1

PM-1 3½"x4" PHOTOGRAPHIC MICROCOPY TARGET
NBS 1010a ANSI/ISO #2 EQUIVALENT

PRECISIONSM RESOLUTION TARGETS

National Library
of Canada

Acquisitions and
Bibliographic Services Branch

395 Wellington Street
Ottawa, Ontario
K1A 0N4

Bibliothèque nationale
du Canada

Direction des acquisitions et
des services bibliographiques

395, rue Wellington
Ottawa (Ontario)
K1A 0N4

Your file - Votre référence

Our file - Notre référence

NOTICE

The quality of this microform is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us an inferior photocopy.

Reproduction in full or in part of this microform is governed by the Canadian Copyright Act, R.S.C. 1970, c C-30, and subsequent amendments.

AVIS

La qualité de cette microforme dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de qualité inférieure.

La reproduction, même partielle, de cette microforme est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30, et ses amendements subséquents.

Canada

**Channelling the Industrial Oil:
The Establishment of Taiwan Telecommunications from 1950 to
1976 for Serving the U.S. Semiconductor Assembly Industry
The Domination and Limit of the Taiwan State in a
Telecommunications-mediated Development**

by

Hamilton Chung-ming Cheng B.A.

**A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfilment of
the requirements for the degree of
Master of Arts**

Department of Journalism and Communication

Carleton University

Ottawa Ontario

November 23rd, 1994

© 1994, Hamilton Cheng, All right reserved

National Library
of Canada

Acquisitions and
Bibliographic Services Branch

395 Wellington Street
Ottawa, Ontario
K1A 0N4

Bibliothèque nationale
du Canada

Direction des acquisitions et
des services bibliographiques

395, rue Wellington
Ottawa (Ontario)
K1A 0N4

Your file Votre référence

Our file Notre référence

**THE AUTHOR HAS GRANTED AN
IRREVOCABLE NON-EXCLUSIVE
LICENCE ALLOWING THE NATIONAL
LIBRARY OF CANADA TO
REPRODUCE, LOAN, DISTRIBUTE OR
SELL COPIES OF HIS/HER THESIS BY
ANY MEANS AND IN ANY FORM OR
FORMAT, MAKING THIS THESIS
AVAILABLE TO INTERESTED
PERSONS.**

**L'AUTEUR A ACCORDE UNE LICENCE
IRREVOCABLE ET NON EXCLUSIVE
PERMETTANT A LA BIBLIOTHEQUE
NATIONALE DU CANADA DE
REPRODUIRE, PRETER, DISTRIBUER
OU VENDRE DES COPIES DE SA
THESE DE QUELQUE MANIERE ET
SOUS QUELQUE FORME QUE CE SOIT
POUR METTRE DES EXEMPLAIRES DE
CETTE THESE A LA DISPOSITION DES
PERSONNE INTERESSEES.**

**THE AUTHOR RETAINS OWNERSHIP
OF THE COPYRIGHT IN HIS/HER
THESIS. NEITHER THE THESIS NOR
SUBSTANTIAL EXTRACTS FROM IT
MAY BE PRINTED OR OTHERWISE
REPRODUCED WITHOUT HIS/HER
PERMISSION.**

**L'AUTEUR CONSERVE LA PROPRIETE
DU DROIT D'AUTEUR QUI PROTEGE
SA THESE. NI LA THESE NI DES
EXTRAITS SUBSTANTIELS DE CELLE-
CI NE DOIVENT ETRE IMPRIMES OU
AUTREMENT REPRODUITS SANS SON
AUTORISATION.**

ISBN 0-315-98543-7

Canada

Name Hamilton Chung-Ming Cheng

Dissertation Abstracts International is arranged by broad, general subject categories. Please select the one subject which most nearly describes the content of your dissertation. Enter the corresponding four-digit code in the spaces provided.

Mass Communications

SUBJECT TERM

0708

SUBJECT CODE

U·M·I

Subject Categories

THE HUMANITIES AND SOCIAL SCIENCES

COMMUNICATIONS AND THE ARTS

Architecture 0729
Art History 0377
Cinema 0900
Dance 0378
Fine Arts 0357
Information Science 0723
Journalism 0391
Library Science 0399
Mass Communications 0708
Music 0413
Speech Communication 0459
Theater 0465

EDUCATION

General 0515
Administration 0514
Adult and Continuing 0516
Agricultural 0517
Art 0273
Bilingual and Multicultural 0282
Business 0688
Community College 0275
Curriculum and Instruction 0727
Early Childhood 0518
Elementary 0524
Finance 0277
Guidance and Counseling 0519
Health 0680
Higher 0745
History of 0520
Home Economics 0278
Industrial 0521
Language and Literature 0279
Mathematics 0280
Music 0522
Philosophy of 0998
Physical 0523

Psychology 0525
Reading 0535
Religious 0527
Sciences 0714
Secondary 0533
Social Sciences 0534
Sociology of 0340
Special 0529
Teacher Training 0530
Technology 0710
Tests and Measurements 0285
Vocational 0747

LANGUAGE, LITERATURE AND LINGUISTICS

Language
General 0679
Ancient 0289
Linguistics 0290
Modern 0291
Literature
General 0401
Classical 0294
Comparative 0295
Medieval 0297
Modern 0298
African 0316
American 0591
Asian 0305
Canadian (English) 0352
Canadian (French) 0355
English 0593
Germanic 0311
Latin American 0312
Middle Eastern 0315
Romance 0313
Slavic and East European 0314

PHILOSOPHY, RELIGION AND THEOLOGY

Philosophy 0422
Religion
General 0318
Biblical Studies 0321
Clergy 0319
History of 0320
Philosophy of 0322
Theology 0469

SOCIAL SCIENCES

American Studies 0323
Anthropology
Archaeology 0324
Cultural 0326
Physical 0327
Business Administration
General 0310
Accounting 0272
Banking 0770
Management 0454
Marketing 0338
Canadian Studies 0385
Economics
General 0501
Agricultural 0503
Commerce-Business 0505
Finance 0508
History 0509
Labor 0510
Theory 0511
Folklore 0358
Geography 0366
Gerontology 0351
History
General 0578

Ancient 0579
Medieval 0581
Modern 0582
Black 0328
African 0331
Asia, Australia and Oceania 0332
Canadian 0334
European 0335
Latin American 0336
Middle Eastern 0333
United States 0337
History of Science 0585
Law 0398
Political Science
General 0615
International Law and Relations 0616
Public Administration 0617
Recreation 0814
Social Work 0452
Sociology
General 0626
Criminology and Penology 0627
Demography 0938
Ethnic and Racial Studies 0631
Individual and Family Studies 0628
Industrial and Labor Relations 0629
Public and Social Welfare 0630
Social Structure and Development 0700
Theory and Methods 0344
Transportation 0709
Urban and Regional Planning 0999
Women's Studies 0453

THE SCIENCES AND ENGINEERING

BIOLOGICAL SCIENCES

Agriculture
General 0473
Agronomy 0285
Animal Culture and Nutrition 0475
Animal Pathology 0476
Food Science and Technology 0359
Forestry and Wildlife 0478
Plant Culture 0479
Plant Pathology 0480
Plant Physiology 0817
Range Management 0777
Wood Technology 0746
Biology
General 0306
Anatomy 0287
Biostatistics 0308
Botany 0309
Cell 0379
Ecology 0329
Entomology 0353
Genetics 0369
Limnology 0793
Microbiology 0410
Molecular 0307
Neuroscience 0317
Oceanography 0416
Physiology 0433
Radiation 0821
Veterinary Science 0778
Zoology 0472
Biophysics
General 0786
Medical 0760

EARTH SCIENCES

Biogeochemistry 0425
Geochemistry 0996

Geodesy 0370
Geology 0372
Geophysics 0373
Hydrology 0388
Mineralogy 0411
Paleobotany 0345
Paleoecology 0426
Paleontology 0418
Paleozoology 0985
Palynology 0427
Physical Geography 0368
Physical Oceanography 0415

HEALTH AND ENVIRONMENTAL SCIENCES

Environmental Sciences 0768
Health Sciences
General 0566
Audiology 0300
Chemotherapy 0992
Dentistry 0567
Education 0350
Hospital Management 0769
Human Development 0758
Immunology 0982
Medicine and Surgery 0564
Mental Health 0347
Nursing 0569
Nutrition 0570
Obstetrics and Gynecology 0380
Occupational Health and Safety 0354
Therapy 0381
Ophthalmology 0571
Pathology 0419
Pharmacology 0572
Pharmacy 0382
Physical Therapy 0573
Public Health 0574
Radiology 0575
Recreation 0575

Speech Pathology 0460
Toxicology 0383
Home Economics 0386

PHYSICAL SCIENCES

Pure Sciences

Chemistry
General 0485
Agricultural 0749
Analytical 0486
Biochemistry 0487
Inorganic 0488
Nuclear 0738
Organic 0490
Pharmaceutical 0491
Physical 0494
Polymer 0495
Radiation 0754
Mathematics 0405
Physics
General 0605
Acoustics 0986
Astronomy and Astrophysics 0606
Atmospheric Science 0608
Atomic 0748
Electronics and Electricity 0607
Elementary Particles and High Energy 0798
Fluid and Plasma 0759
Molecular 0609
Nuclear 0610
Optics 0752
Radiation 0756
Solid State 0611
Statistics 0463

Applied Sciences

Applied Mechanics 0346
Computer Science 0984

Engineering

General 0537
Aerospace 0538
Agricultural 0539
Automotive 0540
Biomedical 0541
Chemical 0542
Civil 0543
Electronics and Electrical 0544
Heat and Thermodynamics 0348
Hydraulic 0545
Industrial 0546
Marine 0547
Materials Science 0794
Mechanical 0548
Metallurgy 0743
Mining 0551
Nuclear 0552
Packaging 0549
Petroleum 0765
Sanitary and Municipal 0554
System Science 0790
Geotechnology 0428
Operations Research 0796
Plastics Technology 0795
Textile Technology 0994

PSYCHOLOGY

General 0621
Behavioral 0384
Clinical 0622
Developmental 0620
Experimental 0623
Industrial 0624
Personality 0625
Physiological 0989
Psychobiology 0349
Psychometrics 0632
Social 0451

**Thesis Acceptance Form
M.A.CANDIDATE**

The undersigned recommend to the Faculty of Graduate
Studies and Research acceptance of the thesis

**"Channelling the Industrial Oil:
The Establishment of Taiwan Telecommunications from 1950 to
1976 for Serving the U.S. Semiconductor Assembly Industry
The Domination and Limit of the Taiwan State in a
Telecommunications-mediated Development"**

Submitted by Hamilton Chung-Ming Cheng, B.A.
in partial fulfilment of the requirements for
the degree of Master of Arts

Thesis Supervisor

Chair, Department of Journalism and Communication

Carleton University

December 1994

Abstract

The thesis primarily explores the contribution of Taiwan telecommunications to the offshore production of the U.S. semiconductor industry. The instrumental approach demonstrates that the control function of Taiwan telecommunications was created by U.S. aid in the context of containment policy. Taiwan relied on aid for building these industrial infrastructure and security system to facilitate the U.S. investments. Taiwan's contribution was not a given fact but rather a postwar historical formation. The structural approach argues that Taiwan's telecommunications was structured by the U.S.-Japan alliance for maintaining the Cold War defense. Mediated by telecommunications of the Nationalist regime, the domestic structure of the Taiwan state, U.S. aid, and local capital encountered with the triple industrial competition between Taiwan, the U.S., and Japan. This structure distributed the benefits of semiconductor production to the Nationalist regime and the U.S. and Japan semiconductor TNCs at the expense of the Taiwan local community and labourers.

Acknowledgements

This thesis could not be accomplish without the following people's helps:

Professor Jeremy T. Paltiel (he is always the most encouraging person by showing his high interests towards my thesis.)

Professor Stephen D. McDowell (developed a historical review course that inspired me to form the concept of thesis.)

Professor Vincent Mosco (gave me a preliminary direction to situate this topic in the political economy of communications studies.)

Professor Peter A. Bruck (critically suggested me to make the thesis "work".)

Mr. Lenny Siegel (his generosity gave me a full access to the resources of the Pacific Studies Center and resulted in finding the critical insights for clarifying the historical formation of thesis.)

Thanks to Mr. Fang, Hien-chee (Special Advisor of ITRI) set the framework for me to approach the history of Taiwan telecommunications during a six-hour interview.

Thanks to Professor Feng, Jian-san (gave me recommendations to obtain the critical data of the political economy of Taiwan development.)

Thanks to the Faculty of Graduate Studies and Research for funding this thesis through Graduate Student Research Fund.

I sincerely thanks my father-in-law who gave me a continuously comprehensive direction for approaching this topic through his senior experiences in the telecommunication industry. And I am very appreciated my fiancée, father and mother who deeply supported my study during such critical years of my life in Canada. As my intellectual teacher, I thanks to Professor Robin E. Mansell for her dissertation and endogenous approach in directing me to further my graduate studies in Canada and accomplish this work in the field of political economy of communications.

Last, but not least, my thanks to Jesus for all the mercies He gives to me and helps me by His eternal source of wisdom.

Abbreviations

AFNT	U.S. Armed Force Network Taiwan
AID	Agency for International Development USA (USAID)
BCC	Broadcasting Corporation of China
CGRA	Chinese Government Radio Administration
CIA	Central Intelligence Agency U.S.
CIECD	Council for International Economic Cooperation and Development ROC
COMSAT	Communications Satellite Corporation U.S.
CUSA	Council on U.S. Aid ROC
DGT	Directorate General of Telecommunications Taiwan
DLF	Development Loan Fund U.S.
DoD	U.S. Department of Defense
ECAFE	Economic Commission for Asia and the Far East U.N.
EIDWG	Electronics Industry Development Working Group
EIRC	Electronics Industry Research Center ITRI
EPZ	Export Processing Zone
GNP	Gross National Product
GTE	General Telephone & Electronics Corporation U.S.
IBRD	International Bank of Reconstruction and Development (World Bank)
ICS	Integrated Circuits
INTELSAT	International Telecommunications Satellite Organization
ITRI	Industrial Technology Research Institute ROC
ITT	International Telephone & Telegraph Corporation
ITU	International Telecommunication Union
JTC	Joint Telecommunication Commission ROC
KMT	Kuomintang (Nationalist Party ROC)
MAAG	Military Assistant Advisory Group USA
MND	Ministry of National Defense ROC
MOC	Ministry of Communications ROC
MOEA	Ministry of Economic Affairs ROC
MSA	Mutual Security Agency USA
NTSC	National Television System Committee U.S.
NTTPC	Nippon Telegraph & Telephone Public Corporation
R&D	Research and Development
R&P	Research and Planning Board DGT
ROC	Republic of China on Taiwan
SRI	Stanford Research Institute
TAC	Technical Advisory Committee ROC
TAS	Taipei American School
TC	Technical Cooperation Program U.S.
TEAMA	Taiwan Electric Appliance Manufacturer's Association
TGC	Taiwan Garrison Command
TL	Telecommunications Laboratories, DGT Taiwan ROC
TNCs	Transnational Corporations
TTA	Taiwan Telecommunication Administration
U.N.	United Nations
VACRS	Vocational Assistance Commission of Retired Servicemen ROC

Table of Contents

	Page
Abstract	iii
Acknowledgements	iv
Abbreviations	v
Table of Contents	vi
List of Figures	vii
List of Tables	ix
List of Charts	xii
Special Note	xiv
Chapter One Introduction: the Problematic	1
Chapter Two Theoretical, Conceptual Frameworks and Methodology	24
Chapter Three The Development of Taiwan Telecommunications during 1949-1967	75
Chapter Four The Microwave Island: Facilitating Export Trade by the Military Origin and Extension	157
Chapter Five Telex-linked International Communications Serving the U.S. Multinationals Assembling Semiconductors	215
Chapter Six The Technologies of Control "Controlled" the Technology	261
Chapter Seven Conclusion: Towards a Comprehensive Review	305
References	333

LIST OF FIGURES

FIGURE DESCRIPTION	PAGE
2.1. The Runaway Military Semiconductor Manufacturers and Their Relocation in Taiwan	40
3.1. U.S. Aid for Telecommunications by DS, DLF, AID CPT and Others	97
3.2. The Security Forces Located on the Telecommunications Network in the North Taipei City (1949-1967)	104
3.3. The Locations of Export Processing Zones in Taiwan	128
4.1. The Trans-island Backbone Microwave System	167
4.2. The Growth of Toll Circuits, Taiwan (1957-62)	170
4.3. Planning the Coaxial Submarine Telephone Network (1964)	189
4.4. Telecommunication Map of ECAFE Region (1969)	201
4.5. The Baseband Configurations in Fangshan Station (Taiwan-Hong Kong, Sino-Philippines)	209
4.6. The Satellite Contingency Plan and the Restoration of Earth Stations	209
5.1. The Toll Network of the World Bank Project in Taiwan	229
5.2. The Locations of the Branch Offices of the U.S. Semiconductor TNCs in Taipei City (1964-1976)	243
5.3. The U.S. Semiconductor Assembly Plants along the Taiwan West Coast (1964-1976)	244
5.4. The Domestic and International Telex Systems in Taiwan (1960-1976)	245
5.5. The Long Term Financial Plan	256

6.1.	The Outline and Process of ICs Manufacturing Project	279
6.2.	The Financial Structure of GTE, 1964-1974	302

LIST OF TABLES

TABLE DESCRIPTION	PAGE
1.1. The International Division of Labour in the U.S. Semiconductor Production (1976-1979)	3
1.2. The Statistical Growth Between GNP and Telex (1964-1972)	7
1.3. The Coefficient of Correlation between Telecommunication and Economic Activities (1962-1971)	7
1.4. The Percentage of Electronics Industry in Export Trade	8
1.5. The Percentage of Semiconductor Production in The Export Trade of the Electronics Industry (1967-70)	9
1.6. Taiwan's Interindustry Domestic/Import Transactions (I) 1966-1976	9
1.7. The U.S. Aid and The Counterpart Fund for The Project Type Program	11
1.8. The Grades of Taiwanese Incentives within the Gang of Four New Industrializing Countries	12
1.9. The Locations of Semiconductor Industry in 1979	12
1.10. Taiwan's Interindustry Domestic/Import Transactions (II) 1966-1976	14
1.11. The Structure of Investment in Electronics Industry (1978)	17
1.12. The Structure of Semiconductor Industry 1980	18
1.13. The Analysis of Electronics Production Export/Import	18
1.14. The Statistics of Semiconductor Exports 1980	18
1.15. The Statistics of Semiconductor Imports 1976-80	19
1.16. The Supply of Semiconductors for Local Demands in 1975	20
2.1. The Structural Relations Model of the Taiwan State and Telecommunications/Semiconductor Industries	65

2.2.	The Contradictory Perspectives on the Results of Taiwan Telecommunications/Semiconductor Industries Development	67
3.1.	The U.S. Aid Contribution to TTA (1951-1964)	88
3.2.	The Statistical Abstract of U.S. Aid on Taiwan Telecommunications	91-94
3.3.	The Overseas Training Programs for Personnel of Directorate General of Telecommunications (1950-1967)	95
3.4.	Sources of Funds, DGT (1952-1962)	101
3.5.	Charge Rates and Traffic Conditions of Taipei City Telephone Subscribers	107
3.6.	Operating Income and Expense in Foreign Exchange, DGT 1950-54	109
3.7.	Overseas Telephone Calls between Taiwan and U.S., 1950-54	109
3.8.	The Suburban Telephone Expansion (FY 1956)	111
3.9.	The Rates of Telephone Service for Different Subscribers	112
3.10.	The U.S. Aid Contribution to AFNT's Infrastructure	115
3.11.	The Comparison between Sino-U.S. and Japan International Communications	123
3.12.	The U.S. Aid Contribution to the Industrial Sites along the Taiwan West Coast	125-6
3.13	The Technical Cooperation Program (1953-1964)	130
3.14.	The Establishment of the United Nations Training and Research Center for Telecommunications and Electronics in the ROC	141
3.15.	The Numbers of Trainees of Telecommunication Detachments and Retire Servicemen (1958-66)	145
4.1.	The Balance of Expenditure and Source, DGT 1961-67	170
4.2.	The Messages of International Telex and Telegraph in the Taiwan Area (1964-1971)	182

4.3.	The Export(Destination)/Import(Source) of Transistors in Taiwan, 1964-1971	183
4.4.	The Processes of ITU Meetings for the SAFE Project, Microwave and Satellite Proposals	187-8
4.5.	The Operation and Comparison of Overseas Telephone Traffic in Taiwan (1965-1969)	202
4.6.	The Philippines Participants in the Transhorizon Microwave Project Connected to the Sino-Philippines Interests	206
4.7.	The Projects under Robert F. McNamara's Jurisdiction Relating to the Vietnam War and Taiwan Development	212
5.1.	The U.S. International Telex Traffic: Top 11 Correspondents (To and Fro), 1979	216
5.2.	The Comparison between the Growth of Telex Outgoing Messages and Production of Semiconductors	223
5.3.	Outgoing Messages of International Telex Service, Grouped by Region	223
5.4.	The Schedule for Operating Telex System in Taiwan	224
5.5.	The Expansion of International Telex Circuits	225
6.1.	The Regulations of Semiconductor Circulation	264-5
6.2.	The Revisions of the Regulations of Transistor Circulation	269-70
6.3.	The Local Sourcing of Semiconductors for the U.S. Multinationals	273
6.4.	The Procurement of Telecommunications Equipment from DGT, 1978-1981	281
6.5.	The Coalition of the U.S.-Nationalist Participants within IC Project and Telecommunications Application	287-8

LIST OF CHARTS

CHART DESCRIPTION	PAGE
1.1. Supplies from the Local Sourcing to TNCs and Their Joint Ventures in the Local Market	14
2.1. The Cooperation of the American Electronics Industry with the Military Establishment on the COMSAT Project in the 1960s Mediated by Armed Forces Communications and Electronics Association (AFCEA)	39
2.2. The Policy Formation Process for Telecommunications/Semiconductor Industries	64
2.3. The Conceptual Framework of Triple Alliance	68
3.1. The Planning Board on Telecommunications Expansion in the New Aid Administration (1950-1964)	84
3.2. The Application for U.S. Aid (Project)	85
3.3. The Cycle of U.S. Aid for Expansion	100
3.4. The Procedure of Procurement for U.S. Aid	106
3.5. The Procedure for Frequency Allocation for Allies' Stations through the First and Second Working Groups of the Second Sub-committee, Joint Telecommunications Commission (JTC)	117
3.6. The Organization and Mission of Telecommunication Deatchment (1961)	147
4.1. The Incorporation of Page Communications and Collins Radio into Military Electronics Giants	176
4.2. The Organization of VHF and Microwave Maintenance Divisions, TTA/DGT/MOC	183
5.1. Establishing a New Telecommunication Administration through the Hub of Reformation: DGT Directorship	221
6.1. The Procedures for the Application for the License/Certificate of Import/Export and Transport of Telecommunication Equipment	272

6.2.	The Application of Telecommunications from RCA-CMOS Project	280
6.3.	The Transition of Taiwan Electronics/ Telecommunications Industries under Competition between the U.S. and Japan	301

*** Special note about the difference between the ROC and Taiwan:**

Primarily, the ROC (Republic of China) and Taiwan always denote the island nation of Taiwan (Formosa) after 1949.

In this thesis, the author builds on the connotative differences between these two terms: when using ROC, author puts emphasis on the ideological level of nation-building or the government policy mainly directed by the Mainlander regime in Taiwan; when using Taiwan, the author deals with the material level of national infrastructure, the geographical distinctiveness of the island, and/or policy on behalf of the Taiwanese rather than as an ideal serving Mainland China. For example:

The ROC prepared for the "Return to China" war.
The Taiwan DGT established a microwave backbone along the west coast.

*** Special note on Chinese names:**

All Chinese names are written in the original sequence which is surname first, followed by the first name: for example, Fang (last name) Hien-chee (first name).

Chapter One

Introduction: the Problematic

1.1. The History

The "Global Assembly Line" movement (see Fuentes & Ehrenreich, 1981) of the 1960s saw the U.S. semiconductor industry¹ start offshore assembly in Southeast Asia after 1962 in order to lower its costs by using cheap labour. One of the first U.S. companies to arrive in Taiwan was General Instrument in 1964.

Basically, the most important factors which influenced the U.S. semiconductor industry to search for cheap labour in Southeast Asia were the following transformations in marketplace, production, and investment environments (Braun & MacDonald, 1982:73-6; Henderson, 1989:31-2,41-45):

1. Military market demand was replaced by the relative growth of the civilian market;
2. Intensive competition from Japanese industry;
3. The processes of semiconductor production from research and development (R&D) to assembly were technically disarticulated;
4. Cheap air transport and efficient telecommunications existed in East Asia in the sixties.

Moreover, and at the same time, the Southeast Asian states

¹The semiconductor industry includes the manufacture of diodes, transistors, photo-diodes, light-emitting diodes, and integrated circuits. (Todd, 1990:7-8)

provided great incentives for the U.S. investment as follows (Henderson,1989:19,72; Scott,1987:145):

1. "A stable and highly reliable labour forces";
2. "Political stability and accommodating forms of state intervention" (e.g., "repressive military dictatorship" in Taiwan);
3. "The creation of a positive business climate and subsidization of the costs of production and social reproduction" (including, favourable capitalist legislation, export-processing zones, tax holidays, freedom to repatriate profits, and infrastructure building).

The infrastructure of Taiwan industry from 1950 to 1964 was reinforced by the fifteen-year U.S. aid program during that time. As part of the global assembly movement, Taiwan was one of the earliest sites of the U.S. semiconductor assembly plants after 1964 (Henderson,1989:51). The importance of Taiwan in attracting assembly plants of the major U.S. semiconductor producers is indicated by the following table.

In an attempt to take advantage of this global assembly movement, Taiwan used the Sixth Four-Year Plan (1973-76) of the Directorate General of Telecommunications (DGT) to strengthen telecommunications expansion in order to establish the base of semiconductor manufacturing. This local plan was a significant ending point of a 27-year span (1950-1976) of semiconductor assembly industry expansion in Taiwan.

Table 1.1. The International Division of Labour in the U.S. Semiconductor Production (1976-1979)

Company	Country	South Korea	Taiwan	Hong Kong	Singapore	Malaysia	Philippines	Thailand	Indonesia
Motorola		a	a	a,m		a	a		
National Semiconductor				a,m	a,m	a	a	a	a
Fairchild		a		a,m	a		a		a
Texas Instrument			a		a,m	a	a		
General Instrument			a			a			
Siliconix			a	a					

a= assembly m= marketing centre (Henderson, 1989: 46-47)

The Semiconductors, seen as the "industrial oil", reconstructed world economy (Chang, Meng-yu, 1983:156; Jayaweera, 1986:33; Mulgan, 1991:43). The importance of the semiconductors drove Taiwan's telecommunication administration to search for any available opportunity (e.g., mediating the cooperation between Transnational Corporations [TNCs] and local partners in producing semiconductors) to establish its own production system, as this thesis shows. The thesis looks at the period from 1950 to 1976: the first U.S. aid for telecommunications expansion was disbursed in Taiwan in 1950; in 1976, the international telecommunications service and the technology of semiconductor production launched another new era (when telecommunication expanded from wireless connection to wire network and semiconductor production was upgraded from assembly to manufacturing). The thesis dynamically demonstrates the domination by Taiwan's telecommunications administration in the process of building the local semiconductor production through channelling the investment by the U.S. semiconductor industry into Taiwan. But at the same

time as the Taiwan government welcomed the U.S. investment, they found themselves limiting the expansion of local production interests in order to serve the interests of the U.S. semiconductor companies.

1.2. Problematic

Owing to an overemphasis on the importance of cheap labour in the global semiconductor assembly movement (in the urban and regional development studies) on the one hand, and the lack of interest in the topic of telecommunications contribution to this movement (in critical communications studies) on the other hand, one question cannot be fully answered by the current research: Why was Taiwan attached to the global assembly line of semiconductor production if cheap labour was globally available from the perspective of the "comparative advantage" strategy² in the sixties?

Moreover, the current research (the East Asia electronics industry development studies) too easily positioned the achievements of Taiwan's electronics industry in the category of the "Gang of Four"³ or "Taiwan Miracle"⁴ successes. These

²According to the "product cycle theory", when the new product was "mature", the know-how technology was widely diffused. As a result, transnational corporations faced intensive competition from local firms. In the eyes of TNCs, the "comparative advantage" was foreseen in the income gap between North and South which located the labour-intensive industry. Finally, the production of the North was shifted to the South. (Gill and Law, 1988:239)

³Taiwan, South Korea, Singapore and Hong Kong.

⁴Taiwan succeeded in achieving an astonishing GNP growth and maintaining extraordinarily high foreign reserves. (Gold, 1986:4-5)

two categories involve a result-oriented analysis regardless of the origin (for whose interests) and the process (how development worked out) of industrial development. By using this existing analysis, it is impossible to answer the following question: What benefits did the U.S. semiconductor industry bring into Taiwan in terms of its different social classes?

The thesis develops its topic from these two questions (above). The thesis proposes that:

1. Based on the history of Taiwan's telecommunications/ security system building, it is clear that, except for the cheap labour, it was the telecommunications that comprised the main attraction for the U.S. semiconductor industry in coming to Taiwan.

2. The real meaning of the benefits which the U.S. semiconductor industry brought into Taiwan is unclear until the relationship is seen between the local structure of Taiwan's semiconductor industry and the structure of this industry in the U.S. and Japan.

A. The Problematic: The lack of the research on the telecommunications contribution to the global expansion of the semiconductor assembly industry

Much research done on geographical expansion and urban/ regional development has pointed out that the overseas shift of the semiconductor industry was mainly facilitated by the development of telecommunications, especially in East Asia (Castells, 1989; Grunwald and Flamm, 1985; Henderson, 1989;

Henderson and Castells, 1987; Scott, 1987; Siegel, 1980; 1993).

Current studies on this topic in the area of urban and regional development usually downplay the importance of the contribution of telecommunications by simply reducing the whole area to a given fact without further consideration given to its importance. For example, Henderson states:

The emergence of the global option, however, would have been inconceivable without the development of information technologies, and particularly telecommunication. (Henderson, 1989:3)

But Henderson gives no further information concerning the importance of telecommunication.

Again, there is a scanty attention given, in the school of critical communications studies⁵, to a basic question: How, in that "global option", did the changing strategies of the semiconductor industry emerge coincidentally with the international expansion of telecommunications service? (For analysis of the interaction between international telecommunications and the international division of labour, see Mosco, 1983:XI, XXV.)

In fact, the history of Taiwan development indicates that Taiwan telecommunications made an important contribution to

⁵In his definition of critical communications studies, Mosco addresses the following themes (Mosco, 1983:IX):

1. They challenge an established perspective in communications research;
2. They connect the communications research issue at hand with a wider institutional complex;
3. They promote the transformation of the system by indicating how critical research can critique the system.

the export trade (see Table 1.2, 1.3.):

Table 1.2. The Statistical Growth Between GNP and Telex (1964-1972)

Year	Outgoing Telex		Incoming Telex		GNP		Total Export		Total Import	
	Message	Growth %	Message	Growth %	N.T.\$ million	Growth %	N.T.\$ thousand	Growth %	N.T.\$ thousand	Growth %
1964	23,159	31.59	132,927	50.29	102,209	12.13	17,361,528	30.71	17,161,449	18.49
1965	33,114	42.99	174,245	31.08	112,867	11.60	17,982,292	3.60	22,296,043	29.92
1966	40,740	23.03	196,999	13.06	125,554	8.55	21,450,780	19.26	24,956,663	11.93
1967	53,188	30.55	251,717	27.78	143,045	10.33	25,629,180	19.48	32,313,880	29.48
1968	74,224	39.55	337,220	33.97	167,975	9.28	31,567,554	23.17	36,221,506	12.41
1969	10,534	21.97	434,793	25.97	190,806	8.73	41,974,582	32.97	48,629,181	34.25
1970	119,918	54.55	624,160	46.93	218,428	11.17	57,131,722	36.11	61,110,446	25.67
1971	206,695	47.73	927,231	48.56	249,275	11.47	79,906,424	39.86	73,941,929	21.00
1972	290,763	40.67	1,267,368	36.68	292,355	10.98	116,648,492	45.98	100,791,412	36.31

(Source: DGT R&D Yearbook 1974:298,300)

Table 1.3. The Coefficient of Correlation between Telecommunication and Economic Activities (1962-1971)

Telecommunication Activity	Overseas Telegraph	Overseas Telephone	Overseas Telex
Export Trade	0.948	0.915	0.995
GNP	0.984	0.974	0.947
Personal Income	0.989	0.927	0.958
Population	0.953	0.934	0.888
Tourism	0.988	0.974	0.959

(Source: DGT, 1972:24)

This thesis basically proposes that the international telex system⁶ in Taiwan was the major contribution to the growth of the production of semiconductors--one of the major items of Taiwan's export trade (see Tables 1.4.-1.6.).

⁶"Telex (short for teleprinter exchanges) is a text-orientated service. It is in many ways similar to the public telephone service, except that it carries teleprinter signals instead of speech signals. The signalling rate is 50 bit/s or 6.6 characters/s. Teleprinters, which are a combination of a keyboard and a printer, generate a paper record of both received and sent messages." (Zorkoczy, 3rd ed., 1990:127)

Table 1.4. The Percentage of Electronics Industry in Export Trade

Year Export	1965	1970	1975
Total (N.T.\$million)	450	1,481	5,309
Banana	10.8	2.1	0.4
Rice	9.1	0.1	0.0
Canned Food	10.5	5.7	2.9
Sugar	13.1	3.1	5.0
Tea	2.0	0.9	0.3
Fisheries	0.3	1.4	3.5
Fibre	15.8	31.7	27.8
Plywood	5.9	5.3	2.5
Wood	2.8	3.4	3.8
Cement	1.9	0.8	0.1
Petroleum Products	0.2	0.4	1.0
Glass and Products	0.4	0.6	0.3
Rubber & Products	0.5	1.0	0.9
Plastics & Products	-	-	6.5
Chemical Manufactures	9.5	2.4	2.0
Iron Products	3.6	4.4	2.3
Metallic Products	1.1	1.9	2.5
Machinery	1.3	3.3	3.6
Electrical Apparatus & Equipment	2.7	12.3	14.7
Others	13.5	19.2	19.8

(Source: Taiwan Statistical Data Book, 1987)

Table 1.5. The Percentage of Semiconductor Production in The Export Trade of the Electronics Industry (1967-70), Unit=U.S.\$1,000

Year	1967		1968		1969		1970	
	Sum	Ratio	Sum	Ratio	Sum	Ratio	Sum	Ratio
Production								
TV Receiver *	334	1.08	10,134	14.49	14,694	13.85	24,598	13.66
TV Component *	1,114	3.62	1,444	2.06	16,239	14.37	31,568	17.53
Radio *	4,836	15.17	17,754	25.39	18,124	16.03	19,852	11.02
Radio Component *	47	0.47	1,603	2.29	2,538	2.24	7,907	4.39
Speaker	98	0.32	287	0.42	1,169	1.03	3,452	1.91
MW & SW Transmitter	0	0	660	0.94	19,217	17.00	23,303	12.94
Transformer	143	0.46	980	1.40	2,853	2.52	6,097	3.38
Transistor	867	2.82	4,937	7.07	4,470	3.95	4,087	2.28
Cassette Recorder	142	0.46	949	1.36	1,653	1.46	4,508	2.56
Phonograph Component	256	0.84	239	0.34	999	0.88	3,959	2.90
Others	22,860	74.22	30,913	44.22	31,044	26.67	50,669	28.14
Total	30,800	100.00	69,900	100.00	113,000	100.00	180,000	100.00

(Korean Institute for Electronics Technology, 1972:33)

* The major end-user of semiconductors

Table 1.6. Taiwan's Interindustry Domestic/Import Transactions (I) 1966-1976

Purchasing	Cement	Steel & Iron	Aluminum	Household Electrical Appliances	Communications Equipment	Other Electrical Machinery	Residential Building
Sector Producing Sector: Tele communications							
1966	2,950	4,985	1,096	3,502	2,999	5,282	1,832
1969	4,078	3,340	715	5,607	8,697	5,351	7,444
1971	5,607	4,919	889	8,864	37,622	8,588	5,569
1976 Domestic	-	2,599	14,651	23,423	174,692	55,707	18,686
1976 Import		0	0	1,288	9,605	3,063	0

Explanation: Each entry represents, in thousands of N.T. dollars, the value of the output supplied by the industry named at the beginning of the row to the industry named at the head of the column.

(Source: Taiwan Input-Output Tables, ROC 1966, 1969, 1971, 1976)

Originally, the infrastructure of Taiwan industry, which successfully served the export trade, was generated by the U.S. aid and the U.S. procurement for two wars (the Cold War and Vietnam War):

Moreover, the inflow of foreign capital, at least during the 1950s and 1960s, was much more motivated by Washington's political and military desire to contain Communism in Asia than an attempt to seek commercial gains or economic domination on the island. (Chan, 1992:176)

And, just as the Korean War provided a much needed stimulus to the moribund Japanese economy of the early 1950s, Taiwan (and South Korea) eagerly seized the business opportunities provided by the massive U.S. spending related to the Vietnam War. (Chan and Clark, 1992:100)

B. The Problematic: Apart from the cheap labour, what is the contribution of Taiwan to the global semiconductor assembly?

This thesis exclusively studies one of the overlooked facts--telecommunications--which is an important necessary condition (contribution) for running the global semiconductor assembly industry. More importantly, the thesis searches for the answers to two questions: Why was Taiwan's telecommunications-building, and not that of other nations, eligible to serve the U.S. TNCs? and, Who installed the telecommunication system in Taiwan? (see Mosco, 1983:XI). The thesis develops this study from the clues provided by global assembly development studies, such as that of Siegel:

This global assembly line, taking advantage of more than ten-fold differences in pay, was made possible by technological innovation in both transportation and communications. (Siegel,1993)

Many locations in Africa, the Caribbean and Latin America attract electronics firms, but only those with the cheapest labor and best investment climate attract semiconductor assembly. (Siegel,1980:11)

Basically, Taiwan's telecommunication system, which provided one of the best investment climates, was expanded by the U.S. aid before Taiwan was involved in global semiconductor production (see Table 1.7.).

Table 1.7. The U.S. Aid and The Counterpart Fund for The Project Type Program

Items	U.S. Dollars		New Taiwan Dollars	
	(million)	Ratio	(million)	Ratio
Agriculture	34.3	9.6	5,590	16.0
Mineral & Manufacture	92.4	25.8	3,739	10.7
Electricity	115.3	32.2	3,714	10.7
Transportation & Communications	50.6	14.1	2,734	7.8
Sanitation	6.9	1.9	1,305	3.7
Education	9.2	2.6	922	2.6
Others	49.2	13.8	16,892	48.5
Total	357.9	100.0	34,896	100.0

(Source: Taiwan Studies Vol. 93, 1967:59)

In an address to the Taipei American Chamber of Commerce in 1966, a representative of the U.S. Agency for International Development (AID) stated the importance of telecommunications expansion in terms of the whole spending of U.S. aid:

And on January 1 of this year, the aid-yet-to-be-received pipeline amounted to about \$100 million, nearly all of which consists of dollar loans to purchase U.S. equipment that will be used to build additional electric power generating plants, telecommunication facilities [underlined by author], and to import surplus agricultural products. (Huffman, 1966:2)

During the next fourteen years, the telecommunications service in Taiwan developed a very good reputation. According to a survey of American and Japanese Chambers of Commerce in 1980 (42% of the sample were represented by electronics and electrical machinery industries), telecommunications was counted as important as cheap labour supply for the investment climate (see Table 1.8.).

Table 1.8. The Grades of Taiwanese Incentives within the Gang of Four New Industrializing Countries

Incentives	Grade
A. Manpower Supply	2
B. Electricity	2
C. Local Know-How	2
D. Transportation and Telecommunications	2
E. Land and Taxation	2
F. Tax Holiday	2
G. Low Wage	2
H. Administration Efficiency	3
I. Free from Strike	1
J. Political Stability	2

(Source: Lee, Shih-chung, 1980:44)

In Taiwan, the telecommunication administration also participated in the establishment of the electronics industry. In order to attract more semiconductor factories to locate in Taiwan (see Table 1.9.), an Export Processing Zone (EPZ) was established by the U.S. Food for Peace Program in 1966 (Siegel, 1980:12).

Table 1.9. The Locations of Semiconductor Industry in 1979

Location	Factory
Taipei City	2
Taipei County	7
Taoyuan City	2
Taoyuan County	2
Hsinchu County	2
Tantzu EPZ	5
Nantzu EPZ	4
Kaohsiung EPZ	3

(Source: Chao, Nan-hung, 1979:31)

After EPZ was established, the Taiwan government applied for a U.N. Special Fund to upgrade the telecommunication training centre in Chiao Tung University at Hsinchu for supplying the managers of semiconductor assembly plants,

Mr. Gustavson, an industrial expert of the U.N., visited the electronics industry in KEPZ [Kaohsiung EPZ] to evaluate the application for a development program in Chiao Tung University. The work was conducted from 4 to 8 September 1967. (EPZ Concentrates, 2:8, pp 12)

Moreover, the telecommunication administration used the local procurement policy to attract multinationals to invest in joint ventures with local partners. These joint ventures could supply equipment to the local telecommunications market, and they also searched for local sourcing⁶ to reduce the costs. The local industry who managed the local sourcing also supplied the components to the 100% U.S.-owned semiconductor assembly plants. Occasionally, the telecommunication administration imported equipment for the local market demand to disburse the multinationals operations in exchange for their firm investment in Taiwan. These two strategies are indicated by the Chart 1.1. & Table 1.10.:

⁶Local sourcing means that local factories supply the components to the multinationals in order to reduce TNCs' costs of component shipments from overseas.

Chart 1.1. Supplies from the Local Sourcing to TNCs and Their Joint Ventures in the Local Market

Table 1.10. Taiwan's Interindustry Domestic/Import Transactions (II) 1966-1976

Producing Sector:	Purchasing Sector	Household Electrical Appliances	Communications Equipment	Other Electrical Machinery	Tele communications
1966	Electronics	---	18,158	.	8,180
	Machinery	103,687	63,298	358,471	10,812
1969	Electronics	3,301	589,064	2,416	3,553
	Machinery	114,934	92,248	453,013	14,551
1971	Electronics	23,124	1,886,269	.	83,810
	Machinery	274,087	370,609	815,779	
1976 Domestic	Electronics	50,454	10,046,855	362,682	0
	Machinery	1,158,371	2,535,999	2,124,247	163,035
1976 Import	Electronics	461,389	15,983,652	36,950	105,678
	Machinery	1,192,174	2,395,306	1,707,097	0

Explanation: Each entry represents, in thousands of N.T. dollars, the value of the output supplied by the industry named at the beginning of the row to the industry named at the head of the column.

(Source: Taiwan Input-Output Tables, ROC 1966, 1969, 1971, 1976)

Finally, the telecommunication administration indirectly contributed to the cheap labour formation. To be an incentive, cheap labour had to be guaranteed for a specified period of time; also, labour performance had to be disciplined. To meet this requirement, a repressive supervision of labour was established by the Taiwan government, assisted by the U.S. Military Assistant Advisory Group (MAAG) in Taiwan:

Interestingly enough, the upper-level management in the US-owned factories, those directly below the few American managers and over the native Taiwanese laborers, is predominantly Chinese military managers retired from liaison service with the United States Military Assistance Advisory Group... Chinese managers trained by Air Asia of Tainan, in retrospect known to be a CIA operation for maintenance of US military planes flying missions in Southeast Asia,... (Arrigo, 1983:4)

The U.S. MAAG (an important agency for operating the U.S. Direct Force Support--one of two major U.S. aid programs in Taiwan), with the plenty of assistance from the telecommunication administration (including telephone service, radio frequency allocation, radio programs, and international communication services), firmly stationed itself in Taiwan to produce the reserves of security officials needed for supporting a pro-export-oriented industrialization policy in line with the global assembly movement.

This thesis proposes that, apart from infrastructure expansion, three more incentives were directly and indirectly provided by the telecommunication administration for the global assembly movement to Taiwan: (1) knowledge training for managing assembly work; (2) local sourcing or market demand;

(3) supervision of the workforce.

C. The Problematic: What were the benefits of this global semiconductor assembly for the different social classes in Taiwan?

The urban/regional development and the East Asia electronics industry development studies usually adopt a simple result-orientated analysis (especially the research done by the school of management in most of universities in Taiwan) to evaluate the achievements of semiconductor industry in the hands of the "Gang of Four" (Henderson, 1989: 67-68; Murphy, 1986: 249-254; Todd, 1990: 250-255; Wellenius, 1993: 66-7, 141-6, 163-74). This analysis neglected the origin/process of industry which were the major part of industry development. Because of the lack of the analysis of the structure of the Taiwan semiconductor industry, this thesis proposes that the current research done by the above two studies didn't pay attention to the question: Whose interests were served in developing the semiconductor industry in the Pacific Asia states, for example, in Taiwan?

Again, two similar questions also need to be answered in critical communications studies (see Mosco, 1983: XI): (1) Who were the beneficiaries in this global trend of shifting industrial sites? (2) What were the different meanings of information technologies development for the different social classes? This thesis also attempts to answer these questions in order to contribute to current critical communications studies.

The thesis uses this above problematic (C) as a critical step in studying the origins of Taiwan's semiconductor industry. Structurally, a horizontal (descriptive) triple relation (Japan, Taiwan and the U.S.) and a vertical (analytic) triple relation (foreign capital, state and local capital) need to be brought into the discussion of the process of industry development. According to the statistics of industry growth, the semiconductor industry in Taiwan had already been structured by the (descriptive) triple alliance/competition (Taiwan, Japan and the U.S.) demonstrated by the pattern of ownership and production input/output (see Tables 1.11.-1.15.).

Table 1.11. The Structure of Investment in Electronics Industry (1978)

Investment Pattern	Factory	Investment (U.S.\$million)	Percentage	Large Scale Plant
Local	1,091	416.94	65.23%	75
U.S.	36	69.11	10.81%	27
Japan	39	20.33	3.18%	30
Netherlands	3	31.72	4.96%	3
West Germany	2	6.82	1.07%	1
Sino-U.S.	7	18.30	2.86%	5
Sino-Japan	46	71.53	11.19%	24
Others	9	---	---	3
Overseas Chinese	22	4.44	0.70%	7
Total	1,255	639.20	100.00%	175

(Source: Industry of Free China, 54:2, pp 13;
Taiwan Industry Yearbook: Electronics 1983:24)

Table 1.12. The Structure of Semiconductor Industry 1980

Country of Investors Sectors	Local	U.S.	Japan	Netherlands	Hong Kong
Material	1				1
Wafer Fabrication:					
IC	2	1			1
Discrete Devices					
Assembly:					
IC	9	5		1	3
Discrete Devices	6	1	5		
Total	18	7	5	1	5
Investment (N.T.\$million)	1 10	10-50	50-100	100-500	500
L=Local; O=Overseas	L O	L O	L O	L O	L O
Material			1 1		
Wafer Fabrication:					
IC				2	
Discrete Devices		1 1		3 1	
Assembly:					
IC		1 2	2	2 4	
Discrete Devices	11	2 2	1 1	1 3	1
Total	11 0	4 5	2 4	8 8	0 1

(Source: ERSO/ITRI, 1982:11-15)

**Table 1.13. The Analysis of Electronics Production
Export/Import**

District	Export					Import				
	74	75	76	77	78	74	75	76	77	78
U.S.	61.7	53.0	54.8	54.7	56.1	29.5	34.2	28.0	27.6	24.0
Japan	6.1	6.3	7.2	5.5	5.0	55.6	49.5	58.0	58.9	62.0
Hong Kong	5.8	6.9	8.2	7.6	6.8	3.7	2.9	3.3	3.8	2.5
West Germany	3.9	5.3	4.6	4.0	4.4	3.1	5.1	3.1	2.5	3.1
Netherlands	2.3	3.1	2.9	2.7	3.0	2.3	2.1	1.8	1.9	1.4
Canada	3.3	2.4	2.4	1.8	1.7	---				

(Source: Industry of Free China, 54:2, pp 20)

Table 1.14. The Statistics of Semiconductor Exports 1980

Export Destination (N.T.\$million)	Hong Kong	Japan	Korea	Other Asia	U.S.	Other America	West Germany	Netherlands	Britain	Other Europe	Australia
Semiconductor:	933.6		54.3	273.2		45.9	596.8	884.2	612.3	332.2	12.9
Monolithic, Hybrid ICs,	2686.1				5079.6						
Diode, Transistor, LED,											
Percentage	8.0%	23.1%	0.5%	2.3%	43.6%	0.4%	5.1%	7.6%	5.3%	2.9%	0.1%

(Source: ERSO/ITRI, 1982:57)

Table 1.15. The Statistics of Semiconductor Imports 1976-80

Origins of Integrated Circuit Year	Quantity (Kilogr)	Japan	U.S.
1976		632,779	203,898
1977		669,276	347,928
1978		596,188	248,609
1979		618,058	245,708
1980		641,938	324,337

(Source: The Trade of China-- Taiwan District 1976-1980)

These tables draw a picture of the trade relationship between Taiwan, Japan and the U.S.: the U.S. and Japan multinationals swarmed into Taiwan to assemble their semiconductors and cooperated with Taiwanese small and medium-sized plants. Except for the U.S. assembly plants, these factories mainly imported components from Japan. The majority of output was shipped to the U.S. to compete for the market share there, and the second largest quantity of exports competed in the Japanese market. Taiwan was located as a transport site of semiconductor production to maintain triangular alliance/competition working. The majority of the semiconductor industry in Taiwan served the demands of the export market. As a result, the local market was controlled by the foreign corporations through importation (see Table 1.16).

Table 1.16. The Supply of Semiconductors for Local Demands in 1975

Category of Product	Demand %		
	Domestic Supply	Overseas Supply	Total
Semiconductor	0.14	99.86	100.00
Integrated Circuit	0.10	99.90	100.00
Print Circuit Board	30.62	69.38	100.00
Picture Tube	19.69	80.31	100.00
Capacitor	43.62	56.38	100.00
Resistor	16.96	83.04	100.00
Coil & Transformer	56.07	43.93	100.00
Total	12.07	87.93	100.00

(Source: Metal Industry Research Laboratories ITRI, 1976:25)

This thesis suggests that the Taiwan semiconductor industry was incorporated as a "subaltern" member among the major international players in the semiconductor production industry (see Sussman, 1984:294). As a result, the achievement of Taiwan semiconductor industry must be scrutinized in the context of this triple alliance/competition framework before the real meaning of "benefits" for all Taiwanese can be understood. The thesis also proposes that the study of the local structure of this semiconductor industry must also look at the role of the Taiwan state--"a repressive military dictatorship" (Henderson, 1989: 72). This connection is suggested by a (analytic) triple alliance (foreign capital, state, and local capital). Moreover, this thesis proposed that the communications were facilitated for the triple alliance by the government's monopoly on telephone service through high installation charges. The electronics knowledge distribution was monopolized by the triple alliance through the tough regulations on personal access to electronics components. The

profits to the triple alliance were guaranteed by the oppression of the labour union through the security supervision.

1.3. The Proposal of The Thesis

Through a historical review of Taiwan's telecommunications contribution to the U.S. global semiconductor assembly (1950-1976), the thesis intends to answer two questions which the development studies (urban and regional and the East Asia electronics industry development) and critical communications studies were unable to answer:

1. Apart from the cheap labour, what kind of attraction did Taiwan have at that time for the U.S. semiconductor industry? Telecommunications? Was telecommunications one of the crucial elements that brought global semiconductor assembly to Taiwan?

2. In the context of the global semiconductor assembly movement, what interests did the U.S. semiconductor industry bring to Taiwan? Under what structural condition was the industry developed there? Who were the beneficiaries in that movement? Who were the losers?

The proposal of thesis, developed from the above three problematics, is demonstrated as follows:

1. The major Taiwan telecommunications contribution to the U.S. semiconductor industry was an international telex system. This system was based on the U.S.-aided infrastructure, which served the Cold War containment policy,

and was advanced by American, Japanese, and local contributions in the form of knowledge and loans in order to serve the Vietnam War economy and the export-oriented industrialization policy. Moreover, telecommunications functioned as the technologies of control in the global semiconductor assembly movement.

2. Through the U.S.-aided expansion, Taiwan telecommunications developed a good reputation in serving the U.S. semiconductor assembly plants. The telecommunications administration also provided the managerial staffs and local market and sourcing to facilitate the U.S. semiconductor production investment. Most importantly, a supervision system for labour unions was established with American military assistance. This assistance was channelled through the Taiwan telecommunication system in building a firm connection between Taiwan and the U.S..

3. Structured by the (descriptive) triple alliance/competition, the Taiwan semiconductor industry was incorporated as the subaltern of American and Japanese players in semiconductor production. Supervised by the Taiwan repressive regime, the corporations of the Nationalist Party (the ruling party which controlled the repressive regime) were the only candidates to be selected as the local counterparts in the semiconductor industry. Foreign capital, a repressive regime, and limited local capital shared the benefits of semiconductor production at the expense of local community and

labour class interests in telephone/technology access and living/working environment.

Chapter Two

Theoretical, Conceptual Frameworks and Methodology

2.1. Introduction

This thesis specifically aims to analyze how Taiwan telecommunications facilitated the operations of the U.S. semiconductor assembly plants during the period of 1964 to 1976. The thesis argues that the telecommunication administration supported the relocation of semiconductor assembly plants through infrastructure expansion and security supervision, assisted assembly operations by providing the managerial manpower and local market/sourcing demands, and, finally, generated vertical integration of semiconductor manufacturing by the U.S. and Japan industries in Taiwan. An analysis of this process answers both questions posed by the thesis: What made it possible for Taiwan telecommunications to facilitate the integration of Taiwan into the global relocation of semiconductor production? and, What were benefits of this semiconductor production to the different Taiwan social classes?

The theoretical framework of this thesis is based on the political economy of the Pacific Asia telecommunications and the political economy of the Taiwan state. The topic of how and why Taiwan telecommunications contributed to the U.S. global semiconductor assembly is examined in the context of the political economy of the Pacific Asia telecommunications. The military function of the Pacific Asia telecommunications

showed how the services for operating the U.S. semiconductor TNCs were transferred from the strategies for maintaining the security system. The question of what benefits the U.S. semiconductor industry brought to Taiwan is scrutinized in terms of the political economy of the Taiwan state. The topic of the "repressive" Taiwan state demonstrates how government directed the national telecommunication administration to serve the U.S. semiconductor industry, and distributed the interests of the semiconductor production to the Nationalist Party. The two frameworks were generated from two precise themes: 1. the control function of telecommunications from the military application; 2 the East Asia development under the war economy¹.

This thesis adopts an endogenous conceptual framework (Mansell, 1987) as the basic methodology to study the Taiwan telecommunications/semiconductor industries development. This concept basically refuted the exogenous conceptual framework used by the developmentalists² for promoting technological

¹The war economy thesis was briefly introduced as follows: "During the long period of the Cold War more than half of the research and development technical manpower of American society was drawn away from civilian industry and into work that was military-supporting, directly or indirectly. The concentration of labor, especially skilled labor, and capital over a long period to this nonproductive economic growth induced a set of deteriorations in American technology, economy and society that were not intended or anticipated by the prophets of prosperity through war production." (Melman, 1974:20)

²The developmentalist's view was interpreted by Mosco: "This perspective links expanding electronic media to urbanization, increased political involvement, and, ultimately, modernization. It is a view that has guided most research on international mass media

contribution by the developed countries to the developing countries after the sixties. The endogenous concept argued that technology could not be studied without looking at its social, economic, and political implications. Moreover, this concept emphasized that any national technology development policy had to be mediated between the local and international interests. This endogenous concept was connected with the dependency theory in the emphasis on one crucial topic: how political and economic powers, serving the information industry policy, were distributed within all social institutions (Mansell, 1987:195-201).

Based on the endogenous concept, the thesis adopts both instrumental (local actors) and structural (international capital) approaches to study the Taiwan telecommunications/semiconductor industries development. The thesis uses the dependency development context--"a conceptual framework of triple alliance" (foreign capital, state and local capital) (Evans, 1987) as an underlying concept of methodology. The method, generated from this triple alliance concept, directs the research to obtain the data in order to describe the history and answer two questions posed in the problematic.

Through a historical review of telecommunications/

and telecommunications since the end of World War II. Promoted by heavily financed U.S. government research, the developmentalist view has justified the position that massive exports of media flowing freely from the West, along with the manufactured goods and other products of the 'free trade' policy, would help create the conditions for economic growth." (Mosco, 1982:141)

semiconductor industries development in Taiwan, this thesis will draw the following three major conclusions:

1. Taiwan telecommunications served the U.S.

semiconductor assembly plants by using a military infrastructure (which originally served the Cold War ideology and the Vietnam War economy) created by a U.S. aid program for economic rehabilitation and military assistance. Following the recommendations of the AID and the International Bank for Reconstruction and Development (IBRD, otherwise known as the World Bank), Taiwan's telecommunications policy further facilitated the export trade at the expense of civilian telephone access due to the high installation charge. The economic goal of building the export trade was achieved by telecommunications functioning as the technologies of control.

2. Those who participated in the knowledge transfer of semiconductor manufacturing in the telecommunications training centre and the local partnerships with the U.S. TNCs were designated by the Directorate General of Telecommunications in Taiwan. Tightly supervised by the security regime, the spin-offs of the transfer were distributed only to the Nationalists Party (for managing or running the local sourcing for the U.S. plants) and generated very few benefits for the civilian innovations in the electronics.

3. Structured by the triple alliance/competition between the U.S., Japan and Taiwan, the interests of Taiwan telecommunications/semiconductor industries were affected by

the Taiwan state's conflicting position with regards to security-priority or trade-priority. Under one of two priorities, the industries negotiated the financial and knowledge offers with the two giants, Japan, and the U.S.. However, the security regime, on behalf of the Nationalist Party's business, regulated the distribution of interests from semiconductor production and repressed any potential threat of intervention in this monopoly system operated by the state, foreign capital, and local capital.

2.2. The Theoretical Framework: a Historical Literature Review under Two Themes

The theoretical framework of the thesis is based first on the military function of telecommunications according to important insights by Dallas W. Smythe and Tran Van Dinh, Herbert I. Schiller, and Vincent Mosco, who explored the function of telecommunication network in connection with the U.S. before the sixties. The framework is also grounded on the recent work by Geoffrey Mulgan demonstrating the hidden function of telecommunications as control. Mosco commends Mulgan's work,

It shows how control is a complex process that involves sometimes contradictory forces at work in technology, the economy, the political and ideological arenas...offering a useful explanation of the potential and limitations in telecommunications networks and in the traditional economic models used to understand them. (Mosco, quoted in Mulgan, 1991, cover)

Telecommunication system as they were originally developed basically served the military demands for defense and control

applications. For example, British Empire's submarine cable network, used to operate her colonial system, was the prototype of the technology of control (Mosco, 1982:143; Mulgan, 1991:55). The United States competed with this cable system by using a system developed by RCA. Financed by the Department of Defense, RCA built the global radio-based communications network. This global network was fully upgraded when the International Telecommunications Satellite Organization (INTELSAT) was established by Communications Satellite Corporation (COMSAT) which consisted of a squad of military officials and the electronics industries (Mosco, 1993:56; Schiller, 1992: Ch.4).

During the Cold War, the U.S. communications system churned out the ideology of anti-communism and mass consumption. This communications system integrated the non-communist countries into the advanced Western capitalism world (Dinh, 1987:48; Mosco, 1993: 50; Schiller, 1979:103). This integration promoted the products and investments of TNCs to the rest of world through a global telecommunications service designed by a military industrial team.

The theoretical framework is also concerned with the origin of semiconductor production in the military--a topic researched by DeGrasse, Flamm, and Molina. The studies of the origin of semiconductor production refer back to the issue of telecommunications-building during the Cold War, i.e., the satellite project. Satellites, produced by both

telecommunication and semiconductor industries, critically contributed to the ascendancy of Taiwan's existing telecommunication system in serving as the base for the U.S. offshore semiconductor assembly during the early period of global semiconductor assembly (in 1969).

The whole issue of global semiconductor assembly and the Taiwan telecommunication system revolved around the fact that the Taiwan infrastructure, after serving the Vietnam War, matched the right curve of the semiconductor production cycle³ with (1) its firm outgoing wireless communication with the U.S. satellite (built by dedicated chip makers for the Vietnam War, RCA, ITT etc.) through microwave, and (2) its labour dispute-free environment under the supervision of security forces (assisted by the U.S. MAAG for the Vietnam War through the telecommunication network between the U.S. and Taiwan).

However, apart from the contribution of telecommunications, the establishment of the semiconductor assembly industry was also supported by telecommunication infrastructure and policy which was designed in the context of the Taiwan political economy:

Telecommunications policy cannot be understood in isolation from the broader political and economic demands and directions with which it is generally in consonance. (Sussman, 1987:103)

³ The right curve of the product cycle in here means that the standardized product, e.g., assembly consumer chips, was separated from the military application, e.g., satellite chips (which was one of the war economy effects).

Consequently, this thesis also relies on the literature concerning the political economy of the East Asia development (which includes Taiwan as one of important topics) under the war economy. The Taiwan state succeeded in achieving an astonishing GNP growth and in maintaining extraordinarily high foreign reserves after the sixties. Situated by the "legacy of Japanese colonialism" (Koo,1987:166), the "Cold War ideology of the United States" (Deyo,1989:48), and the "perfect match between the product cycle and initial drive of Taiwan export trade" (Gill & Law,1988:200; Gold,1986:81), Taiwan achieved the above noted two successful records (Chan & Clark,1992: 10,100; Cumings,1987:45-7,76). These structural factors must be taken into consideration in the case of Taiwan telecommunications/semiconductor industries development because telecommunications and industrial developments were controlled by the Taiwan state under the supervision of the U.S. Cold War ideology. The Taiwan state functioned as a national industrial planning board and the security regime for protecting Chiang Kai-shek's authority.

Actually, much research on East Asian states gained insights from previous Latin American dependency studies. For example, using Fernando H. Cardoso's historical-structural method, Thomas Gold produced a crucial Taiwan study (Gold,1986; or see Evans,1987:204). Meanwhile, Peter Evans used his "triple alliance" framework, generated from the Brazilian case, to study the East Asian case (Taiwan and South

Korea). Finally, Evans successfully developed a Taiwan version of triple alliance. Evans' success is the reason for using the triple alliance as an underlying concept of methodology in this thesis. Evans' Taiwan version of triple alliance originated from his perspective on the effect of the U.S. aid in Taiwan. First, the Taiwan state was strengthened by the U.S. aid,

... but its principal aim was to strengthen the ability of states to confront neighboring Communist regimes.... Most of this aid went to the military rather than to economic development.... (1987:210)

The U.S. aid also reinforced the separation between state and agrarian elites through land reform. However, Evans states:

The Americans could promote land reform only because internal social structure conditions resulted in a politically weak landlord class and a degree of separation between state apparatus and landlord.... Finally, U.S. aid in certain respects strengthened the state apparatus vis-a-vis the local bourgeoisie, especially in Taiwan in the early 1950s. (ibid)

The land reform contributed to the formation of the local industrial capitals and reinforced the autonomy of state in the interests of the local bourgeoisie:

What had been a regime completely dominated by particularistic private interests became on Taiwan relatively more autonomous...first in an extraordinarily thorough land reform followed by pervasive state support for the newly created class of "self-exploiting" small peasant proprietors, second in systematic extraction of the surplus from what became a highly productive agrarian sector to promote industrial capital formation. (ibid, pp 213-4)

Finally, the foreign capital didn't become involved in Taiwan development until the start of export trade in the sixties.

However, Evans thought that foreign capital had already existed in Taiwan in a different manner:

East Asia countries are highly dependent on international trade.... The effects of aid and trade, like the effects of foreign capital, must be understood in the context of particular historical and social situations of dependency. (ibid, pp 209)

Chapters Three, Four, and Five will basically demonstrate how the Taiwan state worked with the U.S. aid agencies and the IBRD to develop the military strategies and industrial plans. Chapter Six will bring the local partners into the discussion about who benefited from the industrial facilities for running semiconductor production. This historical review clearly indicates the triple alliance was the major characteristic of this development.

Moreover, the historical linkage between Taiwan and the U.S. semiconductor industry was the U.S. military-industrial complex--one of the important themes of the war economy. The theoretical framework of this thesis uses the theme of war economy to review this linkage. Historically, the U.S. Cold War ideology created the Pacific Asia containment policy. That policy stabilized the Japanese legacy in Taiwan. The U.S. also aided Taiwan telecommunication expansions for the sake of the West Pacific defense. Later, the Cold War ideology formed the domestic military-industrial complex in the U.S.. This complex financed Taiwanese industry (which was based on Japanese assistance) and security infrastructure for the Vietnam War on the one hand, and ignited the trend of declining profits in

the U.S. semiconductor industry on the other hand. This historical connection consisted of: (1) the start of offshore consumer electronics production (forced to move overseas by the concentrated domestic production of military chips in the U.S.); (2) a successful export-oriented policy in Taiwan (the security system and the advanced industrial infrastructure were established for the Vietnam War).

Thirdly, this particular picture of Taiwan development has also been variously drawn according to the different points of views in the East Asia development studies (Chan,1992; Chan & Clark,1992; Cumings,1987; Gold,1986; Deyo,1989; Koo,1987; Lam,1992). Through interaction with this literature, the framework of this thesis draws a structural picture of why and how the Taiwan state served the U.S. semiconductor industry; and critically demonstrates how the Taiwan state locally served the interests of the U.S. semiconductor assembly industry for the sake of national security and political interests.

Finally, this theoretical framework through the topic of the war economy connects the research concerning the control function of the telecommunications with the studies on the role of Taiwan's repressive regime in supplying both cheap labour and export-oriented policy.

A. The Political Economy of Telecommunications Network and the Semiconductor Industry Relocation in Pacific Asia

As viewed by North American studies on the political economy of communications, the Pacific Asia telecommunications and information network (as part of worldwide system) was partially designed by the U.S. containment policy makers to internationally serve the operation of Command, Control, Communications and Intelligence (C³I) after the Second World War (Dinh, 1987: 70-1; Mosco, 1989: 384, 1993: 51; Smythe, 1986: 66). The military network for the Vietnam War was also fully operated under this design (Bergen, 1986).

To maintain this system, the U.S. Department of Defense (DoD) contracted out the massive procurement and maintenance work to telecommunications/electronics industries (Free Press, June 22 1970; Siegel, 1971). This transaction created the Military-Industrial-Communication Complex in the fifties (Mosco, 1986:76; Schiller, 1992: Ch.4; Sussman and Lent, 1991:10). Moreover, the contracts also financed many supporting agencies (including "executives, lawyers, engineers, and scientists") to facilitate the transaction within the Military-Civilian-Industrial Complex (Dinh, 1987:71; Smythe, 1986:70,74). Funded by taxpayers, these two complexes were basically operated by the R&D branch of DoD.

Subsequently, as the International Telecommunication Union (ITU) had predicted in the sixties, the U.S. space program advanced the global communication network through another military investment in electronics industry--semiconductors (also see Schiller, 1984:6; DeGrasse, 1984:90):

The general character of the ITU during the 1960s was significantly different from that of the past.... While there were changes in some areas, such as the development of semiconductor devices and the emergence of satellite radiocommunication, they did not require extensive new international arrangements at that time. (Coddington and Rutkowski, 1982:41)

From the inception of the satellite age, the booming integrated circuits (ICs) market, created by the space program, reinforced the semiconductor industry (Jayaweera, 1986:37; Molina, 1989:53-55; Mulgan, 1991:43). The U.S. military procurement created this market in order to compete

with the space challenge from the Soviet Union (Mosco, 1986:78). This military goal was subsequently applied to INTELSAT (Dinh, 1987:73-4). The R&D spending on satellite communications rejuvenated the military-industrial complex and "information imperialism" (Wasko, 1984:X). The beneficiaries of the satellite project were the electronics giants, such as TRW, Ford, Rockwell International, RCA, ITT, GTE, and WUI (Mosco, 1986:81; Schiller, 1992:98-103) (see Chart 2.1.).

Meanwhile, semiconductors also contributed to another military application--the computer projects (Flamm, 1985:44; Mosco, 1993:51-2). The U.S. military was the major patron and consumer of computer ICs production from the 1950s to the 1960s (Flamm, *ibid*, pp 40-1, 66). Again, the computer systems facilitated the efficiency of global satellite communications. In the sixties, these electronics communications innovations and systems helped the U.S. semiconductor industry (which was also involved in the satellite project, see Figure 2.1.) to exploit East Asian (e.g., Taiwan) cheap labour. The existing worldwide the U.S. military establishment laid the groundwork for TNCs to expand their worldwide activities in the beginning of the sixties:

An additional component of the international flow of communications is the still considerable military presence of the United States around the world. There is, of course, the exclusive and enormously developed worldwide military communications system of the Pentagon. On a more general level, and accompanying the global deployment of United States military installations, there are the scores of Armed Forces Radio and Television stations.... (Schiller, 1973:468)

After World War II, American transnationals flourished because the United States had the political power [i.e., military, author noted] to keep the international system open (i.e., to assure freedom of operation) and transnational organizations had the necessary means of transportation and communication to pursue (their) strategies abroad... (jet liners, computers, satellites).... (Read, 1976:10-11, quoted in Schiller, 1979:103)

The reason for searching cheap labour at that time was the declining profits in consumer applications of the U.S. semiconductor industry after the sixties. This crisis in falling profits was created by the importation of Japanese consumer electronics appliances which were both more advanced and cheaper than the comparable U.S. products; this situation arose due to the concentration of military production in the U.S. industry (which was caused by war economy, see Gill & Law, 1988:119-122; DeGrasse, 1984:77-79; Jayaweera, 1986; Melman, 1974).

In order to save its profits, the U.S. semiconductor industry adopted the strategy of the "transfer of production to the Third World countries where capital could benefit from the 'comparative advantage' of cheap labor...."; "the instrument of this geographical shipment was the multinational corporation" (Jayaweera, 1986:37).

This solution--to search for worldwide cheap labour to save the U.S. electronics TNCs from the falling profits crisis--was called "Global Assembly Line" (Ehrenreich and Funetes, 1984). Taiwan, already well connected with the U.S. through microwave and satellite earth stations (which were

Chart 2.1. The Cooperation of the American Electronics Industry with the Military Establishment on the COMSAT Project in the 1960s mediated by Armed Forces Communications and Electronics Association (AFCEA)

arranged from Herbert I. Schiller (2nd, 1992:98-103)

Figure 2.1. The Runaway Military Semiconductor Manufacturers and Their Relocation in Taiwan

Source: American Report Dec. 10 1971; Henderson, 1989; Molina, 1989; TEAMA, 1988.

serving the communication needs in the Vietnam War [American Report Dec. 10, 1971; Bergen, 1986:306]), provided cheap and disciplined labour (Melman, 1974:97-101) under an established security system to the U.S. semiconductor industry (Arrigo, 1983). The U.S. semiconductor industry had the firm confidences in the Taiwan environment which was connected with the U.S. by satellite (since 1969) and where labour was supervised by security personnel (from the U.S. MAAG).

Moreover, the TNCs were forced to relocate their plants when military demands were gone (Henderson, 1989:158). Under this market pressure, the TNCs adopted two strategies--toward "a greater exploitation of labour and an intensification of technology" (Jayaweera, 1986:31). The "International Division of Labour" (IDL) which promoted the Southeast Asian semiconductor assembly plants emerged from this market transformation (Jayaweera, 1986:37, 41; Mosco, 1982:143; 1993:43). The global communication network which served the expansion of TNCs was put into operation in assembling semiconductors.

On the local level, Mulgan pointed out that "circular control" was part of the functioning of the telecommunication system. Under the control of this system, a primary requirement of semiconductor production in Taiwan was installed by the authoritarian regime to supervise the semiconductor industry:

All points along the continuum retain the crucial idea that control depends on channels of communication for commands and on channels of feedback to monitor effects and changes (Mulgan, 1991:49).

This requirement of control was applied to the supervision of semiconductor production in Taiwan. The dealers and customers of semiconductors were systematically supervised by the telecommunications inspectors and security forces at each level of the transaction, from producers, dealers to users. (This "circular control" will be demonstrated in Chapter Six.) This supervision, assisted by the U.S. aid, also indirectly guaranteed the resistance-free exploitation of cheap labour through the denial of the civilian access to electronics technology. This resistance-free environment also encouraged TNCs to settle in Taiwan.

Furthermore, Mulgan pointed out that the control function resided in the "informational" system (1991:52):

The word 'control'... carries with it the sense of an informational environment, of a system of influences, commands and feedback.

At the same time, Mosco proposed the value of information in the formation of the New IDL:

It is no wonder that commentators now refer to information as ... a strategic means of control. For business, this means that information technology has opened the way to a truly international division of labor,... (1993:43)

Finally, Mulgan and Mosco consistently emphasized the importance of time in the control effect and the formation of IDL,

... control is clearly situated in time.... Control thus refers to the practice of keeping records over time (Mulgan, 1991:52)

... it enables companies to take advantage of the lowest cost and most easily managed sources of raw material, capital, and workers with fewer and fewer space and time constraints. (Mosco,1993:43)

These insights coincided with Dan Schiller's observation that the business telex service (the prototype of the "keeping records over time" information system) contributed to the intensive global communications developed between the U.S. and Newly Industrializing Countries (1982:101). Conclusively, in Chapter Five, this thesis proposes that Taiwan's telex system (in terms of information, time, and control) was a basic contribution to the operation of the U.S. semiconductor assembly plants.

Historically, Mulgan pointed out that, after "the empires, nations and large corporations" were extended by communication (telegraph) and transportation (railway) (1991:54, also see Carey,1988; Herman,1981:195-196; Innis,1952:29-30; Melody, 1981:5); then "multinationals" were erected by jet and satellite (Mulgan,1991: 54). Communication as a control mechanism mainly processed two functions---exogenous (vertical) and endogenous (horizontal) information flows at the local level. In Taiwan, the vertical information flows were as follows (1) the central exchange of the Directorate General of Telecommunications (DGT) exclusively distributed any local/overseas message to reach any city/country through the early microwave system and telex exchange (see Chapters Four and Five); and (2) the U.S. headquarters directly controlled the assembly plants through satellite (see the discussion of

Siliconix in Chapter Five). The horizontal information flows were performed by (1) the Taiwan defense communications system which was designed in a loop wireless circuit, such as the emergent wireless communications system between the military and civilian sectors (see Chapter Four); and (2) the assembly plants in the web of local industry through domestic telex connection (see the discussion of General Instrument in Chapter Five).

The control effect also worked through the telephone policy. The Taiwan state set a high installation charge in order to deny the application from average income household or who less than that (e.g., labour). This policy oppressed the potential resistance from civilian side to the export-oriented policy. According to the telecommunications history, Mulgan pointed out:

The peculiar technical power of the modern state derives from this extensive capacity: the ability to establish instantaneous links to the most remote regions and to deny such links to the opposition. (1991:70)

Mulgan's proposal that the controlled flow of information served the TNCs contrasted with the position of the developmentalist that the information was free flowing (also see Mosco, 1982:141; Schiller, 1979:103):

...William C. Norris, chairman of the Control Data Corporation--one of the major computer companies--argues "Full implementation (of introducing computer technology, and thereby satisfying global material need) depends upon a consensus in favor of the free flow of data throughout the world." (Schiller, 1979:98)

Looking at the Taiwan case, this thesis proposes that the TNCs

intensively controlled their anti labour union assembly plants. Taiwan provided a haven where TNCs preferred to invest, where there was no freedom of negotiation for the workers (because of the repressive supervision), and no freedom of telephone access in the civilian/labour households (because of high installation charges) who served the TNCs' production lines. Where was the free flow of information? (This argument will be demonstrated in Chapters Five and Six.)

Given the consistent military/trade priority of telecommunications policy, the more U.S. telecommunications channels opened, the more control the U.S. TNCs exerted upon Taiwan's development. This hypothesis argues that functioning as a control mechanism, the Taiwan telecommunication network contributed to the economic development there.

B. The Political Economy of the Taiwan State and the Developing Telecommunications/Semiconductor Industries

The Incorporation of Taiwan into the world economic system after World War II was critically controlled by a strong state (Evans, 1987:210; Koo, 1987:172). The state led by Chiang Kai-shek (Nationalist Party) interacted with the world system according to the terms of his insistence on two relative autonomies: (1) As one of the leaders of the Allies during the Second World War, Chiang prohibited the U.S. from usurping his military jurisdiction and persisted in preparing for the "Return to China" War; (2) the ROC state of Taiwan, which mainly consisted of Mainlander elites (Deyo, 1989:44), efficiently redistributed the properties of the Taiwanese

(e.g., land reform after the massacre of local elite in 1947), in the process creating new local capital, without conflict from local interests; then again, established the state as relatively autonomous from the new local capital (Chan,1992:175; Evans,1987:210,214; Koo,1987:174).

However, Chiang needed to maintain the stability of consumer prices and pacify the class confrontation in order to prevent his regime from repeating the "lose China" experience (Chan,1992:174; Koo,1987:171). Accommodating these needs, the U.S. successfully brought Chiang's regime into the U.S. anti-communism bloc through military assistance and economic aid (Deyo,1989:48).

Taiwan was treated as a frontier by the U.S. containment policy strategists (Koo,1987:175). This strategy integrated the Taiwan state into the Western democratic bloc and generated the Taiwan economic take-off in the sixties:

By the time foreign capital arrived, adequate economic foundations in both infrastructure and human capital had been laid, and the state was in firm control of the economy. The initial political integration of the two countries [South Korea and Taiwan] into the world state system, it can be argued, eased their subsequent economic integration into the world capitalist system. (Koo,1987:169)

Furthermore, the CIA also successfully integrated Taiwan into the Japanese economic hinterland (Cumings,1987:62). The CIA extended the Japanese legacy in Taiwan and advanced the infrastructure by importing Japanese supplies. The local industrial capitals were also reinforced by this Japanese cooperation. The ascendancy of Taiwanese technicians, however,

continued and telecommunication/electronics technologies advanced without ROC Mainlander interference.

These two integrations established the following favourable economic climates as the preparation for Taiwan's export economy take-off:

1. The U.S. Direct Force Support (military assistance) powered the security and defense of Chiang's regime. This security system executed, imprisoned, or expelled the dissident elites and left-wingers on the island (also known as "White Terror"). This repression destroyed the basis of the labour union movement (Chan & Clark, 1992:63; Chen, Yu-hsi, 1981: 287; Deyo,1989:43). The regime dispatched security officers into every public sphere, especially the factories, corporations and schools (Gold,1986:60,90). The result was the so-called "Military Sales effort" which critically ensured the "security of the capitalist system" against the "liberation movement" (labour) in the "economic colonies" (Smythe,1981:12);

2. In order to maintain the legitimacy of the state and obtain the needed defense supports, Chiang committed to economic development. He allowed the technocrats to run the bureaucracy for the U.S. economic aid projects in Taiwan (Chan & Clark,1992:82; Koo,1987:174);

3. The Taiwan state advanced its wireless communications to serve the Cold War strategy and the Vietnam War economy. In return, war procurement diversified Taiwan's industrial

production (based on Japanese specifications) before Taiwan launched the export-oriented policy (Cumings, 1987:76; Gold, 1986:79; Koo, 1987:169).

With such an infrastructure in place, Taiwan was chosen by the U.S. producers as the export site for standardized electronics products in order to maintain the product life cycle (Cumings, 1987: 47; Gold, 1986:81; Vernon, 1979:114). The match between Taiwan industry and the product life cycle was generated from the war economy effects on both sides of the Pacific (in Taiwan, Japan and the U.S.). From the time of the Kennedy administration, the U.S. wage level was lifted by inflation which was produced by the large spending in the military-industrial complex:

As the activity continued through the 1950s it took the shape of a "military industrial complex" and was then transformed under Kennedy-McNamara into a full-fledged centrally managed industrial system. (Melman, 1974:20)

...the Johnson administration allowed business to increase prices at a faster rate.... It [this inflation] was caused by war production.... Business knew how to take care of the lack of consumer goods.... The war in Vietnam created a situation in which businessmen had an opportunity to rob the working man by raising prices and pulling in a bundle....It is primarily prices that pull up wages. (Free Press, June 17 4:3 1970)

Moreover, the military electronics R&D budget created a disadvantage to the consumer electronics industry in facing the Japanese competition (also see Studies on Taiwan Electronics Industry Strategies, pp 89-97):

For example, as research in electronics was channeled into military and related applications a few industries, notably computers, gained from the government-sponsored research in their fields, but a host of consumer

electronics industries like radio and television manufacturing, left to their own devices, have suffered massive depletion, closing of factories, transfer of work abroad and loss of employment opportunity in the United States. (Melman, 1974:23-4)

Using the low wage as a "comparative advantage", the Japanese electronics industry defeated its U.S. counterpart. Japanese economy was rehabilitated by another military goal of the war economy: establishing the U.S. defense frontiers (e.g. Japan and Southeast Asia) on the Western Pacific (Cumings, 1987:61). Japanese industry benefited from the CIA-designed hinterland (Southeast Asia, including Taiwan) strategy.

Afterward, the U.S. electronics industry decided to save its future by starting offshore production of standardized products to compete with the Japanese share of the U.S. domestic market. That decision led to the end of the U.S. aid period in Taiwan and Japan. The U.S. TNCs exploited the Third World cheap labour and stopped the increase of sale prices (i.e., controlled inflation) (also see Jayaweera, 1986: 30, 34, 41):

Between 1967 and 1975 foreign investment in Southeast Asia grew by 1,235 per cent--from \$747 million to \$9,997 million--a continuation of the Vietnam War in another guise, with primarily U.S. electronics companies reaping the benefits of cheap labour and lax environmental policy maintained in the zones. (Nelson, 1989:107)

The war economy effect also contributed to the formation of cheap labour. First, according to Mosco, a disciplined work force was one of the most important incentives:

But wages are not the only consideration in the selection of a labor force. A disciplined work force is a prime consideration. (1982:150)

Serving the Cold War strategy, DoD had provided military personnel training in Taiwan, such as,

... training programs for nationals of Second and Third World countries.... [and] covert integration with counter-insurgent or insurgent military activities in Second and Third World countries.... (see Smythe, 1986: 67-8)

After their retirement, some military trainees were moved over to supervise the labour unions for the U.S. multinationals in Taiwan (Arrigo, 1983). Regulating labour by this repressive means, Taiwan met the requirement of cheap labour for the U.S. multinationals. (Chan, 1992: 174-5; Deyo, 1989: 74, 114, 116; Gold, 1986: 89; Koo, 1987: 174). Thus, the war economy provided a structural basis for the connection between the profits crisis of the U.S. semiconductor industry and the exploitation of Taiwan labour in the trend of "Global Assembly Line". (This structural connection in Taiwan will be demonstrated in Chapters Three and Six.)

After the war economy of the sixties, the relatively autonomous Taiwan "militarized state" turned into a state committed to pro-export-oriented industrialization. This transformation was critically directed by the U.S. Agency for International Development (AID) (Cumings, 1987: 70; Gold, 1986: 77-8; Koo, 1987: 168). Subsequently, the AID presence was taken over by the IBRD (Cumings, 1987: 71; Koo, 1987: 169; Sussman & Lent, 1991: 18). The President of the IBRD, Robert McNamara, who was promoted from Ford and DoD to the IBRD and the International Reporting Information Systems (IRIS), was

responsible for planning the worldwide telecommunications services, especially in East Asia, for the U.S. TNCs after 1968 (Mosco, 1982:150; Sussman, 1987:92). The Taiwan state was directed by the IBRD and its co-founder, the Export/Import Bank to build a public utility for serving the export trade and industrial development:

...the U.S. and U.S.-dominated international agencies such as the World Bank... have helped provide the infrastructure for export manufacturing... [and] telecommunications.... The U.S. Export/Import Bank is providing loans.... (Siegel, 1980:12)

Under the influence of the IBRD, the Taiwan state carried out three other strategies in order to realize the benefits of an export-oriented trade policy. First, the relative autonomy of the state became less autonomous in serving the semiconductor industry due to Taiwan's demand for the advanced knowledge of military chips. Originally, during the U.S. aid period, the state consisted of the security forces and industrial promotion teams (Gold, 1986:62, 77). Those two forces could reach a consensus if a proposal could be packaged under the name of a defense project which was a spin-off from industrial innovation. Telecommunications technocrats played a major role in providing this recommendation, especially in the project of semiconductor production.

Secondly, Chiang Ching-kuo, the head of the secret police (Chen, Yu-hsi, 1981:287), attended the Financial, Economic and Monetary Conference in his position as Vice-Prime Minister of the Executive Yuan. His presence showed that the security

forces were staying in line with the goals of economic development in order to maintain ROC diplomatic relations with the countries who invested in Taiwan (Gold, 1986:90, 92; Deyo, 1989:49; Lam, 1992:153).

Thirdly, the national semiconductor production policy was established through the personal recommendations of high ranking Kuomintang (KMT) (i.e., Nationalist Party) bureaucrats and overseas (U.S.) Chinese rather than by the long-term government industrial working group (Lam, 1992:141). Those high ranking persons used their personal connections with selective TNCs, gained from their working experience with the AID, to negotiate the technology transfer on behalf of military applications and the Nationalist Party joint ventures business.

The Taiwan state, under these three strategies, provided a necessary channel for the U.S. capitals. Once the telecommunication administration was allowed to accept offers from the TNCs, Taiwan began to get involved in the U.S./Japan electronics competition (Cumings, 1987:75-6; Gold, 1986:79-80, 86). The Taiwan state provided the services for the multinationals as follows (adopting Sussman's framework⁴

⁴Sussman used this framework to study "technological-industrial dependency":

"The particular branch of technology that interests us here is telecommunications. It is important to understand the relevance and nature of this advanced industrial technology to appreciate its specific significance to the dominant development model which it serves." (1984:294)

[1984:294-5]):

1. Setting up the national (i.e., owned by the Nationalist Party) communication infrastructure;
2. Setting up industry or the military as the primary users by rejecting general civilian application through high telephone installation charges;
3. Applying foreign loans to telecommunications expansion;
4. Monopolizing the best interests for TNCs and the local KMT elite at the expense of the civilian interests in communications technology innovation through:
 - A. exclusively distributing American and TNCs' technological knowledge through the hands of the national telecommunications administration and security regime;
 - B. linking the TNCs with Nationalist Party businessmen in a monopoly local market (also see Chan & Clark, 1992:79);
 - C. controlling the personal application for the electronics importation license through tough regulation.

These services explained Chan & Clark's observation that the state policy limited the contribution of the telephone to the whole society until the late 1970s:

In the communications realm, mail flow began its rapid growth in the 1950s. Telephone, in contrast, did not become widespread until the late 1970s.... (1992:45)

Melody demonstrated (1985:531) the similar type of policy in the major industrializing countries:

High access charges for local telephone service may force a good many poor people to give up telephone service. But that is tolerable because the estimated consumer surplus gains from increased long distance use by large-volume users will exceed the consumer surplus losses of disconnected customers with no alternatives they can afford.... Finally, it should be noted that... reducing rates for long distance voice and data services at the expense of local telephone rates is to help domestic companies (in the United States and Canada, at least) compete more effectively in national and global markets.

Taiwan practiced this similar strategy to reserve telephone circuits for TNCs (who were frequent long distance users) by setting priorities and high installation charges to deny general civilian and labour applications.

However, the Taiwan state was not without its own conditions in serving the U.S. semiconductor industry. The state actively used the cheap labour advantage to attract foreign capitals to invest or sign joint ventures with the corporations of the Nationalist Party. The state also guaranteed the profits of the TNCs' investments and joint ventures in exchange for their alienation from politics (government sector and oppositional forces) (Gold,1986:90). This exchange enforced the authority of the Taiwan state, a situation which was different from that of other Third World states (also see Jayaweera,1986:36-8; Mosco,1982:148), for example, the Philippines:

... the relative isolation of the latter [Philippines] has brought a more integrative dominion of western capitalism into its state sector while coopting the local bourgeoisie through advanced technology-based joint venture arrangements with transnational corporations (TNCs). (Sussman,1984:293)

Nevertheless, the strong Taiwan state faced some dilemmas

in channelling technological transfers due to internal political and external diplomatic conflicts. These conflicts were created by the confrontation between domestic politics and the triple relation (Taiwan, Japan, the U.S.) (Cumings, 1987: 75-7; Gill & Law, 1988:194; Gold, 1986:79,86). This triple relation troubled the Taiwan state on the issue of distributing the interests between the principals of the three major confrontations: security regime versus trade regime; Mainlander Chinese versus Taiwanese; and the U.S. versus Japan. The three confrontations were fundamental to the dynamics of the whole picture: the security regime which was controlled by Mainlander Chinese consistently served the U.S. interests; the trade regime preserved Taiwanese capitals which had already built close links with Japanese industry.

Basically, the acceptance of the U.S. or Japanese TNCs' offers was decided by the security regime in regard to national security or diplomatic strategy; for example, in the case of the submarine cable plan in Taiwan discussed in Chapter Four. The opportunities for technological transfers were decided by the two giants, the U.S. and Japan, in terms of their own best interests in using Taiwan resources to defeat each other; for example, the case of semiconductor manufacturing transfer in Taiwan discussed in Chapter Six. These conditions also reinforced the Japanese colonial legacy in Taiwan and allowed Japan to take advantage of the U.S. offers in Taiwan, and vice versa. The triple relation played

a very important role in developing the Taiwan semiconductor industry. Finally, after the mid-seventies, the U.S. won out in Taiwan telecommunications/ semiconductor markets because the security regime gave priority to trade with the U.S. due to political considerations (also see Gold, 1986:94-5):

For Taipei, American investment in Taiwan has meant that there are additional voices in Washington calling for the support of the regime in Taipei. The American Chamber of Commerce of the Republic of China has been most vocal in insisting that the United States continue to support Taiwan (Deyo, 1989:49).

The Taipei central government pleased the U.S. investors by allowing them to sell components in local markets at the expense of the Taiwanese who had been previously promoted by national policy to do the local sourcing.

After the two themes of political economy are reviewed, the theoretical framework for the study of the contribution of Taiwan telecommunications to the U.S. semiconductor assembly industry is established. This framework critically presents the historical development of telecommunications in Taiwan during the U.S. Cold War and the subsequent War Economy. These two wars directed Taiwan telecommunications in serving the U.S. defense strategy and forming the security supervision system in Taiwan. The telecommunication system in Taiwan assisted in bringing together cheap labour with overseas connections in the global semiconductor assembly movement. Through the U.S. aid and the resulting link with the U.S.-Japan alliance, a strong Taiwan state was structured. The Taiwan state served the U.S. Vietnam War strategy and was

repaid by the investments of the defense-supported U.S. semiconductor industry. To maintain the profitable alliance with the U.S., Taiwan provided favourable telecommunications and semiconductor industry policies which monopolized the best interests for the U.S.-Nationalist Party joint ventures.

2.3. The Conceptual Framework: the Endogenous Concept

Based on the endogenous framework, this thesis criticizes the developmentalist approach which links telecommunications with the international division of labour but ignores the political, economic, and social contexts. This thesis demonstrates the development of Taiwan's semiconductor industry from the local perspective in the international context, which gives a dynamically endogenous analysis of the participants in this global assembly movement. In this context, the thesis primarily analyzes how local actors (government and the U.S. aid agencies in Taiwan) established the semiconductor assembly industry there, and also shows the interactions between each of the local actors and the international formations involved.

The endogenous framework addresses the exogenous concept of information technologies which is central to the mainstream school of economic development:

A predominant school of thought has treated information 'technologies' as if they were objects isolated from the social, political and economic environment.... The assumptions underlying the exogenous perspective, when combined, contribute to a mythical understanding of 'technology' or a

' technological system' that is inexorable, irresistible, and globally homogenous. (Mansell, 1987:196)

This mainstream thought was applied to the international development issue after the Second World War:

The exogenous approach to 'technology' appears in the post World War II guise of traditional economic development theory. Here, 'technology' is regarded as the key element needed to stimulate economic growth in the less developed countries. Communication, including the mass media, informatics, and telecommunications, is included as a major ingredient for a 'take-off' into sustained economic growth, 'industrialisation', and in the 1970s and 1980s 'informatisation'. (Mansell, 1987:198)

Ithiel de Sola Pool applied this approach to a topic similar to that of this thesis--the contribution of telecommunications to the international division of labour:

Taiwan and Korea, for example, are becoming centers for software coding.

That kind of division of labor depends, of course, upon having access to the technology of global telecommunications. The networks for such international access already exist if national policy permits it.... Programmers in a low labor cost country also need to use the best computers that there are, the best systems that there are. (1981:164, quoted in Mosco, 1982:148)

This linear connection between cheap labour and telecommunications, which exemplifies the exogenous approach, was a basic proposal of the developmentalists in the promotion of a national information technologies policy.

The endogenous concept, on the other hand, proposed to drive the study of information technologies away from the exogenous approach:

The concerns of research need to shift away from the effects of a nebulous technological system, to institutional arrangements and the determinants of public and private sector investment. These are major factors

that affect the particular path of development in the information sector. (Mansell, 1987:199)

According to the endogenous concept, Mansell further argued:

The struggle for power among different national and international interests is a primary factor that guides the outcome of development process. 'Technology' is part of the social fabric in which corporate and government institutions sanction certain innovative products and services and not others. (1987:200)

Thus, Mansell concluded:

Investment in research and development, innovation, production and marketing of information products is affected by social, economic and political conditions. (1987:199)

And furthermore, she suggested:

The dependency theory tradition provides a starting point for the development of an endogenous conceptual framework for information policy analysis. This body of theory has focused on the asymmetrical distribution of political and economic power that is embedded in all social institutions. (1987:201)

Mansell, inferring from this endogenous concept, proposed that the study of information technologies be situated in the national as well as international contexts in order to clarify the real political, economic, and social factors involved in information technologies development. She also argued that the interaction between each factor must also be scrutinized in the dependency context to analyze how the development worked out at the different power levels of social institutions and social classes.

Consequently, this thesis adopts the following approaches:

(1) the instrumental approach to study the local actors who served the global semiconductor assembly industry in Taiwan;

(2) the structural approach to situate Taiwan's contribution to the Cold War containment policy and the international competition between the U.S. and Japanese semiconductor industries; (3) the concept of the "triple alliance" of dependency development to describe how state, foreign capital and local capital cooperated with each other to reap the benefits from semiconductor production and excluded the rest of the social classes from these benefits.

2.4. The Methodology

A. The Approaches

This thesis adopts both the instrumental and structural approaches to study the problematic. This adoption is mainly indebted to Mosco's political economy approach to communications technologies studies (1982:25-40). The benefits of using these two approaches together was proved by Mosco:

The instrumental approach can be deepened and enriched by a structuralist perspective on state-media relations. This perspective contains important implications for both scholarly analysis and political action with respect to the varied consequences of new information technologies. (1982:38)

Emphasizing the local perspective within the international context, the instrumental approach of the thesis analyzes the local and the U.S. aid agencies who participated in the whole process of development in this particular case.

The instrumental approach divides up the participants as follows (see Chart 2.2.):

1. Resources: TNC branches in Taiwan, the Nationalist Party's businessmen, and the Japanese joint ventures;

2. Research: Training and Research Centre for Telecommunications and Electronics (established by the U.N. Special Fund), Electronics Industry Research Center (EIRC)/Industrial Technology Research Institute (ITRI), and Telecommunications Laboratories (TL) of the DGT;

3. Decision-making bodies: Central Standing Committee of the KMT, the Financial, Economic and Monetary Conference, Electronics Industry Development Working Group (EIDWG)/Council for International Economic Cooperation and Development (CIECD), Taiwan Telecommunication Administration (TTA)/DGT, Joint Telecommunication Commission (JTC), ITU, Mutual Security Agency (MSA)/AID, the MAAG, and the IBRD;

4. Opinion-making bodies: Planning & Research Board of the DGT, Technical Advisory Committee (TAC), Taiwan Electric Appliance Manufacturer's Association (TEAMA), Stanford Research Institute (SRI), Economic Commission for Asia and the Far East (ECAFE), and the Economic Daily News;

5. Policy-making bodies: KMT-controlled legislative Yuan, Executive Yuan, DGT, Council on U.S. Aid (CUSA)/CIECD, Ministry of Economic Affairs (MOEA), Ministry of Communications (MOC), Ministry of National Defense (MND), Taiwan Garrison Command;

At the centre of the policy formation and decision making processes, and controlling them, were the strong Taiwan state

(KMT) and the AID, the MAAG and the IBRD. The KMT cooperated with the MAAG and the AID to establish Taiwan as a U.S. frontier on the Western Pacific. The telecommunication facilities served both the MAAG and the AID for establishing military service and policy reform on behalf of the U.S. interests. The IBRD directed the CIECD to advance the existing Taiwanese infrastructure to serve the international trade and industrial policy. These decision-making bodies were the instruments of the historical development of the telecommunications/semiconductor industries in Taiwan.

The structural approach clearly portrays how the triple alliance/competition (the U.S., Japan and Taiwan) interacted with the jurisdiction of the Taiwan security regime and industrial/trade bureaucrats after the Cold War. The thesis analyzes the question Why did the government system work in this way not in another? The approach taken here basically points out the problematic of the survival of the state, or, as Mosco said,

Rather it emphasizes the why of class rule. Structuralism considers the vital functions that the... state must satisfy in order to maintain the system on which the state depends for its survival. (1982:38)

This approach demonstrates the structural formation of the telecommunications/semiconductor industries in Taiwan (see Table 2.1., arranged from Mosco, 1982:39). Taiwan was situated in the U.S.-Japan alliance according to the terms of the containment policy. After the powerful Japanese economy was built, the U.S. military-industrial complex turned to Taiwan

for resources to supply the Vietnam War demands. Towards the end of the Vietnam War, Taiwan began to serve the important partner of this complex--the U.S. semiconductor industry. Supported by the U.S. security system, the Nationalist regime in Taiwan successfully repressed dissenting groups and used the TNCs' investments to protect its legitimacy in Taiwanese society and channel benefits to itself from the semiconductor production. However, the participation of the local businesses in the national development of telecommunication/semiconductor industries was constrained by the U.S. interests and Japanese control in exchange for benefits to the Nationalist regime.

The instrumental view is presented in Chapters Three to Six. This approach describes the activities of the participants within a historical chronicle. In the introductions and summaries of these chapters, the structural approach pinpoints the significance of each historical period. Chapter Six concludes with the results of Taiwan telecommunications/semiconductor industries development.

Chart 2.2. The Policy Formation Process for Telecommunications/Semiconductor Industries in Taiwan

(arranged from Mosco, 1982:26, 39)

Table 2.1. The Structural Relations Model of the Taiwan State and Telecommunications/Semiconductor Industries

Structure		
Authoritarian State		Dominant Power
Function: Accumulation	Agents: TTA	Established System: High Installation Charges Import/export license/ certificate.
	CIECD	Foreign investment and reserves.
Legitimation	President Office	The control of inflation and employment creation; national defense against Communist Party.
Repression	MAAG, CIA Taiwan Garrison Command VACRS	Supervision of Labour Union, threat of death penalty, barrier to communications technology use, the supervision of retired servicemen in EPZs.
General Supervision and Administration	MND, MOEA, MOC, CIECD, DGT, ITRI Financial, Economic and Monetary Conference, KMT	Using triple competition to establish joint ventures, technological transfer for industrial and military applications; serving TNCs in order to keep the U.S. Protecting Taiwan.
Process		
<p>The Taiwan state was incorporated into the U.S.-Japan alliance for the containment policy; Security regime served the Vietnam War by replacing submarine cable with satellite and microwave scattering system; The U.S. military-industrial complex bridged semiconductor TNCs with Taiwan industrial infrastructure; The Taiwan state maintained its legitimacy in economy by using cheap labour to run the triple alliance/competition (Japan, the U.S., and Taiwan); Taiwan's security regime served the U.S. TNCs' interests against the long-term interest of national industrial policy; Triple relation constrained Taiwan local economy by Japanese import-dependency and the U.S. market-driven mechanism.</p>		

B. The Concept of Methodology and the Methods

The history of Taiwan's semiconductor industry and telecommunications development is analyzed by a conceptual framework of the "triple alliance". The thesis uses this

framework in order to answer the two questions posed at the beginning of this chapter.

This conceptual framework is what Peter Evans, in his dependent development studies, referred to as the "triple alliance" idea. The compatibility of this dependency framework with Taiwan is confirmed by addressing the Taiwan dependency in a different manner. The thesis proposes that the "Taiwan Miracle" did not represent the elimination of dependency, but, on the contrary, involved a particular structuring of dependency.

First, "dependency" was defined by Dos Santos as

a situation in which the economy of certain countries is conditioned by the development and expansion of another economy to which the former is subject. (1970:231, quoted in Gold, 1986:13)

This thesis suggests that the first dependency (in this case being studied) began because the opportunities for technology transfer to Taiwan were basically generated from the competition between Japan and the U.S..

Secondly, the Taiwan state was much more autonomous than those of Latin America at the beginning of the fifties (Gold, 1986:14-16; Koo, 1987:175). However, after the Taiwan security regime decided to save the Sino-U.S. diplomatic relations by enlarging the U.S. TNCs' interests in Taiwan, the dependency of the national industrial policy was created.

Thirdly, through the demonstration of the structure of local capital in semiconductor production, the thesis shows how the majority of the benefits of joint ventures (i.e.,

international capital connected to local capital) went directly into the hands of the Nationalist Party. This aspect of dependency was also pointed out by Koo:

Dependency mechanisms, for example, cannot be specified until we have investigated the ways in which external forces are linked to internal class structure. (1987:165)

The Taiwanese state brokered its economy into the world capitalist economy and has exercised great influence on the manner in which local capital is connected to international capital. (1987:173)

In this context the thesis views Taiwan's subordinate status in the connections between the U.S. and the Japanese TNCs and principal (Nationalist Party) Taiwanese businesses which were very much as Sussman described:

To the extent that the local state-bourgeoisie-military/police-ideological apparatus succeeds in the project of incorporation, their representatives are de-nationalized and elevated to subaltern status within the international bourgeoisie. (1984:294)

Finally, adopting Tehranian's framework (1990:81), the thesis examines both the technological advancements and dependency from the points of view of the highest and lowest social classes.

Table 2.2. The Contradictory Perspectives on the Results of Taiwan Telecommunications/Semiconductor Industries Development

Development as Viewed from the Top	Dependency as Viewed from the Bottom
Advanced telephone service; Economic growth; Professional Knowledge Telecommunications inspection for national security; National telecommunications controlled by central exchange;	High installation charges. Low wage and pollution. Access denial. No freedom or privacy with telecommunications use. Local communications relayed through central exchange.

In this thesis, Evans' concept of "triple alliance", which he applied to Latin America, is transferred with some moderation to the Taiwan case⁵(Koo,1987:175). Here, Evans' original concept of the "triple alliance" of active state, local capital, and the U.S. TNCs (1987:205) is replaced by a triple alliance of a strong state of competing bureaucrats, a ruling party-controlled local capital, and TNCs with the U.S. military-industrial complex support (Gold,1986:96). This conceptual framework is shown as follows:

Chart 2.3. The Conceptual Framework of Triple Alliance

⁵ After the massacre and land reform in the fifties, Taiwan was controlled by the Nationalist regime which disciplined local capital. The strong state was also built with U.S. military assistance before the TNCs landed in the sixties.

For the historical review, the thesis has relied upon relevant literature and a series of interviews. These works focus on the agencies in the triple alliance, and are as follows:

1. The Strong State of the Competing Bureaucrats

A. Interviews (31 Dec. 1993; 7 January 1994): Fang Hien-chee, Special Advisor of the ITRI (currently); Director of the DGT (1969-1978); Dean of the ITRI (1978-9); and Director General of the United Microelectronics Corporation (1979).

B. My Autobiography: 1908-1988 by Mr. P.H. Kong, Director of EIRC/ITRI (1974-1977) and TL (1969-1974), who served the U.S. military interests in Taiwan during the 1950s and the 1960s.

C. Historical documents collection: the critical 1961 SRI Report and the industrial policy papers, in the Library of the Council for Economic Planning and Development in Taiwan.

D. Archives materials: the proceedings of international conferences of the ITU and ECAFE for 1959-1970; the seminars for telecommunications-building and operation management conducted by DGT from 1967 to 1976; the applications for U.S. aid and World Bank loans from 1950 to 1970; the Sixth Four-Year Plan of Telecommunications of the DGT (1973-6); and the Yearbook on Communications from 1950 to 1980, in the Technical Library of the DGT in Taiwan.

E. International Telex Directories for 1969 to 1978, from the Telegraph Department of the International

Telecommunication Administration of the DGT in Taiwan.

The research proves that the model of telecommunications in Taiwan originated from a military application during the U.S aid period of 1950 to 1964 and was then transferred to serve industrial strategies based on the needs of the global shift of the U.S. semiconductor industry, as well as the needs of the local partners. However, the research also proves that the industrial/technological goals of the DGT could not be fully realized due to the military/security concerns.

2. The Ruling Party-Controlled Local Capital

A. The Membership Books of the Taiwan Electrical Appliance Manufacturer's Association (TEAMA) from 1969 to 1980.

B. Discussion (18 Feb. 1994) of the technological transfer project of RCA-CMOS (Complementary Metal-Oxide-Silicon) in 1975, at the Industrial Technology Research Institute.

C. Reports (financial, policy, etc.) of the Taiwan electronics industry from the 1950s to the 1970s, in the Central Library of Taiwan.

The research proves that local capital (who served the semiconductor assembly industry or formed the partnerships with the U.S. and Japan TNCs) exclusively consisted of the electronics corporations of the Nationalist Party. Their plants were located on sites where the telecommunication system (including networks and training centre) was already functioning.

3. Transnational Corporations with the U.S. Military-Industrial Complex Support

A. Archives of management policy of the U.S. semiconductor industry (annual reports); the collected readings on the U.S. military-industrial complex; the articles about: (1) the offshore production of the U.S. semiconductor industry; (2) the strategic confrontation between the U.S. and Japanese electronics industries (mainly from Pacific Basin Report), in the Pacific Studies Center in Mountain View City, California (15-17 Dec. 1993).

B. Archives concerning the operations of Motorola, Texas Instruments, General Instrument & Micro-electronics, Philco-Ford & Microelectronics, RCA, Siliconix, Sprague, Ampex, GTE, and ITT (the objects of the thesis) in Taiwan from 1966 to 1976. The criterion for corporation selection in this study is defined by Henderson (1989), Monlia (1989), and Scott (1987). The corporations selected here were involved in five core productions:

1. All companies had supplied the space program and military procurement in the U.S. (see Chart 2.1. and Figure 2.1.);

2. Two companies, Motorola and Philco-Ford, were making consumer electronics application (TV, Radio) from ICs production;

3. Two companies, GTE and ITT, were making Industrial application (switching system) from ICs production (Hybrid IC);

4. Two companies, Ampex and Sprague, were making semiconductors as one of their diversified products;

5. Six companies, Texas Instruments, General Instrument & Micro-electronics, Philco-Microelectronics, RCA, and Siliconix, were exclusively operating semiconductor assembly plants .

The research proves that telecommunications assisted the operation of the U.S. semiconductor assembly plants in Taiwan, and also that the supervision of labour unions in Taiwan was assisted by the U.S. military program. These structural relations were primarily established by the U.S. military-industrial complex for maintaining the Cold War and running the war economy. The research also historically analyzes: (1) the interactions in the triple relation between Taiwan, Japan and the U.S. in forming the infrastructure of the Taiwan semiconductor industry and the expansion of the Taiwan telecommunication system; (2) what benefits Taiwan received from the alliance/competition between the two giants, Japan and the U.S..

2.5. The Goals of the Thesis

Chapter two has established the theoretical, conceptual frameworks and the methodology of the thesis. The following four chapters discuss the main topics by means of the structural approach: (1) the competition/alliance between Japanese and American telecommunications/semiconductor

industries was the basic force in setting up the advanced infrastructure in Taiwan; (2) the conflicts between military/security regimes and industrial developmentalists counterbalanced the Japanese influences and channelled the U.S. interests to the Nationalist Party.

The instrumental and structural approaches show the roles of the participants in the semiconductor industry development process in Taiwan, from the review of the history of telecommunications in serving the U.S. semiconductor assembly plants, through the successive U.S. and Japanese loans from 1950 to 1976 (in Chapters Three, Four and Five). These chapters analyze the interaction between military and industrial demands for telecommunications. The results show how the military application was switched to serve the industrial development on the one hand; how the adoption of technology innovation was constrained by the security regime on the other hand; and how, in order to serve the interests of the security regime and the multinationals, the high installation charges was maintained at the expense of civilian telephone access.

Chapter Six structurally shows the technology transfer and proves that the security regime contributed to the concentration of benefits in the hands of both the Nationalist Party and the U.S. TNCs at the expense of civilian access to communication technologies. The Taiwan Nationalist Party took advantage of the competitions between the U.S. and Japan at

the expense of labour and local community interests, and ended in maintaining diplomatic relations with the U.S. at the expense of national interests.

Chapter Three

The Development of Taiwan Telecommunications during 1949-1967

3.1. Introduction.

The Nationalist Party (Kuomintang) led by Chiang Kai-shek, after its defeat by the Chinese Communist Party in 1949, fled Mainland China to Taiwan where Chiang soon restored the Central Government of the Republic of China (ROC). The previous regime in Taiwan had been corrupted by the Nationalist Party's governor and the Taiwanese elite was slain at the hands of Kuomintang troops during the massacre of 28 February 1947 (Gold,1986:50-2; Kerr,1965:310; Nadeau,1990:127-145).

In 1945, because of the burden of heavy defense expenditures, the Taiwan government could not afford to renovate public utilities; the most they could do was maintain the existing facilities. Taiwan's future was uncertain due to insufficient foreign reserves, tremendous inflation, and the American China White Paper (Wen,1990:85-91).

Not until the outbreak of the Korean War in June 1950 did Nationalist Island China receive stable military and economic aid from the U.S. (Jacoby,1966:29). The U.S. China policy was greatly influenced by the China Lobby and the China Bloc. Moreover, the personnel of the Department of State on Far East affairs had been wiped out due to an attack of McCarthyism, and a new group was recruited

[from] men whose primary qualification for the job was intense hatred and fear of international communism. (Kraft, 1991:13)

This change of staff resolved the conflicts which had previously existed between the Department of State and the Department of Defense with regards to the strategic importance of Taiwan (Kraft, 1991:1-17). On the U.S. Far East Command map, Taiwan appeared as one of the frontiers along the strategic line of the Western Pacific. However, the U.S. defense strategy ceased to be the priority of the Nationalist communications policy in 1967 when Taiwan established an Export Processing Zone in Kaohsiung Harbour and installed the Taiwan-Hong Kong Transhorizon Microwave System. Microwave development leapfrogged over the stagnant submarine cable project to obtain a high volume capacity for international communications from 1967 onward (i.e., during the Taiwan's Fourth Four-Year Plan of Telecommunications) (Yearbook on Communications, 1965).

This chapter will both generally explore the nature of Taiwan telecommunications and its administration-building under the U.S. defense and aid strategies, and will specifically explore AID-promoted economic development. The outputs of telecommunication projects did not conflict with the U.S. military and security strategies. The U.S. strategy facilitated Taiwan's access to Japanese goods by tightening bonds between the two countries through a defensive strategic alliance which served the U.S. interests.

However, the authority of Chiang Kai-shek always counter-balanced the U.S. interests in one way or another. Based on their goals of defense, the U.S. had no choice but to tolerate the Generalissimo's action on redistribution of the domestic interests generated from U.S. aid.

The historical events noted directly and indirectly explain why Taiwan telecommunications could immediately cope with the demands of the export-oriented industrialization policy after 1966 and provide a strong support to multinational semiconductor assembly plants. This historical process can be outlined as follows:

1. U.S. aid renovated and rehabilitated Taiwan telecommunications by using "Defense Supported" Japanese strategy to realize general defense strategies and economic development;
2. Chiang's regime took advantage of aid by linking its security forces' demands to the general aid project;
3. In the 1960s, the termination of U.S. aid forced Taiwan to establish a sound financial base of public utilities. These utilities facilitated the growth of international trade;
4. The MAAC facilities were directly transferred to the hands of American investors and benefits trickled down to Japanese businessmen;
5. Taiwan Economic development planners studied the telecommunications expansion project at an early stage through

the review process of aid-approval. These planners consistently supported the multinationals' telecommunications service;

6. The Council for International Economic Cooperation and Development (CIECD) chose industrial districts which were adjacent to military and security bases where the well-wired telecommunications networks were already in place;

7. The development policy for local manufacturers of electronic components was promoted by the U.S. aid program and Japanese investment. This assistance started, in the sixties, the competition between the U.S. and Japanese electronics suppliers in the Taiwan marketplace.

3.2. The Japanese Legacy in Taiwan Telecommunications

The Initiative of Rehabilitation

Taiwan's telecommunications were entirely built by Japan before the island was returned to China (TTA, 1960). Just after the end of the Second World War, the Taiwan Governor suggested, reasonably, that the telecommunication administration adapt the Japanese specification for rehabilitation by purchasing advanced Japanese equipment. However, no foreign reserves were available for the China Central Government offer. Moreover, the Taiwan administration itself also faced two local dilemmas: (1) lack of financial support as a result of the corruption of the Chinese Governor; (2) lack of well-trained technicians after the evacuation of

Japan in 1945.

Fang Hien-chee, known as the "godfather of Taiwan telecommunications", and one of the few leaders from the Chinese Administration, arrived as Vice-Director of Taiwan Posts and Telecommunications during the period of rehabilitation (1945-49). In his memoir, he describes the recommendations of the Taiwan Posts and Telecommunications Administration in 1947 for handling these two problems above: (1) separating telecommunications from the posts jurisdiction; (2) recruiting Japanese-trained Taiwanese technicians into the administration.

Fang points out that acceptance of this proposal was postponed because of the disagreement between the "Taiwan Administration" and the "Mainland Administration" on these two solutions. The proposal was refused by the Mainlander Administration because the change was countered to the interests of their technicians in the old Taiwan regime--the official pro-European system (DGT Monthly News, 27:4). However, Fang had been a professor of Electronics Engineering at Hsiamen University in the Chinese province of Fukien (the Taiwanese fatherland). He stood for Taiwanese interests on this issue even though he was a Mainlander (Wealth Magazine, 49:134).

Due to the Civil War on the Mainland, the Director of Taiwan Posts and Telecommunications, Chen Shu-Jen, was assigned as China's Deputy Director of the Directorate General

of Telecommunications in 1948. At this time, Chen consistently worked with Fang to overcome the resistance of the Mainlanders to split the telecommunications from the posts administration, and to recruit Taiwanese technicians into a "New" Taiwan Telecommunication Administration which was established on 1 April 1949 (DGT Monthly News, 27:4; Yearbook on Communications 1950-60:709).

Taiwan-Japanese Alliances on Behalf of the U.S. Interests

Behind the scenes of the Taiwan Telecommunication Administration (TTA), the personal relationship of Fang with certain prominent individuals played another critical role in reform. In an interview on 7 January 1994¹, Fang frankly admitted that the Taiwan telecommunications system was completely based on the "New" Japanese system, and that he was quite well-acquainted with Howard Van Zandt through an idea exchange with regard to telecommunications operation.

Howard Van Zandt, an American expert on Japan who served as the Director of Telecommunications at General Douglas MacArthur's headquarters in Tokyo, decided to aggressively reform the Japan telecommunications industry. Through his friendship with Howard, Fang proposed to reform the Taiwan Telecommunication Administration by adapting the prototype of the Nippon Telegraph and Telephone Public Corporation (NTTPC):

¹ The interview was conducted by the author in the Taipei Office of the Industrial Technology Research Institute.

2

PM-1 3½"x4" PHOTOGRAPHIC MICROCOPY TARGET
NBS 1010a ANSI/ISO #2 EQUIVALENT

PRECISIONSM RESOLUTION TARGETS

With the post war reforms, the telecommunications department was spun off from the Communications Ministry in June 1949 to become the Telecommunications Ministry. (Takano, 1992:3)

Another close friend of Fang's was Dr. Kajii, the Director of NTTPC (1952-1958), who was one level in command from Howard Van Zandt. Through this personal connection, Fang continuously contracted out for supplies from Japanese manufacturers. The U.S. also encouraged this connection in order to serve its defense interests in the Western Pacific. Taiwan and Japan were tied together because they shared the same technology and communications specifications. This relationship would not have been so smoothly maintained if it had not been for Taiwan's need for U.S. aid to guarantee the survival of the Mainlander regime. The Mainlanders had fought Japanese military invaders for eight years and Chiang Kai-sek couldn't pacify his hatred towards Japan even after the peace treaty had been signed. Moreover, the Mainlander regime only showed its respect to the U.S. after China aid arrived during the Civil War. Because of the aid, Chiang had to listen to U.S. directions with regard to the Taiwan/Japan alliance.

Consequently, the Taiwan Telecommunication Administration didn't work against the U.S. interests. Fang associated with the high ranking members of MacArthur's headquarters. His associations served to structure Taiwan telecommunications-building in keeping with the U.S. Western Pacific defense strategy.

3.3. The Restoration of U.S. Aid and the New Administration Historical Background

The outbreak of the Korean War in 1950 inspired the restoration of U.S. aid to Taiwan². The Economic Cooperation Administration (ECA) began "a Mission to China" on 8 August 1950. The Chairman of the Council on U.S. aid was Mr. Chen Cheng, Vice-President of the ROC. These two facts indicated that the "Economic Aid Agreement between R.O.C. and U.S.A." was restored under the China Aid Act. The aid jurisdiction was also returned to the J.G. White Engineering Corporation and the Sino-American Joint Commission on Rural Reconstruction (Chao, 1985).

External Aid Administration

This new post-war aid administration functioned as part of the American comprehensive Far East strategy. Aid was functionally divided into economic aid and military assistance. As a result, the new administration was split into the ECA Mission to China and the U.S. Military Assistant Advisory Group (MAAG) in Taiwan; their operations were supervised by the Economic Cooperation Administration and the U.S. Department of Defense respectively. They were also

² Actually, U.S. Aid was first issued to Taiwan in 1948. This aid was part of China Aid in FY1948 for industry loans. Yen Chia-kan, the Commissioner of the Communications Department of the Taiwan Provincial Government, asked Mr. Charles Stillman, a representative of the Economic Cooperation Administration Mission to China, to visit Taiwan. The ECA organized an "Industry Survey Mission" to study the public utilities in Taiwan. Finally, Yen received US\$ 5,000,000 as an expansion loan. (Chao, 1985:10)

locally supervised by the U.S. Embassy in Taipei. The consultant service was assigned to the J.G. White Engineering Corporation of New York. As Jacoby pointed out,

The administration of the economic aid program by the Mission was coordinated with the activities of other U.S. national security agencies in Taiwan by the "Country Team," composed of the heads of all U.S. military and civilian mission, meeting under the chairmanship of the U.S. Ambassador to the Republic of China. (Jacoby, 1966: 57)

Internal Aid Institutions

For seeking U.S. aid, the Executive Yuan ROC created the Economic Stabilization Board (ESB) in 1951. The ESB was chaired by the Governor and Prime Minister in 1951 and 1953, respectively. The ESB functioned as a coordinating body between the U.S. and Chinese economic strategists. Its subordinate body, the Industrial Development Commission (IDC), was the actual supervisory force behind economic development and construction schedules. To comprehensively administer U.S. assistance, the Council on U.S. Aid (CUSA) was established. CUSA, however, didn't achieve its own goal until the IDC was integrated into CUSA in 1958 (Wen, 1990: 222-225; Gold, 1986: 68-9). The functioning of the "new" telecommunication administration in the new aid administration on planning issues is shown in Chart 3.1. and 3.2.

Three officials, K.Y. Yin (1903-1963), Convenor of the IDC (1953), Vice-Chairman of CUSA (1958); Yen Chia-kan (1905-1994), Vice-Chairman of CUSA (1950), Governor of Taiwan (1954), and Chairman of CUSA (1957); and K.T. Li (1910-),

Chart 3.1. The Planning Board on Telecommunications Expansion in the New Aid Administration (1950-1964)

AID = Agency for International Development
 CUSA = Council on U.S. Aid
 DGT = Directorate General of Telecommunications
 ECA = Economic Cooperation Administration
 ESB = Economic Stabilization Board
 FOA = Foreign Operation Administration
 ICA = International Cooperation Administration
 IDC = Industry Development Committee
 IDIC = Industry Development Investment Center
 MSA = Mutual Security Agency
 TCA = Technical Cooperation Agency
 TPG = Taiwan Provincial Government
 TTA = Taiwan Telecommunication Administration

Source: Chao, 1985; Gold, 1986:56-73; Chiang, 1958a:16-19

Chart 3.2. The Application for U.S. Aid (Project)

→ Approval
→ Submission

First Step

Second Step

(Source: Chiang, 1958a:17)

member of the ESB (1953), Secretary of CUSA (1958), dedicated themselves to this aid administration. These three men were well-informed and knowledgeable because of their professions in telecommunications and engineering (Wen, 1990:277-8): they turned out to be key planning engineers in Taiwan's early economic development.

K.Y. Yin, a graduate of the Department of Electronics Engineering, Communications University in Shanghai, worked as the Chief of Operations (1931) of the Dept. of Posts and Telecommunications in the Ministry of Communications in China before he accepted an offer from the U.S. as an electrical engineer at Westinghouse. He was well-respected by the personnel of DGT (Gold, 1986:68; DGT Monthly News, 8:11, pp 11).

Yen Chia-kan, along with his early experience with communications (see n.2), was also well-acquainted with the problems of telecommunications expansion and was able to provide necessary assistance. For example, on his recommendation, the TTA received a NT\$ 100,000,000 loan from the Bank of Taiwan for telephone installation. Success in procuring this loan was a result of Yen's past jurisdiction in the Dept. of Finance of the Taiwan Provincial Government (1946-49) (Communications Development Monthly, 16:12, pp 29). Again, Yen provided the "Legal Opinion" for applying the Development Loan Fund (DLF) No.114--"the Microwave Project"--when he was Chairman of CUSA and, concurrently, Minister of Finance (1958-63) (DLF: Letter to TTA, Nov. 2, 1960).

K.T. Li, a prominent leader on economic planning after the sixties, had an engineering background and a great appreciation for advancements in telecommunications and electronics. In his technology policy think tank, Fang was one of the appointed core members (Wealth Magazine, 54:208).

Consequently, the TTA efficiently communicated with the

aid agencies on planning issues and continuously kept up with the American and Japanese advanced technology, regardless of Chiang's surveillance. In those days of Nationalist Island China, the aid administration functioned like a semi-autonomic regime through a clear-cut division which was built by the lesson of "losing China":

[the Nationalist regime]..., attributing their debacle in large part to the collapse of the economy, gave greater scope over Taiwan's economy to Western-trained experts and intervened less than they had on the mainland. (Gold, 1966:67)

As a result,

Whereas the top councils of the Chinese government were preoccupied with political and military problems of security and "return to the mainland," the Council could concentrate upon the development of Taiwan. (Jacoby, 1966:61)

Moreover, the security regime might ease supervision if the development plan could result in military applications³. Furthermore, technology installation, if free from control, could contribute to economic growth and government revenues, thus sustaining the high defense expenditures (Wen, 1990:226). Judging by the record of corruption in Nationalist Mainland China, these professional engineers were the sole trustees of aid in the eyes of the American bureaucrats. With this in mind, Chiang had to allow CUSA to gain much more autonomy than it previously had in the Mainland if he wanted to continue receiving U.S. aid (Wen, 1990:230-1).

³ Fang said the project was very easily approved under the name of defense project. (interview, 7 January 1994)

3.4. U.S. Aid for Telecommunications

U.S. aid contributed to Taiwan's telecommunications-building from 1950 to 1962. The TTA received contributions from six agencies⁴, amounting to US\$ 11,303,571.40 and NT (New Taiwan Dollar) \$ 64,636,724.92 in aid; US\$ 112,547.98 and NT\$ 749,000 in grants were awarded up to Fiscal Year (FY) 1967 (Statistical Abstract of Transportation and Communications 1967:50-1). Table 3.1. shows the breakdown of aid in FY 1965:

Table 3.1. The U.S. Aid Contribution to TTA (1951-1964)

Category	Total	Period (Fiscal Year)
1. Defense Support (DS) (Project)	US \$ 5,460,443	1951-61
2. Development Loan Fund (DLF)	US \$ 2,000,000	1960
3. AID #12 (Development Loan)	US \$ 5,200,000	1962
4. Counterpart Fund (CPT)	NT \$52,896,725	1954-59
5. Special Account No.4 Loan (SA #4)	NT \$11,740,000	1959-60
6. Technical Cooperation (TC) Grant	US \$ 112,548 NT \$ 749,000	1953-60 1953-60
7. Sino-American Joint Commission on Rural Reconstruction (JCRR) Loan	NT \$ 4,164,000	1956-63
Grant	NT \$ 2,908,417	1956-63

(Source: CIECD, 1964b:1-5.)

The whole aid program was divided into two basic expenditures: (1) expansion projects; (2) personnel training and overseas studies. The aid was applied as follows:

⁴ Economic Operation Administration (1951)
Mutual Security Agency (1951-3)
Foreign Operation Administration (1953-5)
International Cooperation Administration (1955-1961)
Development Loan Fund (1957-1961)
Agency for International Development (1962)

1. The DS and the CPF installed 31,100-line for city telephone facilities, 391-circuit for toll phone and 18-circuit for telegraph;
2. The DLF installed 300 toll phone circuits by microwave;
3. The AID #12 project installed 41,500-line for city telephone facilities;
4. Special Account No.4 installed 8,400-line for city telephone facilities;
5. The JCCR Loan installed 180-line for rural telephone facilities.

Those installations comprised 73% of the total city telephone lines, 54% of the toll phone lines and 17.8% of the telegraph circuits in Taiwan.

The TC program financed two operational staff members in Japanese training courses and twenty-six operational and engineering members in the U.S. training courses from 1953 to 1960. Moreover, five microwave technicians were trained by Collins Radio Company through the DLF project; ten technicians, through the AID #12 project, participated in a switching system internship at Automatic Electric International, Inc. (CIECD, 1964b:9-11).

U.S. aid contributed to 38.5% of the total expenditure for telecommunications-building in Taiwan from 1950 to 1963. The TC program and Japanese suppliers' exchange programs (packaged in U.S. aid procurement, see 3.6.) provided many training and

study programs for the TTA before 1970 (CIECD, 1964b:6,10). The breakdown of expansion programs and the portion of the TC program within the total overseas training are shown in Table 3.2. and 3.3.

Through these programs, the TTA was systematically intertwined with the so-called U.S.-Japan alliance in the Western Pacific. From its operation expansion to management technology, TTA was well-armed with the equipment from the U.S.-Japan alliance. Taiwan telecommunications were located on the front of the U.S. anti-communist battle. To explore the significance of aid to the U.S. semiconductor assembly industry in Taiwan, the next two sections will illustrate, respectively, the track of aid expansion projects and the track of technology installation for knowledge training and transfers.

**Table 3.2. The Statistical Abstract of U.S. Aid on
Taiwan Telecommunications (Shen, 1969:183-4)**

FY No.	Project	DS (US\$)	CPT (NT\$)
51	1 4,000-line new installation for automatic city phone in Taipei North Sub-exchange	629,776.00	
	2 New installation of 18 carrier channels (Taipei-Taichung, Taipei-Kaohsiung)	199,213.00	
	3 1,500 lines of magneto switchboard in various cities	146,036.00	
52	1 New installation of 108-pair underground cable between Taipei and Taichung	87,983.50	
	2 Improvement of carrier testing and measuring facilities	40,350.17	
	3 Repair 800 lines of Kaohsiung automatic city telephones	64,975.52	
	4 300-line increase for manual telephones in Keelung City	56,266.00	
	5 Replacement of 3,500 subscribers' worn-out telephone sets	55,273.00	
	6 Improvement of Ta-An Repair Workshop's facilities	20,249.00	
	7 Procurement of urgent maintenance materials	56,589.00	
53	1 Procurement of 1,000 new automatic telephones sets	15,720.00	
54	1 2,000-line further increase for automatic telephones in Taipei North Sub-exchange		7,171,764.17
	2 An increase of 300-line of Chiayi city telephones		541,502.05
	3 An increase of 300-line of Tainan city telephones		486,733.78

FY No.	Project	DS (US\$)	CPT (NT\$)
55 1	Installation of two additional 6-channel carrier systems (Taipei-Kaohsiung, Taipei-Taichung)	6,548.50	2,791,300.00
2	Installation of message meters in Taipei Exchange	25,249.72	
3	Conversion into multiple magneto office of Taitung, Taoyuan, Fengyuan, Peitou.	166.00	908,700.00
4	Installation of 4-channel carrier equipment for short-haul toll circuits	15,579.44	
5	Conversion of Taichung manual switchboard into automatic	218,986.81	
56 1	An increase of 2,000 lines in Taipei Central-exchange		11,200,000.00
2	Suburban telephone expansion for the residency of US Military Assistance Advisory Group in Tienmu (500 lines automatic)	323,641.42	7,750,437.93
57 1	Expansion of 4,000-line automatic telephones in Taipei city	93,830.02	18,393,646.85
2	Expansion of 102-channel of toll carrier underground system on West Coast	207,694.44	3,291,949.40
3	Expansion of 24-channel VHF system on East Coast	155,188.98	360,690.74
4	Installation of 50-channel long-distance telephone between Chunghsing Village and Taichung	126,765.25	

FY No.	Project	DS(US\$)	DLF/AID(US\$) 60/62	SA #4 SNT
58 1	4,000-line expansion of Taipei North Sub-exchange	751,910.31		
2	1,900-line expansion of Taichung city telephone	428,579.23		
3	Installation of 93 short haul toll telephone circuits	386,610.42		
4	1,000-line expansion of telephones in Taipei south suburb	190,515.10		
59 1	4,000-line expansion in Taipei Central Exchange	725,366.91		
2	80-line expansion of short haul toll circuits	294,531.19		
3	Installation of 18 voice frequency carrier telegraph circuits	48,294.25		
4	Improvement of facilities in Ta-An Repair Workshop	67,967.06		
5.	Installation of message meter in Kaohsiung and Chiayi		1,740,000.00	
60 1	6,000-line expansion of Taipei City telephone in North and Central Exchange Expansion of 1,000- line of automatic switchboard in Sanchung and Chungho		10,000,000.00	
2	Trans-island backbone microwave project		2,000,000.00	
62 1	Expansion of telephone facilities in three developing areas		5,200,000.00	
51-53	Miscellanea	20,584.76		
Total	DS	DLF	AID	CPT+Special #4
	5,460,443.00	2,000,000.00	5,200,000.00	64,636,725.00

FY	JCRR Loan (NT\$)	JCRR Grant	Location Village	Site	Note
1956	364,000	364,000	1	N	
				Chungho	
			7	C	
			9	S	
			3	E	
1957	500,000	412,528	10	N	
				Hsinfeng	
			6	C	
			9	S	
1958	500,000	274,062	2	N	
			3	C	
			8	S	
			2	E	
1959	500,000	291,683	5	N	
			5	C	
			6	S	
			4	E	
1960	500,000	366,144	4	N	
			7	C	
			12	S	
			2	E	
1961	500,000	500,000	7	N	
			3	C	
			7	S	
			3	E	
1962	500,000	500,000	8	N	
			7	C	
			9	S	
			2	E	
1963	800,000	200,000	7	N	
			5	C	
			6	S	

(Source: CIECD, 1964b:11; TTA, 1960:66-71; Yearbook on Communications, 1950-1963)

Table 3.3. The Overseas Training Programs for Personnel of the Directorate General of Telecommunications (1950-1967)

Program Trainee Year	Overseas Training and Studies					Total
	U.N. TA	U.S.Aid TC	Internal Grant	Manu- facturer Support	NSC Grant	
1950-60	8	26 (US) 2 (JA)	60	17	---	113
1961	3	5 Collins	--	14	---	22
1962	-	--	31 (JA) 3 (US) 2 (WG)	--	---	36
1963	-	--	1 (NE) 1 (JA)	--	---	2
1964	-	10 (AE)	2 (SW) 1 (JA)	7 (NTTPC)	---	20
1965	-	1 (AE)	15 (JA) 1 (US) 1 (UK)	2 (OKI)	---	20
1966	1 (US WG)	4 (JA)	6 (US) 9 (JA) 2 (HK)	12 NTTPC 2 (C&W) 2 (HKT) 1 (JA)	1 MAL 1	41
1967	-	--	22 (JA, SWE)	1 Philips 10 (JA)	---	33
Total	12	48	157	68	2	287

(Source: Yearbook on Communications, 1950-1967.)

AE = Automatic Electric Company
 C&W = Cable & Wireless Hong Kong
 HKT = Hong Kong Telephone Company
 JA = Japan
 MAL = Malaysia
 NE = Netherlands
 NSC = National Science Council ROC
 OKI = (a Japanese Manufacturer)
 SW = Switzerland
 SWE = Sweden
 TA = Technical Assistance Program
 WG = West Germany

3.5. The Significance of Aid (I): The Track of Expansion Projects

The biggest portion of aid was designated for "Defense Support" (also see Figure 3.1.):

When the American aid program resumed...its primary objective [was to]...help the Nationalists achieve political and economic stability. To this end, of the \$1.5 billion in nonmilitary aid obligated to Taiwan between 1951 and 1965, 54 percent came under the rubric defense support, earmarked by Congress "to enable the recipient country to maintain an agreed level of military strength without retrogressing economically. (Gold, 1986:69)

.... AID found it convenient to rationalize assistance for developmental as well as other purposes within the loose statutory definition of "defense support." (Jacoby, 1966:33)

The U.S. presumed that aid should serve defense in a broad sense. Through the contribution to economic stability and prosperity, aid balanced military expenses by cutting the spending of defense and providing the budget of defense and military operation through revenues and services from/for economic development (Jacoby, 1966:39). Noting these connections, one recognizes the typical rhetoric in aid applications:

Subsequent programs were recommended by White Engineering on basis of the increased economic recovery and military aid, all of which partly depend on adequate communications. (J.G. White Engineering Corp., Recommendation to MSP/CUSA, Oct. 1952)

The project is related to all other industry projects supported by ICA, as all are dependent on reliable telephone service for greater efficiency. It will also help bolster the defense of Taiwan. (ICA, Project Proposal and Approval Schedule UL, 1957:8)

How did aid simultaneously contribute to both Taiwan's

Figure 3.1. U.S. Aid for Telecommunications
By DS, DLF, AID, CPT and others

(Source: CIECD, 1964b:6)

defense and economy in this case if history showed that these two sectors of development usually worked against each other (Chan, 1992)? The answer could be found in two formations of Taiwan's aid expansion: (A) the conditions of a sound financial project; (B) some correlations between the sites where security forces were stationed in the fifties and those where industrial districts located after 1964.

A. The Make-up of a Sound Financial Project

A sound financial project was a sufficient condition to make a U.S. aid application⁵. "Sound financial project"

⁵Before an aid proposal was addressed, the TTA Planning Executive Committee for U.S. Aid had to provide the seven following conditions (Chiang, 1958a:17):

1. how the completed project would contribute to the social economy;
2. that aid is necessary or urgent for applicant;
3. that the materials or supplies are locally unavailable;
4. that the efficiency of the utility would be enhanced through the project;
5. that a comprehensive schedule for the project has been

basically referred to the capability of repayment. Each project had to guarantee that the new public utility would increase operating revenue through a growth in telephone demand. Thus, a TTA application in FY 1953 indicated:

The growth of the telephone demand during the past few years shows a very promising picture for further development. In Taipei... At the same time, requests for more telephones pour in every day from inland cities and rural sections. (pp 4-5)

It was necessary that the revenue also maintain the operation of telecommunication services. The payment for service finally contributed to the repayment. For example, the TTA proved its repayment ability in the section "Source of Funds" of the FY 1957 Project Proposal as follows (ICA, 1957:16):

Receivables	
a. Long distance telephone revenue	NT\$ 68,850,000.
b. City telephone revenue	
Monthly rental	19,760,000.
Installation charge	43,200,000.
c. Depreciation reserve sinking fund	28,450,000.
Total receivable	NT\$160,260,000.
Balance: Surplus	NT\$ 3,514,375.

Moreover, the growth in demand was also generated by economic activities as the TTA said in the FY 1953 Application:

All these [demands] reflect a general improvement of economy and growing rural and commercial prosperity as a result of the joint efforts of MSA and JCRR as well as a result of the government policy. (pp 5)

In fact, the demands for telephone service were also promoted by other aid projects. U.S. aid provided a package

made;

6. that the source of repayment is confirmed (a balance sheet must be provided);

7. technical specification would be adaptable to future expansion.

program rather than single project assistance. As the J.G. White Corporation said (in the conclusion and recommendation of the FY 1953 Application):

These projects, although appearing to represent a sharp increase in phones, actually are conservative if present industrialization plans and military aid are carried out.

And the TTA (Future Prospect in the FY 1953 Application) interpreted:

As the MSA has secured distinguished achievement in rural reconstruction and began to emphasize industrialization in Taiwan, telecommunication is deemed necessary to keep its pace with.

Following that direction, telecommunications and industrial development mutually supported each other through U.S. aid. In other words, U.S. aid agencies insisted that aid would eventually stimulate economic growth if the money went to the public utilities. Economic growth would demand facilities expansion and generate payment for services to public utilities. This revenue, again, would serve as the biggest source of repayment.

Furthermore, the U.S. aid agency designed a Counterpart Fund (CPT) for the ROC government. This fund, financed the industrial projects, was came from the repayment of public utilities before the dateline for the pay-off of U.S. aid, as the J.G. White Engineering Corporation interpreted:

We realize fully that such rapid repayment against capital expenditures places a difficult burden on the Taiwan Telecommunication Administration. Unfortunately, there is no alternative since the use of the counterpart funds is already planned and necessary for various "common-use" and industrial development projects. This burden, if absorbed by such going concerns as the Taiwan

Telecommunication Administration, will result in the double benefit of securing counterpart funds through a permanent and beneficial addition to the economy. (V.S. de Beausset's recommendation in Application for MES Aid FY 1953)

According to Jacoby (1966:46), repayment was facilitated by soft loans repayable in local currency. The borrowers returned funds to the ROC government in local currency instead of to America in U.S. currency. This form of repayment applied to loans such as DS, CPT, DLF, and Special Account No.4 (Shen, 1969:178-180). Chart 3.3. demonstrates the circular process of this "repayment".

Chart 3.3. The Cycle of the U.S. Aid for Expansion

However, there were two other conditions which the TTA were required to meet in the project proposal: (1) local financial support; (2) reasonable rate-making.

According to the CIECD final report (1964b:6), the value of U.S. Dollars had to be supported by an equal value of N.T. Dollars for local expenditure. From 1951 to 1963, local support financed 61.5% of expansion expenditure, which was equal to 160% of U.S. aid. In other words, for each U.S. dollar applied for, TTA must disburse N.T. dollars equal to US\$1.60. Local funds for the expense were largely supplied from the telephone installation charge and the credits of Japanese factories (see Table 3.4.).

Table 3.4. Sources of Funds, DGT (1952-1962), Unit=Million N.T.D.

Year 19--		52	53	54	55	56	57	58	59	60	61	62
Source of Fund	Appropriated Surplus	6.3	15	19	24	18	14	20	21	35	23	18
	Reserve for Depreciation	-	-	-	7.2	11	13	11	23	61	67	54
	Credit by U.S. Aid	-	-	15	-	16	51	14	2	115	5.5	4.2
	Credit by Bank	-	-	-	-	-	-	-	-	-	-	-
	Credit by JCRR	-	-	-	-	.3	.4	-	.1	.5	.5	.5
	Credit by Japanese Factory	-	-	-	-	17	3	-	37	-	17	-
	Appropriated by Government	-	-	-	-	-	-	-	-	-	-	-
	Local Telephone Installation Charge	-	-	-	-	-	-	-	25	35	39	53
	Capital Reserve	-	-	-	-	-	-	-	.3	1.3	1.8	1.3
	Others	.009	-	3	10	7	42	55	.03	-	.2	.1

(Source: Statistical Abstract of Transportation and Communications, 1967 ROC:174-5)

Moreover, and secondary to revenue, these installation charges were also an important source of repayment (see pp 98). This high installation charge policy (see Table 3.9.) was directly recommended by Dr. Kajii (NTTPC) and Howard Van Zandt in General MacArthur's Tokyo headquarters (DGT Monthly News, 26:8,10;27:5). Again, credit from Japanese factories was also provided by Kajii (DGT Monthly News,26:10). These two sources were great contributions to the funds for expansion as well as the repayment of U.S. loans.

Rate-making was dramatically revised in 1960. The ICA legal consultant submitted a memorandum to Wesley C. Haraldson, Director of the ICA, Mission to China. The consultant reminded the ICA that the fund-receiving country must sustain a sound financial project, otherwise it violated the Mutual Security Act. The ICA informed the ROC government of this in 1959, critically pointing out that the rate-making policy did not produce a fair return. According to Provision 517 of the Mutual Security Act, the ICA decided that no U.S. aid would be authorized until rate-making procedures had been started by the ROC government.

The ICA directed CUSA to revise the rate level of public utilities on 5 Feb. 1959. The ICA suspended U.S. aid projects in FY 1959 (including US\$ 1,000,000 for telecommunications expansion). CUSA asked the Ministry of Communications to establish a "Rate-making Sub-Committee" on 19 March. The sub-committee also asked the J.G. White Engineering Co. and the

ICA to join the discussion (Yearbook on Communications, 1950-60:201). Finally, rates were adjusted and operational net profits increased after 1961 (Yearbook on Communications, 1961:6). This adjustment reinforced the government's payoff ability and prepared Taiwan for U.S. aid withdrawal (details will be discussed in Section 3.6.).

B. Security Forces' Facilities Structured by U.S. Aid

The security forces protected Taiwan against Communist invasion on the one hand, and prepared for the "Return to Mainland" War on the other. As a result, these security forces were divided into two groups:

1. Agencies for protection orientation: the U.S. Embassy, the Seven Fleet Communications Center, the U.S. Mutual Defense Command, MAAG, MSA, TGC, the Police Department of the Taiwan Provincial Government, the Justice Administration, the National Security Bureau, and U.N. agencies.

2. Agencies for attack orientation: the President's Office, the Ministry of National Defense, the Army, Navy, and Air Force of the ROC, Telecommunication Detachments, and the Mobilization Sub-committee of the Ministry of Communications.

In fact, most of these agencies were scattered around the northern part of Taipei city (see Figure 3.2.).

Table 3.2. shows the projects for security forces which can be clearly distinguished from general expansions. The infrastructure of the security forces was also advanced through the continuous U.S. aid and domestic policy.

Figure 3.2. The Security Forces Located on the Telecommunication Network in North Taipei City (1949-1967)

B.1. The Nexus of Networks in North Taipei--the North Sub-exchange

The installation of a 4,000-line switchboard in the Taipei North Sub-exchange in 1951 was the first out of twenty-eight U.S. aid projects on this island.

This sub-exchange was geographically located in the centre of the U.S. Embassy, the U.S. MAAG, and the U.S. Mutual Defense Command. This sub-exchange was further renovated by a 2,000-line automatic telephone switchboard in 1954, and a further 4,000-line addition in 1958 (see Table 3.2.). The switchboard of the Siemens Halske type, was made by Fujitsu Limited of Japan. The U.S. used procurement as an aid to stimulate the Japanese economy (Wen, 1990:206-7) by creating a Counterpart Fund in Taiwan which paid barter dollars instead of convertible U.S. dollars (e.g., the second installation of the sub-exchange) (Chiang, 1958b:24). The procedures of the two kinds of procurement in these projects, as well as those of other projects, are illustrated by the Chart 3.4.

The need for continuous expansion was due to the high volume of communications traffic in north Taipei city. However, keeping the security regime free from disruptions caused by telephone traffic congestion was the major concern. As a result, two solutions were bundled together in the second installation of the north sub-exchange project in 1954: (1) the procurement of message meters for the Taipei exchange system (FY 1955 proposal); (2) "The Temporary Restriction on City Telephone Applications" (regulation promulgated by the

Chart 3.4. The Procedure of Procurement for U.S. Aid

1. Procurement by Free U.S. Dollar

2. Payment through Barter Dollar by Counterpart Fund

Source: Chiang, 1958a:18

MOC on 13 January 1955). Message meters functioned on a per-call charge basis and replaced the flat rate charge. The TTA's basic concern was stated as follows:

Thus, in the absence of suitable means of discriminating usage volumes, the low volume user is penalized to underwrite the costs of providing equipment and service for the high volume, who, in turn, is getting excessive value for his charges. (TTA, 1954:Item II., 1)

The TTA reviewed its operations in August 1953 to prove the necessity of this action (see Table 3.5.). The TTA actually tried to release the government sectors, especially the President's Office, from the telephone congestion (Communications Development Monthly, 16:12).

Table 3.5. Charge Rates and Traffic Conditions of Taipei City Telephone Subscribers

Class of Subscribers	Monthly Rent (NT\$)	Average Daily Cal Completion/Subr.line
Private Residence	34	7
Department Stores & Shops	89	28
Government & Civil Organizations	60	16
Hotels, Theatres, etc	103	51

(Source: TTA, 1954:Item II., pp 2.)

Secondly, Article II of the temporary restriction stipulated the priority of telephone application: first security forces, then factories, and lastly residence. This prioritizing became necessary after total subscribers had consumed over 80% of the exchange system capacity.

To enforce the outgoing connection in north Taipei city, the first international telephone and telegraph service office was established beside the north sub-exchange by the CGRA and TTO on 1 Sept. 1958. The CGRA reinforced international communications facility by reason of Taiwan's security-

supported economic environment. In other words, the U.S. security agencies supported the economy's progress and prosperity by preventing war on the Taiwan Strait on the one hand, and using aid to channel the U.S. and Japanese goods to Taiwan on the other. The northern part of Taipei, particularly along the Chungshan North Road., was not only a strip where security agencies resided but also the location for a group of trading companies.

Nevertheless, no matter how urgent the demands for the revival of economic activities, the telecommunications policy couldn't directly target civilian needs without regarding the security forces' operations. The charge basis even supported the stability of security operations at the expense of local business. The TTA's basic rule was to conciliate the military and civilian demands as well as, later, the industrial and civilian communications operations.

B.2. Suburban Telephone Expansion for the MAAG Residency

The largest project of suburban telephone expansion served the MAAG's personnel and dependents. This project simply let the MAAG and their families use a modern telephone network by paying a far cheaper price than that paid by general civilians.

After the MAAG arrived on Taiwan in 1951, their overseas communications caused great trouble to the DGT. According to the Yearbook on Communications (1950-60:736-7), the outgoing of "overseas telephone calls" usually exceeded the incoming

ones due to the U.S. Armed Forces and the MAAG in Taiwan. To save the DGT's foreign reserves, the CGRA decided to stop expanding its service until the U.S. military dependents moved to Taiwan. This was done to curtail spending of most of the reserves for International Records Carriers (IRCs) (see Table 3.6. & 3.7.).

Table 3.6. Operating Income and Expense in Foreign Exchange, DGT 1950-54, Unit= US\$

Finance Fiscal Year	Income	Expense	Balance the books to Bank of Taiwan (Deputy of Central Bank of China
1950	365,604.72	115,847.03	554.06
1951	172,174.75	61,943.10	-----
1952	92,773.78	29,055.34	-----
1953	190,496.82	192,318.32	78.54
1954	163,990.69.	76,493.02	101.97

(Yearbook on Communications, 1950-60:68)

Table 3.7. Overseas Telephone Calls between Taiwan and U.S., 1950-54

Taiwan-U.S. Fiscal Year	Outgoing Message	Incoming Message
1950	1,752	906
1951	4,186	996
1952	7,165	1,352
1953	7,814	1,153
1954	7,842	977

(Yearbook on Communications, 1950-60:790-793)

This action induced the first negative effect on Taiwan telecommunications policy by rewriting it in favour of

withdrawing the expansion projects to decrease the traffics of overseas service. After their dependents had settled, a new U.S. community was founded at Tienmu--the tip of north Taipei where the families of the MSA members also resided. No sooner had the TTA sent a proposal to the MAAG in March 1956 on American request than the MAAG passed the project to the MSA/ICA, Mission to China, and a new project was approved and named "The Telephone Expansion Project for the North Suburb of Taipei and MAAG Residency".

Originally, the MSA provided US\$ 374,000 as overseas procurement and NT\$ 8,000,000 as local expenditure. The foreign reserve was paid by U.S. aid in FY 1956 and the local expense was granted by the U.S. government. As a result, the U.S. subscriber paid no installation charge, but did pay a monthly rental fee of US\$ 5.00. However, after the project was approved by the MSA in Washington, aid was cut down to US\$ 355,130 and the local grant was cancelled. This project was renamed as the "Suburban Telephone Expansion" under the ROC security regime demands (see Table 3.8). This revision forced the TTA to ask the J.G. White Engineering Co. to search for more funds. Finally, the MAAG decided to increase the monthly rental fees to US\$ 7.00; the extra \$ 2.00 would be directed as a subsidy.

After the infrastructure was built, two proposals were delivered to the TTA to again reinforce communications for the U.S. security forces. The MAAG requested that the TTA should

Table 3.8. The Suburban Telephone Expansion (FY 1956)

Expansion Sites	The Type of Switchboard		Line Capacity
	MAAG Proposal	TTA Proposal	
Tienmu	Automatic		500
Yangming Mountain	Automatic		200
Shihlin	Automatic		100
Peitou	Manual Magneto		100
Hsinchu		Manual Magneto	50
Taichung		Manual Magneto	200
Chiayi		Common Battery	150
Tainan		Common Battery	350
Kaohsiung		Common Battery	200
Tosying	Trunk-relay to AFNT Kaohsiung	Common Battery	
Total			1,850

(Source: CIECD, 1964b:30)

finish its automation of the telephone dialling project by 1959. The first installation was made at Tienmu. The MAAG was equipped with the best telephone service currently available--DDD (Direct Distance Dialling-NEC manufactured)--on 1 Sept 1959. At that time, this service was advanced beyond any civilian communications (Science of Communication, 1961:58).

The second arrangement, "Supplemental Arrangement of Residential Telephone Service for MAAG Personnel in Taiwan", was promulgated on 1 May 1966. Based on (1) the Letter of CUSA (dated Oct. 29, 1951) under the subject: "Telephone Service for American Employees" and (2) a Letter of TTA with concurrence by Major General F.S. Bowen, Jr., Chief of MAAG to the Republic of China (dated December 13, 1956) on the subject by "Suburban Telephone Expansion", MAAG personnel and all its affiliated members and agencies paid a very low price to use this telephone service (see Table 3.9.).

Table 3.9. The Rates of Telephone Service for Different Subscribers, Unit= NT\$

Subscriber	Residency	Business	Government	Public	U.S. MAAG H O
Price					
Install	1,4000	1,4000	1,4000	1,4000	250 500
Move	1,000	1,000	1,000	1,000	250 500
Monthly Rental	70	184	137	207	210 530
Number of calls per month without additional charge	180	300	300	300	300 750
Charge/call	0.39	0.61	0.46	0.69	0.70
Cost per additional charge	0.70	0.70	0.70	0.70	0.70

H= Household, O= Office

(Source: TTA, 1966; Liu, Chi-hao, 1975:139)

This agreement also covered the following benefits

(TTA, 1966):

1. Upon request, maps delineating base rate areas of concerning telephone offices will be provided by TTA to Assistant Chief of Staff, Communications & Electronics, MAAG. (Article 12. Agreement)
2. MAAG subscribers having manual service in Kaohsiung, Taichung, Tainan and Chiayi areas will be converted to dial service at no additional cost from November 1, 1966. (Article 19. Agreement)
3. TTA hereby agrees to provide residential telephone service for US diplomatic personnel who holds Diplomatic or Special Passport in Taipei (to include greater Taipei telephone service area), Taichung and Kaohsiung areas at same rate as quoted in this arrangement (Sec.II, Article 21. Agreement).

4. MAAG technicians with an U.S. military ID Card after A/cofS, C&E certificated, can be provided the residential telephone service as quoted in this arrangement (Article 2. Supplementary Agreement).

Actually, this agreement covered almost all the personnel and families of U.S. agencies in Taiwan through a general definition of **"Residential Support Activity"** (which included theatre, club, bowling alleys, the Taipei American School, etc). As a result, telephone service based on the modern dialling network was comprehensively established for American in North Taipei. Finally, this facility was transferred to serve U.S. multinationals' managers:

Looking at the overall personnel structure of a large MNC such as RCA in 1978... A top American manager makes about US\$40,000 a year... but must also be compensated..., housing provided in the American Tienmou area, and tuition for his children at Taipei American School... (Arrigo, 1983:4)

B.3. The Voice of the U.S. Armed Forces--Armed Force Network Taiwan (AFNT, 1957-1979)⁶

The third establishment served the U.S. security forces' demands for communications/entertainment. An English radio service, Armed Force Network Taiwan (AFNT), was on the air on 25 December 1957.

Based on the MAAG's proposal addressed to the Commission on Telecommunications Advancement in 1953 (Communications Gazette, 3:10), the MOC allowed U.S. stations to serve American soldiers in three areas: AM 1550 KHz in Taipei, 1560

⁶AFNT stopped broadcasting after Sino-U.S. diplomatic relations were terminated. The Nationalist Party took over the shares of the AFNT to keep it functioning for the Taipei American Chamber of Commerce.

KHz at the CCK Air Force Base in Taichung, and 1570 KHz in Tainan-Tsoying-Kaohsiung. In the beginning, the AFNT leased a studio from the radio service of "Voices of ROC Military" until its transmitter and the studio were installed in Hsinchung, Taipei County and Han Kow St., Central Taipei city⁷. During the fifties, the station was named the "Voice of Sino-American Soldiers". The facilities were maintained by Page Co. and Creutz & Waldschmitt Corporation (Jun-sheng Yu, 1959:6; Timothy L. Wang, 1959:15). The AFNT also established the first frequency modulation service in 1965--FM 100.9 MHz Yangming Mountain in Taipei and FM 100.1 MHz at Taichung. All transmitting stations were hooked up by automatic switching telephones or trunk line rental through the 1966 Telephone Agreement and Supplement. The AFNT's communications infrastructure was also well-equipped with the facilities from the previous aid projects (see Table 3.10.).

The AFNT's franchise was authorized by a joint jurisdiction. According to the China Telecommunications Almanac (DGT, 1971:356-60), the U.S. was not allowed to share radio frequencies in Taiwan until the Joint Telecommunications Commission (JTC) was created in 1955:

⁷ The information was provided by DGT Taiwan in 1993.

Table 3.10. The U.S. Aid Contribution to AFNT's Infrastructure

AFNT Facility Location	Operation	Aid Project Available before
Han Kow St., Central Taipei	Studio (1957)	0.9mm x 400P underground cable (FY 1954) 2,000 lines of Central Exchange (FY 1956) 4,000-line expansion of Taipei city telephone (FY 1957)
Yangming Mt. North Taipei	Studio, FM Station (1965)	75-line magneto switchboard (FY 1951) 200-line automatic (FY 1956)
Taichung	AM Station (1957)	Conversion of manual switchboard into automatic (FY 1955)
Tsoying- Kaohsiung	AM Station (1957)	75-line magneto switchboard in Tsoying (FY 1951) Trunk circuit of manual common battery switchboard (FY 1956)

(Source: CIECD, 1964b; Interview with DGT, 1993.)

General W.C. Chase (U.S. Army, Chief of the U.S. Military Assistance Advisory Group) suggested that the Ministry of National Defense should review the existing policy of radio frequency. He also recommended to establish a commission for allocating the frequency. The Ministry of National Defense decided to establish a "Commission on Telecommunications Advancement". The Ministry of National Defense and the Department of Posts and Telecommunications of the MOC started the general meeting on 9 June 1953 by their members who work part-time for this commission. (DGT, 1971:356)

To reject the status of this committee, General W.C. Chase again requested a reform in February 1955 and told U.S. Ambassador Rankin. Originally, Chase's recommendation was based on the framework of the U.S. jurisdiction on radio frequencies which functioned through the President's Interdepartment Radio Advisory Committee. That committee coordinated with the Federal Communications Commission (FCC) and the Joint Communications-Electronics Committee (JCEC). The

President's committee supervised defense communications (Smythe, 1957:58). Chase asked Rankin to force the ROC government to reorganize the Commission on Telecommunications Advancement by appointing to the full-time membership a minister without portfolio as chief, one treasurer, and a legal consultant. He said, "According to the ROC's recent situation, my recommendation is that the issue should be treated as an emergency."

The ROC government reached a compromise with this recommendation. The Executive Yuan established a Joint Telecommunications Commission (JTC)⁸ in May 1955. The meetings were chaired by two ministers with members of the Ministries of Communications (MOC) and National Defense (MND). Eventually, the MAAG and the U.S. Mutual Defense Command were invited to attend all meetings. The AFNT proposal was formally addressed in a JTC meeting (see Chart 3.5.).

On behalf of the AFNT, which was the only full English entertainment in Taiwan before 1962, the ROC government issued another privilege--"the exemption from radio registration fees"--to the MAAG, the MSA and others (Communications Gazette, 1:10, pp 45). This regulation exclusively benefited U.S. Diplomats and "others"⁹.

⁸It also fulfilled the requirement of the ITU in conciliating the military and civilian frequency allocation (Yearbook on Communications, 1950-60:113-4).

⁹ Civilians could not purchase radios until receiving licenses from the TTA and the Taiwan Garrison Command. Radio holders had to report their radio condition every year and pay

Chart 3.5. The Procedure for Frequency Allocation for Allies' Stations through the First and Second Working Groups of the Second Sub-committee, Joint Telecommunications Commission (JTC)

Source: Nee Foh, 1971:35

However, judging by two "exchanges of notes" between the ROC and the MAAG¹⁰, the rough definition of "others" covered

NT\$30 per annum. Holders could not adjust the broadcasting power or frequency spectrum until they received permission from the Taiwan Garrison Command. All kinds of radios were regulated by the Rules of Radio Receivers Registration (Jan. 1953); Martial Law Ruling on Radio Receivers by the Taiwan Garrison Command; Martial Law Ruling on Radio Equipment (13 Dec. 1951); Mobilization Rules of Electronics Communications (5 Oct. 1963). (Communications Gazette, 1:12, pp 7; 2:1, pp 6-7; 3:6, pp 13; Yearbook on Communications 1963:104-107)

¹⁰ 1. Exchange of notes concerning the treatment of Personnel of the United States Military Assistance Advisory Group in Taiwan, 1 Nov. 1952
2. Article 3. Exchange of notes between the Republic of

all Americans living in Taiwan if they had any business relationship at all with the MAAG. Without the registration, American soldiers could give their radios to anyone they liked, even if the persons were not covered by the exemption (Ding, 1964:15). The ROC government made a generous radio policy for all American visitors under all conditions.

B.4. Central Exchange--an Expansion of the Taipei Security Network and Trade Relations

The Central Exchange expansion project was financed by the CPT in 1957. This project equipped the Central Bureau with 200 trunk lines, 40 toll circuits, and the Taipei North Sub-exchange with 20 trunk lines. It reinforced the connections among the Central Exchange, the North Sub-exchange, and the Taiwan's west and east coasts.

Surrounded by projects underway, a complete north-central Taipei network emerged through aid packages and local support. The first of "three underground cables installation projects" (FY 1954) connected the Central Exchange with the North Sub-exchange by a 0.9mm x 400P cable. The second one, paralleled the Nanking West Road to the North Sub-exchange, which installed a 0.5mm x 800P cable. The Third project extended from the North Sub-exchange to Northern Taipei city through a 0.5mm x 400P cable (see Figure 3.2.). This Central Exchange Office was located exactly in the geographical centre of the headquarters of the MAAG, MOC, MND, Taiwan Garrison Command,

China and the U.S.A. for Military Assistance, May 1957.
(Yen, Ching-chang, 1975:16-7)

and the President's Office. The locations of these facilities reinforced the connections between the U.S. forces and the Nationalist security agencies. Moreover, the expansions of the Central Exchange were consecutively financed by U.S. aid in FY 1957, 1959, 1960.

Along with underground cables, the following service offices were erected by local efforts (Communications Development Monthly, 4-11:12):

1. The CGRA installed a teleprinter service office in the Friends of China Club (F.O.C.C.) on 14 November 1955. The FOCC was associated with all foreign correspondents in Taiwan and also was the location for the first Siro-Japan meeting on microwave technology in 1957 (see next Chapter). FOCC was further equipped with the first international public telex booth in Taiwan on 1 December 1961.

2. The Grand Hotel, owned by Mme, Chiang Kai-shek (Chen, Shin-meng S. et al., 1991:110), installed a CGRA operating office on 25 July 1956.

3. The Taipei Telecommunication Office set up the English Service Office for foreign subscribers on 10 August 1956.

4. The TTO Operating Office on Nanking East Road was established one block south of the North Sub-exchange on 8 June 1961.

5. The CGRA installed an international public telex booth in the General Operating Office on Chung Cheng Road. on 15 March 1962.

These services went well beyond the general civilian needs. Again, the installations clearly reflected the importance of overseas communications serving security forces as well as trading companies. These facilities also directed the activities of trading companies and foreign visitors tracked by security forces.

However, this trade-security relation could not be clarified if the ROC military strategy was ignored. First, a renovation of telephone circuits between Sungshan Airport, Chungshan North Road and Shihlin was underway in December 1955 by the President's order. This renovation was finished by the Communications and Electronics Administration of the MND, the Police Department of TPG, and the MOC (MOC, 1960:79). It linked the Air-Defense Shield Wartime Headquarters (inside Yuan Mountain)¹¹ with the North and Central Exchanges after the U.S. aid expansion project had been completed. The Grand Hotel, located on the bottom side of this headquarters, was a place which attracted tourists and businessmen by its traditional Chinese service. Secondly, the connections between this headquarters, the TTO General Office, and the CGRA General Headquarters were also strengthened by the installations of manual telegraph concentrators in 1952, 1955

¹¹ According to the DGT 1962 Report, this Air-Defense Shield was equipped with supplies from the Yuanshan TTA Office as follows:

1. 300-line switchboard
2. 1 receiver, 3 transmitters, 11 sounders
3. 1 telegraph concentrator, 7 teleprinters
4. 50-pair aerial cable to TTO
5. 30 and 20-pair aerial cables to toll circuit

repeatedly (TTA,1960:81). Thirdly, the Civil Defense Broadcast Station was established on the opposite side of Yuan Mountain in 1955. Therefore, both economic and trade developments were located in a security zone along Chungshan North Road.

Apart from Americans, groups of Japanese investors also visited the hotel for the purpose of conducting business transactions and enjoying entertainment through this security network. The benefits to Japanese businessmen were indicated as follows:

1. According to Trade Statistical Series of Taiwan District, except for major procurements from U.S. suppliers, the second biggest portion of imports was shipped from Japan (Wen,1990:206-7).

2. A historical description clearly drew a picture of how Taiwanese channelled Japanese investment:

Many former landlords who received money from the land reform program in 1953 went ahead and used the funds to build a "factory". They then went to Sungshan Airport (in Taipei) and held up a sign to arriving Japanese businessman saying "Factory for Rent" in Japanese. Japanese businessmen would rent the factory, engage the former landlord to hire labour, import the parts to be assembled and a few machines, and presto, create an instant "industry". (interviewed with MacGregor, quoted in Lam, 1991:5)

3. A facsimile service was installed by the CGRA Taipei Headquarters to transmit blueprints of factory and technical instructions to Tokyo and the U.S. in 1951, 1952 (TTA, 1960: 95).

4. Two installations channelled the Taiwan-Japan connection: (A) a teleprinter service was installed for

government communications between Taipei and Tokyo in the CGRA Taipei Headquarters on 22 February 1952 (Communications Gazette, 2:3,pp 12); (B) the CGRA purchased a radio single side band telephone and a C3 double-channel terminal from the Western Electric Company in 1952. All equipment was shifted to the Air-Defense CGRA Station on Tung Yuan Street in 1952. These facilities served the overseas telephone connection between Taipei and Tokyo on 21 August 1954¹² (Communications Development Monthly, 4:12).

5. The message traffic between Japan and Taiwan was usually higher than that between the U.S. and Taiwan (see Table 3.11).

¹² The Western Electric Company was the supplier for the U.S. Army Command and Administration Network (ACAN). It produced the teleprinter for TWX service, LD-R1 and LD-T2 for transmitters and receivers of single side band which were the exact equipment CGRA purchased in 1952. Actually, Taipei-Tokyo radio single side band telephone had connected the U.S. Air Forces bases of Taipei and Tokyo with Vietnam since January 1955. And notably, a C3 SSB double-channel terminal installed a scramble propagation in order to protect messages from interception. (K.P. Liang, 1956:38-41; Yearbook on Communications, 1950-60:780)

Table 3.11. The Comparison between Sino-U.S. and Japan International Communications

Destination /Source Message Service	Japan		U.S.	
	Outgoing	Incoming	Outgoing	Incoming
1951 Telegraph	47,331	41,893	27,872	20,303
Telephone	6,332	6,019	4,186	996
1952 Telegraph	55,716	60,979	29,417	31,789
Telephone	8,302	8,898	7,165	1,352
1953 Telegraph	60,616	67,901	31,749	30,690
Telephone	10,848	12,570	7,814	1,153
1954 Telegraph	58,236	62,320	40,456	41,000
Telephone	15,467	17,508	7,842	977
1955 Telegraph	54,034	56,773	55,271	48,719
Telephone	16,719	15,382	11,628	1,724
1956 Telegraph	54,587	55,017	57,316	57,101
Telephone	15,505	13,900	9,987	2,537
1957 Telegraph	56,816	58,111	59,606	61,141
Telephone	18,980	16,092	6,753	3,182
1958 Telegraph	59,317	63,917	59,210	56,983
Telephone	17,437	16,164	6,423	3,750
1959 Telegraph	62,361	70,555	58,489	58,071
Telephone	15,454	16,646	6,055	3,885
1960 Telegraph	67,520	79,885	71,652	71,319
Telephone	19,031	23,162	5,407	4,406

(Yearbook on Communications, 1950-60:784-793).

B.5. Forming an Emerging Network for Industrial Districts

Outside of the security regime in Taipei, U.S. aid mainly contributed to telecommunications-building along Taiwan's west coast. Those sites, designed by the Taiwan Telecommunications Administration, used to be the centres of local economy, trading activities, and military camps. Finally, the CIECD chose those industrial districts which the telecommunications network had already reached through this Sino-American cooperation.

The CIECD launched a new era of Taiwan economic development after the U.S. announced aid termination in the

early sixties. The CIECD was a pump primer for export-oriented industrialization policy under the U.S. supervision. Several export strategies were applied during the sixties, such as declaring an Export Processing Zone (EPZ) and developing the industrial district along the west coast.

The connection between U.S. aid and military/industrial facilities was demonstrated in Table 3.12. and Figure 3.3.. Originally, the MSA and TTA realized a defense strategy of the U.S. Armed Force concurrently with an economic plan of CUSA. However, behind this general defense/trade network, this infrastructure also worked in the interests of the ROC Armed Forces. This connection was made by two early Ministers of Communications, who were appointed by Chiang Kai-shek for their proficiencies in defense¹³. This military contribution to export economy after 1965 was proved by the following analysis.

¹³ Before 1960, the first two Ministers of Communications were retired Generals. For example, Ho Chung-han (1950-1954), a military member, graduated from Whampoa Military College, was a member of Blue Shirts and later of the Youth Corps factions which showed great loyalty to Chiang during Nationalist Mainland China days (Eastman, 1984:110). The first Director of the DGT in Taiwan, Gisson Chien (1947-1969), was appointed for his association with these sectarian military members (DGT Monthly News, 26:12; Radio-TV & Electronics Technical Quarterly, 6:3-4, pp 203-5). This coordination made the military application work.

Table 3.12. The U.S. Aid Contribution to Industrial Sites along the Taiwan West Coast

FY	U.S. Aid Project	Industrial Facility	Military Strategy
51	18 carrier channels, toll underground cable.	6 between Taipei-Taichung, 12 between Taipei-Kaohsiung	CCK Air Forces Base MAAG Trans-island connection
51	An increase of 1,500-line magneto switchboard (line, switchboard)	Hsinchu(150,70); -industrial belt Fengyuan(200,100); -TEPZ Taoyuan(150,100)- industrial district Panchiao(75,50); Tsoying(75,50)- NEPZ	CCK Air Forces Base Receiving & Transmitting Station Seventh Fleet Harbour
52	108-pair underground cable between carrier station and office	Taipei-Taichung	CCK Air Forces Base
52	800 lines of automatic phone	Kaohsiung Western Exchange-KEPZ	
52	300 lines of Keelung city telephone and 1 manual exchange	Keelung Harbour	Seventh Fleet communications Center
53	Two additional 6-CH carrier systems	Taipei-Kaohsiung -Taichung	Trans-island
55	Conversion of non-multiple magneto office into multiple	Taoyuan, Fengyuan	
55	Conversion of manual switchboard into automatic	Taichung	CCK Air Forces Base Army Tele-communication Administration USA
56	Suburban telephone expansion	Hsinchu Taichung Kaohsiung	
56	Additional conversion	Taichung	
56	Line-setting by JCRR	Chungho	
57	Toll carrier underground system: 12 channels	Taipei-Hsinchu Taipei-Kaohsiung	
57	automation of electricity	Hsinfeng-factory Site	
57	Line-setting by JCRR	Hsinfeng	
58	1,900 lines of city	Taichung	

FY	U.S. Aid Project	Industrial Facility	Military Strategy
58	Short-haul carrier circuit 50-pair toll trunk aerial cable	Keelung(17);Taichung(36) Hsinchu(19);Kaohsiung(10) from Taichung to Fengyuan	
58	300-line common of battery manual multiple-type switchboard	Hsintien-factory site	Investigation Bureau
59	20-line magneto toll switchboards	Panchiao	
59	18 voice frequency carrier telegraph circuits	Taipei(6,12); Taichung(12); Kaohsiung(6)	Trans-island connection
60	1,000 lines of automatic switchboards	Chungho-factory site	Taipei Troops HQ Maritime Radio Supplement Station
60	Trans-island microwave	Taipei-Taichung (120)-Kaohsiung (120).	Connecting South Asia Far East Cable(SAFE)
62	Conversion of manual switchboard into dial operation (line)	Taipei(17,000) Panchiao(900) Keelung(2,000) Hsinchu(3,000) Fengyuan(2,000) Taichung(2,500) Kaohsiung(5,600)	

(Source: CIECD,1964b.)

Firstly, three important EPZs were located beside the bases of military troops and telecommunications exchanges: (1) the Kaohsiung EPZ was adjacent to (a) Western Exchange; (b) the harbour where the U.S. Seventh Fleet was stationed; (c) the central part of city where MAAG had stayed; (2) the Nantzu EPZ located beside Tsoying where the Seventh Fleet and the AFNT had located; (3) the Tantz EPZ was on the middle ground between Fengyuan and Ching Chuan Kang (CCK) Air Force Base--

where a wing of C-130 transport aircraft and a KC-135 tanker squadron were stationed for the U.S. troops and B-52 bomber launching for the Vietnam War (Clough, 1978:23).

Secondly, Keelung harbour, the location of the Seventh Fleet Communications Center, opened one Telecommunication Service Office for the U.S. Armed Forces. Keelung had earlier restored its telecommunications infrastructure and became an export site for the Taipei industrial district after 1965.

Thirdly, Taoyuan and Panchiao were the major locations for the assembly plants of Taipei trading companies, particularly the multinational electronics corporations such as AMPEX, ITT, RCA, Arwin, Bendix, Clinton, Cornell-Dubilier, Motorola, TRW, and Zenith. The high frequency (HF) transmitting and receiving stations were also located respectively in Panchiao and Taoyuan. These facilities served as the exclusive gateway for outgoing/incoming messages between Chiang's ROC regime and the U.S. Armed Forces before 1960.

Fourthly, Hsinchu was a promising industrial site after the sixties. Its communication capacity was enhanced by continuous U.S. aid and reached its climax when the DGT planned the underground coaxial cable project in the Sixth Four-Year Plan (1973-76) (Yearbook on Communications, 1974:249).

Fifthly, the facilities of three factory sites, Chungho, Hsintien, and Hsinfeng were variously financed by the JCRR, DS, CPT, and Special Account No.4. Two important export

industries--Texas Instrument (10th largest one) and General Instrument (22nd) were located on Chungho and Hsintien, respectively (MOEA,1979). In their adjacent areas were also stationed the Investigation Bureau of Justice Administration, the Taipei Troops Headquarters, and the Maritime Radio Supplementary Station. The important indigenous semiconductor industry--Fine Products Microelectronics Corporation was established in Hsinfeng.

Finally, the underground cable carrier system was renovated by five U.S. aid projects during the fifties. This west coast connection was always treated as a military strategy after the period of Japanese Occupation (TTA,1960:51-2). By combining the submarine cable to South China and Japan, this system served the Japanese invasion into Oceania during the Second War World (Mulgan, 1991:73; TTA, 1960:13). This system was totally rehabilitated by a U.S. aid project in FY 1951. Subsequently, the DLF financed the trans-island microwave system for building a second track of west coast connection. Microwave functioned as a central trunk in connecting all short-haul and long-haul circuits to complete the U.S.-Japanese submarine cable plan. As a result, the network of industrial districts along the west coast was spun-off from a defense strategy which linked Chiang's regime with the U.S. containment policy (details will be provided in the next chapter).

3.6. The Significance of Aid (II): The Track of Technology Transfers of Management and Manufacture

Apart from facilities expansion, the U.S. packaged the Technical Cooperation (TC) Program with each fiscal year's projects. The breakdown of the program is illustrated in Table 3.13..

Table 3.13. The Technical Cooperation Program (1953-1964)

Fiscal Year	Training Sites	Trainee	Grant in U.S.\$	Grant in N.T.\$
1953	U.S.	2	10,566	57,400
54	Japan	2	-----	75,800
55	U.S.	2	8,853	61,600
56	U.S.	3	12,950	61,500
57	U.S.	2	7,600	41,000
58	U.S.	6	21,700	156,700
59	U.S.	5	18,182	133,000
60	Collins	6	32,692	162,000
(DLF	Radio			
No.114)		5	-----	-----
63	Automatic			
(AID	Electric			
No.12)	Co. (GTE)	10	-----	-----
Total		43	112,543	749,000

(Source: Shen, 1969:181)

According to TTA Director Chen Shu-jen, the origin of the program was interpreted as follows:

As one of the most important links in the common anti-communism front, Free China, under the leadership of our President Chiang Kai-shek, has been one of leading beneficiaries of the U.S. Aid Programs... TTA also begin to have some of its staff members sent to the United States for advanced training so as to uplift the general standard of the staff members to meet various practical needs. (1958:25-6)

The beneficiaries of this program were classified into two categories:

(1) Top management personnel, whose scopes of study are rather broad and emphasis is placed on overall management

in telecommunication service, and (2) senior staff assigned to study practical phases or subjects in connection with expansion projects, such as equipment, operation, traffic, commercial, etc. (ibid)

As a result, this program created a better understanding of the U.S. telecommunications service on all levels and an improvement of general/technical knowledge and conception/ methods regarding the DGT problems. Fang praised the TC program:

It proves the increasingly high efficiency of the telecommunication workers, which is attributed largely to the technical assistance under the U.S. Aid program. (1964:79)

Moreover, TC trainees retrained the junior staffs and internship students across the country after the overseas program was finished. Their knowledge was disseminated in the following areas (Fang, 1964:80):

1. 15 students in Institute of Electronics of National Chiao Tung University. [in cooperation with the United Nations Training and Research Centre for Telecommunications and Electronics and Hsinchu industrial district, author noted].
2. 63 students in the Provincial Cheng Kung University. [the only place for telecommunications management training in Taiwan before 1960].
3. 108 trainees in the telecommunication training classes for retired servicemen [assisted by the Vocational Assistance Commission for Retired Servicemen which was established with U.S. aid of US\$42,000,000 in 1955].
4. 102 trainees in the training classes for wartime telecommunication detachments [teleprinter and VHF technology training].
5. 314 students in the Taichung Vocational School [contributed to (1) Taichung conversion of the switchboard project assisted by the U.S. Army; (2) and the DLF microwave project].
6. 387 employees under different on-the-job training and other short-term training courses. These local trainings have contributed not only to the high efficiency of the telecommunication employees, but also to the general development of electronic technology of the country.

To indicate the significance of the TC program, this section discusses the programs for top management personnel and local retraining.

The TC Program: a Long-term Operation Plan

Four senior persons (Fang, Jorry, Lee, and Kong) were trained by the TC program and served in reforming the operating policy of telecommunications to promote the export-oriented industrialization policy.

Fang Hien-chee was a pioneer in the TC program during 1953-4. He participated in the U.S. and Japan Telephone Engineering and Management Program. Through this involvement, Fang met Dr. Kajii (President of NTTPC) in Kellogg, a manufacturer for ITT (International Telephone & Telegraph) (DGT Monthly News, 26:10). Fang also appreciated the switching systems of Automatic Electric (A.E.) Company. (a manufacturer for GTE), ITT, and AT&T. This program early informed him of the U.S. specification and influenced his decision on signing the joint ventures for switchboard production twenty years later. The Japan program strengthened his confidence in the Japanese success in achieving a sound financial basis. He believed that the Japan experience really shed light on Taiwan's telecommunications and electronics industry policy (Fang, 1954:3).

As soon as the course was finished, Fang was assigned a teaching position in the Telecommunication Management Program, Provincial Cheng Kung University which was the training base

of DGT junior staff members after 1955 (Yearbook on Communications, 1950-60:288).

Later, Fang participated in telecommunication training classes for retired servicemen where he delivered a discussion paper about making a long-term plan. In the proposal, he presented the core elements of a long-term plan as follows:

(Source: Fang, 1964:2)

This model treated finance as the base of balance. It greatly emphasized the importance of a fair return. Actually, Fang recognized the problem of low rate-making before 1960¹⁴. Chiang's regime denied the rate-revision for public utilities due to the lesson of "losing China". On this occasion, the U.S. really gave a strong support to the TTA in revising the rate-making in 1960.

The TC Program: a Reform of the Rate-Making

The U.S. enforced Taiwan to revise the rate-making in 1959 for U.S. aid termination on the one hand, and for a free market reform on the other. The TTA welcomed this action due to the demand for a sound financial basis. CUSA realized that it was a new era for Taiwan to begin and put import-

¹⁴Fang said (Jan. 1994) that the low rate-making of public utilities was insisted on by the Legislative Yuan.

substitution policy behind (Li, 1976:137; Sivananda, 1980:26-27).

First, the ICA legal consultant submitted the memorandum to Wesley C. Haraldson, Director of ICA, Mission to China. The consultant pointed out that public utilities had to sustain a fair return policy if they were aid beneficiaries, otherwise, the fund-receiving country violated the Mutual Security Act.

In order to solve this problem, two TC program trainees provided the local efforts for the U.S.. Jorry F.K. Chu, Chief Accountant of the Ministry of Communications (in 1960), participated in the TC program of Public Administration in the USA during 1954-55. Jorry pointed out why the ROC started the review of rate-making:

In order to accelerate the economic development, and to work upon the U.S. Aid, our government promulgated in 1960, the 19-Points on the financial and economic improvement. One item of them is the establishment of a committee in the Executive Yuan to function on the study and rectification of the public utility rates. (1961:59)

This spirit of the 19-points was directed by U.S. aid policy:

Another shift in major U.S. assistance goals for Taiwan began during 1959 and 1960, and took definite form by 1961. There was a gradual reduction in emphasis upon general economic development and an increasing emphasis upon the aims of fostering private enterprise, promoting exports, and terminating U.S. concessional assistance. (Jacoby, 1966:34-5)

Jorry supported this revision by using the U.S. perspective:

ICA pointed that the calculation of fair return in rate-making should be: the revenues yield from such kind of rate level, which, after deducting the expenditures and taxes, should have such a kind of balance that is equal to the "fair rate of return times the rate base." This formula been fine and has been adopted by most American and European countries. The so called Rate Base should

mean the net value of operating fixed assets (the cost of fixed assets less depreciations);... (Jorry, 1961:58-9)¹⁵

Later, the review committee reevaluated the value of fixed assets under the supervision of MSA, CUSA, and J.G. White Engineering Corporation. They pointed out that (1) the current consumer price index was 2.7 times more than that of ten years ago, but the rate-making had not been adjusted since 1949; (2) after the reevaluation was counted by currency inflation, the depreciation and U.S. aid interests should be increased and the fair return should be readjusted.

This calculation produced NT\$37,300,000 as depreciation and NT\$4,800,000 as interest from U.S. aid in FY 1959. Consequently, TTA revenue of NT\$37,600,000 was replaced by a deficit of NT\$4,500,000. The TTA had to add NT\$ 48,000,000 more to the fair return. For the sake of the balance, the TTA had to increase the rate level by 21%. This proposal was approved by Executive Yuan Council No. 662 (18 June 1959) with one condition: "contribution to government" should include income tax. The MSA ruled out this argument and forced the MOC

¹⁵The final formula of rate-making which TTA adopted was completely recommended by ICA:
Rate Base= Fixed Assets+Operating Capital+Unfinished project -Long term liabilities-Other liabilities-Depreciation.
Fair Return= Rate Base x 6% (Rate of Return, recommended by the World Bank)
Profit Contribution to Government= Rate Base x 6% (Fair Return) x 25% (changed to 18% later)
(If the Operating Income is lower than the fair return after income was subtracted by Operating Expense and Profit Contribution to Government, the rate level must be adjusted)
(Yearbook on Communications, 1950-60:735)

back to an increase of 28.59% of the rate level instead. The MOC worked out the coverage sheet of new rate-making as follows:

Increase

- A. An Increase of 50% of rate level was applied to long distance call but excluded the Greater Taipei Dial Service Network. Revenue was increased NT\$38,160,000.
- B. The monthly rental fee of city telephones increased 30% in Level I. From Level II to V, the rate increased 20-40%. Revenue was increased NT\$16,196,000.

Discount

- A. Telegrams rate level was reduced 17%.
- B. Telegraph rate level for press and radio station was reduced 50%.

Non-change

- A. Leased circuit of long distance calls for military.
- B. Overseas calls

This proposal was approved by the Study and Rectification Committee on Rates-Making of the Executive Yuan and MSA. The new rate level was put into operation in 1960 (Yearbook on Communications, 1950-60:733-4). This action contributed to trade transaction and military mobilization at the expense of residential subscribers (Yearbook on Communications, 1950-60:735).

William W. Lee, Chief of the Traffic and Commercial Dept. of TTA in 1960, participated in the Telephone Commercial Management and Engineering Program in the USA during 1954-55; he also strongly supported this revision.

The business residence classification recognizes differences in service requirements of business and residence customers and the greater value of business service. (Lee, 1960:54)

The principles of rate-making he referred to were learned from the U.S.:

the fundamental principles underlying rates for exchange telephone service which have been strictly observed by the rate engineers and experts of America's Bell Telephone System in making city telephone rates. (Lee, 1960:49)

Lee, a TTA business representative involved in negotiating the high installation charges policy in 1947 (DGT Monthly News, 27:5), was assigned by Fang as a rate-engineer (DGT, 1981:69). Consequently, Lee's perspective on rate-making followed the direction of the long-term plan set by Fang (see pp. 133).

After the rate-making was adjusted, the DGT kept 75% of the revenue as a fair return and distributed the remaining 25% as profit contribution to the government. Moreover, the annual fair return had to be maintained by more than 6% of the value of fixed assets. The value of fixed assets had to be reevaluated if inflation had been created by a fluctuant consumer price index. These conditions greatly contributed to every project after 1961 (i.e., the Third Four-Year Plan onwards) (Yearbook on Communications, 1950-60:744). A well-financed TTA policy enhanced telecommunications to cope with the demands of export economy. Again, this policy was partially strengthened by installation charges and Japanese factory loans (Yearbook on Communications, 1950-60:250). These two financial assistances were continued to disburse for TTA during the sixties.

The TC Program: the R&D Branch of the DGT

The fourth person was P.H. Kong, Director of the TTO

(1952), Chief of the Engineering Dept. of the DGT (1966), Director of the Telecommunications Laboratories (1969), and Secretary-General of Electronic Industry Research Center (1974). His contribution was very important to Taiwan telecommunications in its early days as well as to the long-term policy of electronics component production (Kong, 1988: 17-37).

Kong engaged with the TC program in the USA in FY 1953. His background was shaped in the missions for the U.S. Far East defense strategies. He was Chief Engineer of the Taipei North Sub-exchange project. With the status of Allies' technician, he went to Allied Headquarters in Tokyo to negotiate with Fujitsu Limited for procurement in April 1951. Most of the DGT engineering staff members were trained by this project (Kong, 1988:18).

Kong participated in a thirteen-month TC program, taking the courses from AT&T, GTE and ITT. As soon as the program was finished, Kong was asked to transfer the knowledge to the DGT. Before 1967, Kong mainly served the ROC/U.S. interests in the Far East. He was Secretary-General of the JTC from May 1955 to October 1963; Special Advisor of the Telecommunications and Electronics Research Group of MND (21 November 1958); the representative of the ROC in the World Administrative Radio Conference (WARC, from August to November 1959)¹⁶; Professor

¹⁶Actually, Kong represented the U.S. interests rather than those of the ROC at the conference. At the suggestion of the U.S. delegation, Kong made a 7-point proposal to counter the Soviet

of the Institute of Electronics, Chiao Tung University and assisted the U.N. Special Fund application (1960-1963); engaged in studying West Germany electronics technology under the auspices of the MND (from February to May 1961). Finally, his early mission ended in accepting a Professional Class 5 telecommunications expert position in South Korea from the U.N. Special Fund (the same source which funded the Hsinchu training and research centre) with CIECD permission in 1963. Many of his students joined the troops in the Vietnam War through their telecommunications professions (Kong, 1988:22-3).

Having served as Director of the Telecommunications Division of Communications Research Institute from 1954, Kong was assigned by Fang to establish the first R&D division of the DGT--the TL in 1968. Again, Fang had acquired this idea from Kajii--Electronics Communications Laboratories of the NTTPC. The TL proposed the strategy of the establishment of local semiconductor industry and the EIRC in the beginning of seventies.

Conclusively, four top management personnel established a base to launch the DGT to target new goals set by the CIECD and security regime as follows:

1. Reforming the DGT's financial base to strengthen the source of expenditure without U.S. aid;
2. Reinforcing the infrastructure to serve

Union bloc. Kong's points conflicted the ROC security regime's interests on the issues of amateur radio and HF band use (Kong, 1960:24-28).

export-oriented industrialization policy on assembling electronics components;

3. Reinventing the military strategy through advanced electronics knowledge.

The Contributions of the Retraining Programs

The DGT also realized the above three goals during the sixties by establishing the relationship between participants in retraining programs and top management personnel in the TC program.

1. The Retraining Program in the Institute of Electronics, National Chiao Tung University

This Institute was built for applying U.N. Special Fund to the establishment of a training and research centre for telecommunications and electronics, which is described under the application's heading "Nature of Project" as being set up

To attain the expansion and betterment of research laboratory equipment and telecommunication training facilities of the newly established Institute of Electronics. (DGT, Application 1959a:1)

The application also pointed out that the U.S. Far East interests could be realized through the previous experience in Taiwan:

There is a precedent that the Civil Aeronautics Administration... established a training centre... [where] approximately fifty ATC Controllers and Communicators of foreign nationalities (Korea, Viet-Nam and Thailand) were trained under the sponsorship and financial aid of the United States ICA. As the geographical position of Taiwan is advantageously located in the Far East, the possible establishment of a regional training centre of radio communications is also of telecommunications development could be carried out in a very active manner. (DGT, 1959a:11)

Under the control of the CIECD¹⁷, DGT Director Gisson Chien successfully established this research and training centre with a U.N. Special Fund of US\$296,100 along with previous Japan and U.S. aid (see Table 3.14.).

Table 3.14. The Establishment of the United Nations Training and Research Centre for Telecommunications and Electronics in the ROC, Unit= Thousand Dollars

Project: Training and Research Centre of T&E (1961)	Date of App- roval	Dur- ation in years	Assistance provided by S.F. (Special Fund)			Estimated Project Costs		
			Exp m/M	Fell	Equip	S.F	GCC	Total
	May 1960	3	7/84	--	US\$ 150	296.1	270	566.1
Project: Institute of Electronics (1958)	Date	Year	Assistance provided by U.S. & Japan			Estimated Project Costs		
			Exp	Fell	Equip	US Aid	GCC	Total
	May 1957	--	4	4	US\$30 (NTTPC) US\$46 NT\$500	US\$ 46 NT\$ 1800	US\$ 30 NT\$ 356	US\$ 76 NT\$ 2156

Exp= Expert, man/Month, Fell=fellowship, Equip=equipment
GCC= government counterpart contribution
(Source: ITU, 1965a:257; Yearbook on Communications, 1950-60:286-7.)

The Ministry of Education signed the contract with the Secretary of ITU, Mr.G.C. Gross, on 3 February 1961. The project was finished in July 1965. During this period, Gisson Chien underlined his perspective on the electronics industry through dedicating his article to celebrate the eight-third

¹⁷The MOC stipulated that every application for the U.N. Special Fund had to be reviewed by the CIECD before the project was delivered. (Communications Regulation Monthly, 4:11, pp 12)

Telecommunications Anniversary:

Political certainty, low-wage labour, plenty of resources all have contributed to the incentives of electronics industry investment.... It is very important to gain technology and experience of developed countries... any technical cooperation and joint venture will be welcomed... [Taiwan] took advantage of the low-wage labour, imported the component from overseas, assembled it to re-export... That is the major way of running transistor radio manufacturer... it is acceptable because the employment was created and foreign reserve was produced. However, advanced skill and production can always create a better opportunity for the ROC than ever. (1964:4)

Gisson designed this center as a prime mover for reinventing Taiwan electronics industry. Apart from on-the-job officers, many private industry owners participated in the short-duration training. This centre also advanced a joint R&D program among the Ministries of Education, Communications, Economic Affairs and National Defense. According to the final report (Chang, Chun-I, 1965:22-27), the joint R&D programs could be classified as follows:

a. several knowledge transfers:

"Logic Circuit Design", "Memory Circuit Design", "Microwave Electronics", and "Semiconductor Electronics" etc. These courses were first introduced to the Institute of Electronics....

Under the directorship of Dr. J.J.Chang...offering new courses of "Semiconductor Electronics", "Solid-State Physics", and "Transistor Electronics"....

b. industrial applications:

Since 1964, the Institute has been bending all its efforts toward the manufacture of high-frequency silicon transistors....

The Institute is adopting the latest manufacturing process which most well-known transistor companies are using....

One is the development of a 1-KW television transmitting equipment for the Ministry of Education....

c. new defensive strategy,

The Microwave and Modern Communication System classes have benefited the technical people from the Ministry of Communications and the Ministry of Defense.

In particular, the pilot project of transistor manufacturing directly strengthened the radio assembly industry as the origin of the semiconductor assembly industry. This project was intended to counterbalance the import dependency on Japanese components. This action was promoted by Gisson and the U.N. technical assistance program in Hsinchu area (Pan, Ben-heng, 1965:18).

2. The Program of Telecommunication Training Classes for Retired Servicemen

This program was another effort to terminate U.S. aid for Direct Force Support and restructure the government expenditure basis in order to generate more capital for economic development.

This training was in coordination with national defense policy. For releasing the surplus military staff members, the Vocational Assistance Commission for Retired Servicemen (VACRS) asked the DGT to recruit these senior staffs as new personnel during the Third Four-Year Plan. It was an action requested by the U.S. government to reduce the ROC government budget on military personnel expenditure (Wen, 1990:168-9) and, as Jacoby noted:

The Vocational Assistance Commission for Retired Servicemen project sought to attack the problem of absorption into the civilian life of large numbers of Mainlander veterans of the Chinese Armed Forces. (1966:171)

Finally, the DGT and VACRS worked out a four-term training project from 1961 to 1967 (see Table 3.15.). The enrolled military members ought to know electronics knowledge. The DGT accepted this program due to its lack of low-paid technical personnel (Kong, 1988:26; Schuh, 1964:4). As a result, this program supplied enough technicians to cope with the demands of economic development. For example, the telegraph/telex service training was started from the second term (1963). That training included 38 hours of teleprinter and 98 hours of typing practice. Finally, this course added 12 hours of telex service training and 96 hours of English teleprinter practice during the fourth term (Chen, Tu-chen, 1967:56-58).

In addition, recruited employees from military staffs would bring professionals to perform the war mobilization tasks and fill the shortage of personnel for the duration of TTA Telecommunication Detachment Training (DGT, 1962a:1; Timothy L. Wang et al., 1968:82). Military members were also much more loyal to Chiang's regime than anyone else was. This transition guaranteed that telecommunications could be further under the control of security forces¹⁸ during the period of a free market reform.

3. The Training Classes for War Time Telecommunication Detachment

War detachment training was a basic military

¹⁸ Of the total trainees, 57.75% (134) had army background, 12.5% (29) were sergeants, 15.08% (35) were graduates of Whampoa Military College. (Chen, Tu-chen, 1967:74)

telecommunications mobilization program. It was authorized by the Outline of Communications Mobilization Project (1952) and controlled by the Mobilization Working Meeting and the Mobilization Sub-committee (5 December 1962). The training included: (1) mobilization for the "return to mainland" war; (2) controlling the telecommunication facilities in the war zone; (3) mobilization for political warfare (Yearbook on Communications, 1950-60:271-2). This program started on 31 March 1958 (see Table 3.15.).

Table 3.15. The Numbers of Trainees of Telecommunication Detachments and Retire Servicemen, 1958-1966 (Yearbook on Communications, 1966:386)

Year	Training Program Number	Telecommunication Detachments	Telecommunications Vocational Assistance for Retired Servicemen
1958		126	-----
1962		-----	54
1963		-----	54
1964		98	-----
1965		-----	60
1966		-----	67
Total		224	235

In order to supply advanced equipment for this program, the government had spent foreign reserve for procurement--US\$ 47,000 in 1954, NT\$ 3,000,000 in 1955. Due to a shortage in the budget, DGT sought another NT\$ 18,968,000 for the latest need in 1962 (DGT, 1962a:1-3). Just before this occasion, the rate level was revised by ICA recommendation (1960). The DGT started the Collection of Provisional Special Defense

Assessments from 1 May 1962 to 30 June 1963 on the new fair return basis. Under MOC regulation, the DGT collected the revenue from subscribers who paid additional 30% fees on each overseas and domestic telephone calls and telegraph¹⁹. However, an exemption was issued to the U.S.Embassy, MAAG and their dependents, MSA/AID, U.N. agencies, CUSA, organizations who received CPT, diplomats with Identification Card, and military-coupon users (Yearbook on Communications, 1963:223-4). No sooner was the collection finished than the "Regulation of Communications Equipment for War Mobilization" (10 March 1965) was promulgated, and the collection was used to pay for the procurements for the Telecommunication Detachment by government regulation (Yearbook on Communications, 1971:165).

This collection equipped the detachment with the new VHF technology and teleprinter (see Chart 3.6.). These facilities connected with microwave, tropospheric scatter, and telex network by a military strategy and provided services for heavy business traffic on telephone, telegraph and telex through trainees' "wartime experience".

¹⁹ This collection caused the drop in the growth rate of civilian toll calls by 7.3% as follows:

Year	Number of Calls	Percentage of Annual Increase
1961	16,796,004	10.43
1962	17,610,745	4.80
1963	18,400,399	4.54
1964	22,191,679	20.60

as well as a drop in local telephone and domestic telegraph uses (Fang, 1967:27).

Chart 3.6. The Organization and Mission of Telecommunication Detachment (1961)

(Source: DGT, 1962a)

4. Provincial Taichung Senior Vocational Industrial School (TVIS)

The TVIS was a forerunner in serving the U.S. interests in telecommunication expansion. In 1953, a Joint Technical Training Program was established at TVIS to meet the needs of expansion. This project was assigned by the Ministry of Education under the recommendation of the MSA/FOA (Chu, 1964: 47)²⁰. The TVIS and TTA both agreed with section three of the MSA recommendation and final proposal. TVIS was also responsible for section two of MSA recommendation.

TTA planned this program by starting a three-year study in

²⁰TVIS received a grant of NT\$4,099,055.29 (US\$100,000) from the U.S. aid program during 1954-1960. (CUSA, 1961:335-6)

1953. The program included: (1) a line plant; (2) engineering of city telephone (automatic switchboard); (3) engineering of toll phone carrier system (microwave); (4) wireless engineering (HF, VHF, Microwave).

In 1958, another program was opened in the Practical Vocational Industrial Training Center of TVIS by the Dept. of Education of TPG. This centre trained the junior telephone technicians in practical skills and technique. Line-plant and engineering programs mainly provided the courses for assisting the U.S. aid project (Chu, 1964:48-50).

Two programs respectively contributed to the U.S. aid project in FY 1955: conversion of the Taichung manual switchboard into automatic; and DLF No.114 in 1960--the trans-island backbone microwave system. The conversion project was the "first invasion" of a U.S. switching system into the Japanese-based Taiwan telecommunications (CIECD, 1964b:27). Starting from J.G. White Engineering Corporation's proposal, the TTA agreed to accept an FOA grant of a 2,000-line automatic switchboard (US \$307,000). This project installation charge was US\$ 195,000. The FOA assigned Telecommunications Administration of USA Army Forces to design this project in coordination with Taiwan technicians. Major Maskell E. Brown was the designer and Mr. J.E. Gibson was supervisor. Three technicians of USA Army Forces, eight engineers of TTA and sixteen workers of TVIS Joint Technical Training Program (1953-4 Switching Engineering Program) participated in this

project. Moreover, Major Brown suggested that the MSA should request the TTA to add a 600-line switchboard onto the original proposal. The TTA soon agreed to purchase the additional Strowger typed equipment from Automatic Electric Company (owned by GTE). This project was finished on 31 May 1958 (information provided by DGT; TTA,1960:30-1). It served the U.S. troops in the CCK Air Force Base and the EPZ in Tantzú by a U.S. specification during the sixties.

The DLF No.114 project was assisted by the line-plant and wireless program in the Practical Vocational Industrial Training Center. The local trainees were directed by trainees from Collins Radio Corporation to establish that system (Chiang, 1960:18-19).

Finally, the total trainees in TVIS were 505 by 1964. They occupied 9.1% of TTA staffs and 31% of TTA technicians (42% of TTA switching engineers, 20% of line plant construction workers) (Chu,1964:48). The graduates of TVIS continuously served the expansions for the U.S. multinationals and military demands during the sixties.

Other U.S. Aid Programs

Four other U.S. aid programs also contributed to the technology transfers of management and manufacture: (1) business training program; (2) credits from Japan factories; (3) the AID #12 project; (4) the USAID-commissioned SRI report.

1. Business Training Program

The American style business training was introduced by the DGT through the assistance of the China Productivity and Trade Center created by the U.S. recommendation in 1955 for serving the purpose of "management practices and industrial productivity improvement" (Jacoby, 1966:64,100). This centre provided a seminar on management taught by the U.S. instructors. Until 1960, ninety-three DGT staff members participated in this program (Yearbook on Communications, 1950-60:308).

Under the directorship of Kong, the Telecommunication Division of Communications Research Institute also held a seminar on management and administration for junior staff members from 30 April 1956. The biggest "Circuit of Seminar" was held in Taichung on 10 December 1956. Sixty-four staff members from eighteen offices in Taichung participated in this program. They occupied 40.51% of total trainees from 34.62% of total offices in this program (Yearbook on Communications, 1950-60:270-1). Subsequently, adopting the example of Bell Telephone of USA, the Taichung Telecommunications Office opened a phone centre in November 1957 (TTA,1960:43).

2. Credits from Japan Factory

These credits created the joint ventures of switching system manufacture. These businesses were the basis for Sino-American cooperation for assembling switching systems in the seventies.

Beginning from a U.S.-established Counterpart Fund, stable finances channelled the Japanese supplies to the Taiwan telecommunications system:

Taipei Central Exchange is all Japanese and should be interchangeable with the new equipment. (ICA,1957:18)

The U.S. asked the TTA to use CPT by paying barter dollar to Japan instead of free US dollar (also see Cumings,1987:62):

Therefore TTA was advised to shift a portion of the loan amount required in the application into CPT fund by which to obtain the barter dollar foreign exchange. (Chiang, 1958b:24)

The TTA contracted out CPT projects to Japanese manufacturers through Dr. Kajii's introduction. The TTA also received the loans from Japanese factories to ease the disbursement burden. Conclusively, CPT stimulated Japanese economy in the first place. Taiwan obtained the benefits from factory loans. Japan earned the long-term interests from building its specification in the Taiwan telecommunications system.

The Japan factory loans were packaged in three U.S. aid projects: (1) Repair of 800 lines of Kaohsiung automatic city telephone (FY 1952); (2) An increase of 300 lines for Keelung city telephone (FY 1952); (3) An increase of 300 lines for Tainan city telephone (FY 1954) (Yearbook on Communications, 1950-60:752). The contractors were OKI, Fujitsu/Hitachi and NEC, respectively.

Packaged with these loans, a technical cooperation program also strengthened the Japanese supplies in the Taiwan market.

To support the engineering demands of U.S. aid projects, the TTA started the technical studies program in Japan after 1952 (Chen, Shu-jen, 1952:26). The DGT also signed a technical exchange program with the NTTPC and sent seventy-eight members to engineering and ten members to operation program by 1960, and more after that (see Table 3.3.) (Yearbook on Communications, 1950-60:717).

The most lucrative program was joint ventures of switchboard production to provide local sourcing. The DGT chose NEC and OKI as two partners with local manufacturers--Taiwan Telecommunication Industrial Company (financed by DLF) and Far Eastern Electric Industry Company (supported by U.S. aid of US\$ 57,154.40) in 1958²¹ (King, Y.H., 1974:22; Shen, 1963:18; CIECD, 1964a:148). Fifteen years later, Far Eastern Electric Industry Company was selected to be a partner with GTE to produce electronics switching systems in the seventies.

3. The AID #12 Project

The AID #12 project was promoted by the new U.S. aid policy after Japan became a competitor in the U.S. market in the late fifties. The AID and its predecessor, the DLF, both regulated that the contractors of projects should be American suppliers (Article 510, Mutual Security Act). It excluded Japan manufacturers from the list of procurement in U.S. aid projects after 1960 (Wen, 1990:207). Consequently, AID #12

²¹The production also included wireless communications-components and transistor production for military and police application. (Shen, 1959:41)

project continuously supplied the same type of switching system to Taiwan after the Taichung project was completed. It bridged the gap between the U.S. specification and Taiwanese Japan-made systems. Again, it paved the way for cooperation between GTE and Far Eastern Electric Industry Company in the seventies.

AID #12 project, named "Expansion of Telephone Facilities in Three Developing Areas" (Taipei, Taichung, and Kaohsiung) was set up to convert manual switchboards into dial operation. After the successful bid was awarded to Automatic Electric Company, General Telephone & Electronics (GTE) International, Inc., American Strowger's "step by step system" was completely hooked up with OKI, NEC, and Fujitsu/Hitachi supplies along the Taiwan's west coast (Telecommunications in Taiwan 1962-4).

The consulting for this project was provided by Page Communications Engineers, Inc. who were the previous advisor in the DLF microwave project. Under this consultancy, the TTA adopted the specification of the Rural Electrification Administration (REA)²² of USA. It was the first time that the TTA and local suppliers (who provided 63% of procurement) associated with the U.S. specification. The TTA started to use the U.S. specification as a paradigm for the expansion projects from the sixties onward (Fang, 1964:6-7).

²²REA requested borrowers to follow the principle as, "There is an understandable tendency for borrowers to want to do a good deal of construction with local labour and materials." (Renshaw, 1964:69)

4. The USAID-Commissioned SRI report (1961)

The SRI report was an original proposal for assembling radio components in Taiwan. The research grant was authorized by the Act of International Development (1961). The Act allowed AID to disburse a special U.S. aid fund for research on industrial development of aid-receiving countries for American investors' interests (CUSA, 1960:11; Wen, 1990:76). The Agency for International Development of USA commissioned Stanford Research Institute (SRI) in coordination with the Industrial Development and Investment Center of CUSA to study several Taiwan industrial products in 1961. One of them was the transistor radio (Lam, 1991:6).

The contact report of this project was critically assisted by an electrical engineer, David Y.D. King, Vice-Chief Engineer of TTA. King, a graduate of the University of Tokyo, participated in the installation of the North Taipei Sub-exchange under Kong's leadership (Kong, 1988:18). Under TTA assistantship, the SRI industrial economist and engineer easily studied the current data of the radio component assembly industry in Taiwan, particularly the joint ventures with Japanese partners such as Tong Chen Dong Electric Manufacturing Company (former partner with NEC), Taiwan Telecommunications, Far Eastern, and International Communication & Equipment Companies. (King, David Y.D., 1962:56-9).

The final report suggested that Taiwan to derive interests

from the previous U.S.-financed electronics assembly plants (Taiwan-Japan joint ventures) in the future as follows:

1. for assembling the semiconductor:

Once a successful transistor radio assembly plant is established, it would provide a suitable base for future expansion into the production of transistor radio parts and the development of a more sophisticated capability through training of personnel and the acquisition of additional equipment. (SRI, 1962:2)

2. for military application and export industry:

Development of this additional capability would permit participation in other [production]... such as the manufacture of TV sets, military electronics... (SRI, 1962:2)

3. for targeting the U.S. market by the export-oriented industrialization policy:

However, the United States has long been a market for Japanese production of electronic items... The success of any Taiwan effort to capture portions of the U.S. electronic market will largely depend upon the success of Taiwan's competition with Japan. (SRI, 1962:5)

This report proposed a profitable future for Taiwan industry by asking Taiwan to take advantage of the Japan-U.S. competition. This recommendation also influenced the minds of high ranking CIECD officials on the way to build their careers in establishing Taiwan semiconductor production from the sixties onward.

Summary

This early history of Taiwan telecommunications development greatly contributed to the U.S. semiconductor assembly plants in two ways: (1) Building the infrastructure for industrial districts, multinationals branch offices, and

their residential environments by spinning-off from the defense strategies (2) Providing the operating management and the know-how of electronics production to the DGT in order to support the operations of the U.S. assembly plants.

Two contributions were mainly generated from U.S. aid-- Defense Support and the Technical Cooperation Program. U.S. aid strongly equipped the TTA with the knowledge of expansion and the policy-making for serving trade activities.

With the supports from the previous CUSA members, TTA top management personnel directed the next decade of telecommunications/semiconductor industries development. However, owing to the U.S. aid policy serving the Cold War ideology, Taiwan telecommunications/semiconductor industries had been structured by the competition/alliance between the U.S. and Japan through their offers from the late fifties onwards.

Chapter Four

The Microwave Country¹: Facilitating Export Trade by the Military Origin and Extension

4.1. Introduction.

This chapter will mainly discuss the microwave communications in Taiwan before 1969. Microwave communication was the trunk line for carrying overseas as well as domestic toll circuits before the earth station (1969), submarine cable (1979), and co-axial underground cable (1980) served this island. This distinctive historical formation developed within the complex context of interests for serving both military application and multinationals' operation. These interests were overseen by the strategical planners who were involved in domestic politics and diplomatic relationships.

To explore those interests behind the expansion of international communications in Taiwan, this chapter will cover the technical policy issues and military communications strategies. Those issues are explored by an institutional analysis, the objects of which were the ROC government, the NTTPC, the U.S. federal government, multinational corporations, and the International Telecommunication Union (ITU).

In sum, the interactions among those interested groups generated an unexpected support for microwave technology on

¹This was a recommendation used by foreign telecommunication experts in a proposal for the Taiwan toll phone system (Wang, 1969:65).

Taiwan. Microwave was introduced by the TTA for its economical expenditure and the fulfilment of the U.S. and ROC military communications demands. Later, microwave turned out to be a critical choice for the DGT to upgrade its trans-island and overseas transmissions due to the decline of ROC legitimacy in the international society. Meanwhile, Chiang's regime kept tight control on security issues in exchange for export trade promotion. This jurisdictional division pushed ahead the microwave system development to enable it to carry the enormous traffic of incoming and outgoing messages involved in transacting export trade and military operations.

This chapter shows through the following historical processes how complex were those interests involved in microwave technology installation:

1. The precursory microwave technology had linked major HF transmitting and receiving stations with the DGT in Taiwan since 1953. This system represented the security function of microwave.

2. The advanced microwave technology was introduced by Dr. Kajii in 1957. The mission of Dr. Kajii served the military, technical and economic planning objectives.

3. On the basis of the VHF network along the east coast, the TTA gained the opportunity to cooperate with Kokusai Denshin Denwa Corporation for the "VHF Forward Scattering Propagation Test" in 1956. This project introduced the transhorizon scattering technology with Kajii's assistance.

4. The trans-island microwave proposal was generated by the Taiwan-Japan cooperation. The plan was encouraged by the ITU Plan Working Group for South Asia and the Far East and Asia Joint Plan Committee in Tokyo in May 1959. Finally, the project was financed by the DLF to realize the U.S. defense interests in the Far East.

5. Financed by the DGT's fair return, the CGRA installed the Taiwan-Hong Kong and Sino-Philippines Transhorizon Microwave Systems in 1967 and 1969, respectively. These projects completed the bi-(military/trade) triangle connection between Taiwan, the U.S. and her allies.

4.2. The Origin of Microwave Application

Microwave technology in Taiwan was first adopted by the CGRA for connecting its central offices with transmitting and receiving stations around the outskirts of Taipei in 1956. This design was mainly to prevent the capital's international communications from disconnection which under attack from Chinese Communists. This connection linked the Air-raid Shelter Station (on Tung Yuan St. in Taipei) with HF Transmitting (in Panchiao) and Receiving (in Taoyuan) Stations on 12 March 1956 through a Motorola-manufactured "Microwave Remote Control System"². The relay circuit to Taoyuan

²Microwave Remote Control System was installed for:

1. preventing telecommunications from the disconnection caused by typhoon;
2. anti-air raid defense. (Yearbook on Communications, 1950-60:782)

Receiving Station was carried by a repeater station in Sanhsia. This network was powered by the CGRA telephone terminals station on Tung Yuan Street and the central telegraph exchange in the International Telecommunication Center at Taipei North Gate (Communications Development Monthly, 16:12; TTA,1960:98; Telecommunications in Taiwan China, 1962:19). These facilities carried out the central control of overseas telephone and telegraph transmissions. The central office was next to the Taiwan Garrison Command. Later, the station on Tung Yuan Street integrated the CGRA central telegraph exchange into its system on 26 March 1961 (Communications Development Monthly, 11:12). In consequence, the microwave technology was primarily controlled by the military and security regimes (DGT,1962a:2). This "Microwave Remote Control System" was the original design of microwave technology in Taiwan and the base for further expansion.

The early progress of microwave technology was promoted by Chen Chin (Chief Engineer of the CGRA). He was the commander for the evacuation of CGRA China from Shanghai to Taipei during the Civil War. He upgraded his knowledge through the U.S. training program during the Sino-Japan War (DGT Monthly News, 26:8).

The TTA did not get involved in the microwave project until the assisted program of microwave technology was inaugurated by Fang Hien-chee and the Minister of Posts and Telecommunications of Japan in 1957. Based on practical

considerations, the TTA used microwave technology to overcome the island's geographical barriers to telecommunication connection, such as mountains, hills, typhoons, and earthquakes (Fang, 1960:87; Wang, 1969:65). However, for easing the application process, Fang did know how to favourably present a project by emphasizing its economical military application, even if its capacity were virtually incompatible with military demands³. Consequently, the first meeting concerning microwave technology development through Sino-Japan cooperation attracted a variety of interested groups. The meeting started with a formal visit of the President of the NTTPC, Dr. Kajii, to Taipei on 1 July, 1957.

4.3. Introducing Microwave Technology to A Tri-Party Interest: A Meeting of the ROC Government, the NTTPC and the Members of the U.S. Aid Agencies

Consistency

This meeting was a three-day conference in Taipei. Its significance was shown by the guest list of the "Welcome Ceremony" on the first night, 1 July 1957 at the Friends of China Club (TTA, 1957).

The list (selective) included representatives from:

Japanese suppliers:

Hitachi, Fujitsu Ltd, Sumitomo Cable,
and Furukawa Electronics Industry Co

The ROC government:

Yen Chia-kan, Governor of TPG

³Fang said in 1994 that co-axial cable and submarine cable are always better than wireless communications--microwave, satellite--in terms of stability and secrecy (also see DGT, 1974:7).

Martin Wong, Secretary of CUSA
 Members of the Industrial Development Commission--
 Li Kwoh-ting, Fei Walter H.
 Economic Stabilization Board
 Vice Minister, Ministry of Foreign Affairs (MFA)--
 Shen Chang-Huan
 Ministry of National Defense: Telecommunications and
 Electronics Bureau--Huang Chia-chen, Director-General,
 Tang Lien-chieh, Vice-Director (member of JTC); Army
 Telecommunications Administration, Air Force and Navy
 Communications Division
 Ministry of Communications--Yu Jun-sheng, Jorry T.K.
 Chu, Fei Li-chuan, Sha Yen-chang
 Sino-American Joint Commission on Rural Reconstruction
 Central Trust of China
 Telecommunications Bureau, National Police
 Administration
 Chang Hsiang-chuan, Speaker of Taipei City Hall and
 Chair of Taipei City Telephone Progressive Association
 Foreign Exchange and Trade Commission
 China Productivity and Trade Center
 Directorate General of Telecommunications
 Chinese Government Radio Administration--Chen Chin
 Radio Wave Research Laboratories
 Taiwan Telecommunication Administration--Fang Hien-chee
Taiwan Corporations:
 Tatung Corporation: Lin Ting-sheng, Chair
 Far Eastern Electric Industry Co
 Tong Chen Dong Electric Manufacturing Co
The Nationalist Party:
 Posts and Telecommunications Division
 The Broadcasting Corporation of China (BCC)
 Central News Agency--Tseng Hsu-Pai, Director
The U.S. Aid Agencies:
 American Embassy--Karl L. Rankin, Ambassador
 Military Assistant Advisory Group--Col. Stanwix-Hay,
 Cofs, C&E
 International Cooperation Administration, Mission to
 China
 J.G. White Engineering Corporation--Mr. V.S. de
 Beausset
 USIS

In sum, significantly, two Japanese suppliers--Sumitomo
 and Furukawa--were the shareholders of Ocean Cable Company
 (OCC) which had involved in the Transpacific Telephone Cable
 (TPTC) project through the Japan-U.S.-Britain cooperation
 (DGT, 1964:21). The participants from the ROC government

consisted i.e. an overwhelmingly powerful group of economic planners and military strategists in the late fifties. The U.S. aid agencies represented political rather than corporate interests. Further discussion of the conference will demonstrate the specific interests behind those participants.

The Significance of the Conference

There were three formal conferences in the next two days. The conference on the morning of 2 July, named by "A Discussion on Operating Policy of Telecommunications", was taken part in by economic planning members, such as K.T. Li, and rate-making engineers, such as Jorry T.K. Chu and William Lee along with many of their colleagues. To deliver the rate-revision in public, the DGT pointed out the predicament of low rate-making for the operation. With recommendations from Kajii and Mr. Yamashita (Deputy Chief of the Commercial Investigation Bureau of the NTTPC Corporation), the TTA gained the support to introduce a fair return policy. It was a triple cooperation--the ROC, Japan and the U.S.--which served the grouped interests. Those interests were created in the following ways:

1. Before the termination of aid, the U.S. paved a way for the DGT to survive on its revenue by a fair return, and introduced technology that the TTA could afford to maintain.

2. Japan wanted to take advantage of the Taiwan infrastructure to extend its connection to Southeast Asia. A

stable trans-island communication network in Taiwan was a start to realize this goal. As a result, Japan proposed to integrate the economical microwave application into its submarine cable plan.

3. The U.S. contributed to this Sino-Japan cooperation with overseas DLF financial support. This aid policy was consistent with the U.S. Far East policy to connect frontiers on the Western Pacific.

It was remarkable to see some of the comments presented by top DGT personnel at that conference:

It wouldn't have been possible for us to have attained these progresses without the necessary capital and foreign exchange through the U.S. Aid.... The problem we are confronting is therefore how to raise the necessary capital for the necessary expansion. Our controlled tariff is so low at present, that it is hardly enough to cover proper maintenance.... (Chen Shu-jen, Director of TTA)

It is a basic principle in the telephone industry that price for service must be consistent with the financial soundness of the industry and capability of rendering good services... I also want to thank Dr. Kajii... for telling us their experiences and giving us their advices. (Gisson Chien, Director of DGT) (TTA, 1957)

To introduce the microwave, three sub-topics would be discussed later in the afternoon of 2 July: (1) Exchange of Visitors; (2) Specifications of Telecommunication Equipment; (3) Microwave Equipment and Techniques. The conference was chaired by Fang with all core engineers of the DGT, such as Chen Chin, P.H. Kong, etc., taking part. These participants reached consensus for an exchange program. The program provided studies for Taiwan's senior staff and training for

junior staff. It was agreed that the specifications and standards of the NTTPC equipment were to be periodically distributed from Japan.

Finally, Leon Y. Chen formally presented the Taiwan trans-island microwave project in the presence of Dr. Kurokawa (Chief of Microwave Construction Bureau of NTTPC). There began the dialogue between Japanese and Taiwan technicians to overcome the difficulties of design and introduce ideas for microwave application.

The last meeting with Kajii was hosted by the MSA/ICA on 3 July. The proceedings of this conference provided no details. However, two arrangements partially explained the importance of that meeting. Before 3 July, Dr. Kajii had an exclusive meeting with Huang Chia-chen, Director-General of Telecommunications and Electronics Bureau of the MND. Kajii also accepted the commission from Col. Stanwix-Hay, Cofs, C&E of MAAG to design a military microwave system before his arrival in Taiwan. The commission was a clue which proved that the project was still required to provide military applications even though the economic development was overwhelmingly emphasized. Again, ICA, J.G. White Engineering Corporation, Chen, Fang, and Y.S. Hsu (Chief, Engineering Dept. of TTA) also attended this meeting. This indicated that aid projects for economic development usually served the military strategies at the same time. To realize how complex the interests were, it is useful to explore this historical

development by an institutional analysis.

4.4. The Analysis of Interests behind the Microwave Project The Process of Construction

The project, "Trans-island Backbone Microwave System", was financed by DLF (Development Loan Fund USA) with US\$ 2 million on 16 June 1960. TTA technicians designed this project from 1957 to September 1958. The TTA adopted 6,000 M.C. with a maximum capacity of 1,800 channels per circuit. The system contained 300 channels of toll telephone: 120 channels between Taipei and Taichung, 60 channels between Taipei and Tainan, 120 channels between Taipei and Kaohsiung. The network was connected by two terminal stations, two terminal-repeater stations, and four repeater stations (see Figure 4.1.).

The specifications of the network met the requirements of the CCIR (International Radio Consultative Committee, ITU). The optical line-of-sight test was performed by a 4,000 M.C. field intensity measurement in 1957. Under the contract conditions, the performance of the proposed route was calculated by the TD-2 and TH systems of Western Electric (AT&T), and the MM-600 system of RCA (Leon Y. Chen et al., 1960). The supplier was Collins Radio Company. The consultant was Page Communications, Inc.. The installation included MW-160D RF Heterodyne microwave, a multiplex carrier terminal, towers, antennas, power supply, air-conditioning, toll dial

Figure 4.1.

縱貫微波系統
THE TRANS-ISLAND BACKBONE MICROWAVE SYSTEM

Source: Telecommunications
in Taiwan, 1964:25.

exchange and manual toll boards, etc. All work was completed on 28 December 1963 and began operating on 1 July 1964 (Telecommunications in Taiwan, 1962-4; CIECD, 1964b:43).

A. The Origin of Economy in the "Trans-island Microwave Project"

The trans-island microwave project was addressed by the TTA in 1957. The switching of the responsibility for design from the CGRA engineers to TTA policy-makers was motivated by the U.S. aid agencies. The TTA, due to its exclusive jurisdiction over domestic communications via all short-haul and long distance circuits, was one of the most important channels for connecting foreign interests with the local economy. As a result, the U.S. inspired the TTA, the biggest beneficiary of U.S. technology installation or knowledge transfer, to address a proposal based on a progressive aid policy of the Agency for International Development (USAID) which concerned terminating the aid by finding an economical resource.

The proposal of the TTA reflected a concern about which way the communications technology should contribute to a less developed country's economy. The solution was directly addressed by USAID in the late fifties. To support the spirit of the "UN Decade of Development", USAID compiled the American points of view under the topic "The Application of Science and Technology for the Benefits of the Less Developed Areas" (USAID, 1963). This special volume on communications technology consisted of the major recommendations for wireless

communications. In the sections on microwave radio, the AT&T expert H.E. Weppler recommended:

It was in this field that the economics of microwave were most attractive at the outset. (Weppler, 1963:96)

For the purposes of this paper, it will be convenient to think of systems with these capabilities as "heavy-route" system... Most heavy-route systems are designed to carry not only message circuits but also television signals and broadband data signals. (ibid, pp 100)

Weppler also admitted the limits of technology (which was clearly understood in Fang's mind):

It should be borne in mind that microwave radio has not supplanted cable and other types of transmission facilities, it has merely provided another tool for the engineer to use in the proper places (ibid, pp 104.)

Finally, Weppler provided an evaluation for this technology,

What all of this adds up to is that microwave radio is today a versatile telecommunication tool capable of economically meeting almost any communication need under a variety of conditions. (ibid, pp 107)

According to the TTA's report, adopting microwave technology for toll circuits was recommended by J.G. White Engineering Corporation and the FCC for its economical maintenance (Chiang, 1960:18; Chen Shu-jen, 1963:80). To cope with the impending growth of business communications using toll circuits (see Figure 4.2.), a stable carrier was urgently needed. However, the TTA had to consider that the maintenance would have to be supported by the fluctuant source of funds after U.S. aid was terminated. From 1951 to 1963, the TTA averagely received US\$ 1 million per annum for expansion (CIECD, 1964b:6). Yet without those supports, the financial sheet of the TTA was close to balancing out in each year

following 1961 (see Table 4.1.).

**Figure 4.2. The Growth of Toll Circuits
Taiwan (1957-1962)**

(Source: Chen, Shu-jen, 1963:77)

**Table 4.1. The Balance of Expenditure and Source,
DGT 1961-67, Unit= million NT\$**

Finance Item Year	Capital Expenditure (Non-Aid Project)	Source of Fund (Without U.S. Aid)	Balance (Source-Expenditure)
1961	132.87	138.94	6.07
1962	144.62	144.79	0.17
1963	158.62	149.78	-8.84*
1964	146.26	155.14	8.88
1965	285.03	285.05	0.02
1966	299.90	299.87	-0.03
1967	460.99	460.97	0.02

(Source: Statistical Abstract of Transportation and Communications, 1967:174-5)

* This huge deficit was caused by the disbursement of U.S. aid for AID #12 project.

Judging by the list of DGT-financed projects, the biggest area for expansion was local telephone installation. The second largest block of spending was for the installations of wireless communications for international service, such as the Sino-Japan VHF Scattering Propagation System (NT\$ 4,195,867.17 in 1963, 10,961,622 in 1964), expansion of VHF circuits in

Ilan (NT\$ 12,480,792 in 1966), Taiwan-Hong Kong Transhorizon Microwave System (NT\$ 7,470,325 in 1966), and the expansions of CGRA equipment (NT\$ 3,154,638.74 in 1962, 606,000 in 1963, 9,624,239 in 1964, 8,295,079 in 1965). Moreover, the TTA was able to pay for the annual expenses of the trans-island microwave project with NT\$ 7.85, 19.06, 113.78, 5.98 million each year (Yearbook on Communications, 1961-66). The result proved that wireless communications was the technology which the DGT could afford if it produced a fair return.

The TTA used this feasible decision to set up a new Sino-American cooperation, which resulted in proposing a microwave system as a local strategy to cope with the following demands:

1. Fulfilling the demands for the following services:
 - a. Toll circuits increased two and a half times those of 1950; the messages of toll phones increased four and a half times;
 - b. Increasing demands for Combined Line and Recording (CLR);
 - c. The Automatization of telephone network (DDD) will be fully put into operation after the first establishment in Tienmu was successful;
 - d. The demands from military, police, government, business and industry for leased circuits;
 - e. Television program transmission.
2. Stability and Security:

Preventing the disconnection caused by typhoon.
(Chiang, 1960:17-8)

B. Concentrating the Resources for Development in the Hands of the Central Government in Taipei.

The microwave system was designed by the TTA to satisfy all local demands on the list above. First, microwave served as the toll connections for industrial development in Taiwan.

Toll circuits, DDD and CLR accelerated the extension and speed of business communications along the west coast. Microwave was a heavy carrier system able to load these transmissions during the next ten-year period (1960-1970). The 6,000 M.C. system could carry 1,860 voice circuits over a single radio channel (Weppeler, 1963:100). For economic development, this capacity was praised by the World Bank in the mid-sixties:

...installed on the existing trans-island backbone microwave system under this project will play a very important role in the materialization of the STD [Subscriber Toll Dialling] service to be introduced under this project.

The demand for domestic long distance telephone service has been growing at even faster tempo than that for local telephone in consequence of the accelerated economic development here in this island....

Communications between the industrial firms and factories which scatter almost over all locations on this island, and the cities along the main route of TTA's toll telephone network have become more demanding than before. (DGT, 1966:37-8,48)

It is also significant that every route of the DLF project started from the terminal station in Taipei. There were no connections between Taichung, Tainan and Kaohsiung (Leon Y. Chen and Wang, 1961:17). This microwave connection was tightly controlled by political and economic planners in the Central Government. This installation implicated a controlled function of telecommunications under the authoritative regime (Mulgan, 1991:1-2). This was important for the many of economic planners and agencies attending the first meeting with the President of NTTPC in 1957, such as Yen Chia-kan (Governor of TPG), K.T. Li (Secretary-General of CUSA), IDC, ESB, JCRR,

Central Trust of China⁴, Foreign Exchange and Trade Commission⁵, and China Productivity and Trade Center.

C. Expanding the Interests of the Television (TV) Industry

Being capable of carrying television signals, microwave was treated as a precious resource by policy makers (Weppler, 1963:100; Timothy L. Wang, 1959:12; Chiang, 1960:18). The purpose to introduce television was put forward by two pioneers after their U.S. trips: Mr. Yu, Vice-chair of CUSA and Tseng Hsu-Pai, Director of the Central News Agency⁶. The proposal was studied by the Posts and Telecommunications Dept. of MOC and CCC in 1953 (Communications Gazette, 3:7, pp 38; China Telecommunications Almanac 1881-1971, pp 286). The above promoters were consistently involved in microwave conference in 1957.

The TV industry interests early fell into the hands of the participants in the microwave meeting of 1957. Taiwan Television Enterprise (TTV) was first established in 1962 by shareholders from Japan and Taiwan. Two Japanese shareholders were Fujitsu and Hitachi. The biggest holder was TPG. The second station, China Television Company, operated in 1969 as

⁴The overseas procurement of the DLF project was assigned to Central Trust of China by a portion of local expenditure (Chiang, 1960:18).

⁵The Foreign Exchange and Trade Commission participated in the Overseas Chinese and Foreign Investment Review Commission with MOC, MFA, and TPG since 1963. (Communications Regulation Monthly, 12:10, pp 13)

⁶The Central News Agency received U.S. Aid US\$17,438.56 in the same year. (CIECD, 1964a:58)

one of the enterprises of the Nationalist Party. The largest share of this station was held by BCC.

During the primary period, the Government rejected the civilian application to establish one local station in Taichung--a rejection which even violated its own regulations. Instead, TTV installed relay stations in central and south Taiwan in July 1964 by the approval of the legislative Yuan (Ding, 1964:14). This privilege couldn't be maintained if there were no centralized relay channels--no trans-island microwave system.

Long before microwave channelled the television signals in 1962, the MOC had already promulgated the "Standard Specification of Black and White TV" in March 1959 (MOC, 1960:76). To assure the availability of equipment, the MOC adopted the NTSC system which was compatible with the U.S. and Japanese TV systems (Timothy L. Wang, 1959:11). Again, after the DLF project was finished, microwave and television technologies were consecutively advanced by the program of the U.N. Training and Research Centre of Telecommunications and Electronics in Hsinchu (see Chapter 3.6.) which was the breeding ground of U.S. technological ascendancy.

Through the connections noted above, the microwave project did channel the TV industry for Taiwan, Japan and the U.S. interests. Moreover, the Central Government also promulgated the "Mobilization Rules of Radio and TV Receivers" (27 Dec. 1963). This stipulated that frequency of a TV receiver had to

be contained between 174 Gc and 210 Gc (NTSC system), otherwise all components would be disassembled and confiscated (Yearbook on Communications, 1963:104-107).

This institutional backing served the operation of TV component assembly plants, such as RCA, Motorola, Philco, and Ampex from the late sixties. It also grounded the joint venture between RCA, Tatung Corporation and the Nationalist Party under the name of Chung-hwa Electronics Development Corporation. (detail in Chapter Six).

D. Serving the Military Application

Microwave had already worked for military application in radar communications since the Second World War (MSN, 1978: 35). The contractors of the DLF No.114 project were also heavily involved in military electronics production. Collins Radio and Page Communications were bought out by the big companies of the aviation industry (also see Chart 4.1.):

The airframe colossus had been involved in defence electronics... aircraft companies began snapping up smaller electronics enterprises in earnest during the 1950s... Northrop took over Page Communications while... RI, for example, bought Allen-Bradley to complement its existing Collins electronics interests.... (Todd, 1988: 260)

As a result, it is reasonable to find that the visit of Dr. Kajii for carrying out the military mission. After the meeting of Huang Chia-chen (Director-General of Telecommunications and Electronics Bureau of MND), Col. Stanwix-Hay (Cofs/C&E of the MAAG) and Kajii, the route selection plan for microwave was rewritten. According to Leon Y. Chen's

Chart 4.1. The Incorporation of Page Communications and Collins Radio into Military Electronics Giants

Source: Todd, 1988: 262.

report, the alternative route plan for microwave was withdrawn due to the priority of another military microwave system (Leon Y. Chen et al., 1960:37-38).

To overcome the long-time fading of signals between Tainan and Kaohsiung, the TTA tried to establish some repeater stations. The sites, chosen by the TTA, were already occupied by unknown (military) microwave terminals. Due to the high expenditure for another alternative route, TTA withdrew the design and installed the high towers in the two cities instead of at the alternative locations (Leon Y. Chen and Wang, 1961: 17).

Moreover, the project advisor was Page Communications, Inc., which was, concurrently, the maintenance contractor of the AFNT assigned by the DoD. Through Page's participation, the project could serve, or at least, do no harm to the AFNT's interest.

Microwave also critically contributed to the new demands for the ROC's central mobilization. The ROC realized that the termination of U.S. aid would induce an uncertainty in the economy. Therefore, the MOC announced a priority policy sheet for the first five years of the sixties. The MOC emphasized three priorities: (1) coordinating economic development with military mobilization; (2) establishing a trans-island microwave to cope with the increasing traffic; (3) revising the MOC annual plan, training the detachment, and recruiting supplies in order to prepare for mobilization. Based on these three priorities, a Telecommunications Division of the Mobilization Working Meeting and Mobilization Sub-committee were created by the MOC on 5 December 1962 (Yearbook on Communications, 1961:6-7; 1962:101).

These three priorities were packaged with new regulations: (1) "The Enforcement of the Protection Act of Communications Equipment during Wartime" (14 March 1961); (2) "Mobilization Rules of Electronics Communications" (5 October 1963); (3) "The Emergency Act of the Coordination between Military and Civilian Communications" (14 May 1964).

The "Enforcement of the Protection Act" listed microwave terminals as one of the protected objects. The "Mobilization Rules" stipulated that illegal wireless communications and radio stations should be punished by the Taiwan Garrison General Headquarter. The "Emergency Act" stipulated that the TTA should support the Communications Administration of the

3

PM-1 3½"x4" PHOTOGRAPHIC MICROCOPY TARGET
NBS 1010a ANSI/ISO #2 EQUIVALENT

PRECISIONSM RESOLUTION TARGETS

Army Supply Command by three underground cables, six microwave circuits, and two VHF circuits which encircled the country during wartime; the Army Supply Command should support two VHF circuits for the TTA and coordinate with the Police Department of the TPG⁷ (Yearbook on Communications, 1961:25-29; 1963:104; 1964:76). Microwave was militarized by these regulations.

Finally, the MOC used microwave to release the military from the shortage of leased circuits by promulgating "The Rules of Military Use and the Payment for Telecommunications (17 Nov. 1964). MOC issued a discount of rental fees for military toll circuits (Yearbook on Communications, 1964:77).

However, these regulations simply defined the military function and the potential military application of microwave. The real application of the trans-island microwave system was indicated by a government report. According to The Proposal of Telecommunication Projects in Coordination with Military Mobilization (DGT, 1962a), two telecommunications mobilization projects were withdrawn: (1) supplementary circuits crossing major bridges along the west coast; (2) submarine cable between Taiwan and Pescadores Island; and one project was installed: the microwave network-served the evacuation plan of

⁷The telecommunication system of the Police Dept. of TPG was financed by NT\$ 3,381 of U.S. Aid in FY 1952. (CUSA, 1957:34)

the Central Government⁸, when the trans-island microwave system was close to completion.

The communications between major bridges, Taiwan and Pescadores Island were never suspended but microwave was substituted for cable. First, because of the damage to the trunk-line caused by the flood on 7 August 1959, the TTA and the Central Government realized that it was urgent to install a two-track trans-river connection along the west coast for the military (Fang, 1959:10). In the aftermath, the military regime decided to adopt microwave as the second track of trans-river communication.

Secondly, according to Telecommunication in Taiwan (1965:11), Taiwan-Pescadores was connected by a microwave circuit switched from parts of the backbone system:

...the Tainan-Penghu microwave system... was relocated from the 24-channel short-haul microwave system originally installed between Taichung, Taping and Tainan.

Thirdly, the microwave-equipped evacuation plan illustrated the superiority of microwave in the minds of military mobilization planners in the ROC Central Government.

Finally, since 20 May 1953, the full operation of psychological warfare for Mainland China had been conducted by the BCC microwave relay station between Taipei and Minhsiung.

⁸Those sites where the government planned to move to restore its functions after evacuation were also established by previous aid projects, including, Sanchung, Chungho (FY 1960), Panchiao (FY 1959), Peitou, Yangmingshan (FY 1956), Ta-An Workshop (FY 1959), Southern Taipei (FY 1958), and microwave circuits between Taichung and Chungshin Village (FY 1957) (CIECD, 1964b).

This experience pushed the BCC⁹ to attend the first meeting in 1957 to seek the advantage of microwave system for its existing system (China Telecommunications Almanac 1881-1971:271).

E. Combining the Spur of the Military Wireless Network--VHF and Its Spin-off: VHF Scattering Technology

The application of very high frequency (VHF) in Taiwan mainly served the military by its frequency modulation (Chen, Shu-jen, 1952:22). According to the DGT Report (1962a) and the "Emergency Act", the trunk line of the Taiwan Military Communications and Administration Network was equipped with a circular VHF network, especially on the Taiwan east coast.

The VHF trunk line along the east coast was established with supplies from the U.S. Armed Forces and U.S. aid (TTA, 1960:58-59). The VHF Forward Scattering Propagation Test was started in northeast Taiwan in 1956 by Japan and Taiwan in cooperation. This project transferred a tropo-spheric scatter techniques on the ionosphere to the DGT. Again, the technique was recommended by USAID to less developing countries (Radford and Rogers, 1963). Through this transfer, the CGRA gained the knowledge to connect the transhorizon microwave system with the existing West Coast Backbone Microwave System. The two systems were hooked up together in the mid-sixties as the international communications gateway to serve trade and

⁹The BCC received U.S. Aid US\$ 48,999.26 and 48,760.26 in 1959 and 1960, respectively, and proposed its short-wave application to the USAID in 1961. (CUSA, 1961:68)

economic development by the DGT (Fang, interview on 7 January 1994).

The Japanese partner in the project was Kokusai Denshin Denwa Corporation (KDD) which was divided from the NTTPC by the new Telecommunications Ministry in 1953. All international telecommunications operations were transferred to KDD (Takano, 1992:3). Apparently, this project could not start on 20 August 1956 without assistance of Dr. Kajii (DGT Monthly News, 26:10). The CGRA installed a station in Ilan to receive signals from Osaka from July 1957. The CGRA forecast that the congestion of the HF band would be too difficult to solve in the near future and sought a solution for the overloaded of overseas messages (Telecommunications in Taiwan 1958).

After the scattering test was finished on 31 December 1958, both sides suggested a business application should be installed (Cheng, Sz-chun, 1960:32; Chen, Chin, 1961:23). The DGT issued the procurement in 1961. The manufacturing was contracted out to NEC. The total cost was NT\$ 4,195,867.17 (Yearbook on Communications, 1962:3-4; 1963:220). After the system was finished on 15 August 1963, the telex circuits between Taiwan and Japan were switched from HF band to VHF propagation ("having an ultimate capacity of 8 teleprinter channels") on 20 January 1964. The destination of outgoing telegraph was switched from Tokyo to Osaka on 13 September.¹⁰

¹⁰The leased circuits to Osaka increased from 1 to 8 during 1964-1966 compared to others circuits linked to Tokyo by 1; to Hong Kong by 3; to New York by 1; and to Manila by 1. (YBCs, 1964-66)

(Communications Development Monthly, 12-3:12; Telecommunications in Taiwan China, 1962). This facility efficiently served the intensive trade and transaction between Japan and Taiwan at that time (see Table 4.2. & 4.3.).

Table 4.2. The Messages of International Telex and Telegraph in the Taiwan Area (1964-1971)

Year	Number of Calls							
	U.S.A.		Japan		Philippines		Hong Kong	
	Out	In	Out	In	Out	In	Out	In
	Telex							
1964	7,287	4,895	10,223	14,996	451	373	1,215	1,241
1965	11,675	8,146	12,608	18,586	502	258	2,437	2,198
1966	12,575	10,288	14,567	18,853	529	311	2,829	3,104
1967	16,046	9,687	19,211	22,792	298	212	4,933	7,214
1968	20,849	8,425	26,334	30,579	430	210	6,045	10,238
1969	25,191	14,791	30,383	36,254	516	489	9,311	14,535
1970	39,125	37,497	46,964	58,058	470	912	12,528	15,985
1971	85,350	71,265	63,996	81,344	430	904	23,147	33,772
	Telegraph							
1964	58,754	75,314	60,603	86,152	22,263	23,271	57,967	57,186
1965	60,187	81,824	69,968	102,063	23,838	24,158	60,548	59,941
1966	72,255	98,216	82,131	120,473	24,913	21,862	68,145	68,797

(Source: Statistical Abstract of Transportation and Communications, 1981:162-3; Yearbook on Communications, 1964-66.)

However, according to the DGT's proposal (1962a), this system was also required to function as a "Wartime Supplementary Chinese Government Radio Administration" by its original design.

Again, it is not surprising to find out that the maintenance staffs of microwave and VHF were supervised by internal security officers. According to Yearbook on Communications 1964 (pp 73-5), two regulations--"Rules of VHF Maintenance Division and Microwave Maintenance Division of TTA" (8 April 1964)--were promulgated to maintain microwave

Table 4.3. The Export (Destination) / Import (Source) of Transistors in Taiwan, 1964-1971.

Transistor, Photo Tubes and Thermionic Tubes or Cold Cathode Tubes.	Export		Ordinary Import		U.S. A.I.D. Import	
	Quantity	Value	Quantity	Value	Q	V
Country of Destination/ Origin						
1964 Japan	1	1.4	3,645,455	43,686	100	0.7
U.S.A.	---	---	63,866	8,778	1,102	801
1965 Japan	---	---	4,061,572	76,860	---	---
U.S.A.	72	3.3	1,051,704	21,925	116	34
1966 Japan	---	---	5,155,951	66,948		
U.S.A.	377,060	1,028	4,744,324	40,935		
1967 Japan	15,251	69,796	12,193,388	155,242		
U.S.A.	4,450,498	20,418	35,092,273	47,648		
1968 Japan	718,380	1,848	13,118,082	213,372		
U.S.A.	16,692,622	51,969	9,165,863	60,294		
1969 Japan	3,697,396	14,015	33,277,251	399,250		
U.S.A.	42,749,012	125,391	12,154,912	87,873		
1970 Japan	25,053,412	153,026	34,101,457	620,063		
U.S.A.	97,789,016	291,375	11,337,274	89,297		
1971 Japan	9,984,805	98,301	43,633,761	802,670		
U.S.A.	105,094,496	332,098	11,863,899	81,172		

Quantity= Kilogrs. Value=N.T.\$ Thousand

(Source: Statistical Series. No.1. The Trade of China, Taiwan District 1964-71.)

Chart 4.2. The Organization of VHF and Microwave Maintenance Divisions, TTA/DGT/MOC.

(Source: Yearbook on Communications, 1964:73-75)

and VHF systems. One staff member who fulfilled the functions of both Personnel Manager and "Security Officer" was assigned to regulate the following issues (also see Chart 4.2.):

1. Enforcing security and investigating leakage;
2. Promoting anti-communist movement;
3. Submitting the reports of security violation;
4. Supervising the anti-espionage activity.

This assignment indicated that the regular operation of VHF and microwave had to be supervised by security forces in order to protect the workforce from the infiltration of Communist sympathizers.

However, the staff only served the trading activities without getting involved in any real military mobilization (or if so, just in a manoeuvre) during the sixties. That was the early nature of Taiwan telecommunications. The installation of telecommunications for serving national economic development was started in regard to political permission rather than pure technical feasibility.

F. Realizing the Interests of the U.S. Containment Policy

According to TTA top management personnel reports (Chiang, 1960:18; Fang, 1960:87), keeping down the costs of the South Asia and the Far East Submarine Cable (SAFE) project was always too important to be neglected. In sum, using the trans-island microwave system to replace the submarine cable in part of Taiwan could save US\$ 4 million on construction. It was the critical reason for the U.S. and Japan to become

actively involved in this microwave project through financial and technical supports.F.1. The International Context of the Microwave Project

The project of the submarine coaxial cable telephone network was controlled by the ITU after the telecommunications network plan extended from Europe to the Mediterranean in 1951. Moreover, several issues, such as the congestion of the HF band, demand for semi-automatic telephone exchange, and telex transmission, forced the ITU to consider an alternative route for international communications (Liang,1962:2; ITU, 1965b:226).

Those demands forced the ITU to combine the International Telephone Consultative Committee (CCIF) with International Telephone Consultative Committee (CCIT) to form a new committee: the International Telegraph and Telephone Consultative Committee (CCITT) in 1957. CCITT, together with CCIR, formed three Joint Plan Committees for three different regions. One of them was the Asia Joint Plan Committee (Coddington and Rutkowski,1982:37,109).

Meanwhile, one of the U.N. agencies--the Economic Commission for Asia and the Far East (ECAFE) was also interested in planning the Asian telecommunication system. ECAFE cooperated with the ITU after the ITU 11th Administrative Council in 1956. These two institutions placed overwhelming influence on the TTA to adopt microwave-linked submarine cable as the major gateway for Taiwan's

international communications (see Table 4.4.)¹¹. The geographical distinctiveness of Taiwan was emphasized due to the search for an intersection for two separate submarine cables crossing Pacific Ocean: (1) the Transpacific Telephone Cable (TPTC), promoted by the U.S. and Japan cooperatively--AT&T and KDD--crossed the Central Pacific by connecting with Hawaii Cable I-II (HC); (2) the Commonwealth Pacific Cable (COMPAC), built by Cable and Wireless Corporation, planned to extend farther west through the South East Asia Cable (SEACOM). Finally, Japan proposed to build the South Asia and the Far East Cable (SAFE) to link SEACOM with TPTC in Taiwan (Liang, 1962:1) (see Figure 4.3.). The backbone microwave system linked two submarine cables through two ends of the Taiwan west coast (i.e., Taipei and Kaohsiung) instead of running another submarine cable under the Taiwan Strait. As a result, the importance of trans-island microwave was continually emphasized and was seen as an excellent design for the submarine cable project (DGT, 1959b: Annex 6; DGT, 1962b:8; 1964:9-10.). The value of this contribution was confirmed by the ITU Plan Working Group for South Asia and the Far East at the Tokyo meeting in 1959. This confirmation formally started the cooperation between Taiwan, the U.S. and Japan for developing the submarine cable plan.

¹¹Source: Chen, Chin, 1961; Coddington, Jr. & Rutkowski, 1982; Communications Regulation Monthly, 5:6; Fang & Chang, 1959; Pai, K.V., 1965; The Reports of ITU Plan Working Group for South Asia and the Far East, DGT 1959b; DGT, 1962b, 1964; TCC ECAFE, DGT 1969b; Yearbook on Communications 1962-1969.

**Table 4.4. The Processes of ITU Meetings for the
SAFE Project, Microwave and Satellite Proposals**

ITU Meetings	Decisions	Actions to Taiwan
<p><u>1. ITU 7th Administrative Council 1952;</u></p> <p><u>2. ITU 9th Administrative Council 1954;</u></p> <p><u>3. ITU 11th Administrative Council 1956;</u></p> <p><u>4. Joint Plan Committees, CCITT Rome April 1958;</u></p> <p><u>5. ITU 13th Administrative Council 1958;</u></p> <p><u>*6. World Administrative Telegraph and Telephone Conference, CCITT in Sept. 1958;</u></p> <p><u>7. CCIR 9th Plenary Assembly in Los Angeles 1959;</u></p> <p><u>*8. Working Party of Telecommunication Experts of TCC ECAFE, 4-11 May; ITU Plan Working Group for South Asia and the Far East, CCITT in Tokyo 11-15 May 1959;</u></p> <p><u>9. Joint Plan Committee, Asia Plan, CCITT in New Delhi in Nov. 1960;</u></p>	<p><u>247: planned to cover Southeast Asia by CCIR, CCIF and CCIT from 1952 to 1956.</u></p> <p><u>292: CCIF chaired the Joint Plan Committees</u></p> <p><u>345: cooperated with ECAFE in planning issues.</u></p> <p><u>Expanded its jurisdiction to the Far East region.</u></p> <p><u>383: approved network expansion project.</u></p> <p><u>Decided to assign Japanese experts opened two meetings of working group in Tokyo, May 1959.</u></p> <p><u>Defined the values of microwave and guidance for tropospheric scatter system.</u></p> <p><u>"Microwave radio-relay and tropospheric scatter system that were of interest in connection with the main arteries of communication in the South Asia and the Far East region."</u></p> <p><u>TPTC met SEACOM in Taiwan and linked Japan with Hong Kong & Manila.</u></p>	<p><u>11th ECAFE decided to plan telecomm. project (1955).</u></p> <p><u>12th ECAFE decided to extend jurisdiction to telecommunications</u></p> <p><u>7th ITC decided to run an expert meeting in Tokyo (1958).</u></p> <p><u>After decision was made, Taiwan was invited.</u></p> <p><u>Taiwan received this direction from Tokyo meetings.</u></p> <p><u>Taiwan decided to replace HF band with submarine cable. Backbone microwave turned Taiwan to be a hub of SAFE cable.</u></p> <p><u>DLF disbursed NT\$ 7,856,209.81 for backbone microwave</u></p>

ECAFE=Economic Commission for Asia and the Far East.

ITC=Inland Transport Committee, ECAFE.

TCC=Transport and Communications Committee, ECAFE.

* Major meeting

<p><u>10. CCIR Geneva Meeting 1961;</u></p> <p><u>11. Secretary-General of ITU recommended on 1 April 1961;</u></p> <p><u>*12. International Meeting on Submarine Cable Plan for South Asia and the Far East in Tokyo, 24-28 April 1962;</u></p> <p><u>*13. Joint Plan Committees, CCITT in Rome, 1963;</u></p> <p><u>*14. 2nd Session International Meeting on Submarine Cable Plan for South Asia and the Far East in Tokyo, 23-25 March 1964;</u></p> <p><u>*15. Second Working Party of Telecommunication Experts of TCC, ECAFE in Tokyo, July 1964;</u></p> <p><u>16. Joint Plan Committees for Asian and Oceania, CCITT, 1966;</u></p> <p><u>17. Southeast Asia Network Committee in Tokyo 1967;</u></p> <p><u>18. 1st Session of Sub-Committee, 17th TCC ECAFE, 1969;</u></p>	<p><u>Released 4-27.5 M.C. band from congestion by microwave and VHF.</u></p> <p><u>Opened the "Microwave and Outdoors Technology Seminar" Tokyo, 30 Oct.-11 Nov.</u></p> <p><u>Recommended microwave or out of sight and tropospheric scattering microwave to connect coast to coast.</u></p> <p><u>Designed automatic switching network for submarine cable.</u></p> <p><u>Guam-Philippines cable would finish in 1964; the significance of SAFE cable would be decreased.</u></p> <p><u>U.S. addressed satellite interacting plan.</u></p> <p><u>Emphasized regional network development;</u></p> <p><u>K.V. Pai recommended to link Philippines with Taiwan by microwave scatter.</u></p> <p><u>Proposed the International Switching Centre for satellite.</u></p> <p><u>Established trans-horizon microwave between Okinawa and Taiwan.</u></p> <p><u>The wide band domestic network and regional networks between the countries of a compact region were importantly considered.</u></p>	<p><u>Taiwan connected Taipei with Osaka by VHF Scattering System.</u></p> <p><u>Leon Y. Chen was the delegation.</u></p> <p><u>DLF disbursed NT\$ 26,915,468.82 for backbone microwave</u></p> <p><u>DGT proposed tropo scattering route (1963).</u></p> <p><u>DGT proposed to hook up Manila with regional submarine cable instead of SAFE cable plan.</u></p> <p><u>DGT signed up for INTELSAT in 1965.</u></p> <p><u>CGRA proposed the Taiwan-Hong Kong microwave scatter route (1965).</u></p> <p><u>DGT proposed atuo-switching centre plan in 1967.</u></p> <p><u>President of Legislative Yuan ROC persuaded Japan to accept the deal.</u></p> <p><u>Philippines DGT negotiated Sino-Philippine Transhorizon Microwave System with Taiwan on 29 May 1967.</u></p>
--	--	---

Figure 4.3. Planning the Coaxial Submarine Telephone Network (1964)

Source: 2nd Session International Meeting on Submarine Cable Plan for South Asia and the Far East, Tokyo 23-25 March 1964, DGT.

F.2. The Triple Interests behind the SAFE Project

The " Proposed Routes for the Main Telecommunication Arteries for South Asia and the Far East" was addressed in the Tokyo Meeting. China (The PRC) was excluded from this project. More militant than ever, the participants in the meeting replaced the name of capital of China--Beijing--with "Peiping" (so-named by Chiang's Nationalist Party). The traffic volume between China and Asia was deleted in current reports. All results pleased the ROC delegations. The participants overwhelmingly praised the importance of Taiwan's position in the conference (DGT, 1959b:7,9-10). Fang Hien-chee concluded the meeting by asking for more cooperation between anti-communist allies (DGT, 1959b:30).

The Japanese delegation interpreted that the U.S./Japan cooperation was suddenly announced by the Japanese Ministry of Posts and Telecommunications on 7 May 1959 due to the competition with the British Commonwealth project (Kewji & Yoshiaki, 1959:10). Judging by the messages delivered by the U.S. and Japan, the cable plan allowed them to realize the interests in Asia to a great extent:

.... and may also be used in providing direct circuits between the United States and other countries in South East Asia and the Far East area as mutually agreed...
[the U.S. Statement]

It might be important to consider that the international arteries should be planned to benefit as many countries in the area as possible. [the Japanese Statement]

The cable system should be primarily provided for the business terminating and originating in the countries concerned. It could also be used transmitting business to

other countries, to the extent that such usage would not interfere with the primary purpose. [stated by the Ministry of Posts and Telecommunications of Japan] (DGT,1959b)

In particular, Japan wanted to overcome the barriers produced by congestion of the HF band between Southeast Asia and itself (Kewji & Yoshiaki,1969:7-8; DGT,1964:19-20). Taiwan also wanted to influence Japan foreign policy by contracting out suppliers to the Japanese electronics industry. This effect was evaluated by the Director of Radio Wave Research Laboratories (RWRL) on 2nd Asia Electronics Conference during 2-8 October 1963 in Tokyo (Communications Regulation Monthly, 4:11, pp 16).

Finally, those projects precisely built the complete strategic line of the U.S. containment policy in the Western Pacific. Submarine cable was much more important for the U.S. military interests if the strategy of the Vietnam War was considered, particularly the fact that Taiwan was chosen to be a major logistical supply base for the U.S. military as well as a recreation resort for the U.S. troops (Arrigo, 1983:4). Moreover, it was impossible to install the Southeast Asia Automatic Telephone System for the U.S. Army Strategic Communications Command in 1965 if there was no submarine cable in this region (Richardson,1971).

Foreseeing that the COMPAC, TPTC/HC2, and SEACOM cables could be finished in 1963, 1964, and 1966, respectively, it was very important to finish the trans-island backbone microwave project before 1963 as the first step of the SAFE

project. Originally, the DLF functioned to compete with low-interest loans from the Soviet Union to the developing countries (Ohlin, 1966, quoted in Wen, 1990:52). It was very significant that as soon as the contract for the microwave project was signed in Washington D.C. by the TTA and DLF, U.S. President Dwight D. Eisenhower visited the ROC on 18 June 1960 to show that the Americans would

"continue to stand solidly behind the Sino-U.S. Mutual Defense Treaty in meeting the challenge posed by the Chinese Communists in this area. (China Yearbook 1978:414)

F.3. The Assistance

Apart from Dr. Kajii's assistance, the U.S. had already sent one expert to help in designing the microwave project in 1957. One senior Taiwan technician was trained in the U.S.. To perform the survey, the NTTPC provided test equipment for 4000 M.C. microwave field intensity measurements. The route selection test was performed using TD-2 and TH systems supplied by Western Electric, and RCA's MM-600 system. The test equipment for 2000 M.C. and 6000 M.C. (Lenkurt 74-A) was supplied by U.S. aid in FY 1958. All the systems performed to meet CCIR/CCITT specification. It took two years to finish the application. According to Leon Y. Chen and others, the system design had already left the space for microwave to link the regional submarine cable projects (also see Chiang, 1960; CIECD, 1964b),

In short, the system performance will fully meet the international standard and would be good to serve as a part of the trunk circuit of the Pacific toll network

which was discussed in the Tokyo meeting last year.
(1960:2)

F.4. Establishing the Microwave Superiority through the Intervention of the Security Regime

Originally, the DGT planned to link the SAFE cable from Taipei to Kaohsiung by backbone microwave. However, after a second meeting of SAFE cable project persuaded in 1964, two incidents altered the ROC government's decision: (1) a new route for the TPTC project; (2) the controversy between the ROC and the Japanese government concerning a diplomatic issue. Finally, the SAFE cable project was suspended. Unexpectedly, microwave technology gained its importance for carrying the major international connections. This superiority was generated by the security regime.

First, the new TPTC route, from Guam to Manila¹², was established at the end of 1964. Taiwan became a less important site than before in terms of the map of the Pacific submarine cable plan. The new connection linked TPTC with SEACOM through another site--Guam. It actually made a detour to avoid going through Taiwan along the West Pacific Rim to Japan. Meanwhile, Taiwan tried to find a new route to connect with the U.S. by linking through Manila to connect TPTC & SEACOM, even though the expenses of connecting Japan was increased by going through Guam. Taiwan considered the plan worthy because it directly communicated with the U.S. instead of transmitting

¹²This cable was finished in the same year when WETWASH cable linked Vietnam with Philippines in 1964. (Bergen, 1986:300)

via Japan through the SAFE cable (DGT,1964:20). This consideration indicated the original attitude of Chiang's regime on the triple Sino-Japan-U.S. relationship. Secondly, a confrontation between the ROC and Japan was escalated by a controversy on 14 March 1962¹³:

Foreign Minister Shen Chang-huan declared China did not recognize Japan's so-called "residual sovereignty" over the Ryukyu Islands. (China Yearbook 1978:415)

This controversy directly stopped the project. The Treaty Division of the Ministry of Foreign Affairs refused a survey team from KDD and the Japanese Ministry of Posts and Telecommunications permission to visit Taiwan on 27 December 1962. However, the DGT was still prepared to negotiate the SAFE project once relations improved (DGT,1964:19).

Unfortunately, year by year, the relations became worse due to Mainland China's endeavour. Taiwan-Japan relations were finally terminated on 29 September 1972. Taiwan lost the contact with the SAFE project. At that time, the major gateway of the ROC was a tropospheric microwave scattering system which was recommended by the First International Meeting on Submarine Cable Plan for SAFE in 1962, and proposed by the DGT after the Telecommunication Plan Committee for Asia of CCITT in December 1963. This project still realized the U.S. interests in the Far East by connecting the U.S. frontiers

¹³Accompanied with a complaint from the ROC about how Japan assisted China to build a caprolactam plant in August 1963. (Yeh,1981:29).

along the Western Pacific Rim (see Figure 4.4.).

The ROC withdrew from the U.N. on 26 October 1971, the ITU on 29 May 1972, and INTELSAT on 10 September 1976. The ROC also terminated diplomatic relations with the Philippines on 9 June 1975. These withdrawals indicated that the DGT's HF band and satellite circuit were under siege. Moreover, it was very difficult for the ROC to sign submarine cable landing rights with either Hong Kong or the Philippines. The existing microwave system won its superiority due to this historical coincidence.

4.5. The Outgoing Connection--Transhorizon Microwave System

The DGT decided to replace the submarine cable to Hong Kong and Manila with two microwave scattering systems in 1962. For coping with impending economic growth in this region from 1963 to 1964, ECAFE/ITU endorsed the DGT's proposal that microwave won credit in the eyes of the ROC government. The DGT processed the project but stayed, itself, in the stage of wireless connection for several years (DGT, 1964:21) due to the lack of capital¹⁴ and intertwined political problems. However, there was a hidden demand to immediately carry the heavy traffic volume of international communications for the Vietnam War. As a result, this transhorizon microwave project (a high capacity frequency-division multiplex system),

¹⁴This judgement was made by an internal document of Nationalist Party. (Chang, Yu-te, 1964 in Monthly Newsletter of Nationalist Telecommunications Division, No.44)

supported by the U.S. military and the ROC security regime, was simply installed during a short period of time.

A. Construction and Assistance

Long before the proposal was addressed, the CGRA appropriated the scattering technology through the KDD's assistance (see Ch.4.4.E.). These two projects (Taiwan-Hong Kong and Sino-Philippines) were assisted by Cable & Wireless Hong Kong and American Radio Engineering Laboratories, respectively, on a turnkey basis. All expenditure for installation was financed by the local revenues.

The Taiwan-Hong Kong Transhorizon Microwave Project was started in 1965. Two connections were located on Fangshan, Taiwan and Cape D'aguilar, Hong Kong. The total expenditure was NT\$ 15,765,404. The project was finished on 24 June 1967. The Sino-Philippines Transhorizon Microwave System was started in 1967. After the negotiation with the Philippines DGT and its related organizations was finished, a tender for that project was opened on 19 October 1967, and the contract was signed with Marconi Company (U.K.). The total cost was NT\$ 46,000,000. The project was finished on 22 July 1969 (Cheng, Sz-chun, 1967:32-7; Communications Development Monthly, 16:12; Yearbook on Communications, 1965-6, 67-9).

B. The Auxiliary Connection--Satellite

Simultaneously, an earth station was built on Yangming Mountain to link the Intelsat III Satellite on the Pacific orbits with submarine cables and tropospheric scattering

systems beyond the horizon on 28 December 1969. This idea was first addressed by the Joint Plan Committees of CCITT in Rome in 1963. The DGT attained the access to the satellite plan in the Extraordinary Administrative Radio Conference to Allocate Frequency Bands for Space Radiocommunication Purposes in October 1963¹⁵. The U.S. continuously supported the satellite plan at the 1964 second meeting of the SAFE Project concerning a future trans-Pacific connection to establish the international ocean-wide switching centres for satellite circuits (announced in Telecommunication Plan Committees for Asian-Oceania, CCITT, 1966 [Communications Regulation Monthly, 5:6; Yearbook on Communication, 1966]).

To meet the ITU's requirement, the DGT set up an ad hoc committee and contracted out a study to the Electronics Institute of National Chiao Tung University in February 1962. The ROC signed the "Agreement Establishing Interim Arrangements for a Global Commercial Communications Satellite System & Special Agreement" and invested US\$ 200,000 in INTELSAT on 17 February 1965. The Executive Yuan approved the earth station plan in November 1966 and consulted with COMSAT for that project. The invitation to bid was issued by Central Trust of China on 17 October 1967. Meanwhile, the DGT proposed to establish an International Switching Centre in Taipei,

¹⁵The satellite plan was promoted by Gisson Chien, Director of DGT under the critical influence of Dr. Wen. Y. Pan, RCA microwave expert. (DGT Research and Planning Board, 1976:23)

which would serve as an automatic switchboard for overseas telephone connection through the following processes:

1. Incoming message automatically switched to local by foreign operator; vice versa, outgoing message by CGRA operator;
2. Foreign operator via satellite circuit crossing CGRA switchboard to another outgoing circuit via transhorizon microwave;
3. or the process above through CGRA operators.
(Yearbook on Communication 1967:189)

This centre was scheduled to go into operation in 1970. A similar switching centre for telex was scheduled to work later. On 22 July 1968, the CGRA awarded a contract to NEC for building an earth station. With the NEC loans, US\$ 680,134, the DGT established the earth station (DGT, 1968:20-21; 1969a:33; Yearbook on Communication 1969-70).

C. The Double Goals (Economy and Military) of Regional Development through Telecommunications Network

C.1. The Origin of the Idea--Regional Economic Development

All the efforts noted above formed the regional network within East and Southeast Asia. According to the report of the First Session of the Telecommunication Sub-Committee TCC 1969, the ROC experts emphasized the contribution of Taiwan to serve this regional development:

Two major projects, one the setup of the Sino-Philippines transhorizon microwave system and, the other, the establishment of a communication satellite earth station,... To coordinate with the setup of the earth station and to meet the anticipated boost of international telephone traffic, an international gateway switching centre is also programmed... These three projects are considered to be the major endeavour of my country in the implementation of regional and sub-regional telecommunication network to provide high quality stable broadband services for the ECAFE region.
(DGT, 1969b:96)

Originally, this idea come out in the 2nd Asian Working Party of Telecommunication Experts, TCC ECAFE in 1964. K.V. Pai, an ITU Senior Expert, recommended that a link should be built between Taiwan, Japan and Southeast Asia by microwave radio relay system. Pai promoted his idea clearly by some specific directions:

In this network as stated above some of the countries have not been provided with suitable outlets... Philippines... China [Taiwan, author noted] are two of these countries. Technically it is feasible to plan microwave scatter route from Hong Kong to Formosa and from there to Philippines.... Completion of such a system will give...direct outlet to much of the Asian World... The Bureau of Telecommunications Philippines is the best authority...Cable and Wireless of Hong Kong may possibly undertake immediate discussion on such a route. (Pai,1965:22)

Basically, to serve the interests of ECAFE, Pai's recommendation promoted a regional economic development:

The completion of all these systems will make it possible to link all the countries of this region together and provide economical and trouble free regional telecommunication service which will be a boom for the development of regional trade and industrial development. (Pai,1965:21)

ECAFE also pointed out to the Sub-committee in 1969 the contribution of telecommunications to the regional economic development:

Taking into account the role of industrial and commercial activities of each country as important generators of demand for telecommunication services,... in studying the utilization factor and telephone density in many of the countries of the world, noted a close relationship between their economic development and telecommunication development. (DGT,1969b:32)

Moreover, after the Second Working Party of Telecommunication Experts of ECAFE met in 1964, the promotion of

regional cooperation for the manufacture and distribution of the low-cost radio receivers had been continuously emphasized as a major issue in each subsequent ECAFE meeting. The ROC delegate supported this policy by proposing in 1970, low-price export and duty-free import of receivers within Asian countries (DGT, 1970, Agenda Item 9; Yearbook on Communication 1964:41-2). Originally, through transhorizon microwave system, Taiwan had already reinforced its radio transistor assembly industry by the U.S. and Japanese investments (see Table 4.3.).

C.2. Towards an Integrated Function--Serving Military behind the Regional Trade Framework

However, three facts indicated that this regional development had been partially integrated into the Vietnam War economy. First, two microwave systems completed the containment policy by linking two submarine cables (SEACOM and TPTC) within a triangular connection (Hong Kong, Taiwan, Philippines) (see Figure 4.4.).

Secondly, the Taiwan-Hong Kong Transhorizon Microwave System immediately served the U.S. troops and their dependents visiting for recreation. The overseas telephone calls had increased remarkably since the mid-sixties (see Table 4.5.). The growth of overseas calls increased due to tourists (including the U.S. troops) in 1965. This growth of telephone calls was even greater than that of tourists in 1966 (Yearbook on Communications, 1966:11). The highest growth was recorded in 1967 (75.5%) once transhorizon microwave system started to

Figure 4.4. Telecommunication Map of ECAFE Region (1969)

Source: DGT (1969b) Report of the Telecommunication Subcommittee (First Session) to the Transport and Communications Committee (17th Session).

Table 4.5. The Operation and Comparison of Overseas Telephone Traffic in Taiwan (1965-1969)

Overseas Telephone Calls	Current Year Message	Growth by Comparison with Previous Year Previous Goal			
		Quantity	%	Quantity	%
Year 1965	189,000	51,000	37.0	40,000	26.8
1966	266,000	77,000	38.5	106,000	66.3
1967	467,000	201,000	75.5	148,000	46.4
1968	764,000	297,000	63.5	260,000	51.5
1969	949,500	185,500	14.3	-44,500	-4.5

(Source: Yearbook on Communications, 1965-1969)

serve the Vietnam War and U.S. aid procurement (ibid, 1967:177). Finally, the growth dramatically dropped in 1969 due to the evacuation of troops for the Vietnam War (ibid, 1969:205). This extraordinary growth was also proved through comparing the annual increase of telex traffic for serving export trade during the same period (at 27.0, 6.2, 25.1, 16.8, 27.6). The contribution of the microwave system was confirmed by a government report:

Particularly significant is the amazingly rapid growth of international telephone traffic since the inauguration of Taiwan-Hong Kong transhorizon microwave system in June, 1967, and the lease of submarine cable circuits between Hong Kong and the United States. This brought about the annual international telephone calls in 1968 to a new record of 56.6 per cent over that of the previous year. (DGT Report of the First Session Telecommunication Subcommittee, TCC ECAFE, 1969b, pp 95)

Thirdly, there was an extension of the triangular network under construction since 1967. This extension erected many backups for communications throughout the U.S., Japan and Southeast Asia during the Vietnam War. Initially, the "Taiwan-Hong Kong Transhorizon Microwave System" connected two subscribed circuits (agreements signed on 23 September 1967

and 25 March 1968) of SEACOM cable via Hong Kong and Guam (finished in August 1966) to the U.S.. The microwave system was linked up with Japan again by subscribing six satellite telephone circuits via the Hong Kong earth station to Japan on 9 November 1969. This connection also functioned as an interim gateway from Taiwan to the U.S. and Japan till the end of 1969 when the earth station was established on Yangming Mountain.

Meanwhile, as soon as the Sino-Philippines Transhorizon Microwave System was established, the CGRA leased four satellite telephone circuits via the Philippines earth station (Tanay 1) to the U.S. on 31 July 1969. Furthermore, the capacity of the microwave system was enlarged by the DGT's signing of the "Indefeasible Rights of Use" with the Philippine Long Distance Telephone Company (PLDT) on 15 March 1976. This agreement allowed the DGT to link the Sino-Philippines troposcatter system with twelve telephone circuits of the TPTC2 cable (Hawaii-Guam-Philippines submarine cable, finished in 1973) to the U.S. (DGT, 1979:330; DGT White Paper 1993:181; ITA, 1976a).

However, before signing the contract for the Sino-Philippines system, the DGT processed a multilateral negotiation. Several groups were involved in the dialogue with the DGT, as shown by the following schedule (Communications Development Monthly 16:12; Yearbook on Communications 1968):

23 April
(1967)

Vice-Director of Economic Coordinative
Bureau/President's Office, Director of Bureau
of Telecommunications Philippines visited
Taiwan;

<u>29 May</u>	<u>Director of Bureau of Telecommunications</u> Philippines dealt with Sino-Philippines Transhorizon Microwave System in Taiwan;
<u>12 July</u>	<u>Director of Bureau of Telecommunications</u> Philippines and Philcomsat dealt with microwave;
<u>21 Sept.</u>	<u>President, Western Union International (WUI)</u> dealt with microwave project;
<u>24 Jan.</u> (1968)	<u>Wireless and Cable (UK), Eastern Extension Co.</u> (Manila), and Westerr Union International dealt with Sino-Philippines Microwave System;

Their efforts basically served the military applications of this project. The government agencies represented Marcos' interests¹⁶. Those corporations, according to Sussman (1982), represented the very complex interlocking interests as follows:

1. Philcomsat:

the Philippine representative to the...(Intelsat) has been in operation as a "carrier's carrier" since 1967 serving the U.S. military,... Originally, established for U.S. military circuits from Hawaii to the Far East for the conduct of the Vietnam War,... (Sussman,1982:5)

2. C&W, WUI and Eastern Extension Corporation:

Eastern Extension Co. (the Philippines branch of Cable & Wireless [C&W]) was a partner in the joint venture along with Eastern Telecommunications Philippines, Inc. (ETPI) which was owned by a Filipino businessman, Roberto S. Benedicto, one of Marcos' close friends after martial law was declared in 1972. Another major shareholder of ETPI was Western Union

¹⁶Marcos' government was connected to the regime of Chiang Kai-shek through Ralph Nuba, a Kuomintang community organizer in Chinatown, who published the United Daily News (Sussman, 1982:5). Marcos also sanctioned an extradition of two Filipino-Chinese journalists to Taiwan. Quintin and Rizal Yuyitung, publishers of Chinese Commercial News, were imprisoned in Taiwan due to their criticisms of the Chiang regime in 1970 (Rosenberg,1979:157).

International (WUI), an international carrier for Taiwan and Philippines. ETPI was also the exclusive carrier for communications in the Bataan export processing zone (ibid, pp 6). Backed by investments of C&W, WUI and Marcos' friend, ETPI (a legacy of a system for serving the Vietnam War [Bergen, 1986:32]) mainly functioned as:

...monopoly participant of the ASEAN cable network that links Philippines with Hong Kong and Okinawa... As backup, an Oceanic troposcatter radio communication system is also connected with Taiwan. (Sussman, 1982:5)

3. Oceanic Wireless Network, Inc. (OWNI):

Oceanic Wireless Network, Inc. was the Philippines owner of the microwave troposcatter system. The other shareholders of OWNI were C&W and WUI. In the seventies, the ownership recruited Philcomsat and ETPI (ITA, 1976a:4). Before the Philippines-Hong Kong cable (OLUHO 1976) was built, the Oceanic troposcatter system continued to carry two groups' (24 Channels) connections between Hong Kong and the Philippines through the Taiwan microwave systems (ITA, 1976b:4-5).

4. Philippine Long Distance Telephone Company (PLDT):

The "Indefeasible Rights of Use" of TPTC2 cable were sold to DGT Taiwan by PLDT. Originally, PLDT provided the terrestrial microwave connection between the submarine cables and Oceanic troposcatter system which served the Vietnam War. PLDT connected to the submarine cable through GTE ownership (Sussman, 1982:7-8). The DGT obtained this offer partially due to the investment of the GTE assembly plant in Taiwan.

Finally, the microwave system operation was inaugurated by

Imelda Marcos and Mme. Chiang Kai-shek one on each end, to represent these "complex interests" in the forms of military strategy and economic alliance behind the microwave project (see Table 4.6.).

Table 4.6. The Philippines Participants in the Transhorizon Microwave Project Connected to the Sino-Philippines Interests.

Corporation or Agency	Principal Partner	Project Contributed to Taiwan or Philippines
<u>Bureau of Telecomm. PLDT.</u>	Marcos-Government GTE.	<u>Supports from/to the Nationalist Party in Taiwan</u> <u>Providing TPTC-2 circuits to Taiwan for the GTE assembly plant in Hsinchu and the switching system market in North Taiwan. (1973)</u>
<u>Oceanic Wireless, Inc.</u>	C&W, WUI, Philcomsat, ETPI, Benedicto-Marcos.	<u>Owner of troposcattering system in Philippines;</u> <u>backing up for ETPI international carrier.</u>
<u>ETPI.</u>	Benedicto, C&W, WUI.	<u>Using Oceanic Wireless, Inc. for Bataan EPZ communications</u>
<u>Philcomsat (Manager: POTC)</u>	Benedicto, Marcos-Government, GTE.	<u>Backing up for its earth station by connecting troposcatter system.</u>

(Source: Sussman, 1982; King, Y.H. 1974; ITA, 1976a.)

C.3. Forming a Triangular Network under Vietnam War Demands

Through the connections above, two troposcattering transhorizon microwave systems built up an exactly triangular connections among Hong Kong, Taiwan and the Philippines (Communications Development Monthly, 18:12, pp 29). The U.S. troops took advantage of these facilities immediately. The importance of these connections was proved by the backup demands of the U.S. military bases in these areas during the Vietnam War:

For fixed telecommunications facilities at each major base camp, air base, and logistical installation in Southeast Asia, the group requested high-quality telephone, teletype, and data equipment similar to that found in commercial facilities in the United States. (Bergen, 1986:291)

First, the CCK Air Base located on Taichung when Taiwan was chosen as a logistical supply station (Clough, 1978:23). Remarkably, the CGRA primarily reinforced the telecommunication service, not of Taipei but of Taichung for the U.S. top leadership, represented by Mr. William Rogers, Secretary of State, who visited Taiwan on 1 August 1969 (Yearbook on Communications, 1969:247). In the meantime, the Philippines was a depot for communications, command and supply of the U.S. Armed Forces. To link Taichung with Clark Air Base in the Philippines, it was not surprising to find out that two groups of Sino-Philippines microwave circuits (24 channels) were leased by the U.S. troops in Taiwan (see Figure 4.5.) in a three-year term contract (Communications Development Monthly, 20:12, pp 26). These two microwave systems also leased 24 channels to Oceanic Wireless Inc. for connecting Hong Kong with the U.S. troops in the Philippines before the submarine cable was established

Secondly, another backup demand was requested by the U.S. Armed Forces as follows:

Although overland segments of the Integrated Wideband Communications System could be used to back up the strategic coastal cable, there was no comparable alternate route for cable circuits to the United States. When a junction box malfunctioned on the commercial cable at Guam in August 1967, the Defense Communications Agency, Southeast Asia Mainland, had to reroute high-

priority overseas transmissions over high-frequency radio and satellite systems. (Bergen, 1986:307)

As a result, Southeast Asian countries had been requested to join the Pacific Plenary Restoration Meetings since the late sixties. CGRA Taiwan joined the meeting with C&W, Oceanic Wireless, and Philippines Overseas Telecommunication Corporation (POTC) in 1971 at the Fifth Working Party Meeting of the Fourth Plenary Committee. The meeting basically worked out an alternative route for the outgoing messages from the Philippines and Hong Kong in case the earth stations in these two regions malfunctioned. This project was named the Satellite Contingency Plan and the Restoration of Earth Stations (see Figure 4.6.) (C.L. Yang, 1971).

This plan solved two problems as follows: (1) if INTELSAT III F4 Satellite malfunctioned, the signals from the Taipei earth station could go through two other Pacific earth stations to the U.S.. This alternative route also backed up Hong Kong, if the malfunction problem occurred there, via transhorizon microwave to connect the Taiwan earth station with Hong Kong; (2) if a typhoon damaged the earth station in the Philippines, the microwave relay system in Taiwan could retransmit the outgoing messages from the Philippines to Thailand and Japan. Taiwan backed up ten times for Hong Kong and six times for the Philippines, respectively, before 1971. Taiwan contributed to the Vietnam War through its regional trade development network.

Figure 4.5. The Baseband Configurations in Fangshan Station (Taiwan-Hong Kong, Sino-Philippines)

(Source: Proceedings of Sixth Working Party/Fifth Plenary Committee Meeting, Pacific Plenary Restoration Meeting, DGT 1972a:29-30.)

Figure 4.6. The Satellite Contingency Plan and the Restoration of Earth Stations

(Source: C.L. Yang, 1971:167-9)

However, except in emergencies, the routine warfare communications were also channelled through the following facilities: (1) a group of troposcatter radio systems were erected: four in Philippines (1959,63,64,67), two in Taiwan (67,69), two in South Vietnam (62,65), and two in Okinawa (61,67) (DGT Monthly News,6:9). These installations had been in coordination with submarine cables for the Vietnam War since 1967¹⁷:

By then the military had cable connections from South Vietnam to the United States via WETWASH undersea cable and leased circuits on a commercial cable recently installed between Hawaii and the Philippines. Circuits were also extended to Okinawa over a contractor-operated troposcatter system connecting the Philippines, Taiwan, Okinawa, and Japan. (Bergen, 1986:306)

(2) These connections were renovated by Philco-Ford to be pioneer electronic battlefield equipment--"Integrated Joint Communications System among Okinawa, Taiwan, and the Philippines" (American Report, 1971). The project was officially named the Integrated Wideband Communications System (IWCS). This system functioned as an extension of Automatic Digital Network (AUTODIN)--a worldwide high speed data network--manufactured by Philco-Ford under a contract with DoD (Bergen,1986:302). IWCS and AUTODIN clearly integrated this triangular network into part of the cross-Pacific commands network for the Vietnam War military strategy.

¹⁷The Taiwan-Okinawa connection was made since the opening of Technical Training Program in 1966 as Telecommunications Annual Report 1967 described: "Chief of Telecommunication Section of Postal Services Agency in the Ryukyus has participated . . the first training program with success."

In fact, to realize how the U.S. military located Taiwan as the centre for manufacture and service of this command system, one decision maker--Robert E. McNamara (President of Ford Corporation [1960], Secretary of Defense USA [1961-1967], President of the World Bank [1968-1981])--should be brought into the discussion of the historical formation (Nissen, 1971: 17) (see Table 4.7.). Basically, McNamara contributed to this war economy as follows:

The government-based top management designed by Robert McNamara was thereby made the master of business-operated military industry. (Melman, 1974:263)

After being appointed the Secretary of Defense by President Kennedy, McNamara was involved in Comsat as well as all other electronics command system projects for the Vietnam War (Schiller, 1992:82,90; Bergen, 1986; Kinsley, 1976:60). Moreover, the primary idea of the electronics battlefield was designed by Philco-Ford under McNamara's presidency. That system successively integrated Taiwan troposcatter radio relay systems into a wideband communications system. The first World Bank-funded Taiwan telecommunication expansion project (506-CHA) was also processed under McNamara's jurisdiction in the IBRD.

Two subsidiaries of Philco-Ford (electronics components assembly plants), as two early beachheads of the U.S. electronics industry in Taiwan, were established by the U.S.

Table 4.7. The Projects under Robert E. McNamara's Jurisdiction Relating to the Vietnam War and Taiwan Development

Projects	For Vietnam War	Taiwan Involvement
<u>*Pacific Scatter System (1960) & Backporch (1962) of Page Comm. & Collins Radio.</u> <u>*WETWASH cable (1962).</u> <u>*Army Teletype Center (1965) of Western Union's specification.</u> <u>*IWCS (1965) manufactured by Page, Philco, and Lenkurt Co.</u>	<u>Commands from Hawaii to Philippines and South Vietnam.</u> <u>Linked the Philippines-Guam submarine cable.</u> <u>Supported the buildup of combat troop.</u> <u>Connected AUTODIN from Thailand to California.</u>	<u>Page was advisor & Collins was manufacturer in backbone microwave project (1960).</u> <u>DGT proposed to link Philippines by a troposcatter (1963).</u> <u>WUI supplied 500-line teletype of switching system (1969).</u> <u>Philco established two assembly plants (1966); Lenkurt surveyed the route of backbone microwave (1959); Stromberg Carlson was a supplier for AID #12 project (1964).</u> <u>DGT signed contract with Comsat (1966).</u> <u>Supplied multiplex facilities for backbone and Taiwan-Hong Kong troposcatters.</u>
<u>*Southeast Asia Automatic Telephone System of Stromberg Carlson</u> <u>*DoD leased 30 circuits from Comsat (1966).</u> <u>*506-CHA World Bank Project (1967).</u>	<u>Served Army Strategic Communications Command (1966).</u> <u>From Hawaii to the Far East for the Vietnam War.</u> <u>Built Infrastructure for Taiwan to supply the war procurement</u>	

(Source: Bergen, 1986; Communication Regulation Monthly, 5:6, pp 28; Kinsley, 1976:60; Leon Chen et al., 1960:21; DGT, 1966, 1968:20.)

capital and military member¹⁸. More or less, the two plants supplied the components for the manufacture of the wideband system as Bergen analyzed:

¹⁸Philco-Ford was introduced by the U.S. General Redford to Taiwan in 1957. The survey of investment was assisted by the ESB. Yen Chia-kan, Director of CUSA, promised to realize this investment as much as he could. (Shen, 1959:108-9)

... Page's 150 subcontractors and Philco's 100 subcontractors... dealing with the same vendors... those vendors were selling to a lucrative international market for transistorized consumer goods and computers as well as supplying parts for sophisticated sensors and guidance systems for South Vietnam.... (Bergen, 1986:329)

McNamara created a small working team by providing telecommunications equipment to the DGT, introducing the U.S. electronics plants to use Taiwan cheap labour, and establishing Taiwan as the logistical supply centre for telecommunications service and manufacture which were demanded by the Vietnam War (see Table 4.7.).

Conclusively, except for satellite circuits, the outgoing messages heading to the U.S. for processing the huge amount of Sino-American export trade during 1967-1976 were mainly carried by two microwave transhorizon systems (to Hong Kong and Philippines). These systems went through Guam, the intersection of Hong Kong (SEACOM) and Philippines (TPTC1/2) submarine cables, to Hawaii, and then to the U.S.. These two submarine cables were partially built for the Vietnam War. The economies of the two connection sites, Guam and Hawaii, were mainly supported by U.S. Naval and military expenditure (Mortara, 1969:61-2; TTA, 1977). The connections discussed above represent a major function of the Taiwan telecommunications development which was structured by the design of the U.S. military-industrial communications complex.

Summary

Taiwan telecommunications moved into an era of superior wireless communications--microwave, VHF and satellite, from

1960. This distinctive historical development showed the priority of export economy as an advanced communication system was needed to carry overload of business communications. One of the major beneficiaries was the U.S. electronic components assembly industry.

Behind this trade framework, the communications network was structured at a deep level, by the security regime for serving the Sino-American cooperation for the Vietnam War as well as the Far East defense strategy. The development of wireless technology installation was again directed by political intention, and the submarine cable technology advancement was also deferred by the security concern.

In fact, technology did tie Taiwan in with U.S. under new economic/political interests and change its partnership with Japan. This transformation contributed to form a telecommunications-served U.S. semiconductor assembly movement. This connection was unexpected from an instrumental view but was foreseeable under a structural institutional analysis. Finally, this chapter shows that the military/control function of the Taiwan telecommunications system facilitated the investment of the U.S semiconductor industry which was originally based on war procurement and later operated with the support by the authoritarian regime to assemble components, as, for instance, in the case of Philco-Ford.

Chapter Five

Telex-linked International Communications Serving the U.S. Multinationals Assembling Semiconductors

5.1. Introduction

This chapter will specifically analyze the domestic supports from the DGT in Taiwan to the U.S. semiconductor assembly plants. A relocation of industrial sites started in Taiwan during the late sixties soon after General Instrument moved to Taiwan in 1964 (i.e., the fifth year of the 19-points on Financial and Economic Improvement) (Lam, 1991:6-7). In fulfilling the demand of global communications to link the assembly plants with parent companies in the U.S., the DGT was one of the most important infrastructures.

To meet the current specifications of business communications, the international automatic switching telex network was established with multiple loans from the U.S., Japan, and the DGT itself. Local technicians were directed by top management personnel who were familiar with the electronics industry development of the past eight years. On the basis of the existing international gateway and the local infrastructure built by ITU jurisdiction and U.S. aid, telex contributed strongly to the early paradigm of global relocation of industrial sites in Taiwan.

The contribution of telex to the Taiwan export economy was shown by a remarkable record of traffic statistics of U.S. International Records Carriers (IRCs) (see Table 5.1.).

Table 5.1. The U.S. International Telex Traffic: Top 11 Correspondents (To and Fro), 1979

Country	Number Telex Messages (000s) In/Outgoing	% of Total U.S. International Telex
UK	14,421	16.2
Japan	6,478	7.3
WG	5,412	6.1
France	4,603	5.2
Italy	3,692	4.1
Australia	3,008	3.4
Hong Kong	3,003	3.2
SW	2,880	3.0
NE	2,599	2.9
Taiwan	2,582	2.9

(Source: Dan Schiller, 1982:102)

This credit was accomplished by the Taiwan telex system in two dependent ways:

1. The Central Exchange Office in Taipei functioned as the central control for the international telex; there was no alternative route on the island;

2. The international telex service operated exclusively on the island for thirteen years before the domestic telex was inaugurated in 1973.

Finally, behind the telex operation, the World Bank-requested sound financial project was a powerful force in reinventing business communications for serving multinationals' interests.

5.2. Administration Reform which Underpinned Telecommunications Development

After four successive Four-Year Plans (1953-68), Taiwan telecommunications stood on better ground due to a fair return operating policy and the U.S.-aided expansion (Fang, interview

in 1994). In order to cope with the growth of the export economy, the members of CUSA were promoted from the off-scene planning board to the platform of the executive board of the Central Government. This new administration commissioned the DGT to advance the local electronics industry.

For initiating the policy reformation, Fang Hien-chee was promoted from Director of the TTA (1965-68) to Director of the DGT (1969-78) because he was very knowledgeable about the U.S./Japan telecommunications/electronics engineering. Before this appointment, he had participated in several conferences of the electronics industry. In the Second Working Party of Telecommunication Expert of TCC, ECAFE, in 1964, Fang supported regional cooperation to produce cheap radio. He also joined the 4th Asia Electronics Conference in 1967. There, Fang ordered the DGT to enroll as a Full Member of the Asia Electronic Union on 18 January 1968. Again, he was the convenor of Fifth Asia Electronics Conference at Taipei in 1969 (YBCs 1964,67,68).

During the sixties, Fang was recruited into the think tank of K.T. Li as one of the core figures. CUSA was replaced by CIECD in 1963. K.T. Li, Vice-chairman of CIECD, set up a Communications Sub-committee to invite Fang, the Director of TTA, to join his work team¹. The sub-committee coordinated

¹Fei Li-chuan, a colleague of Fang, Director of the Dept. of Posts and Telecommunications (1965-69), also participated in this Sub-committee. He had abundant experience of attending ITU meetings, especially the two "SAFE Submarine Cable Meetings".

the telecommunications planning issues with CIECD's industrial development plans. Subsequently, Fang was recruited through his position of Vice-minister of Communications (1968-72) into the reorganized Overseas Chinese and Foreign Investment Review Committee in 1968. Finally, Li made Fang a critical figure in the developing semiconductor industry by assigning him the convenorship of the Electronics Industry Development Working Group/CIECD in 1967 (CIECD Yearbook 1964,67-8).

On the basis of several economic planning profiles, Li was promoted to Vice-chairman of CIECD (1963-73), and Minister of Economic Affairs (1965-69). He formally involved in telecommunication planning after the World Bank application was delivered to Washington. Owing to his first experience in negotiating with the World Bank in 1961, he successfully convinced the World Bank experts to visit Taiwan in September 1965. Meanwhile, under his promotion, the CIECD chose the electronics industry as a very important sector of national development. Consequently, General Instrument was assisted by the Investment and Operation Division (previously IDIC) of the CIECD in establishing plant sites during seven working months. Li also made a speech at the 4th Asia Electronic Conference in Tokyo. In December 1968, he personally visited Motorola and Texas Instruments to encourage them to relocate their plants to Taiwan (CIECD Yearbook,1964-5,68).

Fang's supervisor, Sun Yun-suan, was the first civilian

Minister of Communications (1967-9)². He participated in SRI research in 1961 through his position as Convenor of the Electric Appliance Review Sub-committee/MOEA. He started a new "Joint Technical Training Program" between the DGT and the Institute of Electronics, Chiao Tung University in 1969 (King, David 1962:48; DGT Monthly News, 7:9). Finally, Sun established the primary project of the semiconductor manufacturing transfer. RCA-CMOS in his position as the Minister of MOEA (1969-78).

Yen Chia-kan, one of figures who involved early in the application of U.S. aid, was promoted to Premier (1963-72) and Chairman of CIECD (63-69) by Generalissimo Chiang. Concurrently, he was assigned to the position of Vice-Dean of the Institute of Defense Studies in 1967. Fang enrolled in the 9th Workshop (ten-month course) of this Institute in October 1967 before he was promoted to Director of the DGT (Wen, 1990:278).

Internally, Fang inaugurated a new era in the DGT by his directorship, as a government report to the Telecommunication Sub-committee of ECAFE in 1970 said:

...as our telecommunication administration has launched since last year an overall service and administrative innovation and efficiency promotion movement in coordination with the basic policy of our Government in the political innovation and administrative reform. (DGT, 1970:63)

Fang started this process after the Provisional Tele-

²Sun was promoted by the first Director of DGT China--Chu Yi-Cheng. (DGT Monthly News, 26:12, pp 22-23)

communications Management Reform Board was established in 1968. Under his direction, the Research and Planning Board was formally set up. Through this arrangement, Dr. Wen. Y. Pan, a RCA microwave expert, was invited to be a DGT Advisor. Pan was the pump-primer of the RCA-CMOS project (YBCs, 1972:158).

Secondly, RWRL was replaced by Telecommunications Laboratories (TL). Fang stipulated that this organization should be annually financed by 2% of operating revenues (Wealth Magazine, 54:208). P.H. Kong was assigned as the first Director of TL.

Finally, the Telecommunications Training Institute (TTI) was established by the World Bank; the CGRA was renamed by International Telecommunication Administration (ITA); and the TTA was reorganized (China Telecommunications Almanac 1881-1971:191) (see Organization Chart 5.1.). Fang promulgated a new regulation: "Encouragement Statute of Guidelines for Assisting Private Telecommunication Equipment Manufacturers" on 30 January 1969. This law authorized GTE and ITT as the joint ventures in switching system manufacture. This new administration created the incentives for foreign investments through a welcome policy and the efficient facilities.

5.3. The Expansion of Telex Communications

Judging by the domestic and foreign documents (DGT White Paper 1993:83; Dan Schiller, 1982:101), telex's contribution to export trade was not less important than any other factor in

Chart 5.1. Establishing a New Telecommunication Administration through the Hub of Reformation: DGT Directorship

the process of development. On the contrary, telex was usually treated as one of the most powerful tools for processing export trade during the late sixties and early seventies. Moreover, the new administration facilitated the U.S.

investors in reaching the Taiwan labour market and reinforced the distance between local industry and Japanese supplies through the existing international telex system.

Basically, telex circuits are shared with telephone lines. In other words, subscribing to one telex circuit does not require an application for another telephone account. As a records keeping service using this method, telex won its prominence in business. The DGT opened international telex service on 1 September 1960 and renovated it at the requests of businessmen. Judging by the records collected from operating statistics, apparently the growth of telex messages almost kept abreast of the growth of industrial productions (see Table 5.2.). Calculated by the ITA experts, the index showed that the correlation between volume of export trade and growth of telex service was higher than that between trade and overseas telephone. Shown by correlation index, 0.996, ITA experts forecast that the operation of telex could annually grow at 59.5% which was higher growth rate than that of overseas calls. The telex contributed in an extraordinary way to trade activities by providing 81.7% (1970) and 83.7% (1972) of overall service for transmitting export deals (Liu Shu-chieh, 1973:36-37).

Moreover, after grouping the destinations of messages by region, an inverse telex connections between Taiwan, the U.S. and Japan is shown (see Table 5.3.). Cross-examining the results indicated that more messages went to the U.S. than

Table 5.2. The Comparison between the Growth of Telex Outgoing Messages and Production of Semiconductors

Year	Number of Calls: Telex Outgoing Message			Industrial Production: Transistors ICs	
	Grand Total	Index	Growth Rate	Quantity 1,000 Pcs	Quantity 1,000 Pcs
1960	1,981	100.00	---	---	---
1961	4,731	238.22	138.22	---	---
1962	11,025	555.14	133.04	---	---
1963	17,599	886.15	59.63	---	---
1964	23,159	1,166.11	31.59	---	---
1965	33,114	1,667.37	42.99	---	---
1966	40,740	2,051.36	23.03	7	1
1967	53,188	2,678.15	30.55	5,845	375
1968	74,224	3,737.36	39.55	11,391	5,175
1969	90,534	4,558.61	21.97	19,360	19,975
1970	139,918	7,045.22	54.55	5,062	29,899
1971	206,695	10,407.60	47.53	15,874	35,671
1972	290,763	14,640.63	40.67	22,934	157,238
1973	571,402	28,771.50	96.52	53,017	361,389
1974	942,749	47,469.74	64.99	53,058	498,703
1975	1362,270	68,593.66	44.50	15,577	331,751

Index Base: 1960=100, ICs= Integrated Circuits.

(Source: Statistical Abstract of Telecommunications 1975;
Taiwan Industrial Production Statistics Monthly ROC Dec. 1976)

Table 5.3. Outgoing Messages of International Telex Service, Grouped by Region

Year	Number of Messages			
	U.S.A.	Japan	Philippines	Hong Kong
1970	39,125	46,964	470	12,528
1971	85,350	63,996	430	23,147
1972	135,878	75,185	109	40,556
1973	279,610	131,553	232	84,831
1974	438,462	213,428	588	147,241
1975	619,096	275,790	377	191,078
1976	868,276	389,591	2,221	275,655

(Source: Statistical Abstract of Telecommunications 1977)

went to Japan after 1971 (also see Table 4.2.). These statistics demonstrate the changing partnerships between Taiwan, the U.S. and Japan. Therefore, telex service mainly served the U.S. industry in Taiwan, especially after the ROC-

Japan diplomatic relation was terminated in 1972.

Again, the schedule of the expansion of the telex infrastructure followed the growth of the export economy (see Table 5.4.). The biggest portion of added international telex circuits served the connections between Taiwan and the U.S. (see Table 5.5).

Table 5.4. The Schedule for Operating Telex System in Taiwan

Month/Day/Year	Installation
01/10/1955	teleprinters and leased circuits service;
08/01/1960	"Automatic Error Correction";
09/01/1960	CGRA telex service to the U.S. (40-line of OKI "Strowger" type system);
10/01/1964	the addition of a 200-line system;
03/01/1967	the proposal of the domestic automatic & overseas semi-automatic switching system;
08/02/1967	the World Bank Project (506-CHA);
01/22/1967	the addition of a 120-line OKI system;
01/01/1968	TTA telex service in Kaohsiung EPZ;
06/01/1968	semi-automatic 200-line OKI system;
01/01/1969	WUI's 500-line telex system (100-line in Kaohsiung and 14-line in Fengyuan);
12/16/1969	500-line Siemens system;
12/28/1969	"Pacific Satellite Earth Station" replaced the HF bands to Japan;
02/01/1970	WUI-Siemens 100-line semi-automatic switching system in Kaohsiung;
07/01/1972	semi-automatic operation system;
06/11/1973	500-line full-automatic operation system by BTM, ITT (Pentaconta 1,000A Crossbar); domestic telex service;
12/31/1973	Five telex training seminars for 141 subscribers in Taipei, Taichung, Kaohsiung;
01/29/1974	Indian Ocean Earth Station;
12/31/1974	47 training courses for 262 subscribers;
09/28/1975	Siemens 2,300-line automatic operation;
12/31/1975	11 training courses for 716 subscribers;
12/31/1977	three seminars for 145 subscribers;

(Source: Chou, 1973; CDM, 22-26:12; DGT, 1981:19)

Table 5.5. The Expansion of International Telex Circuits

Year Destination	1967	68	69	70	71	72	73	74	75	76	Relay to others
San Francisco (RCA, ITT, WUI)	5	5	5	7	7	20	54	64	82	94	SEA, SAmer, Eu, Car, Ocean, Af, Manila.
Tokyo Osaka (KDD)	- 5	- 5	- 7	4 8	4 10	14 3	21 1	26 2	31 2	37 2	Eu, Amer, SEA, Af, Ottawa.
HongKong (C&W)	2	3	5	5	6	10	17	18	31	37	SEA, ME, Car, Oc
Manila (RCA, Eastern Ext.)	1	1	1	1	1	1	1	3	3	4	U.S.A.

(Source: Statistical Abstract of Telecommunications 1977:81)

5.4. The Contributions of Telecommunications Expansion Projects

The completed telex network in Taiwan consisted of two elements: (1) basic telephone line and exchange; (2) toll carrier system. The two facilities were upgraded mainly by previous U.S. aid, the World Bank Loan, Japanese Yen Credits, Export/Import Bank Loans, other factory loans, and local expenditure. It was remarkable that the projects which served multinationals were financed by these special foreign and local capitals from overall projects.

A. The Basic Telephone Line and Exchange

1. **AID #12 Project**, the final U.S. aid project basically installed the advanced telephone system in three areas--Taipei, Taichung and Kaohsiung--where the U.S. multinational electronics plants were mainly scattered around from the late sixties.

AID #12 project (conversing manual switchboard into dial

operation) was completed at the end of 1966. The project contributed to the establishment of the Great Taipei Dial Service Network in 1967. The benefits covered the operations of two early plants--General Instrument in Hsintien (1964) and Philco-Ford in Tamshui (1966).

Hsintien was integrated into the automatic telephone area by linking its service to the Taipei Southern Exchange at Chingmei (established by U.S. aid in FY 1958) in 1964. The DGT spent NT\$ 1,441,938 for this integration project when General Instrument chose Hsintien as its plan site. Tamshui was integrated into the Taipei Dial Service Network in 1967 when Philco-Ford started running its second-year of production there. Moreover, on 15 November 1964, a rural 200-line automatic telephone switching system was installed at Shihmen Reservoir--provided a stable water supply for the electronics assembly plants in the northern part of Taiwan (YBCs, 1964, 66-7; Telecommunications in Taiwan 1963:12).

2. The World Bank 506-CHA Project supported Taiwan economic development right after 1967. In fact, the World Bank had already recognized the credibility of the ROC government from the experiences of the previous successful development plans in Taiwan:

They were the financial indicators of a "take-off" into economic independence, confirmed during 1962, when a World Bank mission found that the Republic of China qualified for developmental loans on "hard" terms. (Jacoby, 1966:100)

Originally, the U.S. aid policy didn't emphasize economic

development until the end of the fifties. As a result, the first direct contribution to the U.S. electronics plants was made by the IBRD right after aid termination and before the fully booming export trade.

This first application was finished after the World Bank Appraisal Mission, legal experts, and two telecommunication experts visited Taiwan in 1966. In the application, the DGT interpreted the significance of telecommunications expansion essentially in terms of trade activities, stating its intentions to

Improve telephone supply to the growing national industry and social community and thereby accelerate economic development of this country and enhance the living standard of its people. (DGT,1966:3)

and its confidence in the project was strong,

In view of the fact that the total number of subscribers in 1965 exceeds our original planned target of 94,700 by 4% and the demand for service is rising more sharply than before due to the economic boom in the recent years in Taiwan. (ibid, pp 45.)

Four out of six sub-projects were built for the city telephone switching system, providing 118,000 telephone lines through installation and replacement in Keelung, Taipei, Taichung, and Kaohsiung, and establishing "Subscriber Toll Dialling" (STD) by crossbar exchange in major cities along the west coast .

Through expanding telephones in four cities (Keelung will be mentioned in B.2.), the DGT directly served, in the first place, the demands of industry and the military. For example, in Taipei,

There are about 2,000 factories scattering on the outskirts of the city,...most of which are...electric apparatus... (ibid,pp 50)

[Taichung is] possessed of 1,500 large and small factories scattered in the southeast suburbs, of which, the most important ones are... electrical apparatus manufacturing,... (ibid, pp 55)

[kaohsiung,] being endowed with be a good port,...the largest harbour city, the naval base..., and also the largest industrial area.... In the harbor area, there is an export processing zone,... (ibid, pp 57)

The design of the STD toll network in Taiwan covered the sites of the twelve U.S.-owned assembly plants chosen by this research (see Figure 5.1.)³. This system was fully put into operation at the end of 1973. During the expansion period, almost all multinationals switched their assembly plants from the other side of the Pacific to Taiwan. In this regard, one could see the significance of the design

...which is urgently needed to get underway at the earliest possible date because with Taiwan's rapidly expanding economy there is increasing demands for improved telecommunication service between cities on the island... a most efficient toll line dialling network can be established, which will greatly facilitate the interconnection of the island network with the world-wide communication network through a Gateway Exchange to be located on the island at a later date (ibid, pp 102).

During the late 60s and early 70s, General Instrument leased three exclusive circuits, four teleprinters and two tape reperforators from ITA. These facilities controlled the shipments from its bonded factories to Europe, Hong Kong, the Philippines, Singapore, Mexico, Japan and the U.S.. The

³The telecommunication offices of those places were also protected by air-defense shelters and emergent rehabilitation teams during wartime. (TTA, 1969:69-70)

Figure 5.1. The Toll Network of the World Bank Project in Taiwan

(Source: TTA, 1969:69-70; TTA Research and Planning Board, 1967:159.)

average number of message transactions were 600 per day (Berlain Liang, 1972:93). Moreover, the scale of production of General Instrument was greatly enlarged by building another new plant and a female residence, which were assisted by CIECD in 1967 (CIECD Yearbook 1967:119-120). In return, General Instrument agreed to establish a pilot plant of transistor production in the Chung-Shang Institute of Science and Technology of the MND in Taoyuan⁴, and assist the Ph.D. Program of Semiconductors in the Institute of Electronics of

⁴The operation of General Microelectronics in KEPZ, a subsidiary of General Instrument, was also especially supervised by both the Commander of the U.S. Mutual Defense Command and the Vice-Commander of General Staff, Ministry of National Defense, ROC (EPZ Concentrates, 2:5, pp 10; 9:1, pp 25).

National Chiao Tung University in 1967 (CIECD Yearbook, 1965:98;1966:97;1967:114).

More importantly, the IBRD project primarily introduced the crossbar exchange system to Taiwan by one of two experts: Mr. Bradstrum (former Chief Engineer of the Michigan Bell Telephone Corporation). He proposed to upgrade the production of switching systems by the cross-bar type system:

It is concluded that in planning the expansion program for the IBRD Project period, serious consideration be given to the use of the cross-bar switching equipment particularly when starting new office units. (Bradstrum, 1966:108)

Secondly, Bradstrum introduced the future trend of switching systems:

... it is proposed that crossbar type switching equipment be used,... Except for the newer type electronic switching equipment which is not now and is not likely to become available in quantity on the open market for some time in the future, the crossbar system is the most versatile now available. (ibid, pp 13-4.)

Finally, he advised that the switching system be locally manufactured:

Under one ownership, common standards and a common purpose is shared by both the people who make telephone equipment and those who operated it... The comparatively low labor costs and the savings in customs duties and other miscellaneous charges would materially reduce the cost of telephone equipment if these facilities were made locally under factory ownership by MOC and operated in conjunction with DGT. (ibid,pp 24.)

His recommendation vitally influenced the DGT in inviting foreign companies (such as ITT and GTE) as the partners in switching system production, as well as in promulgating the "Encouragement Statute of Guidelines" to assist the

manufacturers. P.H. Kong, the Vice-executive of the World Bank project, clearly announced this goal in 1967 (TTA Research and Planning Board, 1967:154).

3. **The First Japanese Yen Credit**--this loan was introduced by CIECD to the TTA in 1966. It renovated the Taipei North Exchange by providing 10,000 lines of dial telephone. The beneficiaries were the many branch offices of the U.S. and Japan electronics companies in the northern part of Taipei city (see Figure 5.2.).

The TTA also primarily purchased a 1,240-line exchange of mobile-trailer type dial telephone for the emergent or interim telephone installation. This facility served Taichung, Panchiao, and Nantzu EPZ in 1968, 1967, and 1971, respectively. It backed up the communications of Motorola in Panchiao (1968), Siliconix in Nantzu EPZ (1975). Siliconix was directly connected to its headquarters in Santa Clara, California, without any outgoing gateway to any of its Asian branches--these were also connected through headquarters (interview with Information Dept. of Siliconix in Taiwan in 1994). This central control system of multinationals' telecommunications was connected by the same type of control as that of the Taipei Central Telex Exchange Office.

The Japanese Yen project also extended 685 circuits of short-haul toll telephone along the west coast. Forty-seven circuits served two EPZs in Kaohsiung and thirty-five circuits served the region from Taoyuan to Chungli (an "Electronics

Highway" it was named by U.S. Weekly Television Digest in 1970). The TTA also provided 2,400 and 1,800 lines of automatic telephone at two ends of the highway in 1969. The TTA served RCA and Ampex in their moves to Taoyuan in 1967 and 1968, respectively, with more leased-circuits available along the Taipei-Taoyuan-Chungli region (CDM, 18:12, pp 12; DGT, 1966:36-7; International Economic Information Monthly, 26:3, pp 86; TTA Research and Planning Board, 1967:164-175).

Moreover, Ampex moved into Kueishan of Taoyuan County, (at the northern end of the electronics highway) when this industrial district was established by the Sino-American Fund, a successor of CPT, with an award from CIECD (Bank of Taiwan Quarterly 22:4, pp 235). Soon after moving into Taoyuan, RCA set up a joint venture plant, for producing black and white picture tubes, in Pateh, Taoyuan County. This local investment was introduced by CIECD again. Two of RCA's partners were: (1) China Development Corporation, the agency of industrial loans under the mandate of the CIECD; (2) Chungwha Electronics Development Corporation, established by Fang through his convenorship of the EIDWG/CIECD in 1968 (CIECD Yearbook 1968: 106; 1970:112; TEAMA, 1988:171).

4. **The Second Japanese Yen Credit**--this project was advised by Mr. Robert McNamara on his visiting party in Taipei in May 1970. Under a condition set by the IBRD to directly purchase crossbar exchange systems from NEC on the basis of the First IBRD Loan contract, the DGT successfully signed the

agreement with Japan on 28 September 1972 (DGT,1971:33). NEC's supplies continuously reinforced the systems in major cities along the west coast (DGT,1971:34):

56,240-line	in Taipei North II;
43,840	Taipei East II;
2,720	Panchiao;
1,440	Hsintien;
12,000	Kaohsiung West;
1,600-termination	of crossbar exchange in Taichung;
2,000	Kaohsiung;
1,800	Keelung;
1,800	Taoyuan.

5. **The First and Second Eximbank Loans**--these loans were disbursed by the U.S. Export/Import Bank (EXIMBANK) for competing with supplies of Yen Credits (Yeh,1981:37). The U.S. signed the first contract with the DGT on 28 June 1973. This project basically provided telephone line facilities, stations and power equipment.

The second loan was signed on 14 December 1973. Due to the failure of bidding, this procurement was switched to purchase a 20,000-line "GTE EAX No.1 System". This loan indirectly paid for the operation of the GTE assembly plants in Hsinchu and served its branch office in south Taipei city (YBCs 1975:270).

However, this project originally intended to equip the new industrial belt from Taipei to Hsinchu with an underground coaxial cable. Owing to insufficient space in Taoyuan, the ROC's Sixth Four-Year Plan decided to enlarge the industrial district to Hsinchu. GTE moved into Hsiangshan Industrial Park in south Hsinchu city in 1973 to support the ROC government policy. Consequently, the Hsinchu Office of TTA formally

proposed to establish a South Hsinchu Exchange in 1974 as a reward (Hsinchu Office TTA, 1974:2-1,2,3-1).

6. Local Expenditure for the Telex Exchange

The telex exchange system was totally purchased by the DGT (see Table 5.4.). The preliminary semi-automatic exchange and teleprinters were provided by OKI. OKI was the partner of Far Eastern Electric Industry Company which was the joint venture partner of GTE in 1973. The leased semi-automatic Siemens system was immediately supplied by WUI to Kaohsiung in 1970 in order to serve the relocation of Sprague Corporation. WUI, one of three U.S. international telex IRCs in Taiwan, provided two circuits to New York for Sprague, connecting its headquarters in Worcester, Massachusetts and Concord, New Hampshire (EPZ Concentrate April 9:4, pp 15; MASS HIGH TECH, Oct. 28-Nov. 10 1985; YBCs 1970).

The automatic telex system and teleprinters were purchased in 1972. This equipment fully replaced the systems in Taichung and Tantzú one year before Ampex moved into the Tantzú EPZ⁵ (DGT Monthly News, 6:5, pp 56; YBCs 1972:264).

The full-automatic telex system was purchased from Bell Telephone Manufacturing Corporation, subsidiary of ITT, in 1973 when ITT decided to establish one assembly plant in Taiwan. This system was advanced by a 2,300-line Siemens system in 1975.

⁵Tantzú EPZ, again, was created by NT\$ 32,876,000 from Sino-American Fund for Economic and Social Development. (Ke, 1983:25)

B. Toll Carrier System

The toll carrier system consisted of two facilities: (1) inland carriers: a. underground cable carrier; b. co-axial cable; c. trans-island backbone microwave; d. PCM carrier; e. voice frequency channel; (2) overseas gateway: a. transhorizon microwave; b. earth station. All facilities were advanced by the same projects noted above from 1965.

1.A. Underground Carrier System

Local expenditure was disbursed by the DGT for: (1) rerouting twelve circuits between Taipei and Taoyuan in August 1965 (Hsu, 1965:10); (2) expansion from Taipei to Taoyuan on 14 May 1968; (3) expansion of 696 circuits in 1976 (YBCS 1968,76). The First Japanese Yen Credit was disbursed in 1968 for: (1) expansion of 12 CH to 24 CH system; (2) adding 480 circuits, including 48 circuits in Taipei-Taoyuan, 24 circuits in Taipei-Chungli, and 72 circuits in Taipei-Hsinchu (DGT, 1966:36; TTA Research and Planning Board, 1967:167).

1.B. Co-axial Cable

The First Japanese Yen Credit was disbursed for the installation of 392 circuits of a 4 MC small diameter coaxial cable system between Taipei and Keelung in 1968 to start STD service between these two cities on 1 April 1970. This project was proposed at the request of the military (see Fang's comment in TTA Research and Planning Board, 1967:175). Once again, Keelung was chosen for the reason of its benefits to the U.S. military:

Three LST crews were also to assist in the waterborne logistical effort [for the Vietnam War, author noted]. The LST's belonged to the U.S. Navy port, Keelung on Taiwan. (Dept. of Army, 1975:116)

Nevertheless, General Instrument, as well as other electronics plants in north Taiwan, received several marine containers from this port (Berlain Liang, 1972:93).

1.C. Backbone Microwave

The expansion of backbone microwave was mainly financed by Japanese and American capitals. First, supported by the First Japanese Yen Credit, microwave linked Fengyuan (Tantzu EPZ) with the Central Government at Taipei in 1969. The second Ampex assembly plant moved there in 1973. Consecutively, the short-haul microwave connecting Taipei, Taoyuan, Chungli, and Hsinchu was built by Collins Company as the second track of communications for the overload of traffic on the "electronics industry highway" and for a growing industrial site farther south--Hsinchu (Hsinchu Office TTA, 1974:2-1,2). Finally, a GTE Italian factory credit directly contributed to its assembly plant in Hsinchu, one of the two largest Taiwan electronics firms, by expanding the microwave circuits along the west coast (Telecommunications in the ROC, 1977-8).

Basic Route Project DLF #114	Taipei--120----Taichung (circuits) 6,000 M.C. -----60-----Tainan -----120-----Kaohsiung
Expansion Local (1965-7) Local (1968)	Taichung--12--Tainan Taipei-----12-----Kaohsiung(132) Taichung--24--Tainan(36) -----24-----Kaohsiung 4,000 M.C.--24-Kaohsiung
1st Japanese Yen Credits (1968)	Taipei-----84----- (216) Taipei-----24-----Changhua Taichung---48 Taipei--12---Chunghsing Village --24---Fengyuan -----24-----Pingtung
IBRD (1970) Collins Radio (1973) GTE II Loan (1974)	Taipei--- 4 groups (48 circuits) ----Hong Kong Taipei-Taoyuan-Chungli-Hsinchu (360) the Taiwan West Coast (1,626 circuits): Taipei-----Kaohsiung --Hsinchu--Taichung--Chiayi--Tainan--Pingtung

(Source: CDM,24:12; TTA Research and Planning Board,1967;
Wang,1969; YBCs,1970-5)

1.D. PCM Carrier System

PCM (Pulse Code Modulation) was initially installed by the First EXIMBANK Loan. PCM functions as: (1) Time Division Multiplex for 24 CH PCM carrier telephone systems; (2) voice frequency amplifier. The major installations were located between Taipei and Tamshui (the location of Vidar-SMS Co.--the joint venture partner of PCM carrier manufacturer), 504 channels, Taoyuan and Chungli, 240 channels (DGT, 1972b:4-6).

1.E. Voice Frequency Channel/Terminal (VFC/VFT)

The VFC channel mainly carried domestic telegraph or telex during the interim period. For example, soon after the opening of Kaohsiung EPZ in 1966, three factories--Philco-Ford Micro-electronics, Chicago Telephone supply, and Taiwan Mitsumi--

requested telex service before the TTA and CGRA figured out the international/local telex exchange system. TTA technicians temporarily installed VF terminals between Taipei and Kaohsiung. Connecting with the voice frequency channel, the TTA provided the first local telex system in KEPZ on 1 May 1967. The TTA enlarged VFC capacities to serve General Instrument Micro-electronics and two other EPZs in 1968 (DGT Monthly News, 2:2, pp 53; 2:3, pp 30; YBCs 1973:255). Originally, the installation of this temporary carrier was funded by the U.S. aid program in FY 1959 which covered "18 Voice-Frequency Carrier Telegraph Circuits among Taipei, Taichung, and Kaohsiung" (CIECD, 1964b:39-40). The TTA further provided 144 VFCs in 1969. Taipei-Taoyuan, Taipei-Chungli, and Taichung-Tantzu were served by eight, four, and four circuits, respectively, in 1970 (YBCs, 1969-70).

Conclusively, this VFT installation project indicated two facts: (1) multinationals could force the administration to adopt new technology; (2) under the priority of export trade, bureaucracy used local resources to serve TNCs as much as possible even though the services were currently unavailable for the local community.

2.A. Transhorizon Microwave

Transhorizon microwave was the major gateway for outgoing telex messages after HF bands to Japan and U.S. were shut down on 20 June 1971. Except for four group-channels of the Taiwan-Hong Kong system which were installed by American Radio

Engineering Laboratories design and a World Bank loan, local expenditure was the major support to expand this system (YBCs 1969-76 and see following table):

circuits	1969	1970	1972	1973	1974	1975	1976
Hong Kong-Taiwan	17	3	9	6	2	3	12
Sino-Philippines					2	2	

2.B. Earth Station

The first Pacific earth station was established by an NEC factory loan at the end of 1969. This station mainly channelled the business transactions between Taiwan and Japan. The earth station also provided back up for outgoing messages between Taiwan and the U.S.. In fact, the most of increased INTELSAT III satellite circuits served the outgoing messages between Taiwan and Japan as follows (YBCs 1970-6):

circuits	1970	1971	1972	1973	1974	1975	1976
To Japan	4	8	8	3	16	4	19
To U.S.	1	1	3	3	9	1	12

These statistics show two significant facts: (1) satellite was critically important for Taiwan-Japan trade relations; (2) Japan and Taiwan were close partners in the electronics industry for assembling imported components through the Japanese production system after 1971 (International Economic Information Monthly, 27:6, pp 91-94).

The second Indian Ocean Earth Station was established by the NEC through the Second Japanese Yen Credit on 29 January 1974. This connection was of critical importance for Texas

Instruments (TI)⁶. Texas Instruments leased private circuits to send out its marketing information and design blueprints after 2 April 1977. The messages went through the Indian Ocean Region Satellite Communications Earth Station to its Level II Mainframe in Singapore at the speed of 9,600 b/ps (DGT R&D Yearbook 1978; Craig, 1981; interview with TI in 1993). This transmission was the fastest application on Taiwan. The DGT was forced to revise the current "Regulation of Domestic Data Communications"⁷ on 8 February 1979. Besides, the international telex gateway to Singapore was provided by the ITT in 1975 (YBCs 1975-77). The ITT provided ten circuits to Texas Instruments in 1977 under the following mandate:

Under terms of an agreement signed in 1973, TI uses International Telephone & Telegraph Corp. as its sole vendor for international satellite communications service. (Iversen, 1980:104)

5.5. The Network Followed the Track of U.S. Aid Legacy

A. The Framework

The telex network basically located the U.S. semiconductor industry on the sites where telecommunications had first been

⁶"The technology is transferred directly over and adapted to Singapore, ... Communication with the parent plant is instantaneous as the computers are linked through a satellite, which take 9 seconds. Production problems are thus solved locally or with the help of communication with U.S.." (an interview with TI in 1976, provided by Pacific Studies Center, Mountain View, California)

⁷This regulation was originally promulgated to serve business groups' interests. Again, this action followed the proposal of the U.S. Defense Communications Agency for installing AUTODIN overseas switch in Taiwan from 1968. (DGT Monthly News, 6:5, pp 46-7; Rose, 1969:15-16)

developed by U.S. aid, then later renovated by local sources and Japanese loans. This fact was proved by two pieces of evidences: (1) most branch offices of the semiconductor industry were scattered around the Taipei North Exchange; (2) assembly plants were erected around the three major cities which were connected together by west coast backbone microwave system (see Figure 3.2., 5.2. & 4.1., 5.3.).

The telex network was controlled by the ITA Central Exchange Office in Taipei. With the advanced STD switching system, subscribers sent and received their messages through the toll carrier, i.e., backbone microwave or voice frequency circuit, to/from the gateways, i.e., ITA offices, satellite earth station, and transhorizon microwave system (see Figure 5.4.).

This system was designed to serve the U.S. and foreign investors who were searching for cheap labour and the incentive of leased land in industrial districts. Successively, it facilitated the signing of contracts by the U.S. and foreign investors with their local customers, and, the shipping of orders to factories inside or outside industrial districts. This local cooperation was expedited by domestic telex service in 1973.

As a matter of fact, General Instrument had provided electronics components to the major U.S. assembly plants since 1972. Its customers included Philco-Ford, Admiral, RCA, Zenith, TRW, Motorola, Bendix, and Ampex, many others (Berlian

Liang, 1972:93). Meanwhile, the government also began to mediate between the U.S. assembly plants and local subcontractors to establish joint ventures. On the one hand, CIECD and the Bureau of Industrial Development of MOEA recommended local suppliers to the U.S. plants after 1971. On the other hand, the Investment and Operation Division of CIECD allowed the U.S. assembly plants or bonded plants to supply components to local industry or the U.S. multinationals after 1970 (CIECD Yearbook, 1970:112-3; 1971:101; 1972:91; EPZ Concentrate, 6:4, pp 18). It was not surprising that, when the local telex service began to operate, the first areas covered were Taipei to Taoyuan, Hsinchu, Taichung, and Kaohsiung (YBCs 1973).

Figure 5.2. The Locations of the Branch Offices of the U.S. Semiconductor TNCs in Taipei City (1964-1976)

Source: Abstract of Computer Resource 1980; DGT, 1966: Figure 3.5.; International Telex Directory ROC 1968-1977; TEAMA Membership Directory 1969-1980.

Figure 5.3. The U.S. Semiconductor Assembly Plants along the Taiwan West Coast (1964-1976)

Source: DGT, 1966: Figure 2.2.; International Telex Directory ROC 1968-1977; TEAMA Membership Directory 1969-1980.

Figure 5.4. The Domestic and International Telex Systems in Taiwan (1960-1976)

Compiled from: CGRA, 1970; DGT R&D Yearbook, 1971:144; Huang, 1978:126; Telecommunications in ROC 1968; 1974; ITA, 1976a.

B. The Structure of the Network Users and Manufacturers

Another significant fact was that many multinational assembly plants played a dual role--as the manufacturers and users of networks. The following list shows their involvements.

TNCs	Branches or Plants--Using the Network
GTE	<u>Plant</u> in Hsinchu--Telephone (AID #12 project: "Strowger" step by step of A.E. Co.); Microwave (FL2C-610096 GTE II Loan); <u>*Branch Office</u> on T'nhwa S.R.--Telephone (AID #12 project: 7,000-line Taipei East Exchange).
ITT	<u>Plant</u> in Panchiao--Full-automatic telex operation (Pentaconta 1,000A, BTM); IRCs in COMSAT.
Motorola	<u>Plant</u> in Panchiao; <u>Branch Offices</u> on Chungshan N.R. --"Microwave Remote Control System".
NEC	<u>Partners: Taiwan Telecommunication Industry Co.</u> in Chungho; <u>TTV</u> ; <u>Branch Office</u> on Chungshan N.R.--VHF Scattering System; "Greater Taipei Dial Service Network"; Pacific earth station; STD (World Bank).
OKI	<u>Partner: Far Eastern Electric Industry Co.</u> in Chungho and its subsidiary: Lien Chen Ltd on Chungshan N.R., continuously, was a partner of GTE--teleprinters and semi-automatic telex exchange.
RCA	<u>Consumer Electronics Division</u> : Plants in Taoyuan; <u>Electronic Components</u> : Plants in Taoyuan; <u>Television Picture Tube Division</u> : Plant in Taoyuan, <u>Partners: Tatung Co.</u> on Chungshan N.R.; <u>Sanpo</u> in Panchiao; <u>Chunghsin Electric and Machinery MFG Co.</u> in Chungho; and <u>China Development Co.</u> on Nanking E.R. Taipei; <u>Semiconductor Division</u> : Plant in Taoyuan; <u>Information Systems Division</u> : Plant in Taoyuan; <u>Partners, RCA-CMOS Project: ITRI</u> in Hankow St., the <u>Pilot Plant</u> in Hsinchu--* RCA Global Communications, Inc. on Sinyi Rd. as the IRCs of telex and telephone in COMSAT.

- * GTE, the only branch office in the eastern part of Taipei, created Taipei East Exchange TTA by AID #12 project in 1969.
- * RCA Global Communications, Inc., the only agency in the southern part of Taipei, moved there after ITA Central Telex Exchange was set up on Sinyi Road on 21 May 1973.

In other words, multinationals transmitted marketing information through their own parent technologies. This

performance was a crucial factor in the relationship between U.S. aid and early paradigm of the global industrial shift to Taiwan which was facilitated by the telecommunication administration.

5.6. Readdressing Telecommunications Policy under the World Bank Project

Packaged with the IBRD project, a policy reform had been underway since 1966. Fang pointed out that the World Bank initially sponsored the project and later transferred the managerial skills, as a requirement, to operate the disbursement. Originally, the World Bank was a participant in planning DGT policy rather than only a fund-raising agency for telecommunications expansion. Three necessary conditions the DGT had to meet before applying for funds from the World Bank:

- A. the long term development plan (for an eight-year future duration);
- B. a resume of financial condition;
- C. the economic return on investment. (Fang, interview in 1994)

The World Bank Appraisal Mission visited Taiwan in 1966 to address the following issues, as shown in its "Working Paper" in the 1970s:

In countries where the Bank has been involved in telecommunication development, its participation has often helped operating entities obtain an adequate measure of autonomy in accordance with sound public utility practice, to set tariffs at levels which allow a reasonable percentage of capital expansion to be financed from internal sources, to establish proper accounting systems, and to develop stronger management, planning and engineering capabilities. (World Bank, 1971:16)

The DGT did meet the three major conditions in two applications for the IBRD Loans from the late 60s to the early

70s. Telecommunications policy, under this influence, created an infrastructure for serving business, government, and military, and indirectly denied civilian access to telephone service.

A. The Long Term Development Plan

A.1. The first application covered the period of 1965-72. The significance of the long term plan was divided into three parts:

1. The expansion of telephone circuits had to cope with the demands after 1972. The design followed the rule of the World Bank:

The fundamental decisions in planning are those which relate to the basic network structure and which remain valid for 15 to 20 years ahead. (ibid, pp 9)

Basically, to keep a network serving "a full decade" of development, the communication system had to be standardized:

However, the advantage of standardization are such that most of the developed countries negotiate bulk supply agreements extending over a number of years and it is the concerted view that a change in the basic switching system cannot feasibly be undertaken more often than 10 to 15 years.... (ibid, pp 12)

Under the demand of standardization, the IBRD proposed:

Standardization and bulk supply agreements have also encouraged the establishment of local telecommunication manufacturing industries... with foreign collaboration arrangement or in foreign owned local factories. (ibid, pp 13)

This proposal directly supported the joint ventures between DGT, ITT and GTE as the Engineering Report suggested (see 5.4.A.2). Furthermore, the World Bank believed that switching system manufacturing could update the production of other

professional and consumer electronic products, i.e., semiconductors (ibid, pp:13).

2. The forecast of the growth rate of telerhone circuits was based on the report by an ITU expert, Mr. K.V. Pai, who conducted a comprehensive investigation of telecommunication service in Taiwan in 1965 (Pai,1965:10). The objects of analysis included infrastructure, finance, industry, telex, electronics knowledge, and regional development. As a result, in the IBRD application, the growth of telephone circuits was forecast in terms of "Power Consumption by Industry", "Industrial Production", "Highway Freight Traffic" and "Toll Calls".

Afterward, the design of the toll telephone network was finished with regard to the demands of recent trade development:

With the legislation of the Statute for Encouragement of Investment in 1960, some farm lands have been used as zones for industrial development. A number of industrial districts and export-processing zones have been constructed by the government. (DGT,1966:48)

Besides, the basic concept of STD service was determined by the DGT and the IBRD survey team (see Figure 5.1.) (DGT, 1965:11).

3. The IBRD also took other loans, e.g., AID #12, and the First Japanese Yen Credit, into consideration when the project application was formally delivered (DGT,1966:32-6). This was the basic approach of the IBRD as its experts proposed, in evaluating project application :

The Bank has met part of the foreign exchange requirements for urban, local, long distance, and international telecommunications facilities, and has sometimes helped to bring in other sources of funds through cofinancing arrangements. (Saunders et al., 1983:66, quoted in Sussman, 1987:92)

Mr. McNamara used the above guideline to advise the DGT to purchase the NEC switching system by applying the Japanese Yen Credit again. The result was also consistent with the standardization requirement (World Bank, 1971:18). Moreover, the World Bank even considered the feasibility of a telecommunications project, in terms of its related projects which were underway at the same time, as one of the conditions for approval, as Sussman pointed out:

The Bank's policies in telecommunications, consistent with its other sectoral programs, are premised on preference for trade "liberalization", private enterprise, government austerity, and foreign investment. (1987:92)

At that time, the World Bank financed China Development Corporation (CDC) with US\$ 18 million in 1970⁸. This amount exclusively financed the private enterprise. The World Bank realized that

during the 1960s Taiwan's industrial production grew at an average rate of 16% annually... but a process of diversification is evident from the increasing importance of new industries, such as electronics.... (IBRD Bank Press Release No.70/19)

The World Bank also disbursed US\$ 9 million for establishing vocational education and related training. The aim of the

⁸CDC was established by the International Development Association (one sector of the IBRD) in 1961. CDC received a total of US\$ 35 million from the World Bank during 1964-1967. (Yeh, 1981: 10-14)

project was to

... greatly increase the number of skilled workers required to sustain rapid industrial development... A junior college of technology will be established in Taipei and a similar institution expanded at Kaohsiung. (IBRD Bank Press Release No. 70/37)

A.2. In the second long term plan (1973-6) for the 2nd IBRD Loan application, the expansion of telegraph, telex and data transmission was strongly emphasized (DGT, 1971:43). This expansion was recommended by Mr. Hanselman during his second survey visit to Taiwan. He recalled:

As an initial step, a careful review was made of pertinent economic data for Taiwan available from reports made by the Government, CIECD, DGT... These data included... GNP,... industrial production,... exports, imports,... increase in TV sets,... Also data regarding the increases in the number of industrial organization, manufacturing firms, government offices.... (1971:1)

Also, he spoke about the pressure which the DGT faced:

During this period there have been substantial shortages of telephone... caused a great number of complaints and pressure from many sources, primarily from important industrial and manufacturing firms for whom additional telephone lines are vital adjuncts to their rapidly expanding operation. (ibid, pp 2)

He proposed the telex as the solution for satisfying the demands of the industrial firms:

... the potential market for Telex service appears substantial, particularly among large business firms having branches, warehouse, plants, subsidiaries, etc., in other cities. Many of such headquarters firms have need for rapid written communications, such as production data, sales information, financial reports, etc. (ibid, pp 21)

Finally, the demands of industry directed this long term plan to especially serve the corporate interests. The major expansions of telecommunications services were telex and data

transmission (DGT,1971:44):

Plan had been made to meet these requirements by the purchase of teleprinters for all leased lines both existing and proposed and for the inauguration of domestic telex service to extend the existing international telex service available in the Taipei area. To meet the strong demand for the data transmission service... DGT has made its mind up to introduce such service beginning 1971 first with the lease of TTA's private line data transmission circuits for various remote data processing services. (ibid,1971:48, also see n. 7.)

Meanwhile, the DGT decided on the first and last priorities of expansions in its Sixth Four-Year Plan (1973-76):

First: (1) First IBRD Loan for STD service; (2) Establishment of Indian Ocean Earth Station; (3) Semi and full-automatic telex exchange systems; (4) Central Telex Exchange installation plan.... (DGT,1972:68)

Last: city telephone, city manual switching, public pay-station, and PBXs installation and replacement. (DGT, 1972:69)

Moreover, to maintain the growing telex service, the DGT had to recruit enough technicians to the Department of Telegraph. The DGT estimated that 700-1,000 workers should be annually put on the line. The major source of this trained personnel would be the vocational institute (DGT,1972:89-94) which was partially set up by the World Bank's vocational education project of 1970s.

Two sub-plans of industrial development were also delivered in 1970. The DGT coordinated with CIECD to establish industrial districts. Tantzú and Nantzú were two sites which the DGT planned to link by ten, fifty telex circuits, respectively; but only a few local residential telephones would be built there (CDM,19:12, pp 8).

Finally, with the help of the U.S. know-how, this Sixth Four-Year Plan reinforced the DGT's planning skills. The DGT sent a Telecommunication Management Study Mission to the U.S. in 1972. Introduced by AID, the Mission associated with the U.S. experts who shared their experiences in "Planning and Decision", "Personnel Management" and "Overall Operation". The Yen inflation rate of 16.88% also forced the DGT to seek more U.S. supplies at the same time (DGT, 1972:72-3).

A.3. Two DGT long term plans for loan applications did not address any interest of residential subscribers. On the contrary, the DGT worried about the negative effect of reducing installation charges:

Such potential demand may even be higher in case some measures are taken to reduce the existing installation charge.... (DGT, 1966:37),

The World Bank did consider the reduction as a deficit in service:

A higher rate of increase may be achieved for a short period of a year or so, but at the cost of lowering service standards, with subsequent penalties of network congestion and lower quality service. (World Bank, 1971: 11)

However, the DGT also realized that the prohibitively high charges would counterbalance the economic growth (Pai, 1965:11; DGT, 1965:10). On the basis of the ruling party's interests, a bank loan for telephone installation was proposed by the Sub-committee of the Nationalist Telecommunications Division in 1955 (Nationalist Telecommunications Newsletter No.50:23). The regulation for the loan stipulated that some restrictions

should be issued when telephone lines could no longer be afforded by prospective subscribers (DGT,1966:45). For example, due to the reserve for business users, TTO had to restrict this loan to be applicable only for public officers, teachers and military members from 1969 (CDM,20:12, pp 22)⁹. This regulation favoured the security regime and business groups again. The Planning and Examination Board of the Nationalist Taiwan Telecommunications Division even suggested keeping the existing subscribers paying low monthly rental fees and holding the proprietary right as vendors of telephone assets after the AID #12 project was finished (Chin & Chu, 1966:24). KMT members' privileges were guaranteed by Mr. Hanselman's proposal: to keep the proprietary right as long as the installation charge was high (1971:19).

Finally, thinking positively, the high installation charge was another important financial guarantee for the World Bank project. This issue directly related to the resume for the financial report to the World Bank Appraisal Mission.

B. Resume of Financial Condition

In the Resume prepared for the visit of Mr. Robert Walsh (the World Bank expert) on 21 September 1966, the DGT questioned whether its current financial structure needed a review or not:

⁹Those three sectors consisted of either members of the Nationalist Party or its loyal subordinates. For example, KMT members occupied more than 50% of DGT employees (54.4% in 1969). (DGT Monthly News 8:12, pp 6-8; Monthly Newsletter of Nationalist Telecommunications Division, No.110, pp 10)

The balance has been financed through TTA's own resources, particularly from installation charge collected from new telephone subscribers. It is necessary now to review the whole financial situation in order to work out a feasible long-range budget. Advices from an accredited economic expert specialized in telecommunication administration are required. (DGT, 1965:11-12)

Actually, the DGT wanted a confirmation rather than a consultancy. The DGT had already showed the importance of installation charges as a source of funds from 1966 to 1973 (DGT, 1966:135):

<u>Source of Fund</u>	<u>Amount (NT\$1,000)</u>	<u>Percentage%</u>
Net Profit after Contribution	2,009,201	25.8
Depreciation Fund	2,003,419	25.7
Installation Charge	2,583,405	33.2
Subscriber's Deposit	222,200	2.8
Borrowings	970,635	12.5

Both the TTA and DGT Research and Planning Boards also proposed the importance of installation charges in contributing 36.28% and 33.72% to sources of funds in 1967 and 1972, respectively (CDM, 16:12, pp 26; DGT Research and Planning Board, 1972:263). As a result, Mr. Hanselman pointed out the effect of installation charge reduction:

The installation charges have provided a large proportion of the funds available for construction of new plant and other capital requirements- currently over 40%, exclusive of external borrowings. While..., to eliminate the charge at this time would probably restrict growth even further. (1971:19)

In the World Bank's view of the "Long Term Financial Plan", this income was treated as a major guarantee for receiving the repayment from Taiwan. As Figure 5.5. shows, the balance proved that the DGT could generate enough revenue to

Figure 5.5. The Long Term Financial Plan

* The differences created by TTA's re-estimation in 1967.

(Source: DGT, 1966:135-6; CDM, 16:12, pp 26)

repay the First IBRD Loan after paying out the local expenditure for expansion within the eight-year period (1966-73). Consequently, the World Bank's Report 630, the Project Performance Audit, declared one of five conditions--prohibiting any reduction on the current installation charge

of US\$ 350¹⁰ within the eight years (DGT,1969b:42). The result was just as ECAFE noted:

The developing countries in the world were likely to first provide a telephone service to the business and give a lower priority to residential connexions. (DGT,1969b:42)

However, this condition didn't affect the interests of the IBRD itself. Again, the DGT promulgated a new regulation, "Enforcement of Temporary Telephone Application" (1970), which favoured the World Bank officers by asking only U.N. experts to pay US\$ 12.5 and 25.00 as installation fees and deposit, respectively, before they got a telephone¹¹.

C. Economic Return on Investment

The last side effect of high installation charges was the profitable return, as the World Bank said:

It is no surprising to find that the economic return on investment in expansion of telecommunication services, when measured by willingness of users to pay for installation.... (1971:6)

Fang also appreciated that the World Bank had set another condition to keep 10% of fixed-asset net value (previously 6%) as the annual return on investment. Once the return was lowered down this quota, the DGT could revise the rates without Legislative Yuan approval. In fact, the TTA had reviewed its current financial situation in FY 1966. At the

¹⁰As Hanselman (1971:2) calculated, the real charge in Taipei had to add construction fees of \$25 and a deposit of \$25. The average annual income was \$290 and the annual income for electronics workers was \$180. (Tuan,1967:31)

¹¹This benefit also covered the U.S. warships which were stationed at the harbours of Keelung and Kaohsiung.

1967 Management Seminar, staff members adopted a reference book, A Telephone Development Project (written by Ericsson)¹², which recommended by Fang to survey the TTA financial base as follows (CDM,16:12, pp 27): (* Contribution to Government)

<u>The Survey</u>	<u>Criterion of Ericsson</u>	<u>TTA</u>
Revenue /Net value of	4.2%	30%
Profit Fixed Asset	17.0% (50%)*	12% (40%)*
Net profit	7.4%	6%

After examining the proposals for expansion investment adopted by this book, Fang came up with three suggestions for the World Bank project:

1. 30% of investment per subscriber line should be spent on building toll circuits, as Ericsson suggested;
2. to achieve this goal, the TTA could increase the reinvestment rate if the contribution to government remained low;
3. the reinvestment rate could also be increased through producing more profits (CDM,16:12, pp 28).

Therefore, the World Bank made another condition to set the maximum contribution to government at 25% of profit. By the end of 1969, the DGT had achieved net profit at 27.5% over averaged net fixed assets (DGT,1971:14).

However, this condition didn't cause any harm to

¹²This book was originally adopted by the U.N. expert to assist in planning telecommunications projects in developing countries. Ericsson was one of the bidders in open tender for the World Bank project.

government interests. Through the World Bank proposal of tariff revision, the government took great advantage of traffic growth by regulating a special contribution. This special arrangement adjusted the tariff rates of local telephone (monthly rental, public pay-station, additional charge) and domestic toll telephone on September 1 1965 (International Economic Information Monthly, 15:3, pp 98). The additional revenues were contributed monthly to the government (DGT, 1966:132). According to the World Bank survey, telephone subscriber lines and toll calls increased at 20% and 16% per year during 1966 and 1970, respectively. This growth allowed the government to harvest a great fortune (Hanselman, 1971:2-3).

Secondly, the government introduced a 10% provisional tax on international and domestic telephone and telegraph services from 1 July 1968 to 1974. Again, the U.S. Embassy and the U.N. agencies were exempted from this taxation (YBCs 1973:99). All the revenues contributed to the government's monthly payroll. This collection generated an efficient bureaucracy to serve export trade at the expense of the growth rate of residence toll calls (DGT, 1971:10). The World Bank realized its forecast in 1971:

The high returns are consistent, however, with what one would expect to be the expanding communication needs of a growing economy: for efficient administration of government and industry, for effective competition in business, for orderly marketing and the rational movement of goods, for reduction of industrial and business inventories, ... Telephone facilities in developing countries are useful mainly for government, business and

professional purposes. (World Bank, 1971:6)

Summary

The World Bank project covered the critical years of the growth of Taiwan export economy. The DGT, as one of the most important infrastructures, was provided with new management policy and equipment supplies through the IBRD loan. To cope with the relocation of global industrial sites, the DGT built the telex network on the existing international telecommunication gateway to the U.S. and Japan. This expansion was basically financed by the World Bank Loan and its related funds, e.g., Japanese Yen Credits, Eximbank Loans, and local expenditure, which were mediated by high-ranking personnel in CIECD and the DGT.

Successively, the World Bank reformed the DGT's policy-making. The IBRD directed the telecommunications administration to exclusively serve the industrial demands by transferring the know-how of long term financial planning. In Taiwan's welcoming climate, CIECD and the DGT promoted the local electronics industry to enter into the business partnerships with the U.S. TNCs who both used and provided the telecommunication service. Finally, the World Bank in fact turned Taiwan away from Sino-Japanese cooperation to join a new alliance with the Americans in establishing semiconductor manufacturing.

Chapter Six

The Technologies of Control "Controlled" the Technology

6.1. Introduction

This chapter inclusively interprets the development of the semiconductor industry introduced by the Taiwan telecommunication administration (as "technologies of control" [quoted from Wilson, 1988]) into this country. This chapter focuses on who were the beneficiaries from technology transfers or contracts of procurement in the semiconductor industry. This chapter concludes that the establishment of the ICs manufacturing, one of the new sectors of Taiwan exports, was generated from the competition between the U.S. and Japanese multinationals.

Moreover, this research challenges the current literature on the East Asia electronics industry which supports the theory of the "gang of four little dragons" (Henderson, 1989; Todd, 1990; Wellenius et al., 1993). Alternatively, based on an analysis of the structure of local capitals, this thesis finds that the Taiwan semiconductor industry, mainly established by the DGT, represented a specific sector's interests rather than those of the nation as a whole. The benefits were consistently distributed to the Nationalist businessmen and the Japanese/U.S. partners. The labourers and local community were excluded from the beneficiaries of this establishment. The civilian access to the electronics components and the national policy of local sourcing were either rejected or delayed by the

Nationalist security regime in Taiwan. These results provide another picture, by presenting the local perspective within the international context, which contrasts with the so-called "miracle of 'Taiwan'" which has been exogenously interpreted by previous management studies. Basically, Taiwan's semiconductor production was supervised by two different institutional levels of institution-setting:

1. Regulated by the Taiwan Garrison Command (TGC, later, Taiwan Garrison General Headquarter), the distribution of semiconductors (ICs, transistors, tubes) was tightly controlled by the Licenses and Control Department of TTA from the fifties.

2. Motivated by the CIECD, the DGT started get involved in semiconductor production after the Training and Research Centre for Telecommunications and Electronics, the source of the knowledge of semiconductors and integrated circuits, was approved by the U.N. in 1960.

Finally, Dr. Wen Y. Pan, Director of RCA Advanced Communications Laboratories, bridged the gap between the U.S. R&D for manufacturing technology and Taiwanese assembly know-how through the new telecommunication administration. This action channelled the interests of fabricating semiconductors to the Nationalist Party, the U.S., and the appointed Japanese partners as the original equipment manufacturers (OEM).

6.2.1. The Status of Semiconductors in a Security Context

The communications equipment was toughly regulated by the National Mobilization Law. This law assigned the Taiwan Garrison Command to regulate electronics components after the Nationalist Party fled to Taiwan in 1949 (China Telecommunications Almanac 1881-1971:352-3).

The enemies of the Nationalist regime in Taiwan tried to use radios twice to overthrow the KMT regime. The first event happened after the Incident of 28 February 1947. Formosan used radio to propagate the independent movement and ask people to join the guerrillas (March 29 1947, New York Times). The second event was the radio war between the two sides of the Taiwan Strait (i.e., Nationalist v.s. Communist) from 1952 (Communications Gazette, 2:8, pp 2). As a result, radio transmitters and receivers were toughly regulated in regard to national security. Being the basic components of radios, vacuum tubes and transistors (later, semiconductors) were regulated by the security regime from 1950. That was one of the permanent rules of the Nationalist Party on communications issue in Taiwan.

After the Nationalist regime retreated to Taiwan, the Taiwan Garrison Command asked the TTA to shut down all the exclusive radio stations on this island in June 1950. Moreover, the Taiwan Garrison Command requested the Postal and Telecommunications Department of the MOC to register all radio wave engineers who were not hired by the DGT (CDM, 4:12, pp 66;

Communications Gazette, 4:1, pp 10).

Subsequently, the primary regulation was promulgated for the Formosan tube radio assembly plants established in Taiwan in 1951. The Taiwan Garrison Command comprehensively supervised through two levels of regulations, the circulation of components. In the first place, the TGC licensed the import/export of components. Once the supplies were imported or locally moved, TGC stipulated that the dealers had to report every detail of applications and transactions made by local buyers (see Table 6.1.).

Table 6.1. The Regulations of Semiconductor Circulation

Regulations	Stipulations	Date
Level I		
<u>1. Rules of Application for Import Licence & Transport Certificate of Radio Supplies</u>	<u>MOC and MND respectively ruled the civilian and military users; the transport should be supervised by the Police Dept., military headquarters, Custom Office and TTA; the inventory of radio transmitting equipment was regularly supervised by the staff of the MOC.</u>	18 October 1951
<u>2. Rules of Application for Import Licence and Export/Transport Certificate of Radio Supplies</u>	<u>Added the export regulation; all applications must submit to the MOC; during mobilization, all holders must register at Taiwan Garrison General Headquarter.</u>	5 January 1961
<u>3. Rules of Application for Import Licence and Export/Transport Certificate of Telecommunication Equipment</u>	<u>Wire and wireless equipment were regulated altogether by this single law; Wire equipment was excluded from the checklist but wireless components were not released from the list.</u>	17 Feb. 1967

Level II <u>1. Martial Law of Radio Equipment</u> (Taiwan Garrison Command promulgated)	<u>Owners of tubes and radio transmitters; manufacturers and repairmen of radio equipment must register and be approved by TGC and TTA before running the franchise suppliers. Without registration, transaction is prohibited. Removal, export, or import of equipment must inform the TTA and be approved by TGC.</u>	13 Dec. 1951
<u>2. Mobilization Rules of the Radio Equipment</u>	<u>Licenses were classified as manufacturer, dealer, and repairman.</u>	9 Oct. 1954
<u>3. The Enforcement of the Protection Act of Communications Equipment During Wartime; Revision of Regulated List</u>	<u>Radio equipment was supervised by the License & Control Dept. of TTA.</u> <u>Items under protection:</u> (1) wireless communications equipment; (2) supplies of radio and television; 3. tubes and transistors.	14 March, 27 May 1961
<u>4. Mobilization Rules of the Wire & Radio Equipment; First Amendment</u>	<u>Added tubes, transistors, television and radio receivers to the item list.</u> <u>In coordination with MOEA:</u> export/import of switchboards, telephone sets were released from the list; tubes and transistors functioning as transmission were regulated.	5 Oct. 1963 13 March 1967

(Source: Communications Gazette, 11-2; 2:1; 4:10; 8:3; Communications Regulation Monthly, 8:3; YBCs 1961-2, 63, 67)

Being the end-users of transistors, wire equipment manufacturers were also regulated by the same types of rules, e.g., Rules of Application for Import Licence and Export/Transport Certificate of Wire Supplies (22 October 1952) and Mobilization Rules of the Wire Equipment (22 October 1952)¹.

¹However, the wire equipment suppliers were released from tough regulation in 1967 due to the start of crossbar switching system production by Taiwan Telecommunication Industry Co. and Far Eastern Electric Industry Co. (Communications Regulation Monthly, 8:3, pp 8; DGT R&D Yearbook, 1974:414).

The jurisdiction of the Licenses and Control Department was authorized by Article 15 of the Telecommunications Act of the ROC, in 1958:

Telecommunication materials and apparatus shall not be imported, exported or transited without a license issued by the Ministry of Communications.

However, under Martial Law and Mobilization Rules, the Taiwan Garrison Command was the almighty regime in controlling all issues of semiconductor distribution. TGC jurisdiction was authorized through two provisos in the Mobilization Rules of the Wire and Radio Equipment: (1) to be manufacturers of wireless equipment, suppliers had to be approved by TGC before registering at MOC (Article 3); (2) for enterprises to hold the effective license or certificate, documents had to be reviewed by TGC after being issued from the MOC (Article 12) (China Telecommunications Almanac 1881-1971:352-3). These stipulations granted the final veto power to the Taiwan Garrison Command in case of any critical situation. The License & Control Dept. rubber stamped this regulation. As a regime of ideological oppression and loyalty enforcement rather than one of electronics expertise, the Taiwan Garrison Command excluded all disobedient applicants (who were potential threats to the Nationalist Party) from this business.

The Taiwan Garrison Command dispatched inspectors to every place where transactions were processed, including, the Telecommunication Supervision Office in each EPZ, bonded

plants, corporations, industrial district, airports and post offices. Hiding behind the License & Control Office of TTA, TGC made the final judgment on every critical case (CDM, 20:12, pp 30-1; EPZ Concentrate, 2:2, pp 8).

TGC classified the tubes, transistors and integrated circuits according to their different applications and then issued a notebook to the License & Control Offices. The inspectors also regularly checked the inventory reports of franchise suppliers. No transaction of business or transport of shipment could begin without the approval from the Taiwan Garrison Command (Science and Technology Information Center, 1973:193-195). Finally, the DGT completed the circular supervision (see Chart 6.1.) by promulgating the Rules of Telecommunications Service Inspection on 8 September 1961. The DGT dispatched its senior technicians or business representatives as "inspectors on circuit". The position of inspector was a full time job; the candidate was required to be proficient in English (e.g., personnel from the U.S. TC program) and knowledgeable concerning the Licenses and Control service. Inspector I.D. cards had to be printed in both Chinese and English. Under the cover of market information collection or a service questionnaire, an inspector could visit each telephone subscriber (residence or corporation) in order to find any of their violations according to the conditions and terms of radio and wire equipment.

To assist this institutional security structure, a

reemployment of retired military members was promoted by the government. First, the staffs serving each "Personnel Department" of a U.S. multinational assembly plant, were almost all the Chinese military managers who had retired from the Liaison Service of the U.S. MAAG and the U.S. Air Asia of Tainan (Arrigo, 1983:4). Secondly, each EPZ recruited retired servicemen as the custodians on the recommendations of the Vocational Assistance Commission for Retired Servicemen (Business Week, 11 July 1970, pp 38; EPZ Concentrate, 1:9; 1:11, pp 13). Thirdly, the Directors (1965-1980) of the Warehousing and Transportation Centre of each EPZ were almost all designated to the graduates of Wampho Army College (EPZ Administration, 1987:273).

This omnipotent supervision of semiconductor circulation prevented any dissenting group or pro-independence Formosan from access to this technology which was promoted by national development planners. However, the tough regulations encountered complaints from the Nationalist businessmen chosen by the security regime twenty years before. At the end of the sixties, through the CIECD, the local electronics industry requested deregulation. Both sides reached a compromise to ease control on their performances, but not on the nationwide freedom of civil access.

6.2.2. The Status of Semiconductors in a Trade Context

The cumulative complaints concerning tough regulation reached a climax in the late sixties. According to the "Resume

of Key Notes for Electronics Industry Development" in 1971, Fang announced a clear direction to eliminate the barriers to circulation of transistors (Industrial Newsletter, 1:2, pp 6). The CIECD inaugurated the revision of current regulation in 1970 as follows:

Table 6.2. The Revisions of the Regulations of Transistor Circulation

Review Action	Proposal and Deregulation	Date
<u>1. The Working Group for Review the Rules of Economic Development.</u>	<u>By the order of Chiang Ching-kuo, Deputy Prime Minister, the review procedure was started.</u>	1 June 1970
<u>2. Telecomm. & Post Dept. of the MOC convened a review meeting.</u>	<u>MND, MOEA, CIECD, Ministry of Finance and National Security Bureau concluded the proposal: (1) tubes, transistors and ICs should be continuously regulated only for their transmission capacities; (2) the new "Joint Office" of MOC & Taiwan Garrison General Headquarter processed the application and review together.</u>	25 January 1971
<u>3. Working Group of Electronics Industry Development of the CIECD</u>	<u>Released transistors from tough regulation; established Joint Office of MOC and Taiwan Garrison General Headquarter for small and medium sized business application.</u>	March 1971
<u>4. 7th Joint-Conference on Financial, Economy and Monetary</u>	<u>The proposal for Joint Office was assigned the MOC to study.</u>	July 1971
<u>5. MOC</u>	<u>MOC cooperated with Taiwan Garrison General Headquarter to set up Joint Office.</u>	July 1971

<u>6. Amendment of Rules of Application for Export Certificate</u>	<u>The application fee applied to export certificate application.</u>	17 April 1972
<u>7. Amendment of Mobilization Rules of Electronics Equipment</u>	<u>Reduced the regulated items to only:</u> (1) radio transmitter. (2) active components capacity by 1W transmitting power and 3 MHz frequency onward.	21 June 1973
<u>8. Amendment of Rules of Application</u>	<u>The regulated list was reduced to only two items above.</u>	29 Oct. 1973
<u>9. Amendment of Rules of Application</u>	<u>Active components could be brought in by person who was authorized by schools, or organizations and corporations.</u>	16 Sept. 1977
<u>10. Amendment of Rules of Application</u>	<u>Authorized inspectors in TTA, EPZ, Corp. and industrial district to directly issue the license and certificate, except for equipment by personal application.</u>	24 Oct. 1979

(Source: Communications Regulation Monthly, 20:10; Industrial Newsletter, 1:2; Science and Technology Information Center, 1973; YBCs, 1970-73, 78)

Each final decision above was made by both Chiang Ching-kuo, Deputy Prime Minister and Yen Chia-kan, Prime Minister (Lam, 1992:153). The actions of revisions were inspired by their relatives in the electronics business. Chiang Hsiao-yung, son of Chiang Ching-kuo, founder of Chunghsin Electric & Machinery MFG. Corp., involved in a joint venture of picture tube production with RCA; Yen Chun-tai, son of Yen Chia-kan, was assigned the Director-General of Sprague Taiwan Corporation by the parent company early in 1970. Meanwhile, the Economic Daily News, the voice of the electronics industry, began publishing with KMT support. The press license had been transferred from the Public Tribune after Chiang

Hsiang-chuan (Speaker, Taipei City Hall and the President of the Taipei Telephone Progressive Association) took over its shares through KMT conspiracy in 1964. Through KMT mediation, Wang Ti-wu (subaltern of Chiang Kai-shek) obtained the lucrative "License of Print" (license issue was frozen after 1960 by the KMT). This press also began publishing in 1967 with a DGT subsidy in the form of a discount on telegram transmission (Chen and Chu, 1987:80,130; YBCs, 1950-66).

As a result, the regulation reform was mainly lobbied by businessmen to build a favourable climate for transactions. Not a single revision was aimed at eliminating any barrier to civilian communications rights. First, the reform never covered the general civilian application. Secondly, the semiconductors, functioning as radio wave transmitters, were never released from the regulated list for certificate requirement. The reform basically served the performance of electronics plants and kept regulated semiconductors out of the hands of general civilians. As a result, it denied the civilian access to this technology, even though the imports of transistors grew, silencing those who would criticize or intervene in the cooperation between the authoritarian regime, the ruling party's industry, and the multinationals. The procedure for application for a license/certificate, which was supervised by the Taiwan Garrison Command, is shown in Chart 2.1..

Chart 6.1. The Procedures for the Application for the License/Certificate of Import/Export and Transport of Telecommunication Equipment Application

Source: MOC, 1985.

6.3. The Strategy of Semiconductor Manufacturing Transfer--DGT as a Mediator by Its Manpower and Local Sourcing Policy

In failing to establish cooperation between the U.S. assembly plants and local subcontractors for semiconductor production (see Table 6.3.), the DGT was forced to reconsider

Table 6.3. The Local Sourcing of Semiconductors for the U.S. Multinationals

The U.S. Multinationals	the Local Sourcing of Semiconductors
1. Ampex	Parent and General Instrument.
2. General Instrument	none (from Parent in U.S.).
3. Motorola	none (from Parent in U.S.).
4. Philco-Ford	none (from Parent in U.S.).
5. RCA	Parents (U.S., Hong Kong, and Japan) and General Instrument.
6. Texas Instruments	none (from Parent in U.S.).

(Source: Science and Technology Information Center, 1973:11-68)

the strategy for forming local counterparts². Basically, the DGT could take advantage of two local resources to start the Taiwanese semiconductor industry. First, the DGT hired many graduates from Chiao Tung University who were uniquely knowledgeable concerning semiconductors in the academy or assembly plants to run its own semiconductor production. Secondly, the DGT used local procurement to attract the U.S. and Japan multinationals to invest in joint ventures of telecommunication equipment production in Taiwan. Through this connection, semiconductor manufacturing would be transferred from parent companies to local partners.

A. The Original Design

On the basis of the institutional security system, the DGT

²Only the local know-how of assembly skill was transferred from the U.S. multinationals (e.g., through the promotion of an Overseas Chinese branch manager of Philco-Ford to President of Asionics Taiwan Inc.). This spill-over effect was performed by the coalition of the China lobby and the U.S. (R&D and Evaluation Commission ROC, 1986:28; Schreiber, 1970:21).

started to evaluate the current situation of the Taiwan electronics industry which was overshadowed by the U.S. and Japanese multinationals' interests. Fang addressed his considerations at the Asia Electronics Conference in 1969:

The purpose of the Conference is to offer people in Asia and Oceania an opportunity to discuss about international cooperation in the field of electronics... As telecommunications are closely related with the rapid progress of electronics industries. (DGT,1969b:106)

Originally, the correlation between electronics and telecommunications was made by the progressive application of integrated circuits. This idea was promoted by the World Bank (see Ch 5.4., A.2 and 5.6., A.1.1) and the DGT Advisor, Wen Y. Pan, during the late sixties. Wen Y. Pan, an Overseas Chinese and a graduate of Shanghai Communications University, worked at the CGRA China for a short time before he left for Stanford University. Pan was awarded by a Ph.D. in Electronics Engineering at Stanford University and earned a high rank in RCA. After his critical suggestion for satellite communication won credibility within the DGT, Pan was assigned as an advisor in the Research and Planning Board of the DGT. The first consensus between Fang and Pan for future development was reached after two conferences of the Chinese Institute of Engineers in 1968 and 1969. Fang decided to adopt the specification of the Bell electronics switching system (ESS) (DGT Research & Planning Board,1976:23). Pan pointed out the goal of this decision in a speech:

4

of/de

4

PM-1 3½"x4" PHOTOGRAPHIC MICROCOPY TARGET
NBS 1010a ANSI/ISO #2 EQUIVALENT

PRECISIONSM RESOLUTION TARGETS

The advent of microelectronics marked the solid state technology. Both monolithic silicon and hybrid integrated circuits will undoubtedly become the predominant functions of increasingly more electronic apparatus and systems in the 1970's and beyond.... (1968:145)

In other words, the ESS system could transfer the hybrid integrated circuits manufacturing industry to Taiwan if Taiwan locally established joint ventures for ESS production. This goal was twice chosen as a note and a key sector, respectively, in a long term plan of electronics industry development (Industrial Newsletter, 1:2, pp 4-5). The ESS production contributed to the upgrading of the Taiwanese semiconductor industry from: (1) intensive cheap labour assembly line to high-tech manufacturer; (2) consumer electronics production to industrial application design.

Successively, Pan also introduced the research and design properties of RCA and predicted the future trend of the ICs market. His remarks had a critical influence on the semiconductor policy of the TL. The TL started establishing semiconductor laboratories in 1972 under P.H. Kong's directorship. TL delivered the key notes of the developing local semiconductor industry in 1975. It predicted three profitable manufacturing areas in terms of the ICs market trend (DGT R&D Yearbook 1975): (1) Monolithic ICs: a. Bipolar; b. Complementary MOS (Metal Oxide Silicon); c. N (N-channel) MOS; (2) Microwave Integrated Circuits (MIC); (3) PCM--its application onto switching system which was on the basis of Stored Program Control (SPC).

To keep abreast of these manufacturing developments, the DGT arranged some exchange programs with the U.S. through the core members in R&P Board, TL and ITRI, for its applications during the next ten years.

B. The Performance of the U.S. Technology Transfer

Began from the critical recommendation of Wen Y. Pan, the ICs manufacturing transfer project was simply decided on an hour long breakfast meeting between Fang, Su Jiao (Minister of the MOC), and Fei Walter H. (Secretary General of the Executive Yuan) in February 1974 (Yang, 1989:129). The design of project had been inaugurated after the Research and Development Meeting of the Electronics Industry was established by the Chinese Institute of Engineers in 1973. After the breakfast discussion, Fang and Pan jointly delivered the formal proposal to the Ministers of the MOC and MOEA as follows (P.H. Kong, 1977:15):

1. Major transfer technology: ICs--CMOS, NMOS; Monitor--Liquid Crystal Display (LCD), Light Emitting Diode (LED).
2. Three working terms: a. cooperation with the U.S. factory; b. development of civilian and military applications; c. transfer to business application.
3. Establishing R&D Sub-committee of Electronics Industry and co-working with EIRC/ITRI, TL, and the Electronics Institute of Chiao Tung University.
4. The personnel of sub-committee: Co-chairperson, Fang, and Wang (Dean of ITRI); Wen Y. Pan, Advisor; P.H. Kong, Secretary-General (successor: T.I. Ho, Director of TL and Hu Ting-hua, Special Research Fellow of EIRC).

The EIRC (Electronics Industry Research Center) was formally established on 1 September 1974. Kong was the first director. Hu, Ting-hua succeeded him on 31 August 1976. Both

of them were associated in the Institute of Electronics, Chiao Tung University under the auspice of the U.N. Special Fund.

The Technical Advisory Committee (TAC) was established in the U.S. by Pan on 24 October 1974. One year after the invitation of the technical cooperation program was addressed to the top-14 U.S. semiconductor corporations, the TAC accepted RCA's proposal. ITRI signed the contract with RCA on 5 March 1976. MOEA disbursed the total expenditure--US\$ 1.2 million--through the previous contract with ITRI dated on 23 October 1975. From that time, a three-term project--"IC Demonstration Plant Plan"--was started to invite a group of Nationalist businessmen to harvest the benefits of technology transfers. The formation is shown in Figure 6.1..

This transfer project exactly followed Pan's recommendation (for the U.S. interests) and explored the application of the CMOS project by integrating the current DGT resources (directed by Fang's TL) with the Electronics Institute of Chiao Tung Univ. (funded by the U.N. Special Fund) and the Nationalist's electronics industry (protected and supervised by TGC).

C. The Application of the Project to Telecommunications

After the RCA-CMOS project was started, Pan was appointed as the core member of another committee--Telecommunications Advisory Committee of the DGT in May 1976. This committee recommissioned almost the same members as TAC in the RCA project. The committee planned the RCA project to further

supply the semiconductors as local sources for telecommunications expansion. This design increased the members of the Nationalist beneficiaries and the U.S. partners (see Chart 6.2.).

Externally, this strategy politically defeated the Japanese specification after the ROC-Japan relationship was terminated in 1972. The U.S.-Nationalist joint ventures won a victory in signing the contracts with the DGT to use ICs manufactured by RCA/EIRC on the one hand, and harvesting the local procurement of digital and data communications system provided by the DGT on the other (see Table 6.4.).

Figure 6.1. The Outline and Process of ICs Manufacturing Project

Source: Duh, 1977:32; Electronics Development, No.21; EIRC/ITRI, 1978; ERSO/ITRI, 1983; ITRI, 1976.

Table 6.4. The Procurement of Telecommunications Equipment from DGT, 1978-1981, Unit= NT\$ Thousand Dollars.

Items	Local Sourcing	Overseas Sourcing	Total
Customer Premise Equipment of Information Users	2,250,674	279,000	2,529,674
	89.0%	11.0%	100%
Line-Plant Equipment	12,624,314	696,636	13,320,950
	94.8%	5.2%	100%
Switching System for Data Communications	14,653,365	2,691,504	17,344,869
	84.5%	15.5%	100%
PCM and others	7,721,082	2,105,532	9,826,614
	78.6%	21.4%	100%
Total	37,249,435	5,722,672	43,022,107
	86.6%	13.4%	100%

(Source: DGT 1982:4)

As planned by the DGT, the further application enhanced the capacity of Taiwan electronics industry by processing the RCA project in Hsinchu. Thus, the application project supposedly attracted the U.S. factories to found joint ventures (with the Nationalists partners) in Taiwan to supply the advanced telecommunications equipment to the local market. Taiwan gained the technology and installed the data communication system. The U.S. suppliers produced equipment by paying cheap wages to Taiwan technicians. As the address notes of the First Session of the ROC--USA Economic Council by the Electronics/Telecommunications Group in 1977 indicate, DGT clearly introduced this new incentive for the U.S. investment:

...in the wake of the enforcement of the revised Statute for Encouragement of Foreign Investment, are reflected in the ambitious programs of Hsinchu Science and Industry Park and the establishment of the IC Center..., the U.S. electronic industries show keen interest in this endeavor and would make on the spot survey of the climate. (DGT, 1977:3)

Major benefits could be guaranteed to the U.S. by low wage:

... our sound school system which turns out a good supply of educated engineers, technicians and highly productive skilful labors... They are available at the costs far below the current standards in Japan. (Kung, 1977:3)

And the DGT promised a profitable joint ventures:

...most of the telecommunication equipment and material to be purchased by the US Dollars 1.8 billion investment program are expected to be supplied by domestic manufacturers,.... (Mao, 1977:3)

Internally, the technical strategy, serving the Nationalist-U.S. alliance, was clearly addressed by Pan in a speech in 1976. According to his remarks, the application of ICs manufacturing transfer should be directed by the following recommendations:

1. "To achieve the goals of rural and national telecommunications policy, TL should invest in two facilities to overcome the island's geographical constraints":

A. Message Switching System (MS): this facility transmitted messages through the computer-controlled store and forward functions. The project first brought Hewlett (the schoolmate of Pan in Stanford) & Packard (HP) to cooperate with TL for the MS system design and installation. Secondly, a computer-aided telephone directory information system was functioning by HP1000 computer to serve the Hsinchu Industrial Park in 1976. Thirdly, HP integrated EIRC's Chinese Business Machine into the HP2100 system (DGT Monthly News, 10:5, pp 7; 10:8; Telecommunications in the ROC 1975-6; YBCs, 1977:338).

B. Microwave Integrated Circuit (MIC): through the RCA's associate membership of SRI (Engstrom, 1967), Pan successfully

convinced SRI to sign the accord of technical cooperation with the DGT on 10 November 1975. These programs included "personnel training, radio and communication electronics, systems analysis and planning, operations research, and management information systems" (Fang, 1976:27). The MIC program, the first internship in SRI, was finished at the end of 1977 and then attracted the U.S. Farinon Electric Company to produce the local supply in Taiwan. The mini-microwave system, designed by the SRI training course, mainly served the rural industrialization policy (DGT Research and Planning Board, 1972:265; TL,1977:100; Taiwan Telecommunications Technical Quarterly,18:4,pp 62).

2. "To advance technology and enhance efficiency of telecommunications system, the administration should use CMOS or Bipolar ICs as the cross point of ESS":

The second suggestion directly linked the RCA project with the current joint ventures between the DGT and ITT & GTE (DGT Monthly News,10:5, pp 7; YBCs,1977:340). As a result, the Hybrid ICs-based ESS, a major manufacturing transfer in the ITT & GTE joint ventures, was enhanced by CMOS technology. Moreover, the Bipolar ICs advanced MIC and telephone ICs which were the peripheral equipment of the ESS system.

3. "To install a computer-mediated telecommunication system, TL should invest in the 'Bipolar ICs Project'":

This third recommendation directed the TL to cooperate with the second term of the RCA project for bipolar ICs manufacturing transfer. RCA basically transferred bipolar ICs application to design the central processing unit (CPU), and

stored program control in ESS. Again, this project mediated a cooperation between TL and ITT & GTE joint ventures. Indirectly, TL contributed to the R&D of EIRC telephone equipment through supplying bipolar ICs (Chang, Meng-yu, 1983:54-7; DGT Monthly News, 10:5, pp 8) .

4. "To test the specification of ESS and its components, TL should link ITRI's CMOS project with ITT in manufacturing Hybrid ICs and switching system":

This fourth suggestion finally suggested that TL should closely supervise the local suppliers in the transfer project to decide who were qualified to meet the standard of local sourcing of the ITT & GTE joint ventures (DGT Monthly News, 10:5, pp 10) .

One spin-off of these electrification, digitalization, and computerization systems was the creation of the Computer Aided Design (CAD) Centre. The idea was introduced by Pan at the DGT 1976 Management Seminar. The CAD centre was basically established by two facilities: (1) data transmission; (2) computer centre.

The data transmission was facilitated by PCM carrier equipment. Under Fang's direction, a joint venture between Vida (the U.S. parent--Continental Telephone System Co.) with Sun Moon Star Corporation was established in 1974 in Tamshui, through the First EXIM Bank loan, to produce the PCM carriers (Fang, 1976:26) .

The TTA computer centre was contracted out to the U.S. Control Data Corporation (CDC). A Cyber-72 system was

installed in August 1974. Later, a completed network was hooked up with a group of similar-typed centres in TL, Chung-Shang Institute of Science and Technology, CDC, ITRI, and the Electronics Institute of Chiao Tung University consecutively over the next five years. These facilities mainly served the on-line operation of CAD for the RCA project. (Fang, 1976:29; Wang, Chin-tu, 1976:8-10).

Originally, the design of a computer communication network was mainly inspired by the U.S. Dept. of Defense:

The countrywide Computer Communication Network of the Advanced Research Project Agency (ARPA) sponsored by the U.S. Defense Department is typical of its kind of the development.... (Fang, 1976:28)

Five years before Fang made this note, the MOC had already tested the real-time computing operation at TL, Chiao Tung University and the Data Processing Center of the Executive Yuan in 1972. Successively, the DGT joined the 7th Session Hawaii International Conference on System Sciences in January 1974. Under Kong's supervision, the DGT delivered a research paper--"A Radio-Linked Computer Communication System in Taiwan". It was also the first time for the DGT to study the proposal of ARPAnet--in the name of Aloha: a "Microwave Random Access Computer Communication Network" (i.e., a wireless packet switching system) (YBCs, 1972:65; 1974:65-6).

Again, the beneficiaries of ARPAnet had already established a close partnership with the DGT through SRI since the mid-seventies. SRI, as a receptacle of ARPAnet project, stored the archives and hired the scientists who had

previously worked for ARPA (Rheingold, 1985:209). Moreover, GTE took over the civilian spin-off of ARPA--Telenet Communication Corporation in 1979. ITT and RCA ran the IRCs for the overseas service of Telenet and Tymnet under the name "Universal Database Access Service" (UDAS) in Taiwan. After December 1979, ITRI and the U.S. multinationals, such as General Instrument and RCA, were the major subscribers and receiving their benefits from this Sino-American cooperation (CDM, 29:12; DGT R&D Yearbook, 1982:275; 1983:220; Interview with UDAS DGT in 1993).

After reviewing those applications, it is clear that under the directorship of Fang, the DGT virtually followed Dr. Pan's guidelines to generate TL's semiconductor industry policy and establish the ICs project in the areas of design, manufacturing and testing (CDM, 23:12). The procurement for those projects described above was mainly contracted out to the U.S. suppliers and the Nationalist-American joint ventures.

D. The Display of Interlocking Interests between the Nationalist Party and the U.S.

After creating a firm cooperation with the U.S., the DGT functioned as a channel to distribute the interests to the candidate for benefits--those in the electronics industry who had filtered through the web of security regime in the past thirty years. In Figure 6.1. and Chart 6.2., the participants in joint ventures are grouped together; it is become clear that the partnerships existed in the form of U.S.-Nationalist

coalition. Table 6.5. shows this concrete fact.

Table 6.5. The Coalition of the U.S.-Nationalist Participants within IC Project and Telecommunications Application

Participant	Interests from/to U.S.	Position in Nationalist Regime
1. The Electronics Institute, Chiao Tung Univ.	<u>"Several U.S. telecommunication specialists came to ROC under a U.N. Special Fund project to inject new blood in to communication network design, microwave electronics, computer and electronic control system in 1962."</u> General Instrument assisted the PhD Program of Semiconductors in 1967.	<u>National university; established Taiwan and Cheng Kung Univ. to open "Transistor Electronics" courses from 1966-9; cooperated with Sampo, Tatung, Unitron, Orient Semiconductor, Fine Products Microelectronics to develop ICs of TV receivers in 1973.</u>
2. Chinese Institute of Engineering	<u>New York agency served the investor of American or Overseas Chinese.</u>	<u>Awarded Fung the medal for his directorship of DET in 1976.</u>
3. Hu Ting-hua	<u>Master student of Semiconductors in Chiao Tung (1964-1966); PhD, Solid State Physics, Missouri Univ.</u>	<u>Co-founder and second Director of EIKC; Consultant of Fine Products Microelectronics Co.</u>
4. Chang Pang-yan	<u>First PhD of Semiconductor (1970) graduated from Chiao Tung Univ.; founder of Fine Products and Taiwan Microdevices.</u>	<u>Director in National University of Cheng Kung; Dean in College of Engineering, National Univ. of Chiao Tung.</u>
5. Fine Products Microelectronics Corp.	<u>Producing large-scale integration (LSI) from Fairchild transfer through the RCA Project.</u>	<u>Owned by Vocational Assistance Commission for Retired Servicemen; Yen, Chun-tai, Director General (1979-80); finally owned by Fung Hwa Investment Co.</u>
6. Chung Shan Institute of Science and Technology	<u>General Instrument assisted Institute to establish transistor pilot plant during 1965-7.</u>	<u>owned by Ministry of National Defense.</u>
7. Technical Advisory Committee	<u>Wen Y. Pan (retired Director of RCA Advanced Communications Lab.)</u> Dr. Lo (Princeton); Lin (Maryland); Ko (Case Western Reserve); Li & Lo (Bell Telephone Lab.) Tsao (Columbia).	<u>TAC in ITET; Telecommunications Advisory Committee in TELDET, etc.</u>

Participant	Interests from/to the U.S. or Japan	Position in Nationalist Regime
8. Chung Hsin Engineering Consulting Co.	<u>Contractor of facility design in RCA-CMOS project.</u>	<u>Nationalist's enterprise.</u>
9. China Engineering Co.	<u>Contractor of facility construction in RCA-CMOS project.</u>	<u>Corporation of MOEA.</u>
10. United Microelectronics Corp.	<u>Direct beneficiary of RCA-CMOS transfer project.</u> Investor: Orient Semiconductor; President, Dr. Hung (shareholder: International Communication and Equipment Co.-Matsushita, U.S. aid FY1959 \$75,744.06; NT\$560,000) charging marketing operation; Sanpo cooperated with Japan Sharp (President, M.P. Chen, owner of Tong Chen Dong Electric MFG Co., the early joint venture with NEC in switching system until 1966); Walsin Lihwa Co. cooperated with Sumitomo, Western Electric Co., etc; CDC, Member of Board of Directors-- Li Ting-Sheng 4.2% (Member of Central Standing Committee, KMT; Owner of Taiwan Telecommunication Indus. Co., joint venture: NEC).	<u>Ownership: 1. Bank of Communications (Ministry of Finance); 25%</u> <u>2. CDC (KMT Central Investment Co.) 10%</u> <u>3. MOEA-ITRI-EIRC. 20%</u> <u>4. KMT Kuang Hwa Investment Co. 10%</u> <u>5. Orient Semiconductor Co. 5%</u> (Director-General: Eugene C.Y. Duh supported the company's engineer to be Member of Central Committee, KMT); <u>6. Sanpo (President: Chen Man-pan, Chairman of the Friendship Society of the Armed Forces.) 10%</u> <u>7. Walsin Lihwa Electric Wire & Cable Corp. 5% (President: Chin Shih-tien, supporter for keeping privilege of high installation charge users in Nationalist Telecommunications Division, ex-Vice-Director of TTA).</u> <u>Plant in Tantz EPZ and incorporated company: Dahsen in Taipei city.</u> <u>Founder: son of Chiang Ching-kuo (ownership: KMT Central Investment Co., Tatung, Sanpo, Matsushita, CDC); stockholder of Chung-hwa Electronics Development Co.</u> <u>Joint venture: Weng Family were members of KMT.</u> <u>Director-General, Yen Chun-tai (1980). Owner: Mr. Chou (TTV).</u> <u>Owner: Hsieh Lai-fa, KMT Legislator.</u> <u>Joint venture: DGT 40%; Director, Administration: Robert Y.L. Mao, son of Mao Jen-Feng (Chief of Military Investigation and Audit Bureau--secret police, Associate of Sino-American Special Technical Cooperative Organization).</u>
11. Lingsen Precision Co.	<u>OEM of RCA-CMOS project. Its manufacturing was transferred from Mitsubishi (1973) and OKI.</u>	
12. Chung Hsin Electronic and Machinery MFG Co.	<u>Joint venture of RCA in picture tube project; US aid FY1958 \$9,781.47;</u>	
13. Vidar-SMS	<u>A division of TRW; plant in Tamshui assisted by 1st EXIM Bank Loan.</u>	
14. Intek	<u>Cooperated with Hughes Aircraft Co. for producing digital Watch.</u>	
15. Great Electronics Co.	<u>OEM of AT&T; telephone dialers IC was transferred from UMC.</u>	
16. Taiwan International Standard Electronics, Ltd.	<u>Subsidiary of ITT in Taiwan; company representative: Howard Van Zandt.</u>	
17. Unitron Industry Co.	<u>Buying out by ITT to cooperate with RCA project; the Director-General Chiu, promoted from Philco-Microelectronics, won Medal of Chinese Institute of Engineering (1972). Manufacturing Equipment financed by EXIM Bank (1974).</u> <u>Joint venture with OKI and GTE; U.S. aid FY 1957 \$57,157.40.</u>	<u>Founder: Chiu Tsai-hsing, graduates of Chiao Tung; his company, Kuang-Ta Electronics Co. involved in RCA project as a manufacturer; Director-General of Quasel Co. (ownership: CDC, Central and Kuang-Hwa Investment Co.).</u> <u>Founder: Liu Kuo-tsai, member of KMT, Vice-President of Legislative Yuan (1972).</u> <u>Shareholders: DGT 15%; Liu 30%; GTEI 55%; GTE agreed to marketing the product of Taiwan Telecommunication Indus. Co.</u>
18. Far Eastern Electric Indus. Co.		
19. GTE Taiwan Telecommunication Co.	<u>DGT switched 2nd EXIM Bank Loan to purchase its EAX No.1 switching system.</u>	

Source: Chen, Shen-meng et al., 1991; China Yearbook 1978; CIECD, 1964a; Electronic News, 6/21/76, 12/2/80; Electronics Development, No. 49; EPZ Administration, 1987; EPZ Concentrate, 6:5; EXIMBANK, 1973; Fang, 1976; Information/Electronics Industry Yearbook 1988; IERC/ITRI, 1988; Money Information, No. 49; Science and Technology Information Center, 1973; TEAMA, 1988; Wu, Jo-yu, 1992.

Conclusively, the DGT strategy did work out at a certain level of forming a production cycle of semiconductors in ITRI and the Hsinchu Science and Industrial Park (ERSO/ITRI, 1983: 149). The pump-primer project--ITT and GTE ESS systems production--did replace the mechanical operation by electronics switching. However, these advancements were incidental rather than predictable (details provided in the next section). Moreover, after interests were soaked up by the Nationalist Party, there was really nothing left for "Taiwanese" local community and minorities except misery.

First, the accident at the notoriously low-wage Philco-Ford plant³ at Tamshui was highly publicized in October, 1972 (Liu Chin-chin 1992:267). Due to continuous exposure to toxic fumes from the soldering process in a closed workplace, five female workers died and another nineteen were injured. The first calamity occurred in July. However, Philco-Ford refused to improve the environment (China Times, 27 Oct., 1972). Moreover, according to Arrigo's report, the company even covered up this accident:

Before a girl in the neighboring town died, and the company gave her family forty thousand dollars and told them not to publicize it, to avoid other girls knowing and refusing to work at Philco-Ford. (Arrigo, report manuscript: Electronic Manufacture Prospering in Taiwan, pp 19)

The Government didn't intervene the event until the end of October after the press report (China Times, 27-31 Oct.,

³Philco was sold to Sylvania--a subsidiary of GTE in 1973.

1972). Under orders from the Ministry of the Interior, Philco-Ford announced a three-day shutdown for renovation. This case was finalized by a compensation of US \$2,500 for each death. The result made the Taiwanese angry and they began to have a hateful attitude towards the interests of the U.S. and the Nationalist government:

"It is useless to talk about this kind of matter! At first weren't there people coming to ask and investigate about it every day, and what did it come to?! One American dollar they bring it here and it becomes forty Taiwan dollars. So they take ten thousand American dollars and finished with four lives,...The government doesn't pay attention to these things at all, it is useless to bring them up." (Arrigo, ibid, pp 20).

One year later, a government paper, the outlook for Taiwan electronics industry delivered by MOEA, mentioned this accident with just such an indifferent attitude under the heading "Unfavourable Characteristics" (for investment):

The tragic accident which claimed lives at the Philco-Ford plant is common knowledge to virtually all electronic manufacturers. Whether justified or not, many electronics companies express the opinion that government officials were perhaps too quick to allow the blame to be placed upon Philco-Ford... The accident and its associated publicity has had a negative impact upon the available labor supply with some estimates ranging as high as 15% reduction in the available work force for the electronics industry of Taiwan. (Industrial Development and Investment Center, 1973:58)

Secondly, RCA decided to switch all its black-and-white television production to its Taiwan subsidiary in 1971. This decision closed the RCA Memphis (in U.S.) plant by laying-off most black and female workers (Southern Patriot, March 1971). RCA expanded its Taoyuan plant and started the joint venture with the Nationalist Party (Wall Street Journal, 25 March,

1971). Taoyuan was exactly the same place where RCA not only started running its full operation of TV production but also dumping its toxic wastes into deep wells beneath the plants. A suit was brought against RCA on 2 June 1994 by RCA retired employees and local community. They accused RCA of causing their diseases by poisoning the drinking water (Central Daily News, 4 June, 1994, pp 7). General Electric Corporation (the holding company of RCA) confessed its misconduct in mid-June (Independence Weekly Post, 17 June, 1994, pp 10).

Thirdly, these disputes could not be brought to the public notice at the time they occurred due to the tough regulation on labour unions. There was not any real labour union in Taiwan because:

Common activities of the unions are "education and spirit building i.e. distributing government propaganda, including that in favor of Kuomintang candidates for election, and donating money to the government for typhoon disaster relief. (Arrigo, ibid, pp 4)

The union leaders were elected from the plant managers⁴ rather than labour itself. This "company union" was controlled by a countrywide federation of labour which was a "quasi government/ruling party agency". Under the jurisdiction of martial law, any strike, sabotage and closedown was prohibited, otherwise, the death penalty could be applied to the offenders (Arrigo, ibid, pp 3-4; Investment and Operation

⁴"Here they [managers] can cooperate closely with the "Security Offices" ...branches of the government security agencies... A large foreign company must provide the salaries and offices for four to five "security agents", virtually all... members of... the Kuomintang." (Arrigo, 1983:4)

Division, CIECD:7).

It was no wonder that Taiwan was treated as the haven of a cheap and reliable labour supply⁵ by the multinationals:

American firm would be able to reap an extra profit, or to effect a saving, of US\$2,000,000 yearly if it could shift addition to these advantages, no labor strike has ever taken place in Taiwan. (K.P. Hu, 1966:30)

Finally, tough labour regulation reinforced the interlocking interests between the U.S. multinationals and the Nationalist Party through this repressive system. Taiwan supported both sides (the U.S. and the Nationalist) so as to reap a much bigger portion of benefits through exploitation of labour than that they supposedly earned from joint ventures.

6.4. The International Context of Technology Transfer

This section will mainly clarify the critical conditions under which Taiwan gained the technology transfer after the mid-seventies. At the international level, Taiwan was the only member of the triple alliance who could offer cheap labour, and thus became a field of the marketing battle between the U.S. and Japanese electronics and telecommunications equipment producers from 1960 to 1974. The incentive of cheap labour

⁵This incentive was also introduced by "Mr. Reday, Chief of the Industrial Division of the Headquarters under the Supreme Commander for Allied Powers, who worked for MacArthur in Japan during the critical first year" (Asian Industry, Feb. 1967). This Headquarters created the MAAG in Taiwan. MAAG trained many security officers to be the supervisors of labour unions for multinationals. Except for MAAG's Chinese personnel, the major forces to supervise the unions were from Air Asia of Tainan where a U.S. detachment one of the 405th Fighter Wing was stationed for CIA mission in Vietnam (Arrigo, 1983:4; Clough, 1978:10, 23).

attracted the U.S. and Japan investors who went to Taiwan to make use of the local labour resources through firm joint ventures between the U.S., Japan and the Nationalist Party industries.

This historical process was divided into four stages: (1) U.S. aid supported Japan's economy by issuing procurement from Taiwan (1950-1960); (2) After Japan consumer electronics by its cheap labour defeated the U.S. factories in the American market, the U.S. stopped aiding Japan by forcing Taiwan to buy her goods. However, Japan had already started joint ventures in Taiwan for television and radio production (1961-1966); (3) The U.S. started offshore production in Taiwan to compete with Japan supplies (1966-1971); (4) A cutthroat competition between Japan and the U.S. inaugurated the integration of multinationals' consumer electronics and ICs productions into existing local industrial establishments in Taiwan. That U.S./Japan competition was the direct force behind the transfer of semiconductor manufacturing to Taiwan (1972-1978).

These four stages are sequentially displayed by the following tables:

1. The U.S. aid facilitated Taiwan's purchase of Japanese goods and leading to the aid termination (1950-60):

U.S. Interests	Japan Interests	Taiwan Interests by DGT's Mediation
<ul style="list-style-type: none"> - U.S. imports were banned. + 1. U.S. aid disbursed in 1951, 1952, 1954 for supporting Sino-Japan cooperation. + 2. U.S. aid in FY 1957. + DLF financed Taiwan Telecomm. Industry Co. in FY 1960. + 3. U.S. aid FY 1958 supplied "step by step" type of Automatic Electric Co. + Compatibility of U.S. supplies. + 4. U.S. banned the imports of Japanese goods by its aid in 1960. 	<ul style="list-style-type: none"> + Japan started selling components to Taiwan. + Four Japan switching specifications were built: <ul style="list-style-type: none"> a. Fujitsu (Taipei); b. Hitachi (Keelung); c. NEC (Tainan); d. OKI (Kaohsiung). + OKI's joint venture. + NEC's joint venture. - The end of monopoly of Japan specification. + Compatibility of Japanese supplies. - Transistor import (Kilograms) in 1960 (325); 1961 (397); 1962 (0); 1963 (0). 	<ul style="list-style-type: none"> + 1. Banned the imports of finished tube radio in 1950. + "Relay-Group" system was operated (1957-1963). + Far Eastern Electric Indus. Co. was established in 1957. + 2. Signed joint venture between NEC and Taiwan Telecommunication Indus. Co. in 1959. + Taiwan started to adapt the U.S. specification in Taichung. + 3. Installed NTSC system by promulgating "Standard Specification of Black and White TV" (31 March 1959). - the supplies were delayed by shipping the goods from USA.

+ Positive; - Negative effect; Numbering: the action was issued by this actor.

2. The U.S.-directed export economy policy and Japanese joint ventures structured Taiwan electronics/telecommunications industries (1961-1966):

U.S. Interests	Japan Interests	Taiwan interests by DGT's Mediation
<ul style="list-style-type: none"> - U.S. consumer electronics production was defeated by Japan + Started U.S. TV sales and production in Taiwan. - Started dumping Japanese products in the U.S. market through transport. + Bridged U.S. technology with Taiwan technicians and businessmen. + 1. AID only issued the procurement of AID#12 project to the U.S. suppliers. + 2. The U.S. TPTC submarine cable linked Guam with Manila. + EXIM Bank started loans to Taiwan for competing with Japanese credit in 1965. + 3. AID issued the "Cooley Loan Fund", "Specific Risk Guaranty Program" in 1966. 	<ul style="list-style-type: none"> + Japan subcontracted the manufacturing orders to Taiwan for its exports. + Four companies were shareholders. + 1. Seven companies entered into technical cooperation with Japanese manufacturers such as "National", "Sharp", "Sanyo", and "General". - U.N. Special Fund competed with the NTTPC program. - Japan started opening Taiwan domestic market and being forced to transfer technology to Taiwan and Far Easter Indus. Co.. - Japanese SAFE project was less important in terms of the cross Pacific cable expansion. + 2. First Japanese Yen Credit was signed in 1965 to provide Japanese supplies to DGT in 1965. - U.S. investors swarmed into Taiwan; Japan had to follow the U.S. investors. 	<ul style="list-style-type: none"> + 1. Banned imports of finished transistor radio (1960) and TV (1964). + 2. Established TTV in 1962. + Established the base of TV export industry. + 3. Taiwan established T&E Centre* in Chiao Tung Univ. in 1963, specially for transistor production. + Taiwan primarily installed the completed step by step switching system (1963-64). - Chiang's regime tied Taiwan with U.S. by going through trans horizon microwave to Guam's TPTC cable and giving away from Japanese transfer. + DGT Taiwan gained the loans for expansion after the U.S. aid termination. + Taiwan opened the EPZ in Kaohsiung.

* T&E Centre= The United Nations Training and Research Centre for Telecommunications and Electronics

3. The moving of the U.S. TV industry to Taiwan by the U.S. semiconductor assembly plants supports, and the attack to the Japan domestic ICs market from U.S. subsidiaries in Taiwan (1966-1971):

U.S. Interests	Japan Interests	Taiwan Interests by DGT's Mediation
<ul style="list-style-type: none"> * 1. American electronics industry established subsidiaries. * 2. U.N. rejected the application of Taiwan regional electronics training centre since 1965. - Placated U.S. opposition to Japanese penetration. * 3. The U.S. semiconductor assembly operation started by Philco-Ford in EPZ. * 4. The World Bank financed the crossbar system installation. - The World Bank refused to finance satellite project due to a sound financial measurement for DGT; * RCA, ITT and WUI provided the IRCs services in Taiwan. 	<ul style="list-style-type: none"> - Competition was initiated by U.S. using Taiwan cheap labour. * Prevented Taiwan from being another competitor. * 1. Japan electronics plants moved in EPZ in Taiwan; Joint ventures of production were increased. - Cheap ICs sold to Japanese market. - NEC and OKI had to transfer crossbar production to two joint ventures. Japanese mini-crossbar system faced the U.S. challenge. * 2. NEC, the successful bidder, established the Taiwan earth station in 1969. Taiwan-Japan partnership was reinforced through satellite connection. 	<ul style="list-style-type: none"> * Taiwan solved the unemployment problem and earned the foreign reserves. - Taiwan stayed in the stage of assembly electronics parts. * Benefited Taiwan economy and transferred assembly technology; produced a big growth of Taiwan consumer electronics industry. * Taiwan gained the assembly technology of ICs. * Taiwan advanced its switching technology and built the link with the U.S. specification of ESS. - Taiwan continuously relied on Japanese components imports; * Taiwan took advantage of triple competition.

4. A "Knockdown-Dropout" fight between the U.S. and Japan resulted in channelling technology transfers to Taiwan (1972-1978):

U.S. Interests	Japan Interests	Taiwan Interests by DGT's Mediation
<ul style="list-style-type: none"> + 1. U.S. multinationals issued warning to CIECD that anti-dumping tax would have effect on Taiwan electronics in 1969. + 2. The major competition of TV production started in 1970 by establishing source of component in Taiwan. + U.S. suppliers were more attractive to Taiwanese buyers. + 3. The U.S. President R. Nixon visited China on 27 Feb. 72. + The U.S. ITT & GTE took over Taiwan ESS switching market in 1973. - Motorola, Texas Instrument faced competition in Japan due to the shipment of supplies from Taiwan. + 4. U.S. Dept. of Commerce predicted in 1974: ICs production equipment in Taiwan market would grow to 40% of total global EIPT sales in 1977. + U.S. assembly plants gained another local market in 1976. + U.S. started to switch high-tech manufacturing to Taiwan under new "Statute for Encouragement of Foreign Investment". 	<ul style="list-style-type: none"> - CIECD reconsidered the alliance with Japan for export of consumer electronics and tried to decrease these quotas. + Japan installed more joint ventures to avoid U.S. restriction via Taiwan export. Japan also supplied components to the U.S. plant in Taiwan. - 1. Yen inflation increased the costs of procurement. - The expansion of Japan electronics industry was limited in Taiwan. + 2. Japan terminated the diplomatic relation with Taiwan on 29 Sept. 1972 to gain China market; - lost the tie with Taiwan telecommunications system. + 3. Nippon Communication Indus. Co. began to produce hybrid ICs in April 1971; Mitsubishi Electric Corp. produced bipolar ICs with Lingsen Precision Indus. Co. in 1973. - Favourable to Taiwan in diversifying the source of import components. - Japan suppliers faced the U.S. competition. - Japan was attacked by the U.S.-Taiwan alliance for technological transfer, low wage skilful technicians, and the market shares of computer in Taiwan. 	<ul style="list-style-type: none"> + Signed with RCA for CRT production joint venture. Taiwan TV exports replaced the Japan quotas in the U.S. market after sanction was issued to Japan. - Taiwan labour was exploited; + Taiwan electronics industry received new opportunities of joint venture; Taiwan was top supplier of black and white TV in the U.S. market in 1972. + Taiwan sought the new alliance with the U.S. partners. The TV exports were growing. - Taiwan decided to enlarge the interests of the U.S. investment to keep diplomatic relation. + Taiwan completely started the close partnership with the U.S. manufacturers. Far Eastern Electric Indus. Co. turned out to be a joint venture of GTE. + Taiwan Telecommunication Indus. Co. was reinforced by NEC to cooperate with ITT ESS project; Lingsen participated in RCA CMOE project. + Taiwan signed with RCA for CMOE project; IMR for mask-making; Hughes Aircraft for LCD; AMI for telephone IC; Fairchild for LSI, etc. + 1. promulgated the new regulation of local sourcing to allow bonded and assembly plants to sell parts in Taiwan for saving cost and attracting the U.S. investment. ITT and GTE purchased diode from General Instrument, Motorola, and Texas Instrument. + 2. ROC USA Economic Council in 1977 announced: <ul style="list-style-type: none"> - A. comparatively low cost and high productivity of skilled workers in Taiwan; + B. cross-licensed agreement to compete with Japanese industry; + C. As a distribution centre of the U.S. products to Southeast Asia; - D. Exclusively purchased components from the U.S. plants

Source: DOT, 1964; 1967ab; 1969a; Economic Daily News, 12/8/70; Electronic News, 6/5/72; Yang et al., 1977; Huffman, 1966; Industrial Development Yearbook 1982; Industrial Newsletter, 2:8, 6:4, 8:8; International Economic Information Monthly, 26:2-3, 27:6; MOC, 1960; Pacific Basin Reports, June 1970, Feb. 1971, Oct. 1973; Pal, 1965; Todd, 1990; UNCTC, 1986; US Dept. of Commerce, 1974; Wall Street Journal, 3/27/69; Wen, 1990; World Bank 1975; Yeh, 1981.

6.5. The Long Route of Technological Transfer and the Final Setback

Accordingly, it is clear that almost every transfer of U.S. technology to Taiwan was stimulated by the competition between the U.S. and Japanese industries and the technology transferred to the hands of previous Japanese partners in Taiwan.

The first automatic "step by step" switching system was installed with the U.S. intention to invade the island wide Japanese specification. After that, GTE penetrated the switching system market through the AID #12 project. The second transfer of switching system technology was initiated by the World Bank. The World Bank report invited ITT and GTE to take advantage of the breakdown Taiwan-Japan diplomatic relations, and resulted in ending Japanese technological domination. Far Eastern Electric Industry Company signed the partnership with GTE based on its long-term Japanese assistance. However, Taiwan Telecommunication Industry Company signed the hybrid ICs manufacturing agreement with Nippon Communication Industrial Corporation for producing the re-exported components to compete with the cheap U.S. ICs in the Japanese marketplace.

At an early stage, in order to promote its marketing strategy, Japan also played a leading role in transferring the consumer electronics assembly industry to Taiwan:

[1] For example, a U.S. importer contracts with a Japanese trading company for a complete list of parts for a 6-transistor radio and pays for them by a letter of

credit, the Japanese firm then contracts with a Taiwan radio company for assembly and pays by check or letter of credit (Tuan, 1967:28).

[2] An additional consideration was the desire to get around the growing United States import restrictions by producing in countries not covered by these restriction. This helps to explain the establishment of television plants by Matsushita, Mitsubishi, Sony and others in Taiwan.... (Dicken, 1986:342)

Subsequently, ten years after 1961, these joint ventures contributed to the RCA joint ventures for "Cathode Ray Tube" (CRT) production. Under the name of Chunghwa Electronics Development Corporation, Tatung (assembling transistor radio for Japanese orders), Sanpo (joint venture of Sharp, Hayakasia), China Electronics Corporation (bought kits from Japan), Hsin Yung Industry Company (partner of Radio Shack), and Taiwan Kolin Corporation participated into CRT production through this intertwined alliance (EPZ Concentrate, 6:5, pp 40; Tuan, 1967:28-9).

In the meantime, the development of the Taiwan semiconductor industry in the early seventies, mediated by Dr. Wen Y. Pan, was clearly mapped out by the U.S. Department of Commerce:

With this shifting emphasis in the domestic electronics industry, demand for passive component, semiconductor and integrated circuit production equipment is expected to increase significantly and could represent 40% of the total EIPT [electronics industry production and test] equipment market of \$45 million in 1977. (U.S. Dept. of Commerce, 1974:123)

It is not surprising to find that every step for transferring semiconductor manufacturing was done very smoothly because the U.S. interests had been foreseen. More importantly, compared

to the EIRC forecast, the value of CMOS was viewed differently by its parent:

"Not until the last two or three years have the prophecies about CMOS proven accurate,"...Some industry watchers are not quite as optimistic, pointing out that while RCA has been waiting for CMOS markets to open up,... RCA invented CMOS. It should be head and shoulders above the rest. That's not the case." RCA didn't pursue the CMOS market in the 1970s as strongly as other firms.... (Electronics Week, August 27, 1984:61-2)

RCA didn't treat the CMOS project as a profitable business. RCA was willing to sell CMOS for US\$ 12 million without paying anything for the testing service performed by EIRC in the early stages of CMOS (Lin, Hsi-ming, 1987; interview with ITRI in 1994).

Again, Lingsen Precision Industry Company, the OEM in the RCA-CMOS project, was advanced by Mitsubishi in 1973 to counter the U.S. ICs industry's penetration into Japan. Chart 6.3. displays how the U.S.-Japan competition interacted with the formation of the Taiwan electronics industry.

However, in the final step of this transition process, the ROC government made two policies to force the DGT to serve the security interest again. To save the Taiwan-U.S. diplomatic relation (which finally terminated on 16 December 1978), a pro-U.S. policy was addressed even at worked against the interests of the long-term development of the telecommunications/semiconductor industries.

First, the MOEA issued the "Regulation of the Import of Components from Bonded Plants and EPZs to Local Buyers" on 28

**Chart 6.3. The Transition of Taiwan Electronics/
Telecommunications Industries under Competition
between the U.S. and Japan**

(Source: Fang, 1976:25; Taiwan Industry Yearbook: Electronics 1983.)

January 1976. The MOEA allowed assembly plants or bonded plants in EPZs to supply components to local industry if the

domestic supplies were unavailable. This regulation directly worked against the policy of local sourcing by contracting out the local supplies which were demanded by the U.S.-Nationalist joint ventures to the U.S. multinationals assembly plants rather than the Taiwanese factories. For example, the diodes for X-points of ESS, under the "Joint Venture Agreement" between the DGT and ITT & GTE, had to be bought from local subcontractors. However, ITT and GTE bought diodes from General Instrument, Texas Instruments, the Hong Kong Motorola Branch Office, the Taiwan agency of National Semiconductor, and Rectron (the only local subcontractor) (information provided by ITT, GTE in 1994).

Secondly, the Second EXIM Bank Loan was switched to purchase GTE EAX No.1 ESS because the DGT unsuccessfully opened a bid for the underground backbone co-axial cable project. The switch of disbursement basically saved GTE from financial crisis at the end of 1974 (see Figure 6.2., DGT Monthly News, 9:8).

Figure 6.2. The Financial Structure of GTE
1964-1974

The financing of GTE was structured by a long-term debt at 65%, a common stock at 28%, and a cumulative preferred stock at 7% of total capital (DGT Monthly News,9:8). This switch let DGT wait another five years before installing the backbone underground coaxial cable.

All the efforts described above directly guaranteed the profits of the U.S. investments in order to prevent the ROC-American relations from Chinese Communists' attack. The security regime allowed the U.S. to reap the benefits at the expense of long term national development.

Summary

DGT, owner of the technologies of control, assisted the development of the semiconductor industry with its local resources. In the first ten-year period (1950-60) of the Nationalist regime, the DGT assisted the Taiwan Garrison Command in clearing all dissidents out of the electronics industry. After cleaning up the infiltration by TGC, the CIECD took over the jurisdiction of economic planning to direct the DGT in reforming the regulations on semiconductors, and in establishing the local semiconductor industry by local resources interacting with the competition between the U.S. and Japan industries.

The international competition in assembly technology transfer and in joint ventures for making consumer electronics ignited the battle between the U.S. and Japan electronics

producers in Taiwan. The DGT took advantage of this (descriptive) triple alliance (Taiwan, the U.S. and Japan) with the help of its Overseas Chinese advisor and its local resources. With its welcoming climate as an incentive (e.g., cheap labour), Taiwan built its production cycle by attracting, from the late sixties, the U.S. and Japanese giants to sign joint ventures with the Nationalist's electronics industry.

The interests of joint ventures, before returning to the U.S./Japan alliance, consistently fell into the hands of Nationalist businessmen at the expense of labour (working condition), local community (pollution), and civilian interests (access to electronics components). Moreover, Taiwan lost its long-term interests in the telecommunications/semiconductor industries after the security regime interfered in the development process to serve the interests of the U.S. multinationals and the Nationalist regime.

Chapter Seven

Conclusion: Towards a Comprehensive Review

Based on the theoretical framework of Chapter Two, this thesis has clearly demonstrated the manner in which Taiwan was incorporated into the U.S. defence perimeter. From this perspective, the U.S. defense strategy established the communication infrastructure which the U.S. TNCs and their Japanese rivals used as an important base for the semiconductor assembly industry. Along the way, the Nationalist authorities in Taiwan were able to utilize their position between these industrial rivals to make semiconductor production the driving force in Taiwan's economic development. This growth was importantly marked by Taiwan's dependent relationship on the U.S. and the desire of the Nationalist government to maintain its grip on power.

As shown by the statistical and historical correlations, the answer to the question as to how telecommunications, as an important necessary condition, contributed to the development of the U.S. offshore semiconductor assembly industry, was demonstrated in detail in Chapters Three, Four and Five through an instrumental view. Moreover, telecommunications institutions, i.e., those companies designated by the DGT to do local sourcing and a training centre for managerial manpower and the partners, also contributed to the vertical integration of semiconductor manufacturing by connecting most participants together within the Taipei-Hsinchu industrial

belt.

Combining with the structural view, the history represented how the interactions of military and industrial strategies on telecommunications policy generated the benefits and deficits in establishing Taiwan telecommunications/semiconductor industries under the two economic giants, the U.S. and Japan. Again, based on the structural approach, this thesis has specially analyzed the (descriptive) triple alliance/competition (the U.S., Japan and Taiwan) in Chapter Six, which pointed out the structural constraints on Taiwan semiconductor industry development.

This historical formation is studied in Chapters Three to Five; this discussion concludes in Chapter Six with the following statements: the Taiwan state repressed every dissenting group, created a haven for the U.S. businessmen living in the previous MAAG residency, and provided cheap labour for the U.S.-Nationalist electronics joint ventures. However, the war economy and diplomatic security produced surplus benefits for the U.S. semiconductor assembly industry at the expense of Taiwan telecommunications innovations and semiconductor manufacturing transfer. Overall, the findings describe this process and answer the two questions asked at the beginning of Chapter Two concerning why Taiwan was attractive to the U.S. semiconductor assembly industry, and what benefits resulted from the U.S. investment.

Why Was Taiwan Chosen as the Location of This Development?

Taiwan telecommunications, as a necessary condition for the global assembly movement, attracted the U.S. multinationals because of a structural framework rather than by instrumental design. In other words, the Taiwan telecommunications network served the containment policy of the Cold War. In the first place, Taiwan was integrated into the world of Western democratic capitalism by being chosen as a U.S. strategic defense site. Later, the communication network turned out to be a buffer which saved the U.S. electronics industry from the profits crisis of the 1960s.

Structurally, in order to serve the U.S. defense strategy, Taiwan was equipped with a firm telecommunication network with the U.S. through wireless communications (HF band, microwave, satellite). Domestically, the telecommunication administration used communication facilities to locate the U.S. military agencies in a comfortable environment. The U.S. MAAG and the CIA trained Chinese security officers to assist in the island's defense and security systems in order to whip out any resistance to the combined authority of the U.S. aid agencies and the Nationalist Party.

During the U.S. aid period (1950-1964), the TTA packaged the industrial and military applications of telecommunications together in order to ease the supervision of Chiang's regime. Under this cooperation, the telecommunication administration and security regime smoothly worked out the projects in the

first ten years of U.S. aid. The successful projects, including the North and Central Exchange in Taipei, the radio single side band telephone, the microwave backbone system, the VHF forward scattering system etc., provided necessary channels for trade-offs among Taiwan, the U.S. and Japanese interests through a defense strategy. These outgoing connections integrated Taiwan into the world of advanced capitalism without undermining Chiang's authority on this island.

Primarily, the establishment of the MAAG residency (which included advanced and cheap telephone service, radio station and free radio registration and fees, school, club, bowling alley, shopping centre, bank, etc.) which was assisted by the TTA, was smoothly converted to house a new "security force"--the U.S. managers of TNCs.

Meanwhile, Taiwan recruited its military members into the staffs of the MAAG and the secret mission of the CIA in Southeast Asia. The Vocational Assistance Commission of Retired Servicemen was funded by U.S. aid. This Commission responded to the needs of transferring corps members to the civilian sector. These three agencies provided the majority of reserves for the security staffs to supervise labour unions in the multinational electronics plants and in the international communications division of telecommunication administration. The contribution of the security staffs to Taiwan's favourable investment climate matched the right curve of the product

life cycle--used plenty of cheap labour to make standardized products during Taiwan's economic take-off.

Moreover, the expertise of the Taiwan Garrison Command was enhanced by the DGT during the fifties. Two organizations systematically controlled the circulation of semiconductors to prevent dissenting group from studying new communications technologies and using them to criticize the government for using cheap labour. Taiwan Garrison Command was also notorious for executing left-wingers during the period from 1951 to 1960.

Internationally, the war economy did not just create support for Chiang Kai-shek's Nationalist Island China, but also stimulated Japan's economy by integrating Taiwan into the Japanese hinterland. Consequently, under this umbrella, Taiwan, equipped with Japanese electronics assembly skills, combined with its cheap labour resources, stood on favourable ground to interact with the two competing giants--the U.S. and Japan. This position made it easy for Taiwan to attach itself to the cyclical competition among the U.S. and Japanese semiconductor industries.

The fifteen-year span of the U.S. aid program had already created the breeding ground of export-oriented industrialization policy by establishing the following favourable climates in Taiwan:

1. Full access to world radio communication networks connected with a U.S. aid-supported local infrastructure;

2. The comfortable residency of the U.S. military members turned over to serve their partners in the military-industrial complex--the TNCs.

3. The ubiquitous supervision of the security regime guaranteed the stable supply of disciplined labour;

4. Taiwan, grounded on a Japanese industrial infrastructure, promoted its incentive of "comparative advantage"--cheap labour--through the past partnerships with the U.S. and Japan.

The Taiwan Telecommunications/Security Institutional Formation (1950-1964)

How Taiwan's Telecommunications Served the U.S. Semiconductor Assembly Plants?

The next fifteen-year period (1961-1975) of the telecommunications/semiconductor industries development was primarily started by the AID-directed export-oriented industrialization policy and the Vietnam War-prompted reshuffling of the world capitalism system.

The AID promoted the export-oriented industrialization policy for the telecommunication administration by requesting the DGT to establish a sound financial base. The DGT set up the fair return policy for its telecommunications operation as the basis for the AID-requested sound financial project. The high installation charges demanded by this policy were introduced by top officials who learned of this practice from the NTTPC. This policy denied to people with average and low incomes easy access to telephone service.

Another demand of the fair return policy was profitable rate-making. With the support of the AID, the DGT overcame the inflation-control measures of the security regime to revise the formula of rate-making. The local efforts of the DGT were carried out by the managerial staffs from the TC program. Rate revision gave the DGT a policy option to serve international trade through an efficient public utility. This resulted in an end to the U.S. aid program which had benefited both Taiwan's and Japan's economies. A new era of the (descriptive) triple alliance/ competition was firmly inaugurated. However, while the DGT was financed by local incomes from the fair return

policy, the telecommunications policy still supported military (wireless communications installation) and security (collection of defense assessments) strategies. As long as all strategies were carried out, the telecommunications administration kept building financial supports for military/security, and, later, industrial/multinational interests:

**The Local Investment to Telecommunications Expansion
for Military/Security, Industrial/Multinationals Interests**

The second war economy--the Vietnam War--critically stimulated the U.S. and Taiwan to move together as a military/industrial alliance. On the one hand, Taiwan was equipped with wireless communications to serve the U.S. Vietnam War strategies; on the other hand, the Vietnam War directed the U.S. electronics giants to mainly produce military applications which resulted into a two-sided historical formation: 1. assistance for Taiwan's telecommunication technologies installation; 2. shipment of semiconductor assembly plants to Taiwan. These two aspects were based on the following:

1. On the recommendations of the AID, the wireless communications technologies (originally, military application) expansion was financed by the fair return policy of the DGT;

2. The war economy forced the U.S. electronics industry to withdraw from competition with Japanese consumer electrical appliances industry in the U.S. market and look to Taiwan cheap labour to fight back;

3. The U.S. military assistance and the U.N. Special Fund contributed respectively to the switching of retired servicemen and managers to serve in the sectors of export trade and telecommunication industry, which bridged the operation of the U.S. semiconductor industry with the performance of the Taiwan disciplined labour force.

Originally, all AID-recommended wireless communication technologies (transhorizon microwave, satellite earth

stations, trans-island backbone microwave system, VHF scatter system) served the Cold War and the Vietnam War strategies. The installation of technologies benefited certain interests--military and economic--of the U.S., Japan, Hong Kong, the Philippines, and Taiwan in the Vietnam War. Later, the trans-island backbone microwave system through its central-controlled mechanism ruled out the proposal for a Taiwan regional television station. This mechanism helped to form a central-controlled NTSC television system which was favourable to the U.S. multinationals in running the TV-chips assembly industry in Taiwan. The security regime directly rejected the DGT's submarine cable plan due to the Vietnam War demands and diplomatic liability of Chiang's regime (towards partnership with the U.S. and away from connection with Japan). The submarine cable plan was indirectly rejected by Directors of the DGT, the RCA Advanced Communications Laboratories, and the American Radio Engineering Laboratories who had established the transhorizon microwave and satellite earth station. These installations gave the U.S. multinationals a firm confidence in the capacity of Taiwan international telecommunications. Those international efforts were critically directed by Robert E. McNamara as the secretary of the DoD and the president of the World Bank. The installation of international wireless communications moved Taiwan forward into a close partnership with the U.S., and alienated Taiwan from her colonial overlord--Japan.

Meanwhile, the AID-commissioned SRI research formally proposed that Taiwan should take advantage of its infrastructure to compete with Japan for a share of the U.S. domestic market. This SRI report was a prelude to Taiwan's association with the U.S. as a solution for American industrial depletion. The AID project #12 in 1962 also formally attacked the Japanese share in the Taiwan switching system market through contracting out supplies to GTE. This project paved the way for GTE and ITT investment in Taiwan ten years later.

Channelled by existing wireless communications technologies, the U.S. multinationals started searching for plant sites in Taiwan when the CIECD provided incentives for investment in several military-adjacent industrial districts. These locations had been connected together by telecommunications expansion projects during the U.S. aid period. The enormous volume of overseas messages between the U.S. and Taiwan was carried by international telex service. The maintenance and operation of the service were executed and supervised by retired Taiwan servicemen (placed by the "Telecommunication Vocational Assistance Program"), personnel from the telecommunications detachment which served the "Return to China" war, and the technicians from the U.S. aid-financed Taichung Senior Vocational Industrial School. Local assistance to the investment process was also given by top U.S. military officials in mediating between the Taiwan state

and the TNCs (e.g., Philco, General Microelectronics).

The AID stopped providing American dollars but transferred the knowledge and expertise of the CUSA to the CIECD. The CIECD took over the jurisdiction of the electronics industry development by establishing a think-tank of high ranking telecommunications officers and its (CIECD) supervision of the U.N. Special Fund application. Under the recommendation of the director of the DGT, the Training and Research Centre for Telecommunications and Electronics was established by the U.N. Special Fund in the early sixties. The research centre designed the military electronics application and the local strategy for semiconductor manufacturing. The centre produced a number of managers to assist in the operation of the U.S. assembly plants and Taiwanese partners.

After this, a World Bank mission and loans arrived to take over the functions of the AID in supervising Taiwan economy during the most critical ten-year period of semiconductor assembly production (1966-1975). Coincidentally, the genius of the military industrial complex, Robert E. McNamara, switched from his position as the secretary of the DoD to become the president of the World Bank. During the first five years (1966-1970) of the semiconductor assembly industry in Taiwan, the telecommunication network not only continued to serve the fading Vietnam War but also began to channel investments from the U.S. TNCs. The decline of Vietnam War procurement demands further forced the U.S. semiconductor assembly plants to

relocate in Taiwan. The World Bank Project 506-CHA renovated the complete switching system to supply the DGT with enough capacity to cope with the dramatic growth of the international telex service for the U.S. TNCs' transactions (vertical and horizontal connections). In supporting the renovation project, the World Bank channelled other loans--Japanese Yen Credits, EXIM Bank Loans, an AID Loan, and local expenditure--into a single aid package, and also undertook a comprehensive assessment of the project before approving it.

During that time, the DGT did not establish the domestic telex system until the local electronics industry contracted out supplies to the U.S. branch plants on the thirteenth anniversary of the international telex (1973). Furthermore, the DGT did not release the control of outgoing telex in the Central Exchange, but supervised each outgoing message from the three EPZs and the Taipei-Hsinchu industrial belt (just as the TNCs' headquarters controlled overseas branch plants, early Taiwan microwave and TV systems). To keep the system functioning well, the DGT allowed some the U.S. and Japan multinationals to act concurrently, as players and referees. In other words, the multinationals provided telecommunication services to their branch plants through the DGT's mediation. The locations of branch offices and plants were in the same areas as the facilities built previously for the U.S. and the ROC security agencies in northern Taipei City and in the vicinities of the three big cities along Taiwan's west coast.

The World Bank experts also influenced DGT operation policy by requesting that the DGT provide a long term financial plan and an engineering report. The long term financial plan insisted that the DGT maintain the high installation charges policy; create an self-revising rate-making procedure and the industrialization priority policy; and influenced the DGT to provide privileges in the form of bank loans for telephone installations for government officials, and exemption for the U.N. and the USAID from the tax on telecommunications service. Finally, the World Bank strengthened the authoritarian state to firmly serve the export-oriented industrialization policy during the second five-year (1971-1975) development.

The engineering report of the World Bank recommended that the DGT mediate between foreign corporations and local partners in the production of switching systems. The World Bank not only paved the route for ITT and GTE to participate in the Taiwan market, but also taught the DGT the strategy of using its local market as an incentive to attract foreign corporations to transfer semiconductor manufacturing to Taiwan. This strategy was reinforced by the Japanese investment in Taiwan under the (descriptive) triple alliance/competition. The Japanese investment in Taiwan, when not squeezed out by the U.S. TNCs, underpinned its Taiwan joint ventures by importing out-of-date production systems (after Japan industry had matched its standardized product

with this particular period of the product life cycle). Japan-Taiwan joint ventures, based on the existing know-how of assembly and manufacturing, were selected to be the new joint ventures for running the production of the U.S. and Taiwan semiconductors and their related applications.

Conclusively, this history shows a dialectical correlation between two historical moments: the Vietnam War and export-oriented industrialization in Taiwan. The peak of Vietnam War sales were channelled by the AID-recommended wireless communications technologies between Taiwan, the U.S. and their allies. The decline of Vietnam War sales forced the U.S. electronics giants to relocate in Taiwan and resulted in promoting the AID-recommended export-oriented industrialization policy. During this time, Taiwan's telecommunication system expansion, designed by the security regime, inverted the original relationship between Taiwan, the U.S. and Japan. Taiwan established a much closer connection with the U.S.. The communications technologies which originally served the Vietnam War were transferred to serve the operation of the U.S. semiconductor assembly plants. Taiwan moved away from trade with Japan and forced Japan to sign joint ventures deals. Taiwan used the assembly know-how learned from Japan to serve the transfer project of the U.S. semiconductor industry.

The Taiwan Telecommunications/Semiconductor Industries Formation (1961-1975)

* Including, Microwave, VHF, Satellite, SSB, Coaxial Cable, Data Communication.

What benefits? And for Whom? The Evaluation of the Taiwan Telecommunications/Semiconductor Industries Development.

The Taiwan dependency is not fully represented, indeed, until the social classes participating in this development are looked at in an evaluation of the interaction of the U.S. and Japanese capitals in the Taiwan economy. Looking at this Taiwan case from the local perspective within the international context draws a different picture of the dependency.

Along with the growth of semiconductor assembly and manufacturing, the Taiwan Garrison Command and Taiwan Telecommunication Administration set up a series of barriers on the routes of semiconductor circulation (import, transport and export). The security regime also supervised the only site of semiconductor knowledge transfer--the United Nations Training and Research Centre for Telecommunications and Electronics in Chiao Tung University at Hsinchu. Only the Nationalist Party's businessmen could go through the checkpoints and get access to the technology. They were the principals who signed the joint ventures with the U.S. or Japanese industries in the new era of cooperation in semiconductor manufacturing. However, the benefits of cooperation had already been foreseen by the U.S. government (i.e., the Department of Commerce). The RCA-CMOS project was the right start for the U.S. to reap long-term profits in the sales of semiconductor manufacturing equipment to Taiwan. Moreover, the developing joint ventures between the U.S. and

Taiwan continued to assemble cheap ICs for the U.S. market. Taiwan industry also strongly relied on Japanese importation through the joint venture agreement. Both the U.S. and Japan industries used the low costs of Taiwan's industrial bases to assemble components and sell the end-products in the U.S. and Japanese markets in an attempt to defeat each other. Taiwanese partners joined these ventures under the (descriptive) triple alliance/competition and Taiwan incorporated itself as the subaltern international capital player. Under the terms of the triple alliance/competition, Taiwan accepted the following technological transfers: the step-by-step switching system, TV and radio components assembly, courses in the training centre set up by the U.N. Special Fund, the crossbar switching system, CRT production, black-and-white TV production, Hybrid IC production, Bipolar IC production, and the RCA-CMOS project.

However, the Nationalist island regime intended to use tough regulation of semiconductor circulation to prevent the general public from using this technology to criticize the government policy dealing with foreign investment. As a result, the electronics components were unavailable until security tasks were carried out not only by checking out the functions of the components but also by investigating the customers' profiles. In this situation: the Act of Press License was frozen, TV stations were centrally controlled, and radio broadcasting was tightly monitored by the JTC, this

security system effectively silenced the labourers or local communities while the assembly plants exploited female workers or spread the pollution generated from the technological transfer to their neighbourhood.

Moreover, the Nationalist regime dispatched a local elite, Chang Hsiang-chuan, Chairman of Taipei City Telephone Progressive Association, to take over a liberal press--the Public Tribune. Mediated by the Nationalist Party, a deal was made to sell this exclusive "license to print" to the subaltern of Chiang Kai-sek, Wang ti-wu, under the name of the Economic Daily News, which became a voice for, and one of the principle promoters of, the Taiwan electronics industry development. Again, the Economic Daily News functioned as a megaphone for the Nationalist Party's businessmen to ask for more privileges, in comparison to the general public access to electronics components, in running their electronics productions.

Serving the military and trade priorities, the telecommunication administration used high installation charges to limit general public access to telephones in order to reserve the available circuits for the security regime or the TNCs. Generous discounts on telephone rates were also consistently applied to the MAAG, the IBRD, and the U.N. experts. Again, the MAAG, the USAID, and the IBRD were consistently exempted from the various collections, assessments, contributions, registration fees and rate-raising of the telecommunication

service. However, the benefits from collections (from public users) would contribute to the U.S. TNCs and security/military regimes when a better telecommunication service was established and the authoritarian regime was strengthened through those very revenues which were paid by the general public. For example, the Americans established their own radio station--AFNT--in Taiwan with the assistance of the Taiwan telecommunication administration, but were exempted from paying the annual radio registration fees to the TTA which collected fees from all Taiwanese radio owners. In return, these U.S. agencies protected and strengthened the Chiang regime by repressing civilian resistance to the dictatorship and export-oriented industrialization policy.

Based on a fair return policy, the DGT provided a firm international wireless communication network to serve the demands of the TNCs and the military. The ROC security regime made a decision favourable to the U.S. troops in the Vietnam War to replace the submarine cable with microwave systems and satellite earth stations (1967) in order to strengthen the overseas connections between Taiwan and the U.S.. At this time, Taiwan's telecommunications network was not connected to the Asian submarine cable development. Ten years later, in order to save the U.S.-ROC diplomatic relations, the security regime allowed the U.S.-Taiwan joint ventures to purchase components from the U.S. branch plants, and switched the loans originally intended for the underground backbone cable

installation to buy switching system equipment from GTE and help the U.S. TNC avert financial crisis. The goals of national telecommunications development were depressed again.

The DGT also opened the international telex in Kaohsiung (1967), and data transmission (1968), domestic telex (1973), and computer-mediated communications--Universal Data Access Service--(1980) in Taiwan on behalf of the multinationals and Taiwanese businessmen. These facilities would not have begun operating so early without the demands of the TNCs. The services provided for the TNCs went far beyond the demands of civilians for access to telephone service with low installation charges.

This development and dependency of telecommunications/semiconductor industries in Taiwan is differently viewed by the 'haves' on the top and the 'have-nots' on the general level or the bottom (using Tehranian's model):

Development as Viewed from the Top	Dependency as Viewed from the Bottom
<u>Joint ventures business for the semiconductor manufacturing transfers;</u> <u>Social mobilization;</u> <u>Economic growth;</u> <u>Professional knowledge from training centre and the U.S. TNCs;</u> <u>Telecommunications inspection for national security;</u> <u>Fair return policy and an efficient telephone utility;</u> <u>Advanced telephone service in Tienmu by paying the discount installation charges;</u> <u>Collections for telecommunications expansion;</u> <u>First FM station service, AFNT, free for Americans;</u> <u>Service of the U.S. military and TNCs in building a strong tie between the ROC and the U.S.;</u> <u>Information technologies (telex, data, computer communications);</u>	<u>Long-term benefits for Nationalist Party, the U.S. and Japan.</u> <u>Security barrier.</u> <u>Low wages and pollution.</u> <u>Tough regulation on personal access.</u> <u>No freedom and Privacy with telecommunication use.</u> <u>Prohibitively high installation charges.</u> <u>U.S troop privilege of large discount on service charges.</u> <u>Exemption for the U.S. agencies.</u> <u>Radio registration fees for natives.</u> <u>The setback of national development of telecommunications.</u> <u>No access without TNCs' demands.</u>

The historical path of Taiwan telecommunications serving the development of the U.S. semiconductor assembly industry during a twenty-seven-year span (1950-1976) is represented by the following chart:

Towards a Comprehensive Review of the Historical Formation

Lastly, for a comprehensive study, this thesis exhibits the findings and draws its conclusion in light of the current research dealing with a similar topic. The criticism and suggestions of the thesis are presented into the following two parts:

A. Historical Track:

1. Telecommunications did not exist on its own before the inauguration of the global semiconductor assembly movement. The TNCs could take advantage of existing telecommunications services in Taiwan for their global operations because Taiwan telecommunications had already been structured by the U.S. military-industrial-communications complex under the Cold War ideology. Taiwan's investment climate was structurally favourable to the global shift of the U.S. semiconductor industry because of its firm telecommunications connection with the U.S. and the stable supply of the cheap labour and disciplined under a U.S.-assisted security supervision system. This thesis refutes the linear correlative analysis between telecommunications and IDL made by developmentalist or urban and regional development studies.

2. Again, before the economic take-off, the Taiwan economy was rehabilitated by the USAID and the MAAG through economic aid and military assistance. As a result, Taiwan's infrastructure could serve the TNCs with two welcome climates: (1) global communications and (2) dispute-free labour

environment, which was established by the U.S. aid program. The research on this similar topic must trace the history back to the U.S. aid period rather than analyze the statistics of comparative advantage.

3. Behind the telecommunication administration, the security regime monopolized the knowledge and circulation of semiconductors for the national training centre and the factories. With the tough regulation on the personal application for electronics components, this knowledge monopoly concentrated the benefits of managing and doing local sourcing for semiconductor production in the hands of the U.S. multinationals and the Nationalist Party. These findings suggest that the telecommunications not only provided these two assistances to the U.S. semiconductor assembly operation in Taiwan but also in the other countries of Southeast Asia which developed in the similar historical contexts.

4. The joint ventures and technology transfer of semiconductor manufacturing consistently fell into the hands of the corporations controlled by the Nationalist Party. The early history of the Taiwan electronics industry is reflected in how the members of the Nationalist Party exclusively took advantage of the triple alliance/competition (Taiwan, the U.S., and Japan) to start their own businesses. It was a denational achievement which underpinned one of the successful Taiwan experiences.

5. The contradictions between the actions of the conflict-riven Taiwan state and the goals of its national development were found in this thesis. However, designed by the security regime, the government policy consistently served the coalition of the U.S. TNCs and the Nationalist Party. These internal conflicts must be taken into consideration in the any discussion talking about the relations between the Taiwan state and its technological development.

B. Theoretical Consideration

1. This thesis suggests that interlocking ownerships are found between the U.S. semiconductor assembly plants and the foreign contractors of telecommunications expansion in East Asia. The studies of global semiconductor assembly lines must clarify the connection between these two actors in order to fully understand the origins of the global option for the U.S. semiconductor multinationals.

2. The Taiwan state could not predictably achieve its development due to the external determinant: the U.S.-Japan alliance/competition. However, due to a ubiquitous security supervision, Taiwan could firmly designate who were the beneficiaries from the technological transfer. The Taiwan state performed in its two different positions in its dependency context. These findings should supplement the existing research, especially the Ph.D. dissertation by Danny Lam in 1992.

3. The Taiwan version of triple alliance is proved to comprise a strong state of the competing bureaucrats, ruling party-controlled local capital, and the U.S. military-industrial complex-supported TNCs. These themes should be applied to the other research on the development of the different sectors of the economy in order to expand the studies of Taiwan development.

4. The finding that the war economy (the Cold War and Vietnam War), which created security systems in Pacific Asia, contains the product life cycle is tenable, demonstrated in this thesis by a comprehensive approach, to a study of the problematic of the global shift of the U.S. electronics industry in Southeast Asia.

5. The Taiwan dependency in the development of telecommunications/semiconductor industries is uncovered after the structure of the local capital was located in the context of the international capital for transferring technology. The studies of the East Asian electronics industry need to be revised in light of this aspect.

6. Adopting an endogenous conceptual framework of the information technologies policy, this thesis successfully develops the research project and proposes that the current research should bring more attention to the endogenous concept in studying the information technologies, and expanding on Mansell's 1987 endeavour.

7. This thesis proves that in Taiwan, the contribution of communications technologies to the national development were blocked or redefined by the military/security regimes or the local-elite/TNCs coalition. The conflicting interests are repeatedly presented in the form of military versus trade, and industrial versus civilian demands (for radio and electronics components, telephone application, rate-making, electronics knowledge transfer, and living conditions). The thesis shows that these contrasts are very important to structure the problematic for studies of the political economy or sociological aspects of telecommunications-mediated development.

8. This thesis also proves that the technological development which was directed by the authoritarian regime, facilitated through the control function of telecommunication system, monopolized the benefits for a specified interest group and repressed the social diversity which should have come with the economic take-off. This argument should be treated as the central problematic of the study for questioning what kind of national development was achieved by the dependent state industrial planners in using telecommunications infrastructure.

References

(Texts in English)

Books and Journals

Bergen, John D. (1986) United States Army in Vietnam Military Communications--A Test for Technology Center of Military History. Washington, D.C.: U.S. Army.

Braun, Ernest, and Stuart MacDonald (1982) 2d ed., Revolution in Miniature: The History and Impact of Semiconductor Electronics Re-explored. New York: Cambridge University Press.

Carey, James W. (1988) "Technology and Ideology: the Case of the Telegraph". In Communications as Culture: Essays on Media and Society. Boston: Unwin Hyman, pp 201-230.

Castells, Manuel (1989) The Informational City: Information Technology, Economic Restructuring and the Urban-Regional Process. Oxford: Basil Blackwell.

Chan, Steve (1992) "Military Burden, Economic Growth, and Income Inequality: the Taiwan Exception." In Defense, Welfare and Growth, ed. Steve Chan and Alex Mintz, London: Routledge, pp 163-178.

Chan, Steve, and Cal Clark (1992) Flexibility, Foresight and Fortuna in Taiwan Development--Navigating between Scylla and Charybdis. New York: Routledge.

Chang, Chu-i (1965) "A New Prime Mover for Electronic Engineering Education and Research in the Republic of China--The United Nations Training and Research Center for Telecommunication and Electronics". Journal of Electrical Engineering 8:2 (June):22-27.

Chen, Shu-jen (1958) "TTA & Sino American TA Program". Sino-American Technical Cooperation Association Review Quarterly 2:4 (January): 24-5.

Chen, Yu-hsi (1981) Dependent Development and Its Sociopolitical Consequences: A Case Study of Taiwan. PhD Dissertation Department of Political Science, University of Hawaii at Monao, USA.

Chiang, Shu-liang (1958b) "TTA and US Aid". Sino-American Technical Cooperation Association Review Quarterly 3:2 (June): 23-27.

- Chu, Jorry T.K. (1961) "The Public Utilities Rate-making and Its Rectification". Sino-American Technical Cooperation Association Review Quarterly 6:2 (June): 58-60.
- Clough, Ralph N. (1978) Island China. Cambridge: Harvard University Press.
- Codding Jr., George A., and Anthony M. Rutkowski (1982) The International Telecommunication Union in a Changing World. Dedham: Artech House, Inc.
- Craig, L.C. (1981) "Office Automation at Texas Instruments, Incorporated". In Telecommunications and Productivity, ed. Mitchell L. Moss, Reading, MA: Addison-Wesley, pp 202-214.
- Cumings, Bruce (1987) "The Origins and Development of the Northeast Asian Political Economy: Industrial Sectors, Product Cycles, and Political Consequences". In The Political Economy of the New Asian Industrialism, ed. Frederic C. Deyo, Ithaca: Cornell University Press, pp 44-83.
- De Grasse (1984) "The Military and Semiconductors". In The Militarization of High Technology, ed. John Tirman, Cambridge: Ballinger Publishing Company, pp 77-104.
- Deyo, Frederic C. (1989) Beneath the Miracle--Labor Subordination in the New Asian Industrialism. Berkeley: University of California Press.
- Dicken, Peter (1986) Global Shift--Industrial Change in a Turbulent World. London: Harper & Row, Publishers.
- Dinh, Tran Van (1987) Communication and Diplomacy in A Changing World. Norwood, N.J.: Ablex.
- Dos Santos, T (1970) "The Structure of Dependency". American Economic Review (May): 231-236.
- Eastman, Lloyd E. (1984) Seeds of Destruction--Nationalist China in War and Revolution, 1937-1949. Stanford: Stanford University Press.
- Evans, Peter (1987) "Class, State, and Dependence in East Asia: Lessons for Latin Americanists". In The Political Economy of the New Asian Industrialism, ed. Frederic C. Deyo, Ithaca: Cornell University Press, pp 203-226.
- Fang, Hien-chee (1964) "Development of Taiwan Telecommunication in the Past Decade". Sino-American Technical Cooperation Association Review Quarterly 9:4 (December): 78-81.

- Fang, Hien-chee (1967) "Development of Telecommunications in Taiwan". Industry of Free China 27:3 (March): 23-28.
- Fang, Hien-chee (1976) "U.S. Technology and The Telecommunication Development in The Republic of China". Sino-American Technical Cooperation Association Review Quarterly 21:2 (June): 24-30.
- Flamm, Kenneth (1985) "Internationalization in the Semiconductor Industry". In Joseph Grunwald and Kenneth Flamm. The Global Factory. Washington, D.C.: The Bookings Institution, pp 39-125.
- Fuentes, Annette, and Barbara Ehrenreich (1981) Women in The Global Factory. Boston: South End Press.
- Ehrenreich, Barbar, and Annette Fuentes (1984) "Life on the Global Assembly Line". In Feminist Frameworks, ed. A. M. Jagger and P.S. Rothenberg, New York: McGraw Hill, pp 279-291.
- Gill, Stephen, and David Law (1988) The Global Political Economy--Perspectives, Problems and Policies. Baltimore: The John Hopkin University Press.
- Gold, Thomas (1986) State and Society in the Taiwan Miracle. New York: M.E. Sharpe, Inc.
- Grunwald, Joseph, and Kenneth Flamm (1985) The Global Factory: Foreign Assembly in International Trade. Washington, D.C.: The Bookings Institution.
- Henderson, Jeffrey (1989) The Globalization of High Technology Production: Society, Space and Semiconductors in the Restructuring of Modern World. London: Routledge.
- Henderson, Jeffrey, and M. Castells eds. (1987) Global Restructuring and Territorial Development. London: Sage.
- Herman, Edward (1981) Corporate Control, Corporate Power. New York: Cambridge University Press.
- Hu, K.P. (1966) "The Growing Electronics Industry on Taiwan". Industry of Free China 27:6 (Dec.): 28-33.
- Huffman, Gerald H. (1966) "The U.S. Aid Program and China's Economic Progress". Sino-American Technical Cooperation Association Review Quarterly 11:3 (Sept.): 1-5.
- Innis, Harold A. (1952) Changing Concepts of Time. Toronto: University of Toronto Press.

- ITU (1965b) From Semaphore to Satellite: Published on the Occasion of the Centenary of the International Telecommunication Union. Geneva: ITU.
- Iversen, Wesley R. (1980) "When TI Talks, The Message Moves Fast". Electronics (January 17): 102-104.
- Jacoby, Neil H. (1966) U.S. Aid to Taiwan-- A Study of Foreign Aid, Self-help, and Development. New York: Frederick A. Praeger, Publishers.
- Jayaweera, Neville (1986) "The Third World and the Political Economy of the Communication Revolution". In Communication and Domination: Essays to Honour Herbert I. Schiller, ed. J. Becker et al., Norwood, N.J.: Ablex, pp 30-44.
- Kerr, George H. (1965) Formosa Betrayed. Boston: Houghton-Mifflin.
- Kinsley, Michael E. (1976) Outer Space and Inner Sanctums: Government, Business, and Satellite Communication. New York: John Wiley & Son.
- Koo, Hagen (1987) "The Interplay of State, Social Class, and World System in East Asian Development: the Cases of South Korea and Taiwan". In The Political Economy of the New Asian Industrialism, ed. Frederic C. Deyo, Ithaca: Cornell University Press, pp 165-181.
- Kraft, Victoria M. (1991) The U.S. Constitution and Foreign Policy-Terminating the Taiwan Treaty. New York: Greenwood Press.
- Lam, Danny King-kong (1992) Explaining Economic Development: A Case Study of State Policies towards the Computer and Electronics Industry in Taiwan (1960-80). PhD Dissertation Department of Political Science, Carleton University, Ottawa, Canada.
- Larsen, S.R., and J.L. Collins (1975) Allied Participation in Vietnam. Washington, D.C.: Dept. of Army.
- Lee, William W. (1960) "Fundamental Principles of Telephone Rate Making". Sino-American Technical Cooperation Association Review Quarterly 5:2 (June): 49-54.
- Li, K.T. (1976) The Experience of Dynamic Economic Growth of Taiwan. Taipei: Mei Ya Publications, Inc.
- Mansell, Robin E. (1987) "Information Sector Policy Analysis: Conceptual frameworks and a Canadian illustration". Gazette 39:195-210.

- Melman, Seymour (1974) The Permanent War Economy--American Capitalism in Decline. New York: Simon and Schuster.
- Melody, William H. (1981) "Introduction". In Culture, Communication, and Dependency--The Tradition of H.A. Innis, ed. W. H. Melody, L. Salter and P. Meyer, Norwood, N.J.: Ablex, pp 3-11.
- Melody, William H. (1985) "The Information Society: Implications for Economic Institutions and Market Theory". Journal of Economic Issues XIX:2 (June): 523-539.
- Molina, Alfonso Hernan (1989) The Social Basis of the Microelectronics Revolution. Edinburgh: Edinburgh Univ. Press.
- Mortara, H.A. (1969) "RCA... Pioneer in Pacific Communications". Signal (Oct): 60-2.
- Mosco, Vincent (1982) Pushbutton Fantasies: Critical Perspectives on Videotext and Information Technology. Norwood, N.J.: Ablex.
- Mosco, Vincent (1983) "Introduction". In The Critical Communications Review Vol.1, ed. V. Mosco and J. Wasko, Norwood, N.J.: Ablex, pp ix-xxviii.
- Mosco, Vincent (1986) "New Technology and Space Warfare". In Communication and Domination: Essays to Honour Herbert I. Schiller, ed. J. Becker et al., Norwood, N.J.: Ablex, pp 76-83.
- Mosco, Vincent (1989) "Computer: Impact on Military Affairs". In Volume 1, International Encyclopedia of Communications, ed. George Gerbener, New York: Oxford University Press, pp 383-385.
- Mosco, Vincent (1993) "Communication and Information Technology for War and Peace". In Communication and Culture in War and Peace, ed. Colleen Roach, Newbury Park, CA: Sage, pp 41-70.
- Mulgan, Geoffrey J. (1991) Communication and Control--Networks and the New Economies of Communication. Cambridge: Polity Press.
- Murphy, Brian M. (1986) The International Politics of New Information Technology. Kent: Croom Helm Ltd.
- Nadeau, Jules (1990) Twenty Million Chinese Made in Taiwan. Translated by David Homel. Montreal: Montreal Press.

- Nelson, Joyce (1989) Sultans of Sleaze--Public Relations and the Media. Toronto: Between the Lines.
- Nissen, Bruce (1971) "The World Bank: A Political Institution". Pacific Research II:6 (Sept./Oct.): 9-23.
- Ohlin, Goran (1966) Foreign and Policies Reconsidered. Paris: Development Centre, OECD.
- Pool, Ithiel de Sola (1981) "International Aspects of Telecommunications Policy". In Telecommunications and Productivity, ed. Mitchell L. Moss, Massachusetts: Addison-Wesley Publishing Company, pp 156-167.
- Radford, W. H., and T. F. Rogers (1963) "Advances in and Uses of Tropospheric Scatter Techniques for Communications". In Communications, Vol.12, ed. USAID, Washington D.C.: USGPO, pp 82-95.
- Read, William H. (1976) Foreign Policy: The High and Low Politics of Telecommunications. Harvard University, Program on Information Technologies and Public Policy, (February).
- Ready, Joseph Z. (1967) "Taiwan, A Healthy Place for Industrial Investment" Asian Industry (February).
- Renshaw, E.F. (1963) "Experience of the United States in Bringing Modern Telephone Service to Unserved Areas". In Communications, Vol.12, ed. USAID, Washington D.C.: USGPO pp 67-81.
- Rheingold, Howard (1985) Tools for Thought--The People and Ideas behind the Next Computer Revolution. New York: Simon & Schuster.
- Richardson, Charles S. (1971) "Long Distance Dialing Comes to South-East Asia". Signal (March): 10-13.
- Rose, Joseph (1969) "Autovon and Autodin: Past, Present and Future" Signal (April): 12-18.
- Rosenberg, David A. (1979) "Liberty Versus Loyalty: The Transformation of Philippine News Media under Martial Law". In ed. Marcos and Martial Law in the Philippines, Ithaca: Cornell University Press, pp 145-179.
- Saunders, Robert J., Jeremy J. Warford and Bjorn Wellenius (1983) Telecommunications and Economic Development. Baltimore: John Hopkins University Press.
- Schiller, Dan (1982) Telematics and Government. Norwood, N.J.: Ablex.

- Schiller, Herbert I. (1973) "Authentic National Development versus the Free Flow of Information and the New Communications Technology". In Communications Technology and Social Policy, ed. G. Gerbner, L. Gross and William H. Melody, New York: Wiley, pp 467-480.
- Schiller, Herbert I. (1979) "Transnational Business, the Free Flow of Information, and the Question of Regulation". In Telecommunications Policy and the Citizen, ed. Timothy R. Haight, New York: Praeger, pp 95-105.
- Schiller, Herbert I. (1984) "Informatics and Information Flows: The Underpinnings of Transnational Capitalism". In The Critical Communications Review Vol.2, ed. V. Mosco and J. Wasko, Norwood, N.J.: Ablex, pp 3-29.
- Schiller, Herbert I. (1992) 2d ed. Mass Communications and American Empire. Boulder: Westview Press.
- Schreiber, Jordan C. (1970) U.S. Corporate Investment in Taiwan. New York: The Dunellen Company.
- Schuh, Charles H. (1964) Industrial Research in Taiwan. Taipei: CIECD.
- Scott, A. J. (1987) "The Semiconductor Industry in South-East Asia: Organization, Location and the International Division of Labour" Regional Studies 2:2: 143-160.
- Siegel, Lenny (1971) "Vietnam's Electronic Battlefield". Pacific Research & World Empire Telegram II:6 (Sept.-Oct.): 1-8.
- Siegel, Lenny (1980) "Delicate Bonds: The Global Semiconductor Industry". Pacific Research I:1.
- Siegel, Lenny (1993) "Beyond NAFTA: Competing and Winning against Ourselves". Global Electronics 122 (November).
- Sivanandan, A (1980) "Imperialism in the Silicon Age". Monthly Review (July-August): 24-42.
- Smythe, Dallas W. (1957) The Structure and Policy of Electronic Communication. Urbana: University of Illinois Press.
- Smythe, Dallas W. (1981) Dependency Road: Communications, Capitalism, Consciousness, and Canada. Norwood, N.J.: Ablex.

- Smythe, Dallas W. (1986) On the Political Economy of C³I. In Communication and Domination: Essays to Honour Hebert I. Schiller, ed. J. Becker et al., Norwood, N.J.: Ablex, pp 66-75.
- (SRI) Stanford Research Institute (1962) The Feasibility of A Transistor Radio Assembly Plant in Taiwan. Menlo Park, CA: Stanford Research Institute. (Co-Authors: William T. Kopp and Ned D. Osborn)
- Sussman, Gerald (1982) "Philippines: Corporate Control in Communications". Pacific Research XI:4 (Dec.).
- Sussman, Gerald (1984) "Global Telecommunications and The Third World: Theoretical Considerations". Media, Culture and Society 6:3: 289-300.
- Sussman, Gerald (1987) "Banking on Telecommunications: The World Bank in the Philippines". Journal of Communication 37:2 (Spring): 90-105.
- Sussman, Gerald, and John A. Lent (1991) "Introduction: Critical Perspectives on Communication and Third World Development" In eds. Transnational Communications--Wiring the Third World. Newbury Park, California: Sage, pp 1-26.
- Tanko, Yoshiro (1992) Nippon Telegraph and Telephone Privatization Study Experience of Japan and Lessons for Developing Countries. Washington, D.C.: World Bank.
- Tehrani, Majid (1990) Technologies of Power: Information Machines and Democratic Prospects. Norwood, N.J.: Ablex.
- Todd, Daniel (1988) Defence Industries: A Global Perspective. London: Routledge.
- Todd, Daniel (1990) The World Electronics Industry. London: Routledge.
- Tuan, Kailin (1967) "The Development of Electronic Industries in Taiwan". Industry of Free China 26:6(June): 26-34.
- Vernon, Raymond (1979) "The Product Cycle Model". In Transnational Corporations and World Order--Readings in International Political Economy, ed. George Modelski, San Francisco: W.H. Freeman and Company, pp 108-117.
- Wasko, Janet (1984) "Introduction" In The Critical Communications Review Vol.2, ed. V. Mosco and J. Wasko, Norwood, N.J.: Ablex, pp ix-xvii.

Wellenius, Bjorn, Arnold Miller and Carl J. Dahlman eds.
(1993) Developing the Electronics Industry. Washington,
D.C.: World Bank.

Weppler, H.E. (1963) "The Use of Microwave Radio for
Telecommunications". In Communications Vol.12, ed. USAID,
Washington, D.C.: USGPO, pp 96-109.

Wilson, Kevin (1988) Technologies of Control: The New
Interactive Media for the Home. Madison: Univ. of Wisconsin
Press.

Zorkoczy, Peter (1990) 3d ed. Information Technology--An
Introduction. London: Pitman Publishing.

Public and Government Documents

Bradstrum, Ray E. (1966) Engineering Report on IBRD Loan
Project: Telecommunications Development Plan in Taiwan.
Washington, D.C.: World Bank.

China Yearbook 1978. Taipei: China Publishing Co.

DGT (1959a) Application for United Nations Special Fund for
the Establishment of a Training and Research Center for
Telecommunication and Electronics. Taipei: DGT MOC.

DGT (1959b) The Reports of ITU Plan Working Group for South
Asia and The Far East. Taipei: DGT.

DGT (1965) Resume for The Visit of Mr. Robert Walsh, IBRD
Telecommunication Development Plan in Taiwan (1967-1972).
Taipei: DGT MOC.

DGT (1966) Application for International Bank for
Reconstruction and Development Loan First IBRD Loan
Telecommunications Expansion Project in Taiwan. Taipei: DGT
MOC.

DGT (1967a) The Report to Transport and Communications
Committee (Sixteenth Session), ECAFE. Taipei: DGT.

DGT (1968) The Report to 23TH Session Administrative Council
ITU.

DGT (1969a) The Report to 24TH Session Administrative Council
ITU.

DGT (1969b) The Report of the Telecommunication Sub-committee
(First Session) to the Transport and Communications
Committee (Seventeenth Session), ECAFE. Taipei: DGT.

- DGT (1970) The Report to 18TH Transport and Communications Committee (Eighteenth Session), ECAFE. Taipei: DGT.
- DGT (1971) Application for IBRD Loan Telecommunications Project. Taipei: DGT MOC.
- DGT (1972a) The Proceedings of Sixth Working Party/Fifth Plenary Committee Meeting, Pacific Plenary Restoration Meeting.
- DGT (1972b) Application for Eximbank Loan Telecommunications Development Project in Taiwan. Taipei: DGT MOC.
- DLF, Loan No. 114, Taiwan Telecommunications Administration, Implementation Letter No.1. (November 2) 1960.
- Duh, Eugene C.Y. (1977) "The Development of IC Technology in the Republic of China". In The Report of ROC-USA Economic Council Joint Meeting, ed. Fang, Hien-chee et al., Taipei: DGT, pp 30-4.
- Export-Import Bank of the United States, Cumulative Record by Country 1974. Washington, D.C.: EXIMBANK.
- Fang, Hien-chee, Kuang-ti Chu and Kun-jun Lee eds. (1977) The Report of ROC-USA Economic Council Joint Meeting. Taipei: DGT.
- Hanselman, John J. (1971) Report on Ten-Year Telecommunications Development Program. Washington, D.C.: World Bank.
- (IERC) Industrial Economics Research Center/ITRI (1988) Changes in the Environment and the Development of Telecommunications in Taiwan. R.O.C.. Hsinchu: Office of Planning & Technical Marketing/IERC/ITRI.
- Industrial Development and Investment Center (1973) The Outlook for the Electronics Industry in Taiwan. Taipei: MOEA.
- International Cooperation Administration, Project Proposal and Approval, Schedule UL (84-22-030 C) Fiscal Year 1957.
- (ITU) International Telecommunication Union. (1977) Report by the Administrative Council to the Plenipotentiary Conference. Geneva: The General Secretariat of the ITU.
- International Telex Directory ROC 1968-1977. Taipei: Chinese Government Radio Administration.

The J.G. White Engineering Corporation, Application for MES AID to The Joint Committee on Industrial Reconstruction and Replacement, MSA/CUSA for the Expansion of Key City Telephone Systems, TTA Taipei Taiwan. (Fiscal Year 1953) Oct. 1952.

Kung, Velin (1977) "Background Report of Electronics Industry. In The Report of ROC-USA Economic Council Joint Meeting, ed. Fang, Hien-chee et al., Taipei: DGT, pp 1-6.

Mao, Robert Y.L. (1977) "Background Report on Telecommunication Industry". In The Report of ROC-USA Economic Council Joint Meeting, ed. Fang, Hien-chee et al., Taipei: DGT, pp 1-8.

Pai, K.V. (1965) A Report on Telecommunication Services in ROC. Bangkok: ECAFE U.N..

TTA (1954) Application for U.S. AID for The Expansion of City and Toll Telephone Systems. (Fiscal Year 1955) March 1954.

(UNCTC) United Nations Centre on Transnational Corporation (1986) Transnational Corporations in The International Semiconductor Industry. New York: United Nations.

(USAID) United States Agency for International Development (1963) Communications, Vol. 12 (United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas, Feb. 1963 Geneva). Washington D.C.: USGPO.

U.S. Dept. of Commerce (1974) Export Opportunities for Electronics Industry Production and Test Equipment (Global Market Survey). Washington D.C.: USGPO.

World Bank (1971) Telecommunication Sector Working Paper. Washington, D.C.: World Bank.

Newspapers, Magazines and Others

American Report (1971) "Philco-Ford: a Major Supplier for the Electronic Battlefield." December 10.

Arrigo, Linda Gail, Report Manuscript: Electronics Manufacture Prospering in Taiwan.

Arrigo, Linda Gail (1983) Economic and Political Control of Women Workers in Multinational Electronics Factories in Taiwan: Martial Law Coercion and World Market 'Uncertainty. Paper presented at Dept. of Sociology, SUNY Binghamton, New York May 1983.

- "Counterattack Base for U.S. Companies". 1970. Business Week 11 July, 38.
- "Buyers from U.S. Zero-In on Taiwan". 1972. Electronic News 5 June (by John Hataye)
- "\$12M Taiwan IC Project Due for Completion in 2 Yrs." 1976. Electronic News 21 June. (by Nat Snyderman)
- "RCA Settling down to Gather CMOS" 1984. Electronics Week 27 August, 61-2. (by Robert J. Kozma)
- Engstrom, Elmer W. (1967) Research as A National Resource. Addressed at Stanford Research Institute Associates Day San Francisco, California, Dec. 14.
- "Electronics in Taiwan, Republic of China" 1971. EPZ Concentrates 6:5 (May): 34-42.
- Free Press (1970) "War Causes Strike". 4:3 (17 June).
- Free Press (1970) "RCA and the War Machine". 4:4 (22 June).
- Free Press (1970) "RCA Strike". 4:5 (4 July).
- International Bank For Reconstruction and Development Press Release, 1970. No. 70/19 (8 April); 1970. No. 70/37 (12 June)
- Lam, Danny King-kong (1991) The Myth of State Led Industrialization: the Origins of Electronics Manufacturing in Taiwan. Paper presented at the 1991 Annual Meeting of the American Political Science Association, The Washington Hilton, August 29-Sept.1, 1991.
- Mass High Tech. 1985. (28 October-10 November).
- "Special Report: Milestones in Microwaves". 1978. (MSN) Microwave System News (June): 34-45.
- "Three Days of Slaughter" 1947. New York Times, 29 March. (by Tillman Durdin)
- "US Consumer Electronics Makers' Big Move to the Orient and Their Coming Struggle for Markets with Japan." 1970. Pacific Basin Reports June.
- "Battle for The Cheap Labor: Japanese Electronics Firms Follow US Companies to Taiwan" 1971. Pacific Basin Reports Feb.
- "Making TVs for The US Market" 1973. Pacific Basin Reports Oct.

"Runaway RCA Plant Closes; Leaves 4,000 Jobless; Memphis Plant Moves to Taiwan" 1971. Southern Patriot March.
(by Mike Welch)

"Transcript of Interview with Messrs, O'Brien, Nanda, Quek, Texas Instrument". (31 May 1976) (provided by Pacific Studies Center)

"The Attractiveness of Taiwan Cheap Wage to Investment" 1969. Wall Street Journal, 27 March. (by William D. Hartly)

"RCA Joint TV Venture in Taiwan Plans Making Black-and-White Tubes" 1971. Wall Street Journal, 25 March.

(Texts in Chinese)

Books and Journals

Bank of Taiwan Quarterly (1971) Multinationals, Overseas Chinese Enterprise and Taiwan Economic Development. 22:4 (Oct.).

Chao, Chi-chang (1985) The Distribution of U.S. Aid. Taipei: United and Economic Daily News Publishing Company.

Chao, Nan-hung (1979) The Research of Management of Taiwan Semiconductor Industry. Master Thesis. Institute of Industrial Management, National Cheng Kung University Taiwan.

Chang, Meng-yu (1983) The Study of Supply and Demand of the Major Electronics Components in Taiwan. M.B.A. Thesis. Graduate School of Business Administration of National Chengchi University Taiwan.

Chang, Yu-te (1964) "The Reconsideration of South Asia and The Far East Cable Plan". Monthly Newsletter of Nationalist Telecommunications Division 44 (Oct.): 23-5.

Chen, Chin (1961) "The Test Report of ROC-Japan VHF Forward Scattering Propagation". Communications Development Monthly 10:12 (Dec.): 19-23.

Chen, Leon Y., M. H. Wang, F. Lee, and F. C. Wu (1960) "Seven W's about Taiwan Backbone Microwave System Route Selection". Taiwan Telecommunications Technical Quarterly 4:1 (December): 1-39.

Chen, Leon Y., and M.H. Wang (1961) "The Design Report of TTA Trans-island Backbone Microwave System". Communications Development Monthly 10:12 (Dec.): 17-19.

- Chen, Shin-Meng S., et al. (1991) Disintegrating KMT-State Capitalism- A Closer Look at Privatizing Taiwan's State-and Party-owned Enterprises. Taipei: Illumination Society.
- Chen, Shu-jen (1952) "The Review of Taiwan Telecommunications Development in 1951". Communications Development Monthly 1:1 (January): 22-28.
- Chen, Shu-jen (1963) "The Rehabilitation and Expansion of Taiwan Telecommunications". Journal of Engineering 36:4 (April): 74-83.
- Chen, Tu-chen (1967) "The Report of Six-Year Series Programs of Telecommunication Training Classes for Retired Servicemen". Communication Development Monthly 16:12 (Dec.): 48-75.
- Cheng, Sz-chun (1960) "The Project and Test of ROC-Japan VHF Forward Scattering Propagation". Communications Development Monthly 9:12 (Dec.): 29-32.
- Cheng, Sz-chun (1967) "Introduction to Taiwan-Hong Kong Transhorizon Microwave System". Communications Development Monthly 16:12 (Dec.): 32-7.
- Chiang, Shu-liang (1958a) "U.S. Aid and Taiwan Telecommunications". Communications Development Monthly 7:1 (January): 16-19.
- Chiang, Shu-liang (1960) "The Construction of Trans-island Backbone Microwave System". Communications Development Monthly 9:12 (December): 17-19.
- Chien, Gisson S. (1964) "Telecommunications Development and Electronics Industry". Communications Development Monthly 13:12 (December): 1-4.
- Chin, Shih-tien, and Kuang-ti Chu (1966) The Discussion on City Telephone Expansion, Rate-making and Bill Collecting. Taipei: Planning and Examination Board, Nationalist Taiwan Telecommunication Division.
- Chu, Pin, and Kuo-hsiang Chen (1987) The Forty-Year Development of Taiwan Press (1945-1986). Taipei: The Independence Evening Post.
- Chu, S.T. (1964) "A Summarized Report on Technical Training Programs under The Cooperation of TTA and Taichung Senior Vocational Industrial School". Taiwan Telecommunications Technical Quarterly 7:3 (June): 47-54.

- Chou, Hsuan (1973) The Management of Telecommunication Operation. Taipei: DGT.
- Ding, Yu (1964) "The Relationship between TV and Radio Regulation". Communications Development Monthly 13:12 (Dec.): 13-16.
- Fang, Hien-chee (1954) "The Management Problem of Telecommunication Enterprise". Communications Development Monthly 3:5 (May): 2-4.
- Fang, Hien-chee (1959) "The Schedule and Project of Telecommunications Rehabilitation after The Flood on August 7 1959". Communications Development Monthly 8:12 (Dec.): 9-10.
- Fang, Hien-chee (1960) "Taiwan Microwave Communications System". Current Communications 5 (May): 87-89.
- Fang, Hien-chee (1964) "The Present Status of Telecommunication of TTA and Its Future Prospects". Taiwan Telecommunications Technical Quarterly 7:2 (March): 1-4.
- Fang, Hien-chee (1964) "A Review of The Implementation of the AID Loan NO.12 Project". Taiwan Telecommunications Technical Quarterly 7:4 (Dec.): 3-7.
- Fang, Hien-chee, and Hsin-chih Chang (1959) "The Report of Tokyo Conferences". Taiwan Telecommunications Technical Quarterly 2:4 (Sept.): 27-30.
- Foh, Nee (1971) "The Assignment and Control of the Radio Frequencies in The Republic of China". Radio-TV and Electronics Technical Quarterly 12:1 (June): 31-35.
- Hsu, Y.S. (1965) "An Engineering Report on Telecommunication System in Taiwan in The Past Year". Taiwan Telecommunications Technical Quarterly 8:4 (September): 9-11.
- Huang, Tern-han (1978) A Study on System Dynamics Models for the Management of Telex. M.B.A. Thesis, Institute of Management Science, National Chiao Tung University Taiwan.
- ITRI (1976) "IC Project". Radio-TV & Electronics Technical Quarterly 15:4 (March): 53-58.
- ITRI/ERSO (1982) The Current Report of Taiwan (ROC) Semiconductor Industry. Hsinchu: ITRI.
- Ke, Chen-ou (1983) The Foundation of Export Processing Zones. Taipei: United and Economic Daily News Publication Company.

- Kewji, Dgata, and Ueda Yoshiaki (1959) "Technical Problems Revealed by The Far East Telecommunication Network Planning Committee of ITU". Taiwan Telecommunications Technical Quarterly 3:1 (Dec.): 6-11. (translated by H.L. Lin and P.Y. Lee)
- (KIET) Korean Institute for Electronics Technology (1972) The Survey Report of Taiwan (ROC) Electronics Industry. Translated by R&D Sub-committee of Applied Science and Technology. Taipei: MOEA.
- King, David Y.D. (1962) "Report on the Participation of Research of Electronic Industry in Taiwan by SRI". In The Encouragement of Local Manufacturing for Communications Equipment, ed. MOC, Taipei: Research Institute of Communications, MOC, pp 47-70.
- King, Y.H. (1974) "The Working Report of Sino-American Joint Venture of Producing Switching System and DGT Assistance". In The Proceedings of Telecommunications Management Seminar 1974, ed. DGT Research and Planning Board, Taipei: DGT, pp 22-27.
- Kong, P.H. (1960) "An Abbreviated Report on the Proceedings of Committee 4 of The International Radio Administrative Conference Held in Geneva from Aug. 17 to Dec. 21, 1959". Taiwan Telecommunications Technical Quarterly 3:2 (March): 24-28.
- Kong, P.H. (1977) "The Promotion of Taiwan Electronics Industry Development". Journal of Electrical Engineering 20:2-3 (Oct.): 15-17.
- Kong, P.H. (1988) My Autobiography: 1908-1988.
- Lee, Shih-chung (1980) An Evaluation of Taiwan's Investment Environment by Foreign Companies. M.B.A. Thesis, Institute of Management Science, National Chiao Tung University Taiwan.
- Liang, Berlain (1972) "An Introduction of General Instrument Corp., G. I. C.". Radio-TV & Electronics Technical Quarterly 12:4(March): 91-95.
- Liang, K.P. (1956) "U.S. Military Communications Service". Communications Development Monthly 5:12 (Dec.): 38-41.
- Liang, K.P. (1962) "Submarine Telephone Cable System and International Communications". Taiwan Telecommunications Technical Quarterly 5:3 (June): 1-15.

- Lin, Hsi-ming (1987) The Process of Developing Industry in NIC--the Case of Taiwan IC Industry. Master Thesis, School of Business, National Taiwan University Taiwan.
- Liu, Chi-hao (1975) "The Analysis of Rate-Making of Taiwan Telephone Service". Bank of Taiwan Quarterly, 26:4 (December).
- Liu, Chin-chin (1992) The Analysis of Postwar Taiwan Economy. Translated by Wang, Hung-jen, Chi-wen Lin and Ming-chun Lee. Taipei: Human Publication Company.
- Liu, Shu-chieh (1973) "The Perspective and Growth of International Telecommunications". Communications Development Monthly 22:12(Dec.): 35-38.
- Pan, Ben-heng (1965) "The Perspective on Taiwan Electronics Industry from Transistors Manufacturing in Chiao Tung Univ." Overseas Chinese Monthly No.155 (July): 18.
- Pan, Wen Y. (1968) "The Role of Integrated Circuits in Taiwan Electronics Industry". Radio-TV & Electronics Technical Quarterly 11:3 (Sept.): 145-154.
- Science of Communications (1961) "The Automatigation of Taipei North Suburban Telephone Network". 5:4 (April): 58-67. (Author: Chen, Yu-kai)
- Shen, Shou-liang (1959) The Studies of Local Sourcing of Telecommunications Supplies. Taipei: Research Institute of Communications, MOC.
- Shen, Shou-liang (1963) "The Current Progress of Telecommunications". Communications Development Monthly 12:12 (Dec.).
- Shen, Shou-liang (1969) "Taiwan Telecommunications Utility". Bank of Taiwan Quarterly 20:3 (Sept.): 173-196.
- Studies on Taiwan Electronics Industry Strategies. Unknown Author and Publisher.
- Taiwan Telecommunication Administration (1960) The Rehabilitation of Taiwan Telecommunication. Taipei: TTA.
- Wang, Chin-tu (1976) "The Current Contribution of the Technology Innovations to Telecommunications Enterprise". Journal of Electrical Engineering 19:2 (June): 5-11.
- Wang, Mei-hua (1969) "The Development of Current Microwave System in West Coast". DGT Monthly News 3:1 (January): 64-5.

- Wang, Timothy L. (1959) "The Proposal of Taiwan TV Station Installation". Communications Development Monthly 8:12 (December): 11-15.
- Wang, Timothy L., Shou-liang Shen and Lien-chieh Tang (1968) Military Telecommunications Service. Taipei: Research Institute of Communications, MOC.
- Wen, Hsin-yin (1990) The Hidden Side of Taiwan Miracle-A Political Economy Analysis of U.S. Aid on Taiwan Development. Taipei: Independence Post Publishing Company.
- Wu, Jo-yu (1992) The Political Economy of Postwar Taiwan Public Utilities. Taipei: Chang Yung-Fa Foundation Institute for National Research.
- Yang, Ai-li (1989) The Biography of Sun, Yun-suan. Taipei: Commonwealth Magazine Company.
- Yang, C.L. (1971) "The Satellite Contingency Plan and The Restoration of Earth Stations". Taiwan Telecommunications Technical Quarterly 14:1-2 (June): 166-172.
- Yeh, Hsueh-shan (1981) The Inflows of Foreign Capitals. Taipei: United and Economic Daily News Publishing Company.
- Yen, Ching-chang (1975) The Legal Status of United States Armed Forces in the ROC. Taipei: Sun Min Book Company.
- Yu, Jun-sheng (1959) "The Review and Perspective of Taiwan Broadcasting Service". Communications Development Monthly 8:12 (December): 6-8.

Public and Government Documents

- The Abstract of Computer Resource 1980. Taipei: Electronic Data Processing Center, Directorate General of Budget, Accounting & Statistics, Executive Yuan.
- China Telecommunications Almanac 1881-1971. Taipei: DGT.
- Chinese Government Radio Administration (1970) The Handbook of TELEX and Tieline. Taipei: DGT.
- (CIECD) Council for International Economic Cooperation and Development (1964a) The Current Report of U.S. Aid. Taipei: CIECD.
- CIECD (1964b) A Final Report of Taiwan Telecommunications under U.S. Aid Assistance. Taipei: CIECD.
- CIECD Yearbook 1964-1972. Taipei: CIECD, Executive Yuan.

(CUSA) Council on U.S. Aid (1957) Current Sino-American Economic Assistance and Cooperation. Taipei: CUSA.

CUSA (1960) Current Sino-American Economic Assistance and Cooperation. Taipei: CUSA.

CUSA (1961) The Beneficiaries of U.S. Aid in Past Ten-Year. Taipei: CUSA.

DGT (1962a) The Proposal of the Telecommunication Projects in Coordination with Military Mobilization. Taipei: DGT.

DGT (1962b) The Report of International Meeting on Submarine Cable Plan for South Asia and The Far East. Taipei: DGT.

DGT (1964) The Report of The Second Meeting on Submarine Cable Plan for South Asia and The Far East. Taipei: DGT

DGT (1967b) The Specification of City and Toll Telephone Switching System in World Bank Telecommunications Expansion Project. Translated by DGT. Taipei: DGT.

DGT (1972) The Sixth Four-Year Plan of Telecommunications. Taipei: DGT, Ministry of Communications (MOC).

DGT (1974) The Report of The First Southeast Asia/Pacific Submarine Cable Systems Plenary Planning Meeting. Taipei: DGT.

DGT (1979) "Submarine Cable Communications System" In DGT Corporate Policy Seminar on Communication Networking. Taipei: TTI, pp 329-335. (Author: Yu, Kung-Chiu).

DGT (1981) Centennial Issue of Telecommunications in China. Taipei: DGT.

DGT (1982) Telecommunications and Industry in Information Week 82. Taipei: DGT.

DGT Research and Planning Board, The Proceedings of Telecommunication Management Seminar 1972, 1974, 1976. Taipei: DGT.

DGT R&D Yearbook 1971 (Directorate General of Telecommunications Research and Development Yearbook) "The Proposal for Operation of Telex and Gentex". (Co-Author: Lan, Chien-chen, and Yen-ting Wu)

DGT R&D Yearbook 1974, "An Empirical Analysis of the Correlation between International Telecommunication and Economic Development & The Predictable Model of Service Growth", pp 295-378. (Co-Authors: Liu and Wu)

DGT R&D Yearbook 1974, "Assisting Production of Cross-bar Automatic Switching System of Toll and City Telephone", pp 411-5. (Co-Authors: Kuo, Shih-mien, and Chun-yi Cheng)

DGT R&D Yearbook 1975, "The Proposal of Developing Local Semiconductor Industry", pp 47-62. (Author: Wang, Mei-hua, Cho-chen Huang, Kai-yi Tang and Kan-cheng Yeh)

DGT R&D Yearbook 1978, "The Studies of the Future of International Data Communications Development and Operation", pp 97-108. (Co-Authors: Yung-yen Yang et al.)

DGT R&D Yearbook 1982, "The Studies of Rate-making for Domestic Data Communications", pp 269-308. (Co-Authors: Lu, Chen-chia, Tien-Kuei Lee, Hsiu-mei, Liu et al.)

DGT White Paper 1993. Taipei: DGT MOC.

(EIRC) Electronics Industry Research Center/ITRI (1978) "Introduction to MOS Integrated Circuit Demonstration Plant". Journal of Electrical Engineering 21:2 (August): 5-12.

(ERSO) Electronics Research Service Organization/ITRI (1983) The Second Term of Electronics Industry R&D Plan. Hsinchu: ERSO.

Export Processing Zone Administration (1981) Export Processing Zones at Its 15TH Anniversary. Taipei: MOEA.

Export Processing Zone Administration (1987) The Foundation and Development of ROC EPZs. Taipei: MOEA.

Hsinchu Office of TTA (1974) Fifteen-Year Long Term Development Project. Hsinchu: Hsinchu Office TTA.

Industrial Development Yearbook 1982. Taipei: Bureau of Industry, MOEA.

Information/Electronics Industry Yearbook 1988. Taipei: Taiwan Institute of Economic Research.

Investment and Operation Division, Introduction to Taiwan Labour Supply. Taipei: CIECD. (Year Unknown)

(ITA) International Telecommunication Administration (1976a) The Studies Report on Philippines Overseas Telecommunication Co. Taipei: DGT (Co-Authors: Yang, Chin-ling, and Lo, Kuang-chuan).

ITA (1976b) The Studies Report on Oceanic Wireless Network, Inc. Taipei: DGT (Lee, Kuei-to, and Lee, Mao-hsiung).

(MOC) Ministry of Communications (1960) MOC's Review of Six-Year Task and Administration (1955-1960). Taipei: MOC

(MOC) (1985) The Procedure of Authorization on License/Certificate of Import/Export--Transport of Telecommunication Equipment. Taipei: MOC.

MOEA (Ministry of Economic Affairs) (1979) List of Manufacturers and Traders of the ROC with Good Export Record in 1978. Taipei: MOEA.

Monthly Newsletter of Nationalist Telecommunications Division (1960) "The Documents of The Third Congress of Delegates, Nationalist Telecommunications Division." No.110 (April).

R&D and Evaluation Commission, Executive Yuan ROC (1986) Technological Transfer and Administrative Supervision: The Case of Taiwan Micro-computer Industry. Taipei: Executive Yuan. (Co-Authors: Ko, San-chi, and Chao-kao Lee)

Science and Technology Information Center (1973) The Reference of Electronics Industry Vol.1-2. Taipei: National Science Council.

Statistical Abstract of Telecommunications 1975, 1977. Taipei: DGT MOC.

Statistical Abstract of Transportation and Communications 1967, 1981. Taipei: MOC.

Taiwan Electrical Appliance Manufacturer's Association (TEAMA) (1988) Special Issue of 40TH Anniversary. Taipei: TEAMA.

TEAMA Membership Directory 1969-1980. Taipei: TEAMA.

Taiwan Industrial Production Statistics Monthly (ROC) January 1975; December 1976; February 1982. Taipei: Department of Statistics, Ministry of Economic Affairs (MOEA).

Taiwan Industry Yearbook 1983: Electronics. Taipei: China Credit Information Service, Ltd.

Taiwan Input-Output Tables ROC 1966, 1969, 1971, 1976. Taipei: Overall Planning Department, CIECD.

Taiwan Statistical Data Book 1987. Taipei: Council for Economic Planning and Development (CEPD).

Taiwan Studies (1967) "Twenty Years of Taiwan Economy". 93 (Sept.) Taipei: Economic Research Dept., Bank of Taiwan. (Author: W.A. Yeh)

Taiwan Telecommunication Administration (1957) The Report of the Visit of Dr. Kajii, President of NTPC. Taipei: TTA.

Telecommunications Annual Report 1967. Taipei: DGT.

Telecommunications in Taiwan 1962-5. Taipei: TTA.

Telecommunications in Taiwan China 1958, 1962. Taipei: DGT.

Telecommunications in ROC 1968, 1974, 1975-6. Taipei: DGT.

(TL) Telecommunications Laboratories (1977) The Studies Report of Mini-Microwave Communications System. Chung-li: TL TTA. (Co-Authors: Lin, Shun-chi, Ming-kao Fan, Chin-yi Yu and Ching-wen Hsu)

The Trade of China (Taiwan District) 1950-1981. Taipei: Statistical Department, Inspectorate General of Customs.

TTA (1966) Supplemental Arrangement of Residential Telephone Service for MAAG Personnel in Taiwan.

TTA (1969) The Abstract of Long Term Communications Development Project 1969-76. Taipei: TTA MOC.

TTA (1977) The Studies Report on Guam Telephone Authority. Taipei: DGT. (Co-Authors: King, Y. H., Ping-yao Lee and Tien-tsai Tseng)

TTA Research and Planning Board (1967) The Proceedings of Telecommunication Management Seminar 1967. Taipei: DGT.

World Bank (1975) "Report 630, Project Performance Audit Report: Telecommunications Project (506-CHA), February 14". Translated by Executive Office of International Loans of the DGT. In The Proceedings of Telecommunication Management Seminar 1975, ed. P&R Board, Taipei: DGT, pp 137-143.

(YBCs) Yearbook on Communications 1950-60, 1961-1981. Taipei: Research Institute of Communications, MOC.

Newspapers and Magazines

Central Daily News (International Edition): (Chung Yang Jih Pao)

"Long Term Dumping of Organism Poison by RCA" 1994. 4 June, 7.

China Times: (Chung Kuo Shih Pao)

"The Incident of Philco-Ford" 1972. 27 Oct., 4; and others in 27-31 Oct.

(CDM) Communications Development Monthly: (Chiao Tung Chien She)

"The Annual Milestone of Telecommunications Development 1955-67". 4-16:12.

"The Synopsis of TTA Management Seminar 1967". 16:12. (Author: King, David Y.D.)

"The Current License and Control of Telecommunications" 20:12. (Author: Chien, Chia-pen)

"IC Development Project in Telecommunications Laboratories" 23:12, 30-1. (Author: Yeh, Sheng-nien, and Liang Chen)

"Introduction to the Task of IC Laboratory in TL" 25:12, 30-35. (Author: Chang, Lai-hsi)

"The First Anniversary of UDAS Service" 29:12, 16-20. (Author: Sha-fei Cheng)

others in 4:12; 18:12; 19:12; 20:12; 22-26:12;

Communications Gazette: (Chiao Tung Kung Pao)

1:11, 1:12, 2:1, 2:3, 2:8, 3:6-7, 3:10, 4:1, 4:10, 8:3

(CRM) Communications Regulation Monthly (Chiao Tung Fa Ling Hui Pien)

4:11, 5:6, 8:3, 12:10, 20:10.

DGT Monthly News: (Chu Wu Chien Hsun)

"The Inauguration of Telex Service in Kaohsiung Telecommunication Office". 2:2, 53-5. (Author: Hsin Sheng)

"Introduction to Telex Service". 2:3, 29-33. (Author: Ko-chiang Chang)

"The Inauguration of Data Communications". 6:5. (Author: Chang-ming Liu)

"New Purchase of Teletype Equipment". 6:5, 56.

"The Current Worldwide Transhorizon Microwave System". 6:9, 42-47. (Author: Sheng, Yu-tsang)

"The Exchange Programs between DGT and Chiao Tung University". 7:9, 36-39.

"The Story of Members of DGT". 8:11, 10-11. (Author: Yi Feng)

- "DGT and KMT, KMT and DGT". 8:12, 6-8. (Author: Cheng Yi)
- "The Capital Crunch and A Few Key Solutions for GTE". 9:8, 25-28. (Author: Yang, Chen-hsing)
- "A Speech about the R&D of Taiwan Telecommunications by Dr. Wen Y. Pan". 10:5, 5-12.
- "Introduction to Experimental Computerized Message Switching System". 10:8, 30-37. (Author: Huang, S.Y., et al.)
- "The Story of Howard Van Zandt". 26:8, 13-4. (Fang, Hien-chee)
- "Memorial to Mr. Chen, Chin". 26:8, 15-6. (Author: Cheng, Sz-chun)
- "Dr. Kajii and His Achievement". 26:10, 8-9. (Fang, Hien-chee)
- "Memorial to Two Previous Directors of DGT". 26:12, 22-3. (Fang, Hien-chee)
- "Memorial to Mr. Chen, Shu-jen". 27:4. (Fang, Hien-chee)
- "Chang, Hsiang-Chuan and Telecommunication Progressive Association" 27:5. (Fang, Hien-chee)
- Economic Daily News: (Ching Chi Jih Pao)
- "The Triple Relation of Electronics Industry" 1970. 8 Dec., 2.
- Electronics Development: (Tien Tzu Fa Chan)
- "The Milestone of Electronics Research Service Organization" No. 21, 4.
- "Introduction to Kuang-Ta Electronics Co." No.49, 4.
- EPZ (Export Processing Zone) Concentrates: (Chia Kung Chu Kou Chu Chien Hsun)
- "A Brief Report of The Supply of Labor in Taiwan" 1:9, A1-A6 (Author: Investment Operations Division, CIECD)
- "Monthly List of Visitors or Guests" 2:5, 10; 2:8, 12.
- "General Micro-electronics Co." 9:1, 24-25.
- "Taiwan Sprague Co." 9:4, 15-16.
- and others in 1:11; 2:2; 6:4, 18.

The Independence Weekly Post: (Tzu Li Chou Pao)

"RCA Confessed the Dumping" 1994. 17 June, 10.

Industrial Newsletter: (Kung Yeh Chien Hsun)

"Resume of Key Notes for Electronics Industry Development 1971" 1:2, 3-6. (Author: EIDWG/CIECD)

"The Trend of Major Electronics Products in U.S. Market" 2:8, 8-10. (Author: Chao-hsiung Lin)

"The Process of Importing Electronics Components to Assembly Plant for Re-export" 6:4, 28.

"The Taiwan TV Industry" 8:8, 4. (Author: Hung-mou Yao)

Industry of Free China: (Tzu Yu Chung Kuo Kung Yeh)

"The Current Report of Taiwan Electronics Industry (I)". 1970. 54:2 (August): 13-23. (Author: Planning Dept., CEPD)

(IEIM) International Economic Information Monthly: (Kuo Chi Ching Chi Tzu Liao Yue Kan)

15:3, 98; 26:2, 82-5; 26:3, 84-8; 27:6, 91-4.

Taiwan Telecommunications Technical Quarterly: (Tai Wan Tien Hsin Chi Shu Chi Kan)

"DGT and SRI Reached Accord for Technical Cooperation" 1975. 18:4 (Dec.): 62.

Radio-TV & Electronics Technical Quarterly: (Wu Hsien Tien Kuang Po Tien Shih Chi Shu Chi Kan)

"The Pioneer of ROC Telecommunications Enterprise-- Mr. Gisson Chien, Director of DGT MOC" 1965. 6:3-4 (Nov.): 203-5.

Wealth Magazine: (Tsai Hsun)

"The Problems from the Transition of Two Directors of DGT" 1986. No.49 (April): 132-135. (Author: Yang, Chih-ming)

"The Analysis of the Think-Tank of K.T. Li" 1986. No.54 (Sept.): 208-211. (Author: Wang, Chung-yi)

The List of Interviewees

1. Fang Hien-chee, Special Advisor, ITRI in Taiwan.
2. Engineering Department of the DGT in Taiwan.
3. The Information Dept. of Siliconix in Taiwan.
4. The Public Relation Office of Texas Instruments Taiwan.
5. Universal Data Access Service Department of the DGT in Taiwan.
6. Computer & Communication Research Laboratories of ITRI in Taiwan.
7. The Procurement Departments of GTE & ITT in Taiwan.

END

3 | 0-05-95

FIN