Political Economy of the Semiconductor Industry
Course Outline

The semiconductor industry has become strategically important in economic growth and international relations. This course is designed to demystify the complexity of the global semiconductor industry in terms of technological development, market competition, geopolitics, and interactions of national policies. It is an interdisciplinary course bringing together the knowledge of engineering, management, economics, and political science. The course is divided into five parts and to be taught by five instructors, with each instructor covering a part for three weeks. The rest of the time will be used for class organization and evaluations.

The five parts are, in a sequential order, (1) development of the semiconductor industry, (2) characteristics and evolutions of the global semiconductor market, (3) case studies of East Asian semiconductor companies, (4) technology policies pertinent to the semiconductor industry in East Asia, (5) geo-politics and geo-economics in the semiconductor industry. The detailed contents of each part are listed below.

Part 1: Development of the Semiconductor Industry (Chintay Shih)
Part 2: Global Semiconductor Market (Kenneth Kin)
Part 3: Case Studies (Chen-Fu Chien)
Part 4: Technology Policies (Chan-Yuan Wong)
Part 5: Geo-politics and Geo-economics (Tain-Jy Chen)

Class Plan
Thursday, R6-R8 14:20 – 17:10

Week	Date	Instructor	Topic
1	112/9/14	TA	Course introduction
2	112/9/21	Part 1 - Chintay Shih	Semiconductor industry dev. (1)
3	112/9/28	Part 1 - Chintay Shih	Semiconductor industry dev. (2)
4	112/10/5	Part 1 - Chintay Shih	Semiconductor industry dev. (3)
5	112/10/12	Part 2 - Kenneth Kin	Global semiconductor market (1)
6	112/10/19	Part 2 - Kenneth Kin	Global semiconductor market (2)
7	112/10/26	Part 5 - Tain-Jy Chen	Geopolitics & geo-economics (1)
8	112/11/2	Part 5 - Tain-Jy Chen	Geopolitics & geo-economics (2)
9	112/11/9	Part 2 - Kenneth Kin	Global semiconductor market (3)
10	112/11/16	Part 3 - Chen-Fu Chien	Case study (1)
11	112/11/23	Part 3 - Chen-Fu Chien	Case study (2)
12	112/11/30	Part 3 - Chen-Fu Chien	Case study (3)

Week	Date	Instructor	Topic
13	112/12/7	Part 4 - Chan-Yuan Wong	Technology policy (1)
14	112/12/14	Part 4 - Chan-Yuan Wong	Technology policy (2)
15	112/12/21	Part 4 - Chan-Yuan Wong	Technology policy (3)
16	112/12/28	Part 5 - Tain-Jy Chen	Geopolitics & geo-economics (3)
17	113/1/4	Reserved	
18	113/1/11	No class	Make-up for 9/28 recess

Grading Policy

Homework #1: short essay for case studies, evaluated by Professor Chien (20%)

Homework #2: short essay for technology policy, evaluated by Professor Wong (20%)

Debate Exercise : to be assigned and evaluated by Professor Kin (20%)

Final Essay: evaluated by Professors Shih and Chen (30%)

Class Participation: 10%

Part 1 Development of the Semiconductor Industry

Description:

Topic I: Introduce semiconductor technology evolution and global semiconductor industry value chain.

Topic II: Important technological breakthroughs in the early days (1950-1980).

Topic III: How Japan and Korea developed their semiconductor industries in the 70's and 80's

Topic IV: How Taiwan did it? (1976-1994): Key persons who helped the semiconductor industry development in Taiwan

Reference:

- John Matthews 1995, "High-tech Industrialization in East Asia: the case of the semiconductor industry in Taiwan and Korea" CIER
- 張如心 "矽說台灣" 潘文淵文教基金會 天下文化出版 2006
- https://en.wikipedia.org/wiki/History_of_the_transistor
- https://en.wikipedia.org/wiki/Microprocessor

- Shih, W., Shih, C., and Chien, Chen-Fu (2008), Horizontal specialization and modularity in the semiconductor industry, Harvard Business School Case Study (9-609-001).
- Shih, W., Chien, Chen-Fu, Shih, C., and Chang, J. (2009), The TSMC Way: Meeting Customer Needs at Taiwan Semiconductor Manufacturing Co.,

Harvard Business School Case Study (9-610-003).

Part 2 Global Semiconductor Market

Description: This course is designed to provide students with a comprehensive understanding of the global semiconductor market and supply chain. Students will gain an in-depth understanding of the political and economic factors that drive the semiconductor industry, including market trends, supply chain dynamics, and the role of Taiwan in the industry. The course will cover key topics such as the semiconductor market by industry, by technology, and by region; the semiconductor supply chain; and future challenges and opportunities in the semiconductor industry. Through lectures, case studies, discussions, and projects, students will develop a strong foundation in the political economy of the semiconductor industry and its role in global economics.

Learning Outcomes: Upon completion of this course, students will be able to:
- Understand the political and economic factors driving the global semiconductor market
- Analyze trends in the semiconductor industry by industry, technology, and region
- Understand the dynamics of the semiconductor supply chain
- Assess the role of Taiwan in the semiconductor industry
- Identify future challenges and opportunities in the semiconductor industry

Course Topics:
- Overview of the Global Semiconductor Industry
- Market Trends by Industry, Technology, and Region
- The Semiconductor Supply Chain
- The Role of Taiwan in the Semiconductor Industry
- Future Challenges and Opportunities in the Semiconductor Industry

Recommended Reading:
- Chris Miller, 2022, Chip War: The Fight for the World's Most Critical Technology, London: Simon and Schuster.
- The Political Economy of the Global Semiconductor Industry (by Boy Lüthje and Sigrid Quack

Part 3 Case Studies

Description: Part 3 of this course is designed to elaborate the trends identified in Part 2 to use a number of case studies for illustrations toprovide students with a comprehensive understanding of the evolution of semiconductor ecosystem and nature via PDCCCR interrelated decisions. This module will cover key topics such as the horizontal specialization and vertical integration in the semiconductor industry, the horizontal specialization and modularity, and future challenges and opportunities in the semiconductor industry. Through case studies and discussions, students will develop a strong foundation in corporate planning and strategic decisions for the semiconductor industry.

Learning Outcomes: Upon completion of this course, students will be able to:
- Understand the driving forces and evolution of semiconductor business ecosystem
- Analyze trends in horizontal specialization and modularity in the semiconductor industry of the semiconductor industry
- Understand interrelated decisions of PDCCCR for semiconductor manufacturing
- Case studies of TSMC, GUC, Mediatek
- Discuss future trends and challenges for coevolution of semiconductor industry

Course Topics:
- Double helix of horizontal specialization and vertical integration in the semiconductor industry
- Shanzhai! MediaTek and the "White Box" Handset Market
- TSMC Way: Meeting Customer Needs via PDCCCR
- Virtual Vertical Integration of Semiconductor Industry: TSMC and GUC

Recommended Reading:
- Shih, W., Shih, C., and Chien, Chen-Fu (2008), Horizontal specialization and modularity in the semiconductor industry, Harvard Business School Case Study (9-609-001).
- Shih, W., Chien, Chen-Fu, and Wang, J. (2010), Shanzhai! MediaTek and the "White Box" Handset Market, Harvard Business School Case Study (9-610-081).
- Shih, W., Chien, Chen-Fu, Shih, C., and Chang, J. (2009), The TSMC Way: Meeting Customer Needs at Taiwan Semiconductor Manufacturing Co., Harvard Business School Case Study (9-610-003).
- Shih, W., Chien, Chen-Fu, Kuppuswamy, V., and Koai, Y. (2009), Powerchip

Semiconductor Corporation, Harvard Business School Case Study (9-609-063).
- Shih, W., Shih, C., Chien, Chen-Fu, and Chang, Y. (2008), System on a Chip 2008: Global Unichip Corp., Harvard Business School Case Study (9-608-159).
- Shih, W. and Chien, Chen-Fu (2012). Global Unichip Corporation (A). Harvard Business School Case Study (613-048).
- Shih, W. and Chien, Chen-Fu (2012). Global Unichip Corporation (B). Harvard Business School Supplement 613-049.

Part 4 Technology Policies

Topic I: Learning the art of technological catching-up: the case of semiconductor industry.

Topic II: Post industrial catch-up development agenda

Topic III: Crisis and innovation: policy responses in East Asia economies

Recommended readings:

Ohno, K. (2013). *Learning to industrialize: From given growth to policy-aided value creation*, Routledge.

Keller, W. W., & Samuels, R. J. (Eds.). (2003). *Crisis and innovation in Asian technology*. Cambridge University Press.

Lee, K. (2019). *The art of economic catch-up: Barriers, detours and leapfrogging in innovation systems*. Cambridge University Press.

Yeung, H. W. C. (2016). *Strategic coupling: East Asian industrial transformation in the new global economy*. Cornell University Press.

Wong, C. Y. (2022). *Experimental Learning, Inclusive Growth and Industrialised Economies in Asia*. Palgrave Macmillan.

Part 5 Geo-politics and Geo-economics

Topic I: US-Japan trade war on semiconductors; Sematech (US industrial policy to revitalize the semiconductor industry); Demise of the Japanese semiconductor industry (the 1980s)

Topic II: Rejuvenation of the US industry through the fabless; Intel's rise to platform leadership; Globalization of semiconductor supply chains (the 1990s).

Topic III: TSMC's rise as a semiconductor powerhouse; China's challenge on semiconductor technologies; US-China technology war and threats on globalization (the 2000s).

Recommended Readings:

Kenneth Flamm, 1996, *Mismanaged Trade: Strategic Policy and the Semiconductor Industry,* Washington DC: Brookings Institution Press.

Larry Brown and Judy Shetler, 2000, *Sematech: Saving the US semiconductor industry,* College Station*,* Texas, Texas A&M Press, p.111.

Annabelle Gawer and Michael Cusumano, 2002, *Platform Leadership: How Intel, Microsoft and Cisco Drive Industry Innovation*, Cambridge, MA: Harvard Business School Press, Chapters 2-4.

Craig Addison, 2001, *Silicon Shield: Taiwan's Protection against Chinese Attack*, Nashville, TN: The Fusion Press.

Chris Miller, 2022, *Chip War: The Fight for the World's Most Critical Technology*, London: Simon and Schuster.