<u>A Comparative Institutional Analysis of Taiwan's</u>

Organizational Strategy for IT

**Doctoral Dissertation 2004** 

Graduate School of Asia Pacific Studies

Waseda University

Alan Dale Partee

4000S0287

Chief Examiner: Lim Hua Sing Deputy Examiner: Umezu Hiroyoshi Examiner: Kobayashi Hideo Examiner: Liu Shinkei Table of Contents for Doctoral Dissertation

List of Tables Used in this Dissertation Introduction A. Research Synopsis B. IT Hardware Industry Overview 4 C. Central Issues of Doctoral Research 8 D. List of Working Definitions and Technical Terminology 10 E. List of Acronyms 18 F. Overview of the Doctoral Dissertation and Analytic Framework 23

# PART I. Analytic Survey of the Literature on East Asian Development and Institutions 28

## Introduction to Part I 28

# Section 1.1 The Organization of the IT Hardware Industry in Taiwan and Japan 30 1.11 How to Organize? 30

1.12 The State in Taiwan & Japan 37

Section 1.2 Some Different Theories on East Asian Development Concerning Taiwan and Japan 39

1.21 The Theoretical Camps 39

1.22 Statist Approaches 43

1.23 Anti-statist Approaches 53

1.24 Recent Revisionist Arguments 58

**1.25** Politics and Flexible Production Strategy Argument 63

Global Division of Labor and Production Network Arguments 64

Section 1.3 Toward a New Comparative Approach: Comparative Institutional Analysis 66

1.31 Towards Understanding CIA 66

1.32 Foundations of Comparative Institutional Analysis 76

## Section 1.4 Diversity and Mobility of Human Resource Networking 81

1.41 Accelerated Catch-up for ICs 81

1.42 Theory and Propositions 83

# Section 1.5 Case Study -- Integrated Silicone Solutions Networks in Silicon Valley: the Global Diversity of Human Resources 85

Conclusion Part I: Comparative Institutional Analysis as a Diversity Strategy 92

Part II. Political Intervention: Analysis of Organizational Strategies for State Institutions Related to IT 95

Introduction to Part II 95

Section 2.1 Institutional History of Taiwan's New Paradigm for Rapid IT Development97 2.11 Taiwan Makes Some Big Moves 97

2.12 Stage 1: Start of IC Assembly (1965-73) 99

2.13 Stage 2: Establishing UMC, STAG, & Hsinchu Science Based Industrial Park (1979-83) 105

2.14 Stage 3 VLSI Project and the Creation of TSMC (1984-88) 109

2.15 Stage 4: The Submicron Project and the Growth of Privatization

(1989 TO 1997) 113

Section 2.2 The Role of the State 118

## 2.21 Taiwan Style Intervention 118

Section 2.3 Leadership, Politics and IT Policy in Japan 120

2.31 Intervention Japanese Style 120

## 2.32 Japan and the PC Revolution 121

2.33 History of Japan's PC Industry 124

2.34 Global Competitiveness 131

Failures in Soft Wars 132

Japan's Hardware Gets Softer 133

U.S. Standards Make Japan Reliant 134

Industry Structure for Software 137

2.35 Domestic Market: Slow Adoption of Information Technology 141 Human Resources 143

Conclusion Part II 144

Part III. Bureaucracy and NGOs in IT Industries: ITRI & MITI 148 Introduction: Japan's Bureau Pluralism & Taiwan's Open Pluralism 148 Section 3.1 Diversity of Institutions: NGOs & NPOs & IPOs 150 3.11 The General Definition of NGO, NPO and The Triangle Method 150 3.12 The Role NPOs and NGOs in Japan's Economy and IT Hardware Industry153 Section 3.2 The Case Study for ITRI and ERSO (1974-78) 155 Details of ITRI's Incubator and Organization 159 The Role of NPO's Spun Off From State Agencies 160 Section 3.3 Bureaucracy and Open Pluralism in Taiwan's IT Success 163 3.31 The National Science Council and National S&T Conferences 163 3.32 The Ministry of Economic Affairs 165 3.33 Other Ministries and Their OSTAs 170 The Science and Technology Advisory Group 170 Academia and Overseas Chinese Engineers 171

## Section 3.4 Bureaucracy & IT Policy in Japan: MITI and Bureau Pluralism 174

3.41 Introduction to "Bureau Pluralism" in Japan 174

The Dilemma of "Bureau Pluralism" in Japan 174

## 3.42 Bureaucratic Industrial Policy 178

**R&D** Consortia and Bureaucracy 179

The Sigma Project 181

The TRON Project 182

3.43 R&D Projects of the 1980s  $\ 183$ 

## **Targeting Software 185**

3.44 MITI Policy and Bureau Pluralism in the 1990s 187

Policy Coordination: Bureau Pluralism and Competition with the NII 189 Conclusion Part III: Open Pluralism has Some Advantages Over Bureau Pluralism 193

Part IV. Background and Analysis of Corporate Organizational Strategies for the IT Businesses with Case Studies 197 Introduction Part IV 197

Section 4.1 Vertical Division of Labor: Strategies for Taiwan's IT Hardware Industry 199

#### 4.11 Dividing the Labor 199

The Division of Labor of the Win-Win OEM Strategy (苗豊強 1997) Has Given Birth to a Globally Competitive IC Industry in Taiwan 200

4.12 Key Points on Taiwan's Unique Vertical Division of Labor for IT Hardware 202

## Section 4.2 Industry Case Study A: Taiwan's IC Foundries and Fabless ICs 206

4.21 Specialization, Integration, and Global Competency are Major Factors Contributing to the Competitiveness of Taiwan's IC Industry 206

4.22 Taiwan's Human Resource Competitiveness is Helped by its Unique Stock Bonus System 210

4.23 The Benefits of Taiwan's Stock Bonus System 213

4.24 Taiwan's IC Industry Corporations Sustaining Development 216 Developing Long-term Strategies 217 How Can Taiwan's IC Industry Continue to Develop? 217

Going with the Trends 218

## Independent Technology Development 223

4.25 Introduction to Company Case Studies 224

Case Study 1: UMC United Micro Electronics 226

Case Study 2: Taiwan Semiconductor Manufacturing Company (TSMC) 240

Case Study 3: Winbond Electronics Corporation 255

Case Study 4: Weltrend Semiconductor Incorporated 270

Case Study 5: Macronix International Company 277

Case Study 6: Mosel Vitelic Inc. 287

Case Study 7: TI-Acer (Texas Instruments - Acer Joint Venture) 296

#### Section 4.3 Industry Case Study B: Taiwan OEM Notebook Computers 303

4.31 OEM Hub Becomes ODM Hub: Taiwan Flourishing from Notebook Production

4.32 More Value-Added: Logistics and Support 306

4.33 China: Early Stages of ODM Relationships 312

4.34 Gateways to Diversification: Server Outsourcing 316

Case Study 8: Compal Electronics OEM Notebooks -Current Trends 319

Case Study 9: Quanta Computer 329

Case Study 10: Mitac International Corporation 338

Case Study 11: First International Computer Incorporated 344

Case Study 12: Inventec Corporation 351

Case Study 13: Hon Hai Precision Industry Company 357

Conclusion Part IV 364

# Part V. For and Against Taiwan: Confronting Criticisms and Revealing Success 366

Introduction Part V 366

Section 5.1: Some Common Criticisms of Taiwan's System 368

Section 5.2: Ethnic Chinese Economies' Criticisms by Cultural Theory, Conven -tional Wisdom and Anti-familism 371

Section 5.3 Familism and Patrimony Can be Stewardship and Leadership 375

Section 5.4 Productivity of Taiwan's IT OEMs Compared to USA / Japan Big Brands for IT 380

Conclusion Part V 390

## **Conclusion to Dissertation 395**

Notes 421

#### **Bibliographic References** 437

Chinese References 437 Japanese References 439

English References 442

Appendix A Timeline for IC Development 453 Appendix B Performance Indicators of Taiwan's Top 21 459 Appendix C List of Top 500 Taiwan Companies in 2002 465

# List of Tables Used in this Dissertation (Total = 105 Tables)

## Table A.1 Computer Hardware Production in Asian NIEs, 1985-1995

Table 2.01 Growth of Taiwan's IC Industry, 1989-93

Table 2.02 Taiwan's National Science Council

Table 2.03 Expenditure for Research by the Science Council (Unit: 100 Million TWD)

- Table 2.04 TDP Performance
- Table 2.05 TDP Application in 2000
- Table 2.06 Occupancy of Hsinchu Science-Based Industrial Park, 1993

Table 2.07 Details of Taiwan's Early IC Manufacturers, 1989-93

Table 2.08 Early IC Manufacturers in Taiwan, 1993

Table 2.09 Taiwan's Production Lines for 16M DRAM, 1996

# Table2.10 Computer Hardware Manufacturing Market Share : Japan, Taiwan, Korea 1995 and 2000 Compared

Table 2.11 Revenues and Profits of IBM and Japanese Computer Makers US\$ Millions

## Table 3.01 The 5 General Aspects of NPOs Around the World

Table 4.01 Computer Hardware Production in Asian NIEs, 1985-1995

## Table 4.02 The Best Practices of Taiwan's Corporate Model

Table 4.03 The Advantages of the Taiwan System are Numerous

Table 4.04 1999 OEM Orders by Brand Name

Table 4.05 Global Outsourcing

Table 4.06 The B/B Ratio Of IC Equipment

Table 4.06 UMC's Early Years: Sales, Expenditures, R&D and Staff

 Table 4.07 UMC: Sales Analysis, by Product 1989-1993 (by percent)

## **Table 4.08 Recent Sales at United Micro Electronics**

Table 4.09 Sales Comparisons for UMC (Fiscal Year Ending 2001)

Table 4.10 Profitability Comparison for UMC

Table 4.11 Financial Positions for UMC

**Table 4.12 Analysis Summary: United Micro Electronics Corporation** 

## Table 4.13 Sales & Profitability Summary: United Micro Electronics Corporation

Table 4.14 TSMC's Early Period & 2000: Sales, Investment and Employment

Table 4.15 Recent Sales at Taiwan Semiconductor Manufacturing Company

Table 4.16 Sales Comparisons for TSMC (Fiscal Year ending 2001)

Table 4.17 Summary of Company Valuations for TSMC (as of 3/7/03)

Table 4.18 Profitability Comparison for TSMC

Table 4.19 Financial Positions for TSMC

## Table 4.20 Analysis Summary: Taiwan Semiconductor Manufacturing Corporation

# Table 4.21 Sales & Profitability Summary: Taiwan Semiconductor Manufacturing Corporation

Table 4.22 Sales Chart Winbond: Sales and Employment, 1988-94 Table 4.23 Recent Sales at Winbond Electronics Table 4.24 Sales Comparisons for Winbond (Fiscal Year ending 2001) Table 4.25 Profitability Comparison for Winbond Table 4.26 Financial Positions for Winbond Table 4.27 Stock Performance Indicators Note: All Figures are in U.S. Dollars Table 4.28 Cash Flow and Sales in billions of U.S. Dollars Table 4.29 Sales Comparisons for WSI (Fiscal Year ending 2001) Table 4.30 Recent Stock Performances for WSI Table 4.31 Profitability Comparison for WSI Table 4.32 Financial Positions for WSI Table 4.33 Stock Performance Indicators Note: All Figures are in U.S. Dollars Table 4.34 Cash Flow and Sales in Millions of U.S. Dollars Table 4.35 Recent Sales at Macro nix International Company Limited Table 4.36 Sales Comparisons for MICL (Fiscal Year ending 2001) Table 4.37 Recent Stock Performance for MICL Table 4.38 Profitability Comparison for MICL Table 4.39 Financial Positions for MICL Table 4.40 Stock Performance Indicators Note: All Figures are in U.S. Dollars Table 4.41 Cash Flow and Sales in Millions of U.S. Dollars Table 4.42 Recent Sales at Mosel Vitelic Inc. Table 4.43 Sales Comparisons for MVI (Fiscal Year ending 2001) Table 4.44 Recent Stock Performance for MVI Table 4.45 Profitability Comparison for MVI Table 4.46 Financial Positions for MVI Table 4.47 Stock Performance Indicators Note: All Figures are in Taiwanese Dollars **Table 4.48 Recent Sales at Compal Electronics Incorporated** Table 4.49 Sales Comparisons for CEI (Fiscal Year ending 2001) Table 4.50 Recent Stock Performance for CEI Table 4.51 Profitability Comparison for CEI Table 4.52 Financial Positions for CEI Table 4.53 Stock Performance Indicators Note: All figures are in U.S. Dollars Table 4.54 Cash Flow and Sales in Billions of U.S. Dollars Table 4.55 Sales Comparisons for Quanta (Fiscal Year Ending 2001) Table 4.56 Recent Stock Performance for Quanta Table 4.57 Profitability Comparison for Quanta Table 4.58 Financial Positions for Quanta

Table 4.59 Stock Performance Indicators Note: All figures are in U.S. Dollars Table 4.60 Cash Flow and Sales in Billions of U.S. Dollars Table 4.61 Recent Sales at Mitac International Table 4.62 Sales Comparisons for Mitac (Fiscal Year ending 2001) Table 4.63 Summary of Company Valuations for Mitac Table 4.64 Profitability Comparison for Mitac Table 4.65 Financial Positions for Mitac Table 4.66 Recent Sales at First International Computer Incorporate Table 4.67 Sales Comparisons for FICI (Fiscal Year ending 2001) Table 4.68 Summary of Company Valuations for FICI Table 4.69 Profitability Comparison for FICI Table 4.70 Financial Positions for FICI Table 4.71 Stock Performance Indicators Note: All Figures are in U.S. Dollars Table 4.72 Cash Flow and Sales in Billions of U.S. Dollars Table 4.73 Recent Sales at Inventec Table 4.74 Sales Comparisons for Inventec (Fiscal Year ending 2001) Table 4.75 Recent Stock Performance for Inventec Table 4.76 Profitability Comparison for Inventec Table 4.77 Financial Positions for Invented Table 4.78 Stock Performance Indicators Note: All figures are in U.S. Dollars Table 4.79 Cash Flow and Sales in Billions of U.S. Dollars Table 4.80 Recent Sales at Hon Hai Precision Industry Company Limit Table 4.81 Sales Comparisons for HHPICL (Fiscal Year ending 2001) Table 4.82 Recent Stock Performance for HHPICL Table 4.83 Profitability Comparison for HHPICL Table 4.84 Financial Positions for HHPICL Table 4.85 Stock Performance Indicators Note: All Figures are in U.S. Dollars Table 4.86 Cash Flow and Sales in Billions of U.S. Dollars Table 5.01 Four of the Primary Types of Entrepreneurial Strategies of the **Ethnic Chinese** Table 5.02 Taiwan's World Market Share in PC Related Products, 1994 
 Table 5.03 Computer Table Hardware Production by Country 1985-2000
 Table 5.04 Computer Hardware as % of GDP Table 5.05 Average Profit on Sales 1985-2000 Top 20 Taiwan OEM vs. Top 20 Brands **Table 5.06 Domestic and Offshore Computer Production Taiwan** 

# 5 New Contributions of this Doctoral Dissertation

1. 72 New Interviews in Japan, Taiwan and China: Interviews with corporate insiders, industry or university experts and government officials were conducted and used as direct references throughout this study. This allowed the author the chance to add completely new material and insights in order to verify facts and get a direct interview survey of the IT industry in Taiwan and Japan.

2. 16 New Case Studies that Utilize First Hand Original Data: 16 completely new case studies using original sources from Chinese, Japanese and English publications. Japanese Company studies are not included because they are readily available in many languages but references to many Japanese studies are referenced and quoted often. Because OEM case studies are very hard to find for Taiwan Companies, This study puts together a new set of 16 studies including Studies 1-13 plus Studies A, B, and Section 1.5.

3. Wide Use of Chinese, Japanese and English Sources: After reading through hundreds of books and articles on this topic over the last 5 years, I have found few in English that take full use of Chinese and Japanese sources so I focused on including a full range of sources as a new contribution.

4. New Type of Analysis: This research contributes to the analytical richness of institutional approaches. As discussed earlier, the existing paradigms in explaining development and organizational strategies, the statist approach in particular, have been criticized due to their ambiguous explanation about the causal linkage between structure and outcomes such as economic performance. By analyzing the effects of structure upon institutional settings, and again by explaining how changed institutional settings affect the actions and reactions of the key actors in the state and society, this study sheds light on the causal relations between structure, individual behavior, and political economic outcomes.

**5.** New Theoretical Contributions : This study makes a few important contributions to the study of development. First of all, the existing literature deals with the state in East Asia either as a dominant actor (a leader) in economic management or a supporter (a follower) of the market factors. The uniform application of either the statist or the market-oriented approaches, that is, the dichotomization of the role of the state in development, is no longer appropriate in explaining development. The institutional settings in which the state and societal actors interact have been well established as developments proceed, and thereby they affect the behavior of core actors in the policy-making process rather differently. Thus those who intend to study development have to look at the complex interplay between the state and society under the changing institutional environment. The recent democratization that Taiwan and Japan have undergone is particularly important in this regard because it will change the ways that interests are represented in the two societies though the process may be gradual.