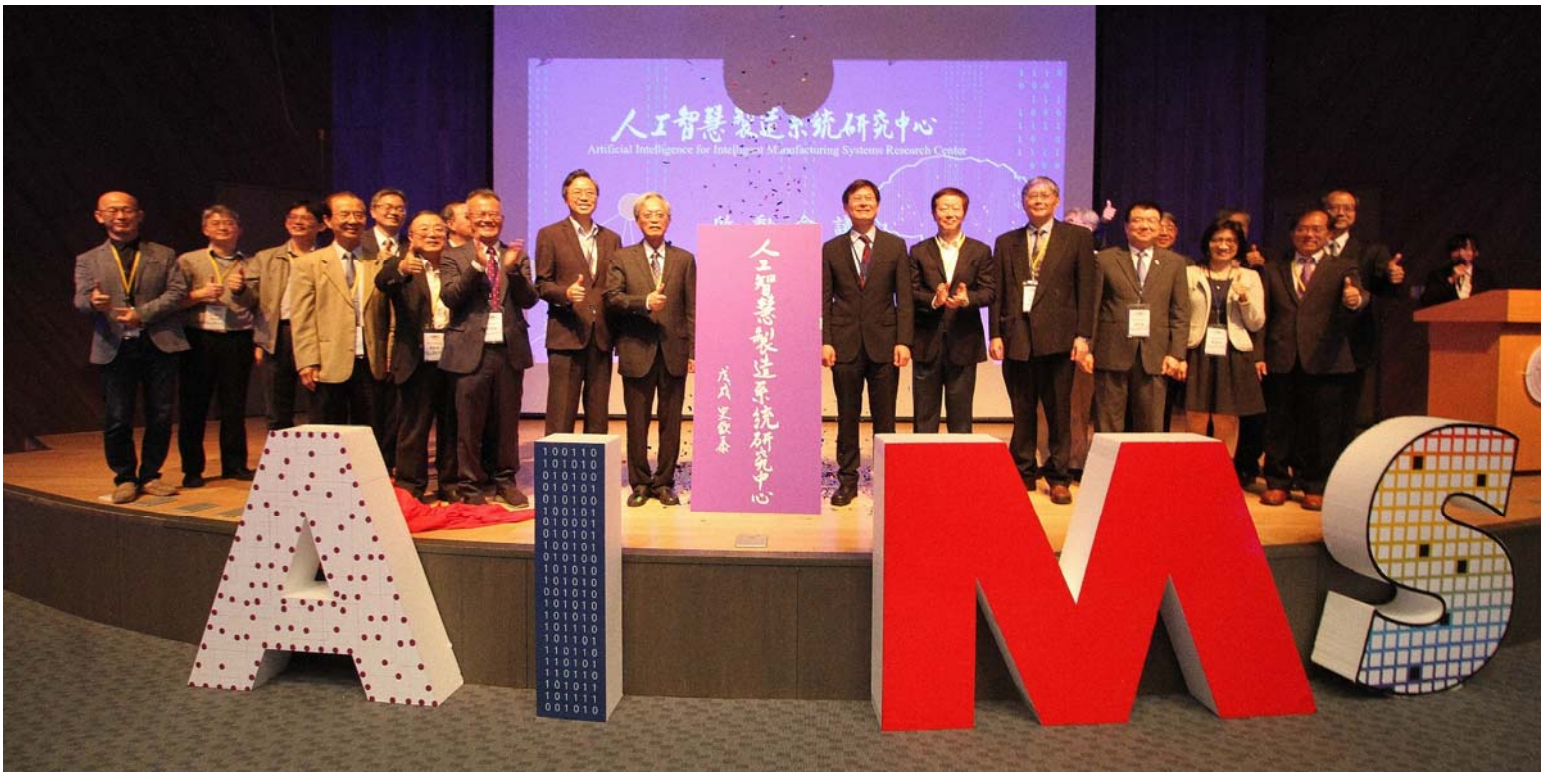
AIMS vision

AIMS will be established as a world leading AI research center based on core competencies of Taiwan's manufacturing industries & soft power of Made by Taiwan.

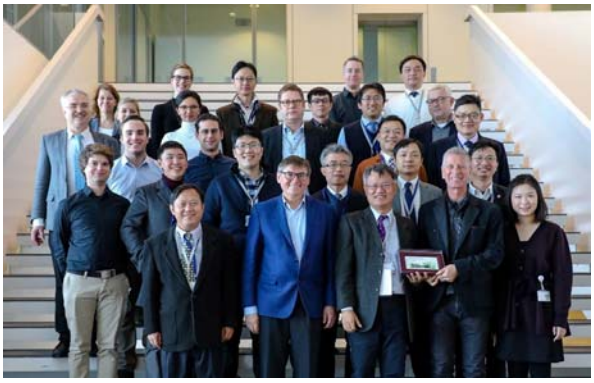
- Interdisciplinary Collaborations & Innovation
- AI enabled spinoffs Entrepreneurship ecosystem
- AI, Big Data Talent cultivation
- AI spin-in Intelligent Manufacturing
- International collaborations

AI Technology R&D Guidelines of MOST, Taiwan

AIMS Board

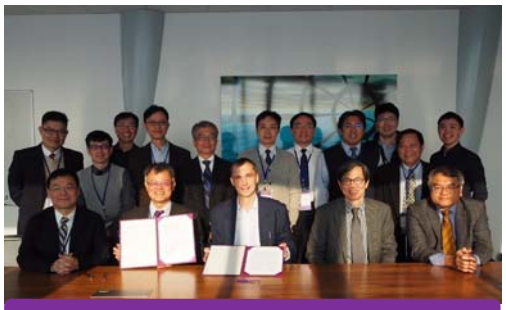


International Collaborations



MOU with Infineon, Germany

Taiwan-Japan Science and Technology Collaboration



MOU with CIIRC, Czech

Industry 3.5@NCRP, Philippines

Stanford Research Institute, USA

Industrial Collaborations and Vertical Integration among AIMS Teams

Industry 3.5

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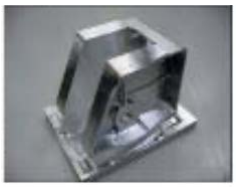
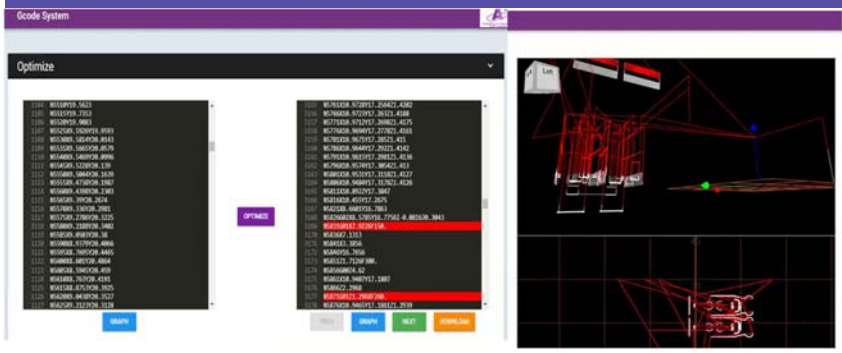
NC program optimization via AI & Big Data Analytics

- Optimize cutting path of Numerical Control Machine
- Current prediction system developed via AI
- NC program scoring for KM and improvement



Current & Feed Rate Optimization



Scoring System

Increases productivity 8~20% without reducing quality

Artificial Intelligence for Intelligent Manufacturing Systems (AIMS) Research Center, MOST, Taiwan

漢 En

Taiwan News 台灣英文新聞
VOICE OF THE PEOPLE · BRIDGE TO THE WORLD · ESTABLISHED IN 1949

Home / Society

How a team of technicians is helping Taiwan triple mask production

Over 100 Taiwanese technicians boosted Taiwan's mask production from 4 million to 13 million in just 6 weeks

7814 Like 2.9K Share Tweet 分享

By Central News Agency
2020/03/25 11:01

(CNA photo)

In industrial parks across northern Taiwan, a team of some 100 technicians has spent the last six weeks assembling 92 surgical face mask production lines that will boost the country's daily production capacity from 4 million to 13 million masks.

Updated : 2020-04-08 09:07 GMT+08:00

MOST POPULAR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Latest figures on China's coronavirus outbreak


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Taiwan CECC head shows how to disinfect mask with rice cooker


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Taiwan police offer Singaporean woman shelter


Taiwanese doctor invents device to protect US doctors against coronavirus


Chinese woman describes Wuhan virus patients being burned alive


Doctors warn of spike in coronavirus cases in Taiwan over holiday


Taiwan reports 10 new cases of Wuhan coronavirus

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Taiwan-Based Everest Textile USA Plans Manufacturing Facility In Forest City, North Carolina

Area Development News Desk
12/07/2016

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Electricities Helps North Carolina Build on a History of Aviation Success
Evaluating the U.S. Corporate Tax Environment

Everest Textile USA will establish a 610-job manufacturing facility in Rutherford County, North Carolina. The Taiwan-based maker of high-performance sports apparel will invest $18.5 million over five years at a site in Forest City.

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- Allison Transmission Builds Vehicle Test Facility in Indianapolis, Indiana 03/01/2019
- Brennan Investment Group Builds Poultry Operations Complex in Londonderry, New Hampshire 03/01/2019
- SuperATV Locates Manufacturing-Distribution Complex in Shreveport, Louisiana 03/01/2019
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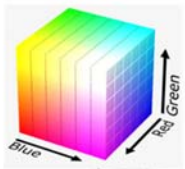
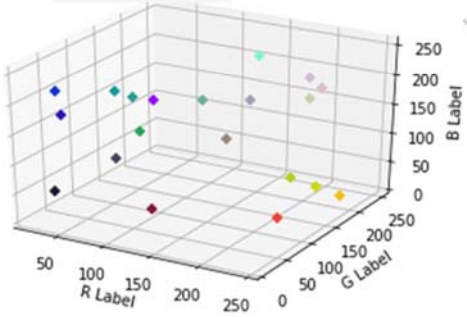
Textile Smart Manufacturing via Industry 3.5





Artificial Intelligence for Intelligent Manufacturing Systems (AIMS) Research Center, MOST, Taiwan

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Industry 3.5 Solutions for Emerging Countries

Philippine MOST Minister Fortunato T. De La Pena

DIGITIMES電子時報

No. 5187 2019年3月20日 星期三 農曆己亥年二月十四 www.digitimes.com

產業動態

台灣工業3.5 更適合新南向國家

菲律賓國家研究委員會年會 台灣學者首次受邀演講

台北訊

科技部人工智慧製造系統研究中心(AIMS)主任、科技部工業工程與管理學門召集人、國立清華大學清華講座教授暨美光講座教授簡禎富，日前(11日)應邀於菲律賓國家研究委員會(NRCP)年會演講「工業3.5混合戰略以優化新興國家人力資本」，為首次在菲律賓科技會議暨國科會年會中演講的台灣教授。

本屆NRCP大會由菲律賓科技部長Fortunato de la Pena主持，共計超過1,300多位學者與會。會議主軸為「人性化第四次工業革命」，特邀簡禎富講座教授於「工程與產業研究群」分享所提出的「工業3.5」策略。

簡禎富教授認為：新興國家工業基礎並不足以一步到位地推動工業4.0，同時也需要解決更多就業和貧富差距等社會問題，因此必須發展適合自己產業結構和核心能力的製造戰略。「工業3.5」作為工業3.0和工業4.0之間的混合策略，藉助人工智慧和大數據等破壞性創新技術，發展本土智慧製造解決方案。

簡教授並介紹AIMS的研究成果和台灣產業實證案例，與菲律賓目前發展工業4.0面臨的挑戰與實際需求不謀而合，受到熱烈迴響和深入討論交流。簡禎富教授並以他撰寫的台積電、聯發科、創意電子、晶元光電等哈佛商學個案的典範企業為例，說明台灣製造軟實力和工業3.5，更能當作菲律賓產業升級參考，以擴大台灣在東南亞國家的影響力。

會後菲律賓NRCP理事長Ramon A. Razal院士並邀請各研究群組主席，與簡禎富教授進行圓桌會議，討論國際合作和人才培育等議題。簡禎富表示：「台灣應把握新興國家面對工業4.0的產業升級壓力和挑戰，讓工業3.5成為台灣製造的品牌，成立國家隊整合相關企業和台商，發展更符合新興國家需求的工業3.5解決方案，讓台灣製造軟實力在東南亞國家發揮更大的影響力」。

▲菲律賓科技部長Fortunato de la Pena(左)與簡禎富教授(右)同席並聆聽演講。

Artificial Intelligence for Intelligent Manufacturing Systems (AIMS) Research Center, MOST, Taiwan

Humanizing Industrial Revolution via Industry 3.5 as a Hybrid Strategy to Optimize Human Capital as Force for Good in Business in Emergent Countries

Chen-Fu Chien, Ph.D.
Tsinghua Chair Professor & Micron Chair Professor
National Tsing Hua University, Hsinchu, Taiwan
Director, Artificial Intelligence for Intelligent Manufacturing Systems (AIMS) Research Center, Ministry of Science & Technology (MOST), Taiwan
Convener, Industrial Engineering and Management Program, MOST, Taiwan
cfchien@mx.nthu.edu.tw

11 March 2019@NRCP

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APO Center of Excellence (COE) on Smart Manufacturing for APO members

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APO coordination meeting assesses smart manufacturing needs

14 Nov 2019

Transformation to smart manufacturing requires a phased approach.

The Asian Productivity Organization (APO) and China Productivity Center (CPC) organized a coordination meeting for the research project on Assessment of Smart Manufacturing and Needs of Member Countries in Taipei, 12–14 November 2019. The project is being carried out under the APO Center of Excellence (COE) on Smart Manufacturing. Chief Expert Professor Chen-Fu Chien of National Tsing Hua University and six national experts comprising Dr. Chia-Yen Lee (ROC), Umashankar Prasad (India), Abdullah Sanusi (Indonesia), Franklin D. Quiachon (Philippines), Dr. Anan Mungwattana (Thailand), and Dr. Ha Minh Hiep (Vietnam) laid the groundwork for conducting the research on the current to mid-term smart manufacturing needs of APO members while improving overall industrial productivity in each country. APO Secretariat Research & Planning Department Officer David Sehyeon Baek also attended as the research coordinator.

YouTube TW 搜尋 https://youtu.be/won5saQsSQQ

Productivity 6.0: Forging ahead with Smart Manufacturing

決策分析研究室 http://DALab.ie.nthu.edu.tw

Industry3.5 International Symposium

Industry 3.5

International Symposium on Industry3.5 for Intelligent Manufacturing

September 25 - 27, 2019, National Tsing Hua University, Hsinchu, Taiwan

https://www.aims.org.tw/industry3.5/

Aims and Topics:

Global manufacturing networks are facing disruptive challenges due to newly technologies such as Artificial Intelligence, Big Data, Internet of Things, and 5G. Leading nations including Germany and USA have reemphasized the importance of advanced manufacturing and initiated national manufacturing strategies such as Industry 4.0 and AMP. The manufacturing sectors in Asia-pacific regions and emerging countries are playing important roles for economic growth and job opportunities, yet their industrial structures may not be ready for the migration for Industry 4.0 directly.

"Industry 3.5" that is proposed as a **hybrid strategy between the existing Industry 3.0 and to-be Industry 4.0**. This international symposium calls for **disruptive innovations** from theoretical research, methodological developments, case studies, and industrial practice to address the needs for **humanizing industrial revolutions and sustainable migration** including, yet not limited, the following topics:

Internet of things (IOT)	**Big Data Analytics & Data Mining**	**Cyber Physical System**
Circular Economics	**Smart Production**	**Smart Agriculture**
Green Supply Chain & Sustainability	**Total Resource Management**	**IE Education/ Curriculum Design**
Deep Learning Applications	**AI & Computational Intelligence**	**User Experience & Innovative Design**
Augmented Reality & Virtual Reality	**Advanced Process/equipment Control**	**Enterprise Resource Planning**
Virtual Metrology	**Defect Detection and Classification**	**Image Analysis, Visual Inspection**
Evolutionary Algorithm	**Simulation Optimization**	**AMHS/ Automatic Guided Vehicle**

Keynote speech, Exhibit, and Factory Visiting:

Industry3.5 Symposium will provide a platform to facilitate related activities such as keynote speeches, factory visiting and exhibition to enrich the conference. Details can be founded in https://www.aims.org.tw/industry3.5/

Organized/sponsored by:

Industrial Engineering and Management Program (IEM), Ministry of Science & Technology, Taiwan
Artificial Intelligence for Intelligent Manufacturing Systems Research Center (AIMS), MOST, Taiwan
NTHU-TSMC Center for Manufacturing Excellence, Taiwan
Department of Industrial Engineering and Engineering Management, National Tsing Hua University, Taiwan

Important Dates:

Deadline for Full Paper/Presentation-only Abstract Submission:	**July 31, 2019**
Notice of Acceptance:	**August 10, 2019**
Deadline for Camera Ready Manuscript:	**September 1, 2019**

Registration Fee:

Regular registration:	**US$300** (Early bird, before August 15, 2019) / **US$500** (Regular)
Students:	**US$100** (Early bird, before August 15, 2019) / **US$150** (Regular)

Paper submission:

Full paper must be written in English with a maximum length of 5 pages. For paper format, submission, and related information, please visit: https://www.aims.org.tw/industry3.5/ and submission to conference.industry3.5@gmail.com. Selected papers in Industry3.5 will be recommended for reviews and possible publications in related special issue of SCI journals (https://www.aims.org.tw/industry3.5/CFP).

Venue:

National Tsing Hua University (https://www.nthu.edu.tw/), where special offers of NTHU guest house (https://affairs-guesths.ym.nthu.edu.tw/en/index.php) and hotels nearby are available.

人工智慧製造系統研究中心 Artificial Intelligence for Intelligent Manufacturing Systems Research Center

清華-台積電 卓越製造中心 NTHU-TSMC Center for Manufacturing Excellence

https://www.aims.org.tw/industry3.5/

Resources, Conservation & Recycling 152 (2020) 104482

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journal homepage: www.elsevier.com/locate/resconrec

ELSEVIER

Industry 3.5 for Sustainable Transition and Total Resource Management

Chen-Fu Chien (Managing Guest Editor)[a], Ming-Lang Tseng[b], Raymond R. Tan[c], Kimhua Tan[d], Ondrej Velek[e]

[a] Department of Industrial Engineering and Engineering Management, National Tsing Hua University, Taiwan
[b] Institute of Innovation and Circular Economy, Asia University, Taiwan
[c] Center for Engineering and Sustainable Development Research, De La Salle University, Manila, Philippine
[d] School of Business, University of Nottingham, United Kingdom
[e] Czech Institute of Informatics, Robotics and Cybernetics at Czech Technical University, Prague, Czech

Leading nations have emphasized manufacturing with national competitive strategies such as Industry 4.0 and Advanced Manufacturing Partnership (AMP). The paradigm of global manufacturing networks is shifting, in which the increasing adoption of artificial intelligence, Internet of Things (IOT), data analytics, and robotics have empowered manufacturing intelligence and smart production. On the one hand, international enterprises are battling for dominant positions in this newly created arena via providing novel manufacturing platforms such as cyber-physical systems. On the other hand, new business models and manufacturing solutions will impact global resource utilization and the environment. However, little research has been done to address management and environmental implications of industrial transition. Furthermore, most of emerging countries may not ready for the transition to Industry 4.0 directly. Alternatively, "Industry 3.5" is proposed as a hybrid strategy, i.e., between Industry 3.0 and to-be Industry 4.0, to call for disruptive innovations to address the need to manage the potentially disruptive socio-economic impacts of such a transition, while taking into account total resource management for sustainability, manufacturing. Prior studies are lacking to address flexible decisions and sustainable resource utilization before ready for Industry 4.0 transition.

This virtual special issue (VSI) aims to collect practical approaches for achieving concrete, measurable progress across economic and environmental pillars to ensure the sustainable resource utilization via novel studies for sustainable migration for Industry 3.5 and Industry 4.0. This VSI will guide future directions that will facilitate successful and sustainable migration of industrial revolutions.

Interested topics for the VSI include but not limited to:

- Resource and environmental implications/impacts of transitions to Industry 3.5;
- Frameworks for sustainable Industry 3.5 transition;
- Assessment of sustainable Industry 3.5 transition;
- Industry 3.5 and the Circular Economy;
- Novel theories and solutions for total resource management to realize the hybrid strategy of Industry 3.5.

ng Systems (AIMS) Research Center, MOST, Taiwan

紫式大數據決策
DALabx

「產業醫生 Dr. Fab」
分析服務業
Analytics as a Service
台灣產業轉型升級也需要
完整的醫療和健保體系!!!

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紫式大數據決策
DALab Solutions x Associates

台北訊

紫式大數據決策股份有限公司（DALab Solutions x Associates Co., Ltd.）2018年1月10日掛牌進駐清華大學創新育成中心，史欽泰院長、清大副校長陳信文、大清華基金、水木創顧總經理 林俊吉和創業師生團隊一起出席揭幕慶祝活動。史欽泰院長並書寫「紫式大數據決策」墨寶作為公司招牌，期許公司以超越摩爾定律的速度成長，成為大數據時代台灣新創公司的獨角獸。

點擊圖片放大觀看

右起：清大副校長陳信文、史欽泰院長、簡禎富教授、水木創顧總經理 林俊吉

紫式大數據決策股份有限公司為清華講座教授簡禎富研究團隊執行科技部AI計畫和深耕工業基礎技術專案計畫累積研發成果，已獲得多項發明專利，並協助高科技產業發展大數據分析和智慧製造系統，經清華大學萌芽功能中心輔導所衍生的新創公司。國立清華大學和創業師生團隊均持有股份，該公司已經與清華大學簽訂技術授權合約，並為清華大學IC產業同盟會員廠商，研發大數據分析技術、最佳化與人工智慧演算法等智慧製造和智慧服務相關技術之模組化，結合領域專家的管理經驗和製造智慧，發展滿足台灣製造升級需求的解決方案和分析服務。目前已有多家公司委託分析服務，以協助其發展彈性決策和聰明生產的解決方案。

科技部人工智慧製造系統研究中心主任、清華大學講座教授簡禎富表示：「為響應科技部AI創新研究中心推動AI產業化、產業AI化的目標，清華團隊新創公司將整合各種資源，加速研發大數據分析和AI技術的解決方案和分析服務，成為

科技部萌芽十年有成　紫式大數據助台廠推動工業3.5

新竹訊

科技部「研發成果萌芽計畫」10周年有成，協助大學研究機構科研成果產業化。日前舉辦萌芽計畫十周年成果展，邀請33組師生新創團隊，技術領域涵蓋智慧製造、奈米材料、精準醫療、農業、半導體、到太空科技，提供臺灣多項產業升級時所需之關鍵技術。

會中科技部長吳政忠說明，2007年國科會(科技部前身)主委是前副總統陳建仁，他則是國科會副主委；國科會邀請中研院院士王佑曾主持「台灣學術里程與科技前瞻」計畫，2011年接續推動「研發成果萌芽計畫」，迄今已有超過73家以研發成果衍生成立的新創公司，累計吸引超過25億民間資金投入。吳政忠表示，科技部將持續支持學研成果和前瞻技術產業化，未來也將跨部會合作培育新創，加強鏈結國際資金來台，讓台灣新創生態系統更健壯。

在本次成果展中，由清華大學工工系講座教授簡禎富決策分析研究室(DALab)團隊，執行科技部計畫深耕大數據分析、智慧製造、資源調度優化和數位決策的技術和系統，經清華大學萌芽功能中心輔導，移轉研發技術新創「紫式大數據決策股份有限公司」(DALabx：DALab Solutions x Associates Co., Ltd.)進駐清華大學創新育成中心，加入清華大學「先進智慧製造系統(AIMS)聯盟」成為會員廠商。

該公司並贊助「科技部鼓勵企業參與培育博士研究生」計畫，加速研發大數據和AI智慧製造技術的模組化解決方案和分析服務，協助無法自建分析團隊的中小企業和傳統產業廠商，提升彈性決策和智慧製造能力，推動數位轉型。目前已有多家公司委託分析服務，以協助其發展彈性決策和聰明生產的解決方案。

科技部人工智慧製造系統研究中心主任、清華講座教授簡禎富表示，DALabx不僅是科技部計畫研發成果的萌芽新創公司，透過產業化的資源，培育跨產業實證臨床經驗的「產業醫生」(Dr. Fab)，推動分析服務產業化(Analytic-as-a-Service)，協助台灣產業升級工業3.5智慧製造，更希望結合台灣製造的軟實力和管理經驗，發展建立完整產業醫療體系就像是清華大學附設的「產業醫學中心」，對症下藥研發台灣各個產業升級所需要的各種解決方案，進而輸出至其他新興國家，擴大台灣製造解決方案的國際影響力，使台灣成為全球彈性製造中心。

前副總統陳建仁(右2)、科技部長吳政忠(右3)訪視科技部萌芽紫式大數據決策研發成果。

Industry 3.5

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The Impact of Country Image and Travel Constraints on Revisit Intention: The Case of Thai Tourists Visiting Taiwan

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Abstract

The number of foreign tourists has increased in Taiwan Tourism more all the time.Taiwan is a country that is familiar and known with Thai people for a long time. There are advertisements through various media, whether social media, magazines, television and radio, including talking about traveling in Taiwan that cause a wave of popularity among Thai tourists is bigger. Based on decision-making models and planning behavior theory, this study aims to exploring the impact of country image and travel constraints the tourist perceived on revisit intention. The quantitative research was conducted, and a questionnaire will be used for Data collection. The survey is planned to conduct with Thai tourist who have been to Taiwan before. The finding of current study is expected to provide suggestion about marketing and developing strategy for decision maker of government and managers of tourism-related industries.

Keyword: Country Image, Travel Constraint, Revisit Intentions, Theory of Planned Behavior

The Disaggregate Productivity Change in Taiwan's International Tourist Hotels

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Abstract

With the rapid demand of the international tourism and more competitive market, the International Tourist Hotels (ITHs) industry must pay more attention to the productivity performance whether their output have reached the optimum stage or not, to cope with the overall market environment and enhance their competitiveness. Therefore, this study utilizes a panel dataset of 56 ITHs in Taiwan to evaluate the disaggregate productivity change by using the Luenberger productivity index based on directional distance function. Empirical findings are as follows: First, the overall productivity change of ITHs in Taiwan shows a growing trend and the main source of productivity change is the technical change rather than the efficiency change. Productivity growth mainly from the innovative effect, which non-chain operated of ITHs have a higher productivity growth than the chain-operation ITHs. Second, from disaggregate perspective, the non-chain operated ITHs show an increasing trend in the productivity of room and other facilities, but the chain-operation ITHs have a growing trend in the productivity of food and beverages. Third, the main source of productivity change among the 56 ITHs is the room and other facilities items.

Keyword: Disaggregate Productivity, International Tourist Hotels (Iths), Directional Distance Function, Luenberger Productivity Index

A Study on the Trends of Global and Asian Cruise Industry Development and Challenges of COVID-19 Pandemic

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Abstract

The purpose of this study aims to analyze the trends of global and Asian cruise tourism industry development, to link with implementing the solute to ocean policy of Executive Yuan, to understand the market structure of Taiwan's cruise tourism, and to promote Taiwan's cruise tourism industry development. In addition, the impact and challenges of the Coronavirus (COVID-19) pandemic on the global and Asian cruise tourism industry development will be explored as well.

The research method is to analyze the statistical data of growth trend of global and Asian cruise passengers, the cruise lines deployment by region, the passengers from top sourced markets in Asia, the destination countries of cruise tourism, and the growth capacity of the Asian cruise industry in recent years. In addition, the Pearson product moment correlation analysis is used to analyze the relationship between the passengers from Mainland China, Taiwan and the population, GDP, unemployment rate and average wages. The population penetration rate of top 10 Asian sourced cruise passengers is also explored.

The results are as follows：1. Number of global ocean cruise passengers increase by 7.21 million and growth rate has increased 33.8% from 2013 to 2018 while number of Asian ocean cruise passengers has increased 182% from1.51 million in 2013 to 4.26 million in 2018. The growth rate of Asian ocean cruise passenger number far exceeds that of Europe, America and other regions of the world. Therefore, Asia has become the most prosperous region in the global cruise tourism industry. 2. Among the top 10 Asian cruise sourced passengers countries, the first is China (55.33%), and the

second is Taiwan (9.18%). It means that cruise traveling is rising in popularity by Taiwanese. 3. Among the top 10 destinations countries for Asian cruise tourism, the first is Japan (38.94%), the second is China (16.60%), and Taiwan is the eighth (4.56%). 4. For 2019, there are 10,245 operating days for Asian cruise industry, a 137% increase from 4,307 operating days in 2013. 5. According to the Pearson product moment correlation analysis, the correlation coefficient of Taiwan between "sourced cruise passenger number" and "population", "GDP", "unemployment rate" and "average wages" were 0.987, 0.997, -0.998 and 0.883. It is found that larger population, higher GDP, higher average salary and lower unemployment rate will have higher sourced cruise passenger number. 6. According to the analysis, the population penetration rate of the top 10 Asian sourced cruise passengers, the first is Singapore (6.50%), the second is Hong Kong (3.38%), and the third is Taiwan (1.66%). The population penetration rates of other countries except top 10 Asian sourced cruise passengers are not over 1%. It shows that Asian countries have great potential to develop the international cruise tourism industry compared that to the US or Europe. 7. Due to the impact of the COVID-19 global pandemic, Carnival Corp. has announced an US$4.4 billion loss from Jan. to May, 2020. The monthly spending for the second half of 2020 is estimated to be 650 million US dollars even stop operating temporarily. It caused the cruise company huge financial burden. 8. The stock prices of top three international cruise companies, Carnival Corporation & plc, Royal Caribbean International and Norwegian Cruise Line Holdings LTD., have declined nearly 58.5%, 39.4%, and 63.9% of its value from February 24 to July 31. It means that, due to the impact of the COVID-19 pandemic, the market investors' confidence in cruise industry is shaken.

Keyword: Cruise Industry, Cruise Tourism, Ocean Tourism Industry, Coronavirus Disease**(COVID-19)**

Do National Parks or Different levels of Scenic Areas Drive Lodging Business Performance?

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Abstract

The reasons why peoplevisit national parks, and national or county-level scenic areas do matter because nature-based tourism is a large and rapidly growing global industry (Eagles, 2002). National parks or protected areas are not only physical places, but also sources of ecosystem services as well as biodiversity's reservoirs. According to Liu (2014)'s research, after typhoon Morakot's damage, the entire Maolin National Scenic Area and Park in Taiwan lost over 700,000 visitors within one and a half year; consequently, this disaster has caused a loss of NT$1.39 billion in tourism business. As such, national parks, national scenic areas, and county-level scenic areas are important tourism resources in Taiwan and play vital roles in tourism economics. This study examines whether there are causality relationships between three lodging accommodations and national parks, national, or county-level scenic areas, respectively by using the Granger causality test. The findings of this study show that the tourist arrivals of National Scenic Areas and the average daily rates of all of three lodging accommodations (B&Bs, international tourist hotels, and standard hotels) exhibit bi-directional causality relationships, respectively. This implies that not only can national scenic areas spur all types of lodging accommodations, but all lodging accommodations' business performances can also lead to national scenic areas' tourism growth.

There are also bi-directional causality relationships between national parks' occupancy rates and all three lodging accommodations: B&Bs, international tourist hotels, and standard hotels, respectively. This indicates that national parks can lead all types of lodging accommodations' occupancy rates, and the same is true for the reverse direction from lodging accommodations' ORs to national parks' tourism growth. From this study, we are awakening to the fact that national parks not only conserve biodiversity and ecosystem services, but also are powerful players for commercial

opportunities through generating visitors' or tourists' entry, activity, or lodging fees to increase tourism and hospitality industry's revenue, to support local economy and regional infrastructure development, and to tackle uncertain external economic and environmental changes. Meanwhile, businessperformances of lodging industry spurs the arrivals of national parks as well, so to speak. In other words, national or county-level tourist attractions and business performance of the lodging industry have a reciprocal or symbiotic relationship to a certain level.

Keyword: National Park, Lodging Industry, Business Performance

Government Debt and Fiscal Execution Efficiency

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Abstract

Governments have used deficit policies in recent years to enhance economic development, yet many still face fiscal debt problems. Thus, this research uses Data Envelopment Analysis (DEA) to analyze the financial performance of local governments, providing a new method that can deal with negative data to better scrutinize the relationship between government debt and fiscal execution. We adopt the Range Directional Measure Dynamic Directional Distance Function (RDM Dynamic DDF) model with negative data to explore the financial efficiency of 22 local governments in Taiwan from 2011 to 2018. The results are as follows. (1) The counties and cities with the best efficiency include Hualien County, Taitung County, Jinmen County, Lianjiang County, Nantou County, Chiayi County, and Taipei City. For 7 local governments with poor efficiency, 2 municipalities fail to even meet the fiscal improvement goals of planning a major change in local institutions. (2) The fiscal performances of outlying islands and eastern local governments are better than those of western local governments. (3) Kaohsiung City government has the highest accumulated debt among all local governments, showing that its self-financing resources are insufficient. (4) Tainan City government exhibits poor financial performance due to debt limitation and insufficient self-financing resources.

Keyword: RDM Dynamic DDF Model with Negative Data, Government Debt, Fiscal Efforts, Central Financial Resources, Local Self-Financing Resources

Food Efficiency of European Union Countries by Considering Ammonia Emission and Food Wastes

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Abstract

This study uses the two-stage dynamic undesirable data envelopment analysis (DEA) Model by considering global warming as an exogenous condition to assess the agricultural performance of European Union (EU) countries. The two stages are food production and consumption. The first stage explores the concept of food security for the food production efficiency of the relationship between fertilizer use and ammonia air pollution, while the second stage analyzes the idea of food loss and wastes for the food consumption efficiency that issues of population growth and food waste. According to the empirical results, we find that the efficiency of the general agricultural production stage is poor, and the efficiency of the food consumption stage is affected by general food waste. In over half of the countries, first-stage fertilizer utilization efficiency is less than 0.5, suggesting in response to food production corresponding to European food demand that fertilizers are overused. Moreover, if we do not consider the exogenous conditions of global warming and discuss the agricultural efficiency of European countries, then bias in the underestimation of efficiency appears.

Keyword: Food Waste, Ammonia Emission, Two-Stage Undesirable Dynamic Data Envelopment Analysis, Production and Consumption Efficiency

The Assessment of Energy, Health Efficiency and Total Factor Dynamic Overall Efficiency with OECD Economies

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Abstract

Exploring the performance of the efficiency is the main focus in the past studies of evaluating energy and environment. In order to fulfill the inadequacy, this study takes 34 economies in the Organization for Economic Cooperation and Development (aka OECD) as the research object and divides the total input and output factors into two stages. Also use the Dynamic network SBM (aka DN-SBM) to evaluate the impact from OECD in energy, health efficiency, and productivity change between 2011 and 2015. According to the empirical results with the energy stage, the average efficiency value from the 18 economies of Estonia、Finland、France、Germany、Hungary、Iceland、Ireland、Japan、Luxembourg、Mexico、New Zealand、Norway、Portugal、Slovenia、Sweden、Switzerland、Turkey and United States is the best with efficiency values of 1 with 24 economies above the average and 10 economies below the average. The economies with the worst efficiency values are Israel (0.6859), Netherlands (0.6652) and Belgium (0.5492). And in the health stage, the average efficiency value from the 11 economies of Estonia、Finland、Hungary、Iceland、Mexico、New Zealand、Poland、Portugal、Slovenia、Sweden and Turkey is the best with efficiency values of 1. There are 25 economies that are above the average and 9 economies below the average. Ireland(0.2454)、Netherlands(0.2014) and Denmark(0.1945) are the economics with the worst efficiency values. Regarding to total factor dynamic overall efficiency, Estonia、Finland、Hungary、Iceland、Mexico、New Zealand、Portugal、Slovenia、Sweden and Turkey are the 10 economies reach Pareto optimal efficiency. And Ireland(0.4469)、Israel(0.4179) and Netherlands(0.3697) have the worst efficiency values. This study chooses to use dynamic intertemporal data to evaluate the overall efficiency and productivity of OECD based on the index of DN-SBM. It can provide more objective research results for various economies to make reference for energy policies, national health and forest conservation related policies.

Keyword: OECD, Energy, Health, DN-SBM, Efficiency

Dynamic Linkages among Economic Development, Environmental Pollution and Human Health in Chinese

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Abstract

Background Research on the relationships between economic development, energy, environmental pollution, and human health has tended to focus on the relationships between economic growth and air pollution, energy and air pollutant, or the impact of air pollution on human health. However, there has been little past research focused on the complex relationships between energy consumption, economic growth, air pollution and health treatment.

Methods:There has been little past research focused on the complex relationships between energy consumption, economic growth, air pollution and health treatment. To go some way to filling this gap, this paper developed a modified two stage Undesirable Meta Dynamic Network model to jointly analyze energy consumption, economic growth, air pollution and health treatment data from 31 Chinese high-income and upper-middle income cities from 2013–2016.

Results:The results were as follows. 1. While the overall efficiencies in both the high-income and upper-middle income cities declined, they were higher in the higher income cities. 2. The production stage efficiencies were higher than the healthcare resource utilization stage efficiencies in most cities. 3. The high-income cities had limited technology gaps than the upper–middle income cities. 4. The high-income cities had higher average energy consumption efficiencies than the upper-middle income cities. 5. In general, the health expenditure efficiencies were the lowest of all inputs. 6.The high-income city’s respiratory disease was less than the upper–middle income cities, and the high-income cities had lower mortality rate, but the upper-middle income cities had increasing mortality rate.

Conclusions:To effectively respond to these challenges and problems, the government needs to actively adapt measures to local conditions, develop scientific governance systems, and formulate short, medium- and long-term dynamic strategic management directions.

Keyword: Air Pollutant, Data Envelopment Analysis, Economic Efficiency, Energy Consumption, Healthcare Resource Utilization Efficiency

Prioritizing Value Measures on Smart Buses by AHP

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Abstract

Considering the development of smart cities, smart public transportation systems are essential. This research uses the analytic hierarchy process to measure the importance of various characteristic indicators (function value, safety value, information value, convenience value, etc.) of smart buses and ranks various special items. As a result, "convenience value" is the most important, and "information value" is the least important (seems to have been replaced by smartphones), which hints at the development direction of intelligent transportation systems and intelligent public transport.

Keyword: Smart Bus, Value Factors, Analytic Hierarchy Process (AHP)

The Factors of Users Trust in Online Customer Reviews on Amazon.com

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Abstract

This paper is based on four theories to discuss the influencing factors of trust in online customer reviews, including Transfer of Trust, Relevance Theory, Source Credibility and Selective Attention. And combined with the four parts of the information that users can see when reading reviews, including review’s title, review’s content, product star rating, and the helpful vote. We used questionnaires to investigate users who have used Amazon to shop online, hoping to find out the factors that users trust in reviews.

Keyword: Online Customer Reviews, Trust in Reviews, Transfer of Trust, Relevance Theory

Customer Loyalty: A Study on Women's Beauty Salon in Kolkata, India

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Abstract

The title of the thesis is 'Customer Loyalty: A Study on Women's Beauty Salon in Kolkata, India'. The research speaks about the loyalty of the customers towards Marina Beauty Salon as well as the correlation between customer satisfaction and loyalty in a Beauty Salon. The main purpose behind this research was Kolkata being rich in people and diversity has a great potential for beauty salon business but unfortunately there has been limited research on this particular issue. Secondly, Various business sectors, especially brick and mortar stores have been economically affected due to the rapid growth of digitalization and evolution. The in-house service provider app with the offer of door-to-door in-house services at a reasonable price and also the dominant big stores have pulled thousands of customers towards their company. Customers prefer such stores because of better quality and services. Hence many physical stores who were unable to provide such services and products, unfortunately, were forced to shut down their business, beauty salon being one of them. In this turmoil and uncertain environment, one such beauty salon has struggled and maintained the trust and loyalty of its customers for many years. Lastly, there is an emotional attachment with Marina Beauty Salon because the researcher has been their customer since childhood so she has experienced the Salon grow and develop into what it is today and also had the chance to interact with some of their clients when she was in Kolkata. Hence, it adds a sentimental value on this research. Hence, the author felt it necessary to select this topic as her Thesis.

In-order to find the answers to the research questions, the author applied qualitative approach and had 8 interviewee samples for deeper understanding. The samples of this research were all Indian women customers from Marina Beauty Salon.

The results indicates that apart from having a trained, skilled and reliable employees with an honest services as well as being Responsive, well-groomed employees with a hygienic environment, having quality products and a flexible working hours as well as a convenient location. The most important factor or reason behind customer loyalty is the behaviour of the owner and the employees. They are professional as well as friendly and provide a Warm, relaxing and homely ambience to their customers. Furthermore, The little kind gestures that Marina does for her customers like for instance, providing lunch when she realized that one of her clients was hungry or waiting and accompanying her customer for the car because it was late in the evening, suggesting some remedies which can be easily available at home and not imposing her customers with expensive products, opening her Salon during her off day because of her customer's emergency situation, sending one of her staffs to her client's house because she was not well are the reasons that the participants could connect and open up to her and trust her. The owner and the staffs' earnest behaviour helped to establish a bond and a relationship with their customers and through these factors and reasons the customers felt happy, special and satisfied which ultimately led to customer loyalty towards Marina Beauty Salon.

Keyword: Customer Loyalty, Customer Satisfaction, Beauty Salon, SERVQUAL

Constructing a Smart Medical Nutrition Consultation App system -As Example C.G.M.F.

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Abstract

According to data from the National Health Administration of the Ministry of Health and Welfare, in recent years, the number of obese people in my country has increased sharply. Obesity can even lead to chronic diseases, which has a huge impact on the physical and mental health of Chinese people. Some patients turn to a dietitian for a series of consultations on weight-loss plans, in which obesity determination is an important key. Nowadays, although APPs on the market have the function of measuring BMI, they cannot distinguish between genders in actual clinical practice. As a result, the clinical reference value of dietitians is not high, and consultations must be repeated during outpatient clinics, which causes a heavy burden on patients, physicians, and health insurance. In view of this, this topic has cooperated with the Chiayi Chang Gung nutritionist group, combined with the power of information and medical treatment, to construct a nutrition consultation posture determination APP, which can be used as a basis for interpretation in clinical practice. In addition, fingerprints are also used to protect the security of data. Hybrid encrypted file protection system technology to protect personal data and strengthen medical care and health.

Keyword: Posture Judgment, Knowledge Transfer, Consultation, Security of Medical Data

The Influence of Social Media Advertising on User Purchase Intention

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Abstract

With the progress of information technology and the high adherence of the public to mobile devices, businesses want to further promote consumers to click on advertisements to watch and generate purchase intention by using mobile advertisements to interact with consumers or contact new consumer groups. This study is based on advertisement value model, adding emotional appeal, advertising credibility, and advertising click to explore the influence on consumers product evaluation and purchase intention. This study took social media users as the research subject and collected 292 valid questionnaires through the Internet. The results show that: (1) informativeness, entertainment, advertising credibility and emotional appeal had positive effects on advertising attitude, while irritation had negative effects on advertising attitude; (2) entertainment and advertising attitude had a positive effect on advertising clicks; (3) advertising clicks had a positive impact on product evaluation; (4) advertising attitude and product evaluation positively affected consumers' purchase intention; (5) informativeness had no significant effect on advertisement click.

Keyword: Social Media, Advertisement Value Model, Ad Clicks, Product Evaluation, Purchase Intention

Film Tourism in Travel Decision-Making: The Roles of Authenticity, Memorable Tourism Experience, and Celebrity Involvement

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Abstract

The crucial role of film tourism on tourist destination choice has been recognized by scholars and practitioners. Both authenticity and celebrity involvement are vital to film tourism. However, few studies have investigated both of them in the same framework. Data from 405 film tourists who have visited the South Korea indicated that authenticity had both direct and indirect influence on behavioral intentions through memorable tourism experience. However, celebrity involvement only had an indirect influence on behavioral intentions through memorable tourism experience. Finally, authenticity was a better predictor of behavioral intentions than celebrity involvement.

Keyword: Authenticity, Celebrity Involvement, Memorable Tourism Experience, Behavioral Intentions

The Effect of Perceived Quality and Brand Image on Green Purchase Intention for Tesla in Taiwan

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Abstract

As environmental awareness has become more widespread, customers often consider the environmental impacts of the products when making their purchase decisions. This study focuses on how perceived quality in terms of driver experience and environmental impact influences brand image and green purchase intention, and how brand image influences green purchase intention of Tesla battery electric vehicles (BEV). Questionnaire survey with a convenience sampling method is used for this study, adopting descriptive analysis, assessment of reliability and validity, factor analysis, correlation analysis, and regression test. The findings of this study suggest that perceived quality has a significant and positive influence on brand image and green purchase intention, and brand image also has a significant and positive impact on green purchase intention. Comparing the two factors, driver experience and environmental impact, extracted from perceived quality used in this study, the results indicate that driver experience has a greater positive effect on brand image and green purchase intention than that of environmental impact for Tesla BEVs.

Keyword: Perceived Quality, Brand Image, Green Purchase Intention, Tesla

More Crowed? More Violent? The Physical Factors Influencing Customer Misbehaviors

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Abstract

This research investigates whether Customers would be ruder or violet while being in a crowded environment and whether negative emotion and anticipated regret would stimulate rude or violent behavior. To test this relationship, the present study use data from 399 samples from four kinds of service situations (i.e. crowed restaurant, night market, exhibition, and concert). The results reveal that with the different crowed environment, customer misbehavior varies significantly.

This result can clarify that the psychical factors would stimulate customer psychological responses and then lead to customer misbehavior. And this study suggests that service managers shall avoid the psychical factors influencing customer misbehavior such as avoiding the crowed environment.

Keyword: Customer Misbehavior, Psychical Factors, Psychological Responses, Crowed Environment

The Effect of Perceived Quality and Customer Satisfaction on Purchase Intention in the Cinema Industry

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Abstract

The cinema industry is a monopolistically competitive market, where each cinema offers almost identical products, thus generating fierce competition in the industry. As such, this study aims to investigate the relationship among perceived quality, customer satisfaction, and purchase intention in the cinema industry in order to provide further information on how best cinemas can retain their customers and continue to have customers utilise their service. Convenience sampling was used in the study, garnering 252 valid samples for data analysis. The results indicate that aspects of perceived quality, such as convenience, had a positive effect on both customer satisfaction and purchase intention. However, there is a significant positive relationship illustrated between customer satisfaction and purchase intention. In addition, insights into how further studies could be enhanced, alongside what aspects cinemas should focus on to increase their customers are explored.

Keyword: Perceived Quality, Customer Satisfaction, Purchase Intention, Cinema Industry

The Importance of Perceived Consistency to Increase Consumers' Adoption toward AI Robots: Korean Case

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Abstract

Recently, the healthcare industry has adopted AI service robots to provide better service quality to patients and consumers. However, several factors are known to affect AI service robots' adoption behaviors negatively. Accordingly, to managers, identifying factors to enhance consumers' intention to adopt service robots has become critical in hospitals or marketplaces. In this manuscript, we examined consumers' adoption toward an AI service robot in a hospital based on the Service Quality Model. Our findings indicate a functional aspect, such as perceived consistency, matters to increase consumers' attitudes to adopt AI service robots.

Keyword: Artificial Intelligence (AI), Service Robot, Usability, Service Quality Model

Market Sentiment, Marketable Transactions, and Returns

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Abstract

Using unique data from the Taiwanese stock market, I explore the transaction aggressiveness of mutual funds, foreign institutions, dealers and retail investors during periods of different market sentiment. Retail investors' marketable transaction ratios are positively related to stocks' systematic risk. In contrast, mutual funds and foreign institutions' marketable transaction ratios are negatively related. Although the marketable transaction ratios of all the four types of investors are higher when market sentiment is more fearful, mutual funds' trades on the *sell* side can mitigate price shocks of stocks during market panics. Marketable transaction ratios of the four types of investors have significant impacts on stock prices, both directly and indirectly through the influence on order imbalances.

Keyword: Market Sentiment, Transaction Aggressiveness, Order Imbalance, Types of Investors.

Patent Informatics Contributes Investment In China Stock Market

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Abstract

Patent is strongly meaningful for almost every country's economy growth and technology development. China, the world No.2 stock market, is the world largest patent application country. In this study, we observed 2,197 China listed companies of RMB common stocks (A-shares) distributed in four stock boards from 2016 to 2018 including Shanghai Main Board, Shenzhen Main Board, GE Board and SME Board. The relationship among the earnings-per-share ratio (EPS) and 570 valid patent indicators were examined. We constructed patent prediction equations for predicting EPS via Granger Causality test and time series regression model. The investment strategies based on patent prediction equations were discussed. We found that stock portfolios constructed by the higher predictive EPS have outstanding performance than the market trend for almost every stock boards except GE board, even though China stock market is seriously impacted by the China-US trade conflict. The underlying concept behind this study is that though the overall economic environment fluctuated, the patent based prediction algorithm proposed was proved to be useful to discover good stock portfolios in China.

Quantitative Option Trading Strategies based on Fourier Transform

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Abstract

The essence of the trading is to obtain the ideal profit expectation value under the premise of appropriate risk control. After Renaissance Technology Company achieved huge profits of 66% annual profit with quantitative trading strategy for 20 years, quantitative trading strategy has attracted attention in recent years. The benefit of quantitative trading is to use big data to establish a stock price prediction model and rely on this model for trading. The advantages of quantitative trading are mainly two: (1) the use of data science technology to extract more meaningful transaction signals in historical data, as a basis for future transactions, which is more objective and scientific; (2) to avoid the subjective transaction easily recognized error. We can decompose the data at hand through Fourier transform, find out its ups and down cycles, and establish a quantitative model based on Fourier transform to predict the future trend of stock prices. Because trading options has three major benefits: (1) the fault tolerance of the transaction, (2) the ease of risk control and (3) the asymmetry of earning compensation, and the two major profit engines: (1) the correct judgment of up or down trends to earn the spread profit; (2) long and short hedges to earn time value, is an ideal trading commodity. Therefore, this study focuses on quantitative trading of options. We designed a stock price movement model based on Fourier transform. At different stages of the model, the three major features of three major benefits of the options and two major profit engines were used to achieve the desired profit expectations under appropriate risk control.

Keyword: Quantitative Trading, Stock Price Prediction Model, Risk Control, Options, Fourier Transform

Financial Crises: Transition Drivers for Uncovering Stock Markets Instability

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Abstract

Evidence from financial crisis episodes suggests that distresses tend to emerge when capital markets experience sudden regime shifts near phase transitions. In this work, we introduce a novel method to uncover Early Warning Signals of such critical transitions. We identify the departure of the system from a given equilibrium by detecting a group of observable variables that we label as the Leading Temporal Module. We show that changes in the statistical properties of this group reflect the transition of the system into an upcoming phase of market instability. The proposed measure is model-free and the financial application, as well as the comparison with alternative systemic risk measures, highlight the usefulness of our approach in signaling the emergence of distress phases. Computational results indicate that the proposed approach is effective and it may constitute a relevant decision support tool for macro prudential policies and investment strategies.

Keyword: Financial Crisis, Early Warning Signals, Critical Transition, Leading Temporal Module

An Analysis of a Feed-in Tariff in Japan's Electricity Market

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Abstract

This article constructs a simple four-stage game with a traditional electricity firm, a renewable firm, and new entrants in order to examine how liberalization affects outcomes of the feed-in tariff policy. Moreover, we implement numerical simulation on the basis of the real cost parameters in Japan. On the one hand, promoting renewables mitigates environmental damage, involving higher cost. On the other hand, obviously new entrants lower the electricity price, increases electricity consumption, and in turn increase the environmental damage. The simulation shows that social losses due to higher cost of renewables can be compensated to some extent by enhancing competition in the electricity market.

Keyword: Feed-in Tariff, Renewable Energy, Liberalization

Does Good Corporate Social Responsibility Lead to Better Corporate Performance in the Global Retail Industry?

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Abstract

The contribution of the retail industry to regional economic growth has been demonstrated in recent years, making it an important industry for development and integration. With the development of this industry, performance measurement has become an important practice. The aim of this research explores the impact of corporate social responsibility (CSR) on corporate performance in the global retail industry. First, by using the Data Envelopment Analysis (DEA) Game Cross-Efficiency approach, we evaluate the longitudinal performance for the listed retail companies which are provided by Forbes 2000 from 2013 to 2018. According to the performance result, the Americas retail industry has a steady growth and still takes the lead as compared to other remaining regions. Second, a hierarchical regression is implemented to analyze the Environmental aspects of CSR which has an impact on performance. The regression results reveal that the index of the Environmental dimension in CSR was significantly and directly correlated to firm performance. Ultimately, this research also offers managerial and strategic implications for policy makers to enhance their efficiency by applying the CSR dimension in the retail industry.

Keyword: Corporate Social Responsibility, Corporate Performance, Data Envelopment Analysis, Game Cross-Efficiency, Global Retail Industry.

New Avenues for Brand Extension: How Does Apple Watch Signify a Change in Paradigm in the Way Apple Engages with Different Industries?

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Abstract

This paper investigates how Apple used brand extension to expand its business scope to an industry that was dominated by many traditional and well-established companies. Apple Watch became the world's largest watch company in 2017, a mere 2 years after Apple Watch was introduced. Rolex, a traditional watch company and well over a century old, was removed from the number one position by an industry newcomer.

This paper uses a sample of university students to identify the motivations behind owning or intending to own an Apple Watch. Based on this sample an interpretation of the potential of Apple Watch among young people and not traditional wristwatch wearers were identified. The research draws upon those findings to provide a conclusion on the change in paradigm Apple implemented to successfully engage the watch industry.

Keyword: Smartwatches, Apple Watch, Rolex, Watches, Luxury, Fashion

Does Cross Culture Behavior Have an Impact on Multinational Enterprise Performance? Empirical Study of Mining Industry.

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Abstract

The purpose of the study is to investigate the impact of Cross Culture Behavior on Multinational Enterprises' performance of mining industry. We measure the performance of multinational enterprises by applying Stochastic Nonparametric Envelopment of Data (StoNED) approach. The sample consists of 81 global mining enterprises from 2016 to 2018. The empirical results show that Cross Culture Behavior positively influence on Multinational Enterprises performance. There are significant differences between four sub-industries. In particularly, the results indicate that each sub-industry has different implications which generate better performance to the multinational enterprises of mining industry.

Keyword: Cross Culture Behavior, Multinational Enterprises Performance, Mining Industry, Data Envelopment Analysis, Stochastic Nonparametric Envelopment of Data

Kernel Density Estimation of Bivariate Copulas: A Review and an Application to Debt and GDP Growth Dependency

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Abstract

Modeling dependence between random variables using copula functions has seen an increase in the last two decades. The reason is the exibility copula functions provide in characterizing the joint dependence separately from the marginals. Since copula functions are distribution functions with uniform marginals, their density function can be utilized to provide a nice visualization of the dependence between variables. In this paper, we review the state of the art methodology in nonparametric copula density estimation and to illustrate its value we investigate the question whether high levels of public debt a_ect negatively GDP growth, that has attracted the attention of economists after the great _nancial crisis of 2008. Using data for 8 Asian countries, we study the existence or not of negative deendence between Debt to GDP and GDP growth.A second purpose of this paper is to encourage more researchers to understand use this methodology in their own field.

The Welfare Effect of Vertical Licensing in the Presence of Complementary Inputs

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Abstract

This paper focuses on how the final goods are produced by two complementary inputs influences the incentives of a vertically-integrated firm that licenses the production technology of its core input to an external firm. We find that the licensor strategically faces a higher wholesale price through vertical licensing so as to lower the price of complementary input when the products are differentiated. From the view of welfare, vertical licensing causes welfare reduction and leads to an irreconcilable difference between the licensor and social welfare when the product differentiation is high.

Keyword: Vertical Licensing, Two-Part Tariffs, Input Pricing, Complementary Inputs, Vertically-Related Market, Social Welfare

The Dynamic Performance of Energy Use in ASEAN Plus Six Countries

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Abstract

Performance of energy use plays an important role in economic growth and sustainable environment. The Association of Southeast Asian Nations (ASEAN) Plus Six countries have the bright economy performance over the past two decades. Also, these countries result in increased GHG emissions, and the most of these emissions have come from fossil-fuel combustion. Therefore, ASEAN Plus Six countries devote to improve energy efficiency as one path for reducing production cost and fossil energy use to strengthen a country's competitiveness and development. This study uses progressive time-weighted dynamic efficiency model to investigate the performance of energy use and further discusses issues concerning the energy decoupling rate and decarbonization. This study imposes additional constraints on the weights of the input and/or output variables and takes a long-term viewpoint to emphasize the intertemporal activities of decision making units (DMUs) between two consecutive time periods. Main results are shown as follows: First, ASEAN countries exhibit more improvement of energy use than other six countries, implying that the room for improvement of energy use performance for rapid economic developing countries is always larger than those well-developed countries; Second, energy decoupling rates in most ASEAN countries are lower than other six non-ASEAN countries; Third, we find that ASEAN Plus Six countries do not converge to decarbonization. Finally, this study provides policy implications and directions of future research for performance of energy use in ASEAN Plus Six countries.

Keyword: Performance of Energy Use, ASEAN Plus Six Countries, Dynamic Efficiency Perspective, Data Envelopment Analysis

Impact on Electricity Consumption on Services Industries during Pandemic of COVID-19 in Taiwan

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Abstract

The pandemic of coronavirus disease 2019 (COVID-19) is leading to severe global socioeconomic disruptions impacting on all economic sectors, special on services industry.

Electricity consumption on services industries can be separated three types, contract capacity 800 upper, Contract Capacity 800 kw lower, and others. The goal of this study is to show the impact on electricity consumption on services industries and lockdown of the services activities in Taiwan and to discuss the effects of COVID-19 outbreak on services industries output value. According Electricity contract capacity types and the city scales, we discuss the changes in electricity demand elasticity.

Keyword: COVID-19

An Investigation of the Relationships Among Goal Orientations, Utility Perception, and Training Satisfaction

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Abstract

Goal-setting theory shows that individuals' goal orientations would impact their job performance or learning outcomes. In a training program, mastery-learning goal orientation has been considered to be positively associated with training outcomes, contrarily, performance-avoidance goal orientation is shown to be negatively associated with training outcomes. The purpose of the study proposes that individuals' utility perception mediates the relationships between the two orientations and training satisfaction in a training program. The results showed that utility perception fully or partially mediated the relationships between the two orientations and training satisfaction. Besides, the current study further explored the differing impact of mastery-learning goal orientations and performance-avoidance goal orientation on training satisfaction. The results showed that mastery-learning goal orientation demonstrated a positive influence on training satisfaction, while performance-avoidance goal orientation did in a converse direction. Directions for future research and practical implications are discussed.

Keyword: Goal Orientation, Training Utility Perception, Training Outcomes

The Effect of News Media on the Number Preferences in the Taiwan Lotto Market

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Abstract

The lottery market combines the advantages of the stock market and the laboratory designs, and is better suited for testing the concepts of rationality for people in the face of uncertainty. In this paper, I try to provide a psychological perspective to explain why Taiwan lotto players have much non-rational behavior. First, I test whether the “halo effect” influences the demand for lotto ticket sales are unexpectedly high following a large jackpot. Second, some players may be influenced by the recommendable numbers list published from the public medium. Since winning numbers are random, it follows such numbers list can provide no information about the winning numbers in the current draw. Furthermore, the paper aims to investigate whether the players who rely on the media expert pick those who were better past performances, showing behavior consistent with the hot hand fallacy.

Keyword: Cognitive Bias, Media Coverage, Hot Hand Belief, Taiwan Lotto Market

Research on the Correlation between Corporate Governance and metafrontier Efficiency-Taking Mainland China Semiconductor Industry as an Example

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Abstract

In recent years, the semiconductor industry in mainland China has been undergoing transformation and development. In addition, it is facing strong international competition. In addition to the improvement of technical level and vigorous support of policies, since the industry's management capabilities are also a major competitive focus, corporate governance capabilities have played a certain role. There have been many discussions on the relationship between corporate governance and corporate performance in the past, but there is no more consistent conclusion. This study intends to strengthen the research methods and propose more detailed analysis and comparison. Because there are three levels of in this industry : upstream, middle, and downstream enterprises, this article believes that group comparisons should be taken into consideration, and the performance of similar groups should be considered, without losing the objectivity. This article uses the metafrontier efficiency analysis of DEA from the corporate governance variable group to compare the performance of different groups in the industry. Through the method of common performance frontier, it proposes governance variables that affect the performance in different industries levels, and proposes an effective and reasonable corporate governance structure for each branch industries.

Keyword: Corporate Governance, DEA, Metafrontier Efficiency, Semiconductor Industry

Global Warming and Agricultural Land Use of European Countries

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Abstract

This study conducts the modified exogenous undesirable dynamic data envelopment analysis (DEA) model to assess the agricultural production efficiency of European countries. We further apply the average temperature change as an exogenous variable to consider the global warming condition from the concept of environmental sustainability. The agricultural land use, the agricultural labor, and the agricultural energy use are set as the input variables; the agricultural product is the desirable output variable, while the CO_2 emission is the undesirable output variable. The agricultural fixed asset is the intertemporal carry-over variable which impacts the intertemporal efficiency from one period to the next period. Our results show that nearly half of the European countries' agricultural efficiency would be underestimated if the model does not consider the exogenous condition of the global warning. The reasons for the inefficiency of agricultural production in the above-mentioned countries are found to be mainly from agricultural land use, CO_2 emission, and energy use efficiency lagging behind other countries. Thus, when studying the evaluation of agricultural production performance, the exogenous conditions of global warming must be applied into the assessment.

Keyword: Dynamic Undesirable DEA Model, Exogenous Variable, Global Warming, Agricultural Land Use, CO_2 Emission, Agricultural Production Efficiency

The Impact of Bank Ownership Structure (Private Banks vs. Government Banks) on Bank risks: Evidence from Taiwan

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Abstract

The purpose of this paper is to explore the impact of bank ownership structure (private banks vs. government banks) on bank risks in Taiwan. The paper further divides the government bank variable into two types: the full government bank variable and the part government bank variable. In terms of bank risks, this paper includes both insolvency risk and downside risk. The main empirical results are as follows. First, overall, government banks have lower insolvency risk and downside risk than private banks. Second, part government banks have lower downside risk and insolvency risk than private banks. Third, full government banks have lower insolvency risk than private banks; however, there is no significant difference in downside risk between full government banks and private banks.

Keyword: Ownership Structure, Government Banks, Bank

The Impact of Bank Concentration on Bank's Interest-Rate Risks and Exchange-Rate Risks: Evidence from Taiwan

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Abstract

This paper explores the impact of bank concentration on bank's interest-rate risks and exchange-rate risks for Taiwan over the period from 1996 to 2016. This paper uses two kinds of approaches to measure bank's interest-rate risks and exchange-rate risks. One is based on both accounting data (earnings data) and the concept of sensitivity. The other is based on both accounting data (earnings data) and the concept of Value-at-Risk (VaR). The empirical results show that the following two conclusions: First, the increase of bank concentration can reduce bank's interest-rate risks. Second, on the whole, the higher bank concentration, the lower bank's exchange-rate risks.

Keyword: Bank Concentration, Interest-Rate Risks, Exchange-Rate Risks, Value-at-Risk

Strategic Knowledge Ownership and Business Models in marketplace: Lessons from US Patent Transactions

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Abstract

With the growth of global competition and the press of continuous technological change, business models and strategies associated with patent transactions increasing over the last few decades appear to vary considerably between firms. Few studies have identified the rigorously defined patent transactions and analyzed strategies of how to sell and purchase patents. Exclusive patent ownership transactions are crucial strategies for firms that commercialize patents or develop them for third parties. This exploratory investigation is a first step, providing a glimpse into the complex world of patent transactions, addressing sector trends, business models, and strategies of companies operating in this field.

Keyword: Patent Transaction, Knowledge Ownership, Open Business Model, Patent Strategy

Analysis of Airline Service Quality Impact Towards Passenger sending word-of-mouth intention

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Abstract

Airlines industry has played an important role in the global economy, since this industry supported other industries such as tourism, international business, and many other industry sector. This has caused high competition between airline companies. Therefore, airline companies adapted competitive strategy to fulfill passenger's need, one of the strategy is to increase their service quality. Airline companies strive to find ways to improve their service quality to gain competitive advantage and passenger satisfaction. The purpose of this study is to analyze the impact airline service quality (including reliability, responsiveness, assurance, empathy, tangibles) towards passenger satisfaction, perceived value and word of mouth. This study proves that service quality significantly affecting passenger's satisfaction, perceived value, and word of mouth. This study also found out that airline company need to pay more attention in empathy dimension.

Keyword: Service Quality, Airline, Satisfaction, Perceived Value, Word of Mouth

Exclusive Content, Developments Cost and Platform Competition in Online Television

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Abstract

We consider an over-the-top media service market, which consists of a vertical integrated incumbent and an independent firm. We explore the incentive of vertical integrated incumbent to license its exclusive premium content with two-part tariff licensing for its rival, who may alternatively develop its own premium content for an imperfectly substitutable product. We identify the incentive for licensing based on the development cost incurred by the rival and the quality of premium content is developed. Moreover, we find that the incumbent always has an incentive to license its premium content to its rival. However, it is detrimental to the consumer surplus.

Keyword: Two-Part Tariffs, Vertically-Related Market, Social Welfare, Exclusive Content

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