

THE PEOPLE'S REPUBLIC OF CHINA

**FEASIBILITY STUDY ON
TELEPHONE NETWORK AUTOMATIZATION PLAN
IN DEHUI COUNTY, JILIN PROVINCE**

SUMMARY

SEPTEMBER 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

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国際協力事業団

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Preface

In response to a request from the Government of the People's Republic of China, the Government of Japan decided to conduct a feasibility study on Telephone Network Automatization Plan in DEHUI County, JILIN Province in the People's Republic of China and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to China a study team headed by Mr. Yoshiro IIMURA, NTT International Corporation, twice between August 1990 and July 1991.

The team held discussions with the officials concerned of the Government of China, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of China for their close cooperation extended to the team.

September 1991

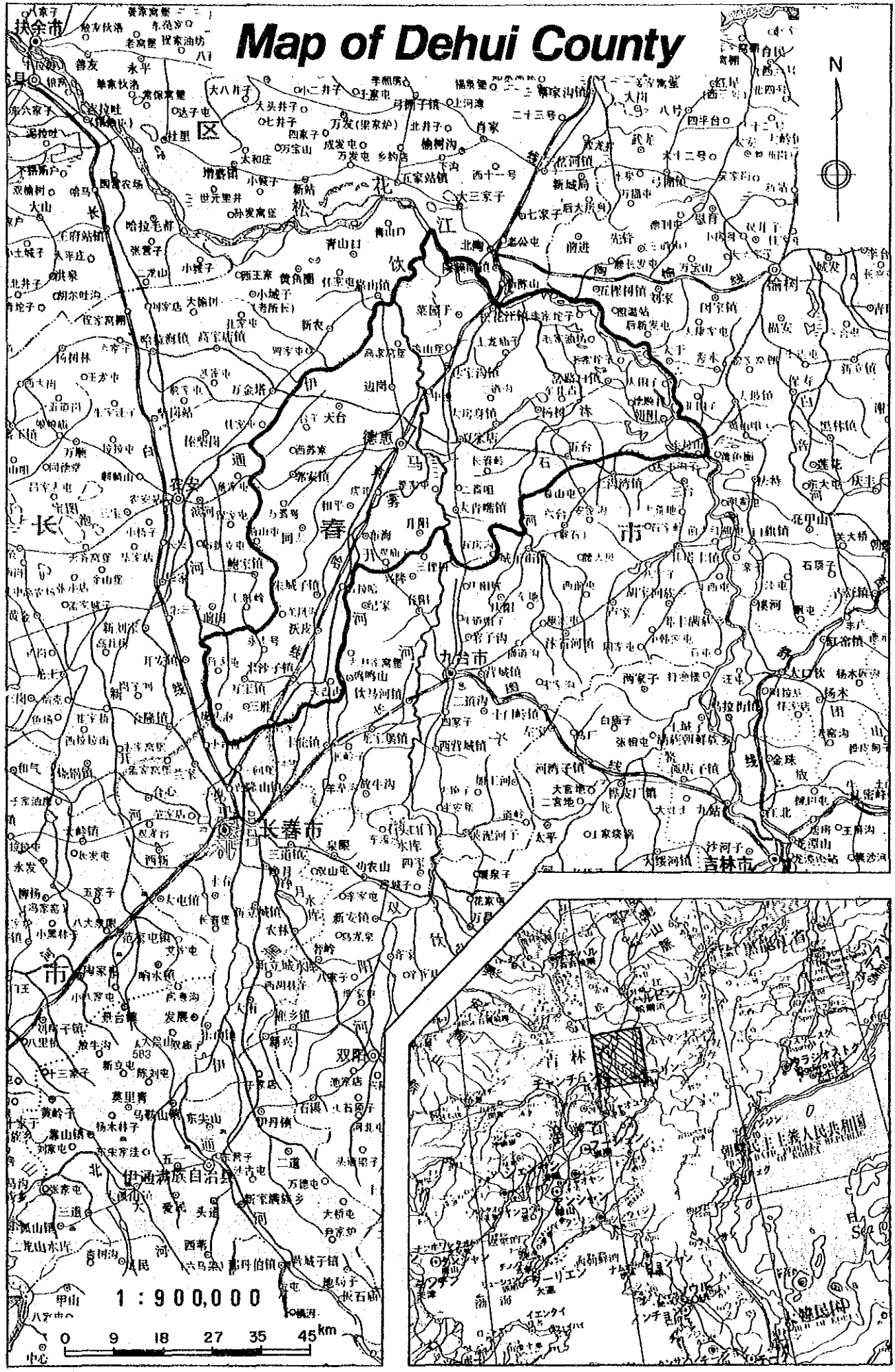


Kensuke Yanagiya

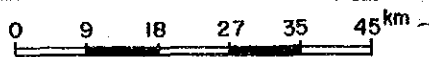
President

Japan International Cooperation Agency

Map of Dehui County



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Map of Dehui County

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List of Abbreviations

ATRK	Analog Trunk
A/D Converter	Analog to Digital Converter
CIF	Cost, Insurance and Freight
DDF	Digital Distribution Frame
DP	Dial Pulse
DTMF	Dual Tone Multi-Frequency
EIRR	Economic Internal Rate of Return
EN	End Battery
erl	erlang
FIRR	Financial Internal Rate of Return
LC	Line Circuit
LTE	Line Terminal Equipment
MAS	Multiple-Access System
MDF	Main Distribution Frame
OJT	On-the-Job-Training
PCM	Pulse Code Modulation System
SID	Silicon Dropper
SPC	Stored Program Control
SXS	Step-by-Step

Chapter 1 Introduction

This is a summary report of the feasibility study on the Telephone Network Automatization Plan in Dehui County, Jilin Province in the People's Republic of China, which is prepared by the Japan International Cooperation Agency (JICA) in cooperation with the Ministry of Posts and Telecommunications of China, and the Posts and Telecommunications Administration of Jilin Province

1.1 Background

Dehui County is located at approximately 80 kilometers northeast from Changchun, the capital city of Jilin Province, one of China's three northeastern provinces. With the recent implementation of the policies on economic reform and opening to the outside world, the county is experiencing considerable industrialization. As a result, new industries, including food processing, manufacture of electronic equipment, agricultural machinery, cement, etc., have been newly developed. Two main arteries, the Beijing-Harbin Railway and the Beijing-Harbin Highway, run through the county, making it one of the important transportation areas in the northeastern region, and this situation also facilitates industrial growth in this area. However, with the development of local enterprises as well as joint ventures between China and other countries, more information has been exchanged with areas outside the county, causing serious telecommunication congestion. But the existing outdated telecommunication facilities are unable to cope with the increasing demand of communications resulting from the agricultural and industrial growths, and are not capable of improving the present situation. There is a plan in Jilin Province to construct optical fiber cable between Beijing and Harbin, which is a part of the Chanchung district's telecommunication development project. Through implementing the plan, the telecommunication congestion is expected to be alleviated among the county center and higher-rank cities. However, the implementation will not lead to the improvement of the telecommunications among the small rural areas since the old-fashioned manual switchboards are still in use.

Taking account of the above circumstances, the Chinese government requested the Japanese government in August 1988 to cooperate in formulating plan to automatize Dehui County's telephone network. In response to the request, the Japanese Government decided to conduct the study and entrusted the study to JICA. JICA dispatched a preliminary study team to China in March 1990, and a main study team in August 1990.

The study is to formulate the Telephone Network Automatization Plan in Dehui County, Jilin Province, which is regarded as a pilot plan for telephone development in the rural areas throughout China.

1.2 Objectives of the Study

The objectives of this study are to formulate a telephone network automatization plan in Dehui County, Jilin Province in cooperation with the Ministry of Posts and Telecommunications of China, and Posts and Telecommunications Administration of Jilin Province, and to examine feasibility of the plan. Through the study, in addition, some technology will be transferred to the Chinese counterparts on the methods of survey, data analysis and formulation of automatization plans, etc.

Chapter 2 The Socio-economic Conditions in China

2.1 The Current Socio-economic Situation in China

China's 1987 gross national product was the ninth largest in the world. However, since its gross national product per capita was approximately \$330 in 1988, China was classified by the World Bank as a developing country with low-level income.

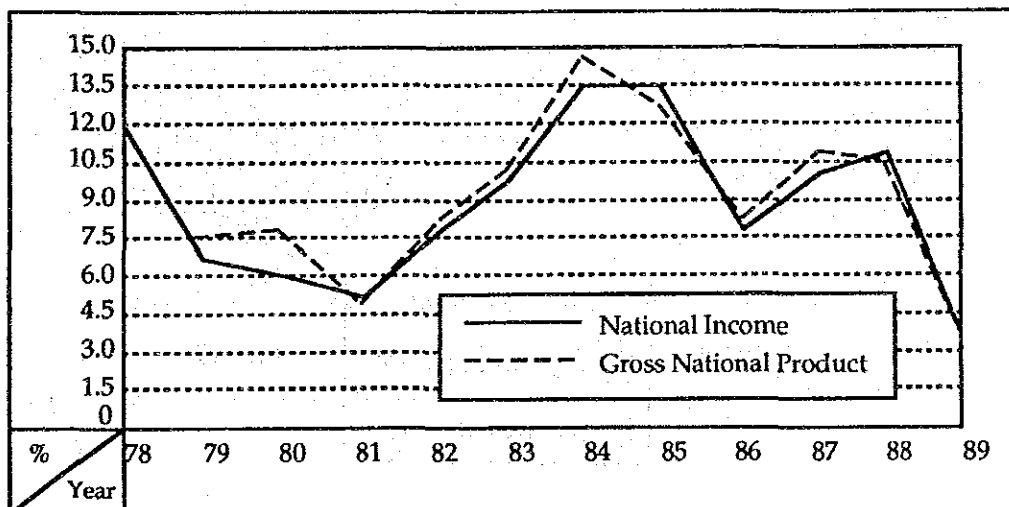
2.1.1 Post-Reform Trend of Chinese Economy

In 1978, China embarked on an economic reform by launching a series of epoch-making policies including the introduction of market principle, opening to the outside world, and large-scale delegation of authority (corporate autonomy, introduction of system to give full responsibility to factory directors, and other measures).

As a result, the country's annual average economic growth rate rose to 5.8 percent in the '70s, then surged to 9.8 percent from 1980 to 1989. Agricultural production, in particular, grew substantially due to the abolition of the People's Commune and the introduction of incentives such as the recognition of free markets.

But the high inflation rate of 1988 induced such social confusion as cornering and other incidents. To cope with the situation, the government decided to curb gross demand by adopting the so-called economic adjustment policies including, among other measures, monetary restriction. The policies were effective in bringing down inflation rates, but companies found themselves lacking in operating capital, and as a result, production became stagnant. In 1990, the government reintroduced a policy to stimulate the market. Figure 2.1.1-1 shows the country's real economic growth rates after 1978.

Figure 2.1.1-1 Real Growth Rates of National Income and Gross National Product

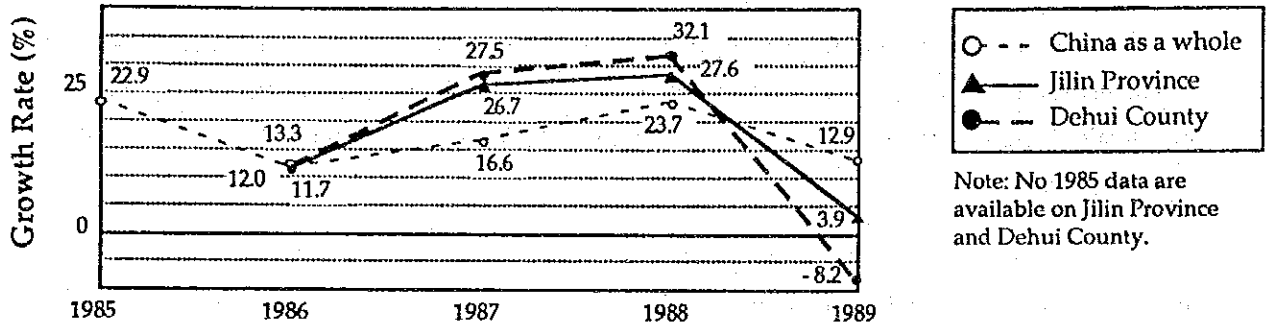


2.1.2 The Current Situation of the Economy

(1) National Income and Gross National Product

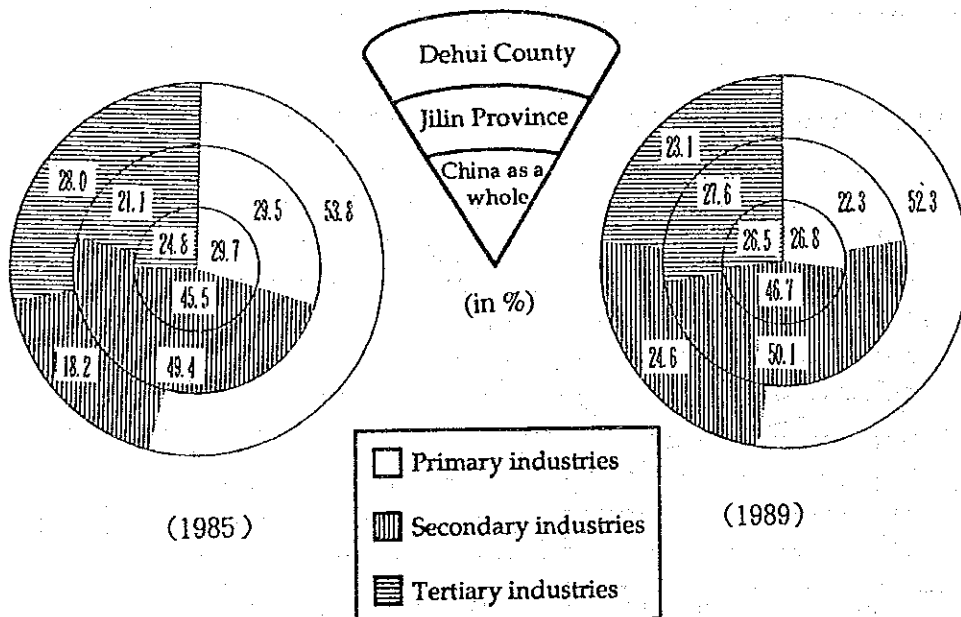
The national income and gross national product, which had temporarily slackened in 1986, showed steady growths from 1987 to 1988, then stagnated once again in 1989. Figure 2.1.2-1 shows the changes in the growth rate of gross national product.

Figure 2.1.2-1 Changes in Gross National Product Growth Rate



Industry-specific configuration of gross national product shows that the share of primary industries is gradually on the decline, and the share of secondary industries, on the rise. Figure 2.1.2-2 shows the 1985 and 1989 industry-specific configuration ratios.

Figure 2.1.2-2 Industry-Specific Configuration Ratio of Gross National Product



(2) Agriculture

The hike in the buying price of agricultural goods as well as the reform in the agricultural management system, implemented after 1979, helped to boost farmers' motivation to produce more, and as a result, gross agricultural products increased sharply. Figure 2.1.2-3 shows changes in the gross agricultural products from 1978 and 1989 and Figure 2.1.2-4 shows changes in the gross agricultural product growth rate of the entire China, Jilin Province, and Dehui County after 1985.

Figure 2.1.2-3 Changes in Gross Agricultural Products

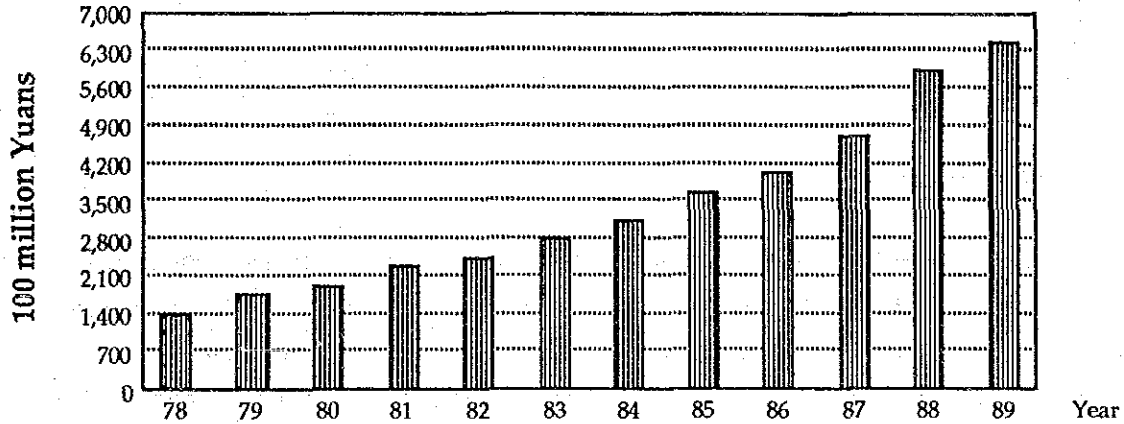
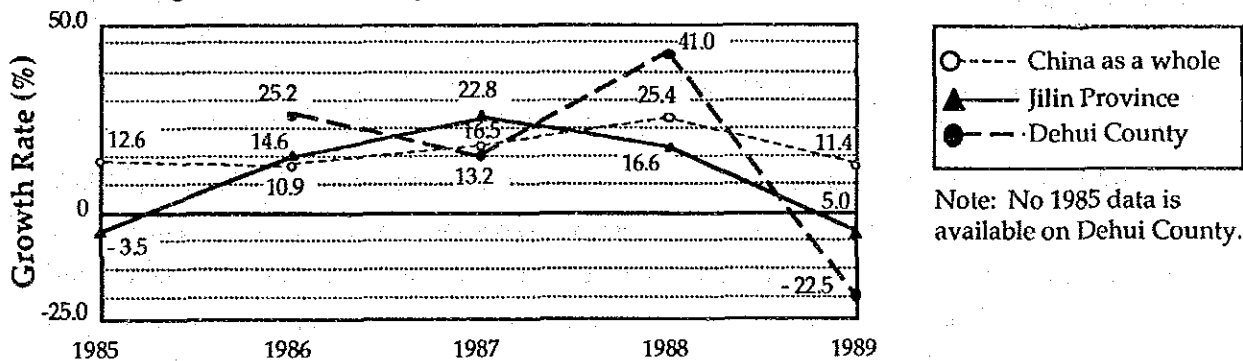


Figure 2.1.2-4 Changes in Gross Agricultural Product Growth Rate

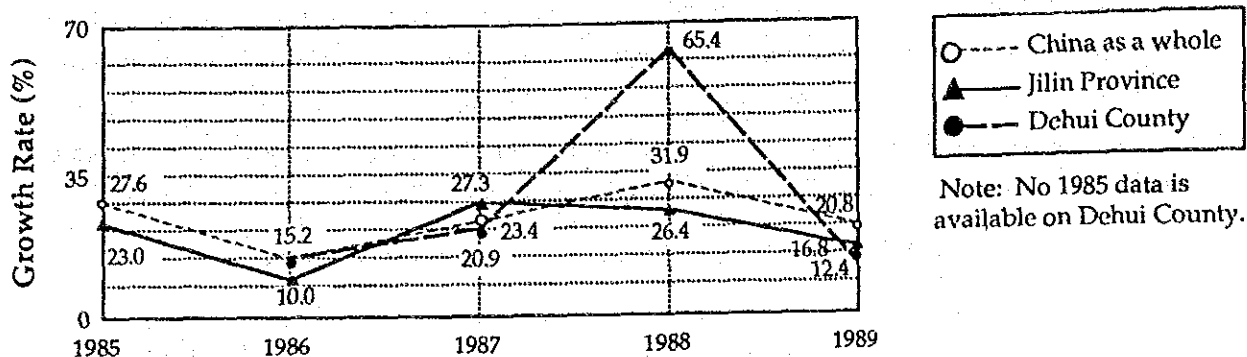


Employees engaged in primary industries account for over 60 percent of all laborers in China. However, with the recent rising productivity of agriculture, there is a surplus of labor, causing more workers to shift from agriculture to other industries.

(3) Manufacturing Industries

Gross industrial product maintains a high-level growth rate of 20 percent, and as was mentioned previously, its share in the gross national product configuration is steadily increasing. Figure 2.1.2-5 shows the changes in the gross industrial product growth rate of the entire China, Jilin Province, and Dehui County.

Figure 2.1.2-5 Changes in Gross Industrial Product Growth Rate



(4) Local Enterprises

Local enterprises helped to soak up much of the redundant labor in rural areas and modernize the villages. In doing so, however, they consumed a vast amount of electric power and raw materials, and ended up destroying the balance in the overall national management. After 1988, when economic adjustments took place, a large number of local enterprises were shut down. In recent years, the government is showing renewed interest in developing an economy centering on the vitality of such local enterprises.

(5) International Trade and Foreign Currency Reserves

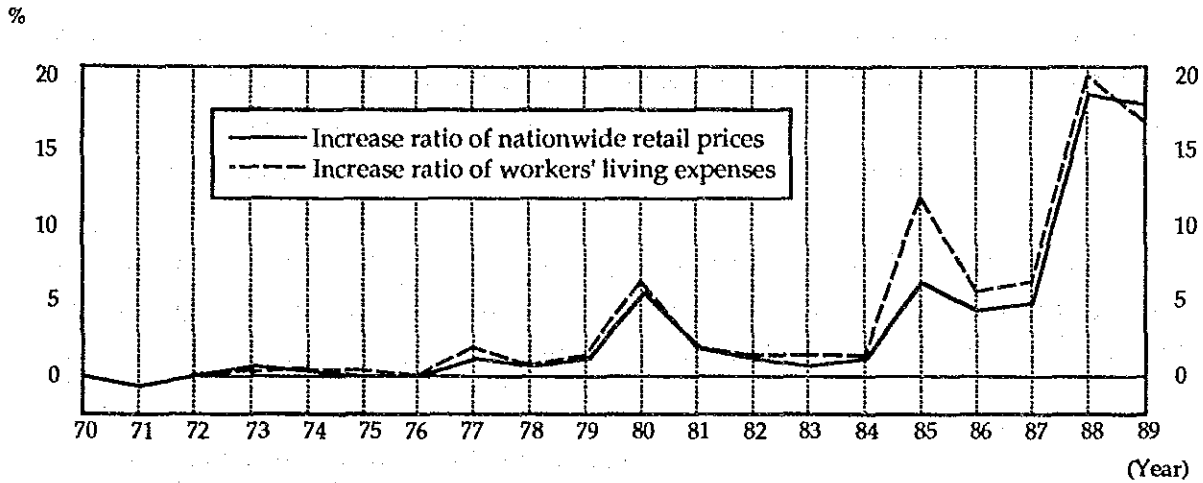
Although both imports and exports have been steadily increasing in terms of trade volume, China still has huge trade deficits. To earn foreign currency, the government is placing emphasis on tourism. Still, the country's foreign currency reserve is far from adequate, and the national finance remains basically in the red. In an effort to promote exports and curb imports, the government devaluated its currency against the U.S. dollar in 1989 and 1990. The current exchange rate is 5.22 yuan for every U.S. dollar.

(6) Increase Ratio of Commodity Prices

The increase ratio of commodity prices in China had remained relatively stable until around 1984. It soared from 1985, however, and double-digit inflation was posted in 1988. One main reason is the gross demand surplus, or shortage of supply against rising personal incomes.

Although inflation is more or less controlled at the moment, there is potential danger of re-inducing large-scale rise in prices or stagflations if foreign exchange rates are lowered. Figure 2.1.2-6 shows changes in increase ratio of commodity prices after 1970.

Figure 2.1.2-6 Increase Ratio of Commodity Prices



(7) Inadequate Infrastructure

One problem facing the Chinese economy is the inadequacy of its infrastructure. Lack of proper setup in transportation, telecommunications, and energy are thought to greatly hinder the country's economic development.

2.1.3 Social Conditions

(1) Population

The population issue is one of the unique problems in China. In 1990, the total population of China was said to be approximately 1.13 billion, 200 ~ 300 million of which live in urban areas, and between 800 and 900 million in the rural areas. A single-child policy has been adopted by the government to curb the population.

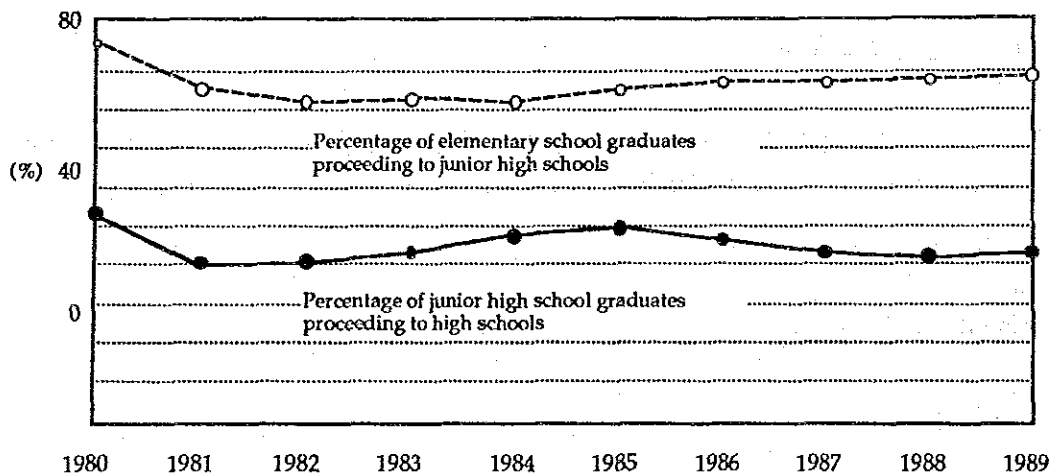
(2) Migratory Movement from Rural Areas to Urban Areas

Along with the advancement of economic reforms, an increasing number of people are now moving out of rural areas into large cities, which has become a major problem of Chinese society. The population outflow from rural areas to large cities increased rapidly after 1976. During the 5 years from 1976 to 1980, 77 percent of the factors causing increased population in the city areas were attributed to the outflow, and 87 percent during the five years from 1981 to 1985. More job opportunities must be created in rural areas, for instance, setting up local enterprises, to prevent people from moving out.

(3) Cultural and Educational Levels

According to a 1987 sampling research of 1 percent of the population in China, 26 percent of people aged 12 years or older were either illiterate or had obscure cultural levels. Figure 2.1.3-1 shows the changes in the percentage of people receiving higher education after 1980.

Figure 2.1.3-1 Percentage of People Receiving Higher Education



(4) Living Standards

After the government introduced policies to reform and open to the outside world, people's living standards rose dramatically. Compared with 1980, the per capita income increased 2.87 times in the city areas, and roughly 3.14 times in rural areas. However, there is a great gap between cities and rural areas: those in cities spend more than twice as much for living expenses.

2.1.4 Socio-economic Situations of Dehui County

(1) Social Situations

Dehui County, located adjacent to Changchun City, the capital of Jilin Province, is conveniently located for industrial growth, with the Beijing-Harbin Railway and National Highway running across the center of the county. The county is attracting attention for its development potential. Currently, agriculture is its main industry, but various industries have been developing in recent years in the form of local enterprises, and the share of industries in the gross product is rising each year. Table 2.1.4-1 shows outline of Dehui County.

Table 2.1.4-1 Outline of Dehui County

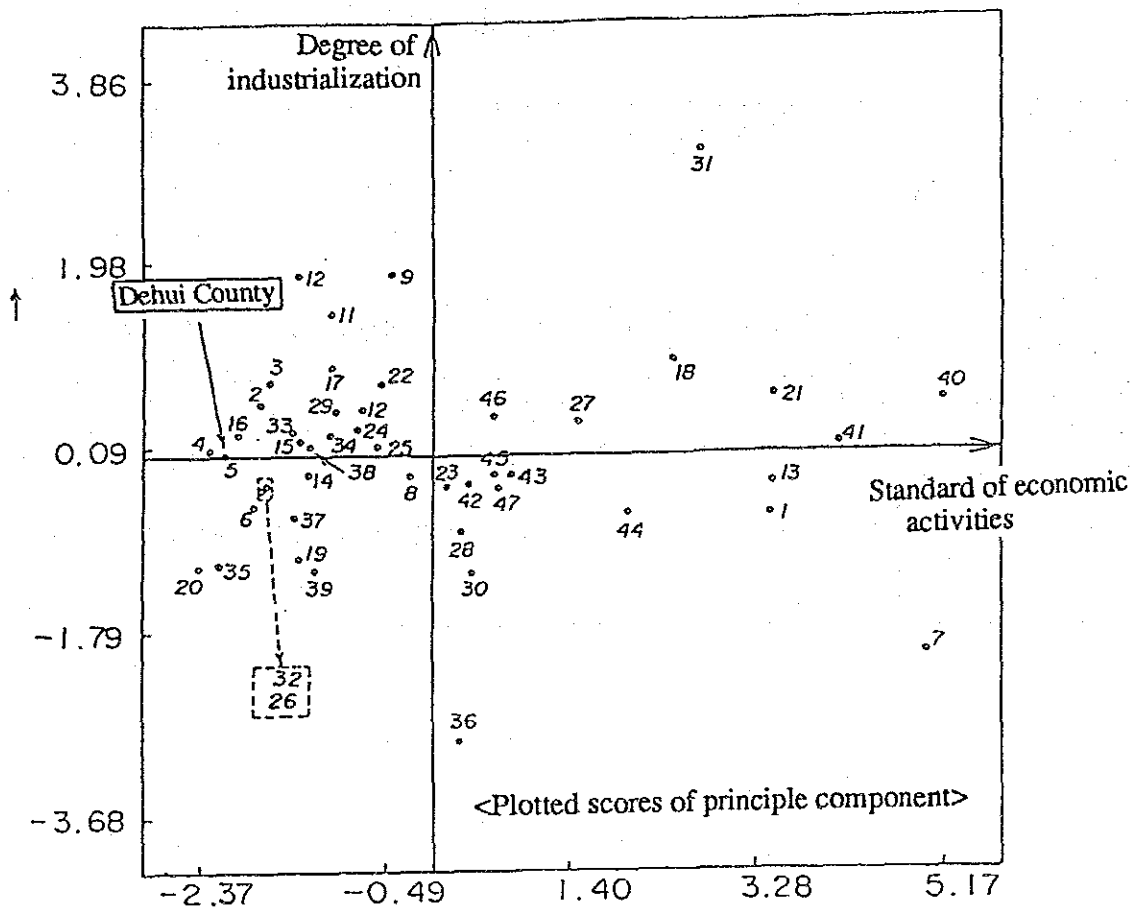
• Total area	3,435 km ² (cultivated acreage: 2,140 km ² , roughly 80 percent of which are farmland)			
• Total population	823,405 (as of the end of 1989)			
• Total number of households	182,642			
• Number of townships, etc.	Countries: 14	Towns: 10	Villages: 303	Hamlets: 2,826
• Major industries and output:	Agriculture: corn, rice, stock-farming 530 million yuan Industries: food processing, metal industry, construction materials including bricks 470 million yuan			

(2) Economic Condition

The economic activity level of Dehui County was examined with a principal component using ① gross national product per capita, ② gross social product per capita, ③ percentage of non-agriculture population, ④ total retail sales of social merchandise per capita, ⑤ ratio of tertiary industry products in gross domestic output, and ⑥ fixed asset investments per capita. Figure 2.1.4-1 illustrates the results.

The current economic condition of Dehui County is one of the underdeveloped counties within Jilin Province, leaving much room for improvement. Organizing adequate infrastructure setup, particularly of communications facilities, is necessary to further invigorate the economy.

Figure 2.1.4-1 Economic Activity Level of Various Cities and Counties within Jilin Province



- | | | | |
|-----------------------|----------------------|----------------------|---------------------|
| 1: Changchun City | 2: Jiutai City | 3: Yushu County | 4: Nong'an County |
| 5: Dehui County | 6: Shuangyang County | 7: Jilin City | 8: Huadian City |
| 9: Jiaohe City | 10: Yongji County | 11: Shulan County | 12: Panshi County |
| 13: Siping City | 14: Gongzhuling | 15: Lishu County | 16: Yitong County |
| 17: Shuangliao County | 18: Liaoyuan City | 19: Dongfeng County | 20: Dongliao County |
| 21: Tonghua City | 22: Meihekou City | 23: Ji'an City | 24: Tonghua County |
| 25: Huinan County | 26: Liuhe County | 27: Hunjiang City | 28: Fusong County |
| 29: Jingyu County | 30: Changbai County | 31: Baicheng City | 32: Fuyu City |
| 33: Taonan City | 34: Da'an City | 35: Changling County | 36: Qianguo County |
| 37: Zhenlai County | 38: Tongyu County | 39: Qian'an County | 40: Yanji City |
| 41: Tumen City | 42: Dunhua City | 43: Longjing City | 44: Hunchun City |
| 45: Helong County | 46: Wangqing County | 47: Antu County | |

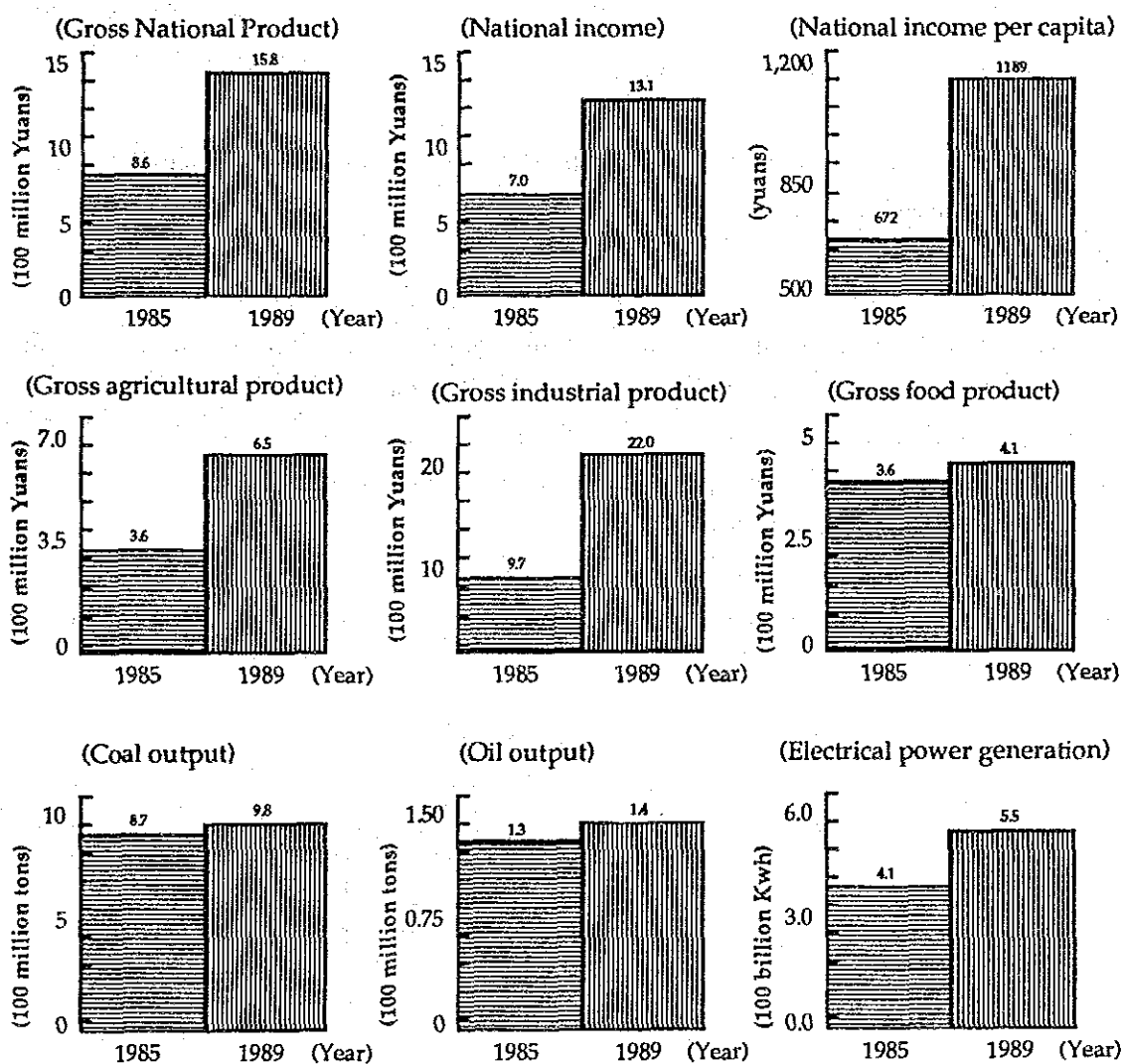
2.2 National Development Plan

Ever since the launch of the first 5-year plan (1953-1957), the Chinese government has implemented several national development plans, and the seventh 5-year plan was recently completed in 1990. The eighth 5-year plan is currently underway. Results and achievements of the seventh 5-year plan as well as an outline of the eighth 5-year plan are summarized below.

2.2.1 Results and Achievements of the Seventh 5-Year Plan

The seventh 5-year plan, with the basic target of ① promoting the economic management system reform; ② stabilizing the economy; and ③ enhancing economic efficiency and improving the people's lives, was terminated in 1990. Figure 2.2.1-1 illustrates results of some major industries in 1989.

Figure 2.2.1-1 Results of the Seventh 5-Year Plan



2.2.2 The Eighth 5-Year Plan

The eighth 5-year plan (1991-1995) was drafted and devised after the latter half of 1989. It was deliberated and adopted in December 1990 as "A Proposal Related to the 10-Year Plan on National Economy and Social Development, and the Formulation of the Eighth 5-Year Plan".

The major characteristic of this plan is the transfer from the current high-level growth-oriented policy to a stable growth-oriented policy, since it continues the current adjustment policies for the first two years and aims at attaining a stable annual average GNP growth rate of approximately 6 percent. Furthermore, a long-term, 10-year economic plan (a ten-year plan of national economy and social development) viewing the year 2000 was drafted simultaneously, which aims at fundamental solution of problems related to the economic system and designing and structuring an economic circulation mechanism based on the combination between planned economy and market adjustment. The plan has been decided to be implemented in 1991.

Main points of the eighth 5-year plan is as follows:

- ① Organizing adequate energy, transportation, and telecommunications setups; balanced development and stable growth
- ② Curbing gross demand
- ③ Strengthening agriculture: developing industries related to chemical fertilizers
- ④ Prevention of inter-area gaps: reinforcement of subsidies by government and economically advanced regions toward economically underdeveloped regions
- ⑤ Cooperation between the provinces and central areas
- ⑥ Coexistence of economic development and economic system reform
- ⑦ Thorough management of corporations
- ⑧ Promotion of introducing market mechanism
- ⑨ Continuation of economic system of opening to the outside world: maintaining coastal area development policy

Chapter 3 The Current Situation of Telecommunications and Development Plan

3.1 The Current Situation of Telecommunications

Telecommunications services in China have been developing rapidly as a result of the government's telecommunications preferential policies in recent years. However, due to its vast land and huge population, the country is in an inadequate situation both in terms of quality and quantity.

3.1.1 The Current Situation of Telecommunication Service

Some of China's major communication media are telephone, telegram, telex, facsimile, etc. Telegrams, in particular, are among the most frequently used communication media. In 1989, as many as 290 million telegrams (about 200,000 in Dehui County) had been sent. The use of telexes and facsimiles has increased in the past years.

(1) Current Situation of Telephones

Telephones are divided into local telephones in the urban areas and rural telephones for rural areas (under county level). A total of approximately 2.66 million telephones increased from 1985 to 1989. Of these, 2,207 million telephones increased in local areas (average annual growth rate: 19 percent), and 454,000 telephones in rural areas (average annual growth rate: 12 percent). Figure 3.1.1-1 shows the 1989 telephone sets density and Figure 3.1.1-2 changes in telephone main lines density per 100 persons after 1986.

Figure 3.1.1-1 Telephone Sets Density per 100 Persons (1989)

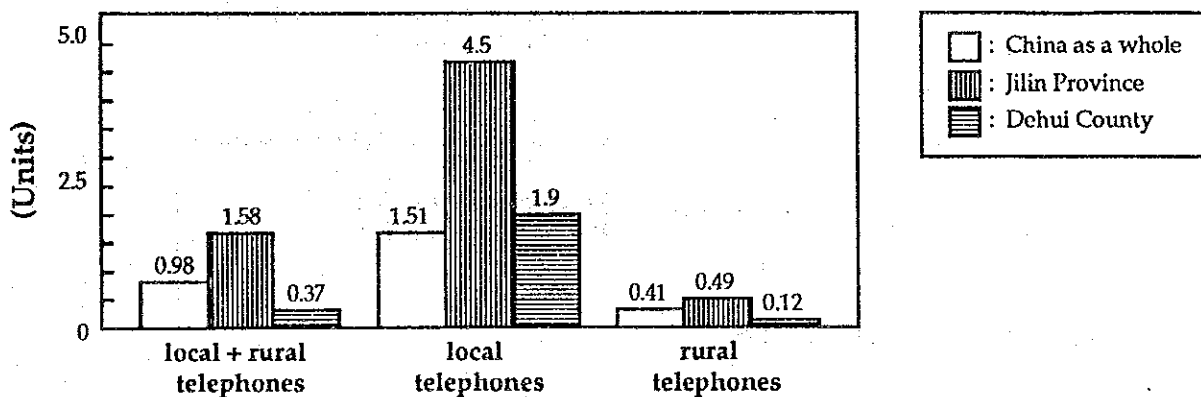
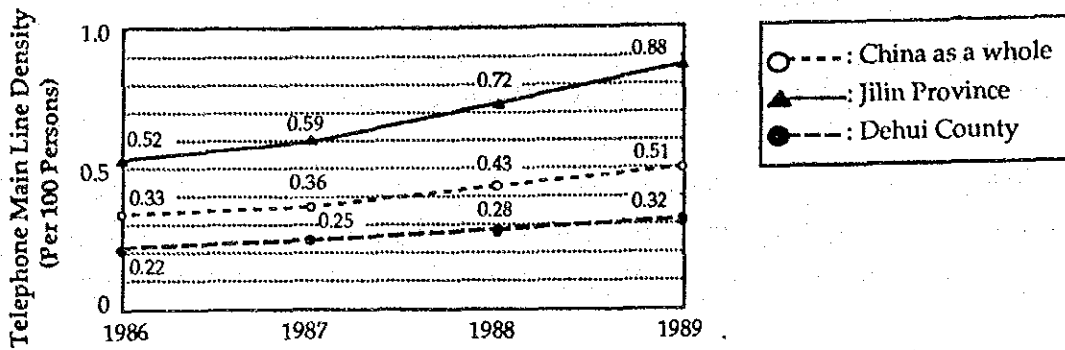


Figure 3.1.1-2 Changes in Telephone Main Line Density per 100 Persons

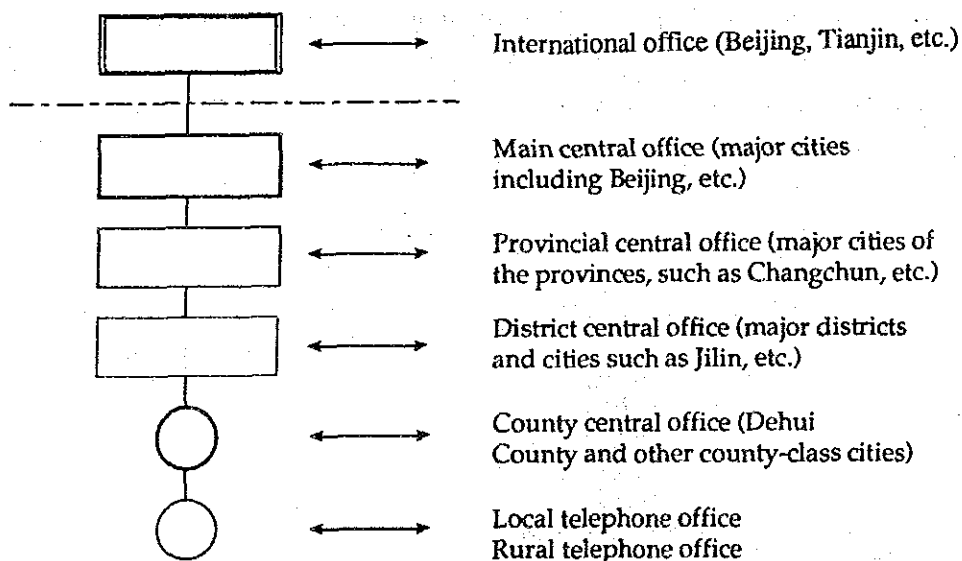


3.1.2 The Current Situation of Telecommunication Facilities

(1) Telephone Network Configuration

The nationwide telephone network in China consists of 5 stages : Main central office, provincial central office, district central office, county central office, local telephone office and rural telephone office. Figure 3.1.2-1 shows the telephone network configuration.

Figure 3.1.2-1 Telephone Network Configuration

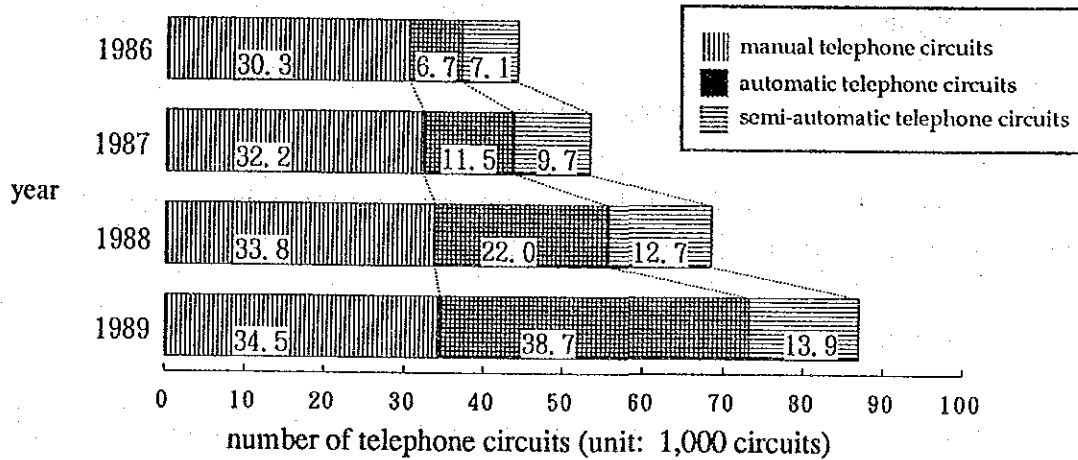


(2) Domestic Long-Distance Circuits

As of the end of 1989, China had 87,137 domestic long-distance circuits. During the three years from 1986 and 1989, long-distance circuits grew at an average of 25 percent per year. Of all the

circuits , 44 percent are automatic telephone circuits , 16 percent, semi-automatic, and the remaining 40 percent, manual. Figure 3.1.2-2 shows changes in the number of domestic long-distance circuits from 1986 to 1989.

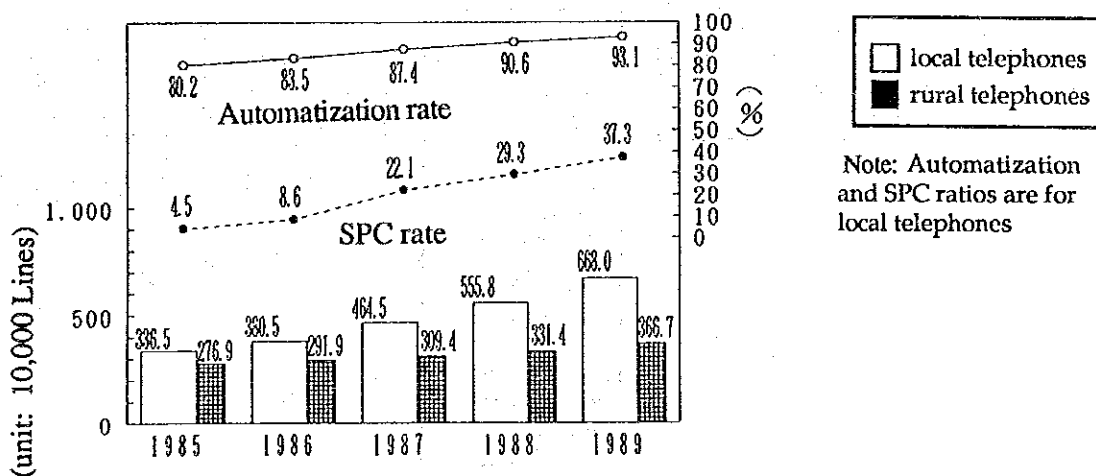
Figure 3.1.2-2 Changes in Domestic Long Distance Circuits



(3) Switching facilities

As of the end of 1989, switching capacity was 10,348,900 lines including digital stored program control (SPC) exchange, with an annual growth rate of 14 percent over the past four years. Figure 3.1.2-3 shows the results of installed telephone switching facilities from 1985 to 1989.

Figure 3.1.2-3 Results of Installed of Telephone Switching Facilities



(4) Transmission Facilities

Most transmission facilities in China adopt the analog system. However, more and more facilities are rapidly adopting the digital system in recent years. The length of installed optical fiber cable was 2.76 times in 1989 over the previous year. A European-style hierarchy is used in digital transmission.

(5) Radio Facilities

(a) Microwave Fixed Radio Communication System

To connect large cities, 2, 4, 6, 8, 11 GHz bands are used as radio communication system, mainly composed of the analog system (84.3 percent as of 1989).

(b) Subscriber's Radio Transmission System

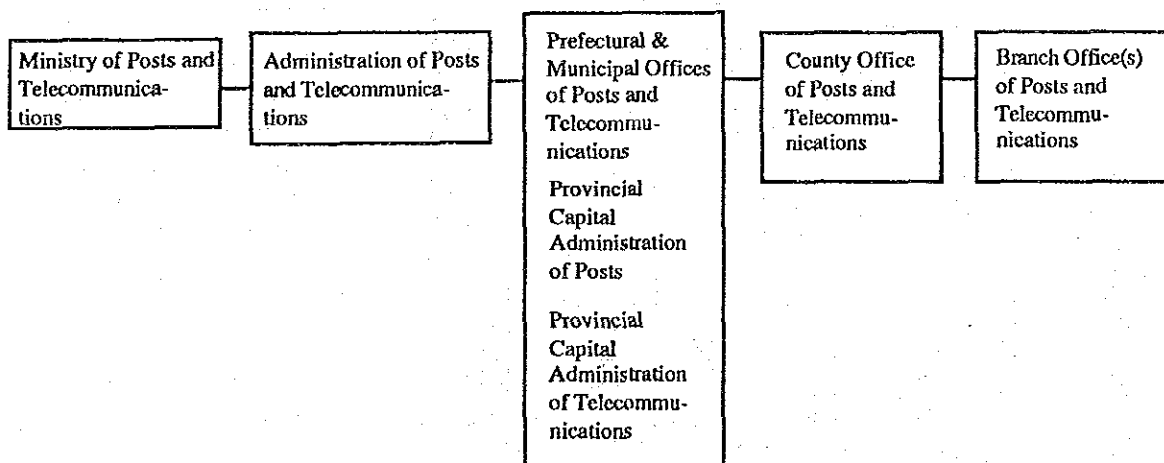
As subscriber's radio transmission system, both 150, 560, 900 MHz bands and 1.5, 2, 8 GHz bands are used. In recent years, a digital multi-access system using 1.5 and 2 GHz bands has been introduced.

3.1.3 Organization and Personnel

(1) Organization

The central administration organ in charge of telecommunication is the Ministry of Posts and Telecommunications, China, which administrates overall telecommunication services as well as domestic and international postal service. The service operation structure corresponds to that of the administration, and is composed of 5 stages, outline of which is shown in Figure 3.1.3-1.

Figure 3.1.3-1 Outline of Business Operation Structure



(2) Personnel

Table 3.1.3-1 shows the number of personnel who are in charge of telecommunications within the Ministry of Posts and Telecommunications, the Posts and Telecommunications Administration of Jilin Province as well as Dehui County Office of Posts and Telecommunications and the number of subscribers per one employee.

Table 3.1.3-1 Number of Personnel in Charge of Telecommunications

	Ministry of Posts & Telecommunications	Within Posts and Telecommunications Administration of Jilin Province	Dehui County Office of Posts & Telecommunications
No. of personnel	487,000	11,300	223
No. of subscribers per one employee	11.7	18.5	11.9

3.1.4 Outline of Telecommunications in Dehui County

(1) Present Situation of Services

Major telecommunication services in Dehui County consist of telegrams and telephones. In 1989, number of outgoing/incoming telegrams totalled roughly 190,000, approximately 120,000 of which were local, and about 70,000, rural.

Telephone service consists of ordinary subscriber telephone service and public telephone service. A total of 27 public telephones (5 local and 22 rural telephones) are installed at various Branch Offices of Posts and Telecommunications in township. Table 3.1.4-1 shows the current situation of telephone services as of the end of 1989.

Table 3.1.4-1 Current Situation of Telephone Services in Dehui County

Items	Local	Rural	Total
(1) Telephone Services			
• No. of telephone sets	2,201	847	3,048
• Telephone set density per 100 persons	1.9	0.12	0.37
• No. of telephone main lines	1,809	839	2,648
• Telephone main lines density per 100 persons	1.56	0.12	0.32
• Waiting applicants	420	1,997	2,417
(2) General area situations			
• Area (km ²)	173	3,262	3,435
• Population (person)	116,131	707,274	823,405
• Population density (person/km ²)	671	217	240
• No. of townships	2	22	24
• No. of villages	11	292	303
• No. of hamlets	80	2,746	2,826

(2) Current Condition of Facilities

The office level hierarchy of Dehui County Office of Posts and Telecommunications is the county central office, in which a SXS (step by step) local exchange (2,500 lines) and manual switchboards are installed. On the other hand, manual switchboards (some are small-size automatic exchanges) are installed in the 22 Branch Offices of Posts and Telecommunications within the county which are connected with Dehui County Office of Posts and Telecommunications via the open wire system. Figure 3.1.4-1 illustrates the existing county telephone network configuration, Figure 3.1.4-2, the existing inter-office trunk routes, and Table 3.1.4-2, the existing condition of telephone facilities within the county.

Figure 3.1.4-1 Telephone Network Configuration of Dehui County

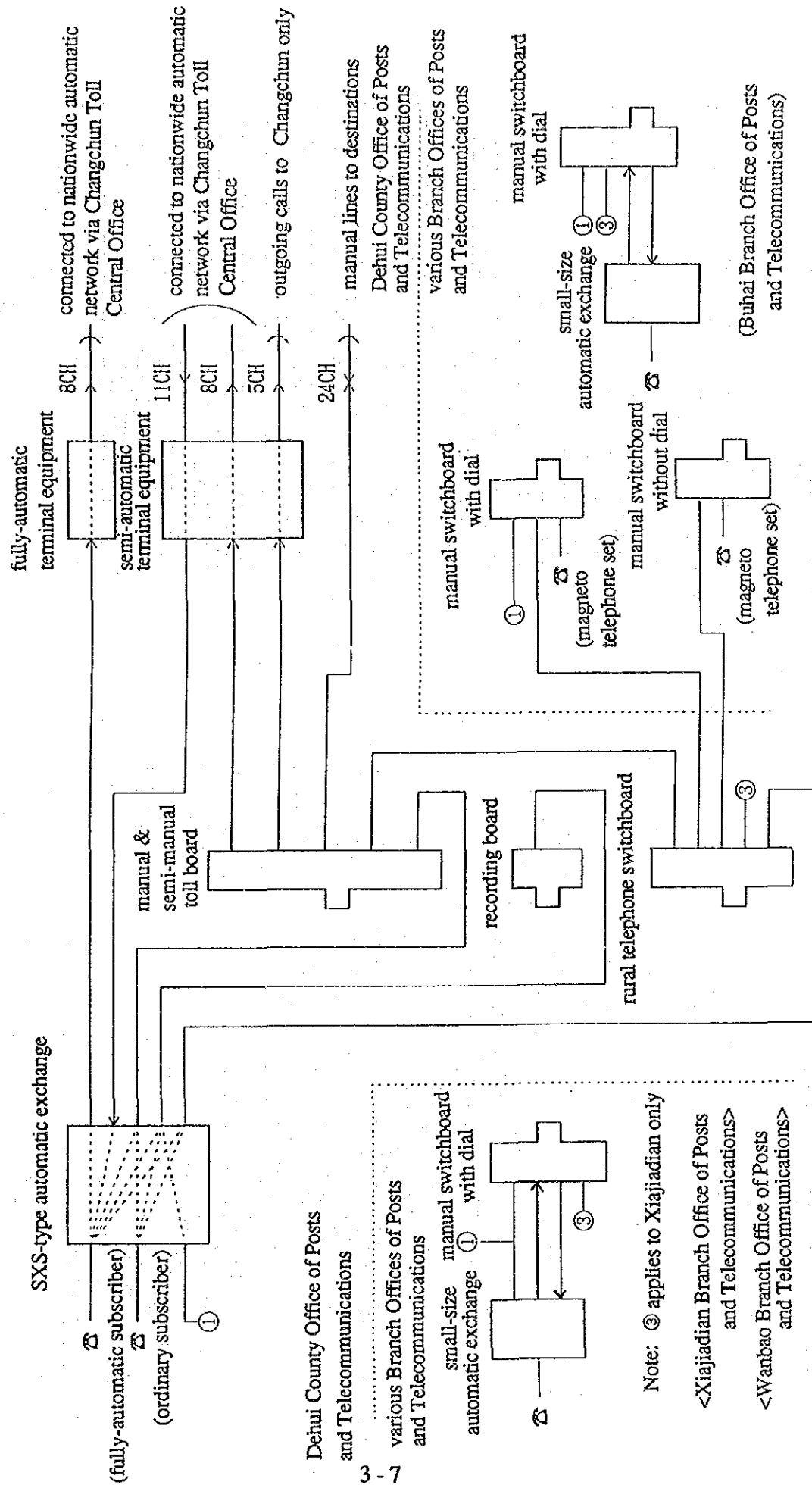


Figure 3.1.4-2 Outline of Inter-Office Trunk Routes

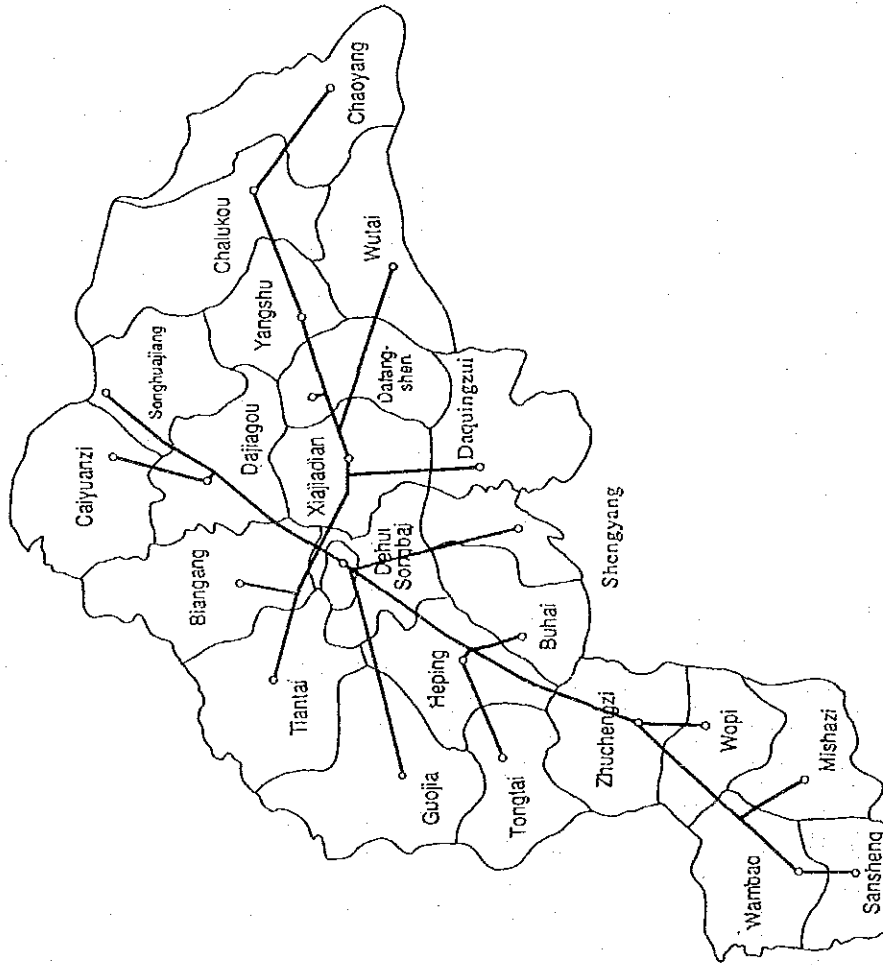


Table 3.1.4-2 Rural Telephone Facilities in Dehui County
(As of end of 1989)

Exchange	Switching unit	No. of subscribers	No. of trunk circuits
Dehui	S X S	1,799	—
Songbai	—	10	—
Caiyuanzi	Manual	32	1
Songhujiang	Manual	35	1
Dajiaogou	Manual	34	3
Chalukou	Manual	49	3
Yangshu	Manual	31	2
Chaoyang	Manual	25	1
Xijiaodian	Automatic	41	5
Dafangshen	Manual	52	4
Wutai	Manual	41	2
Buhai	Automatic	34	2
Shengyang	Manual	28	2
Daqingzui	Manual	40	2
Guojia	Manual	48	2
Tiantai	Manual	37	2
Biangang	Manual	36	2
Tongtai	Manual	30	2
Heping	Manual	28	2
Zhuchengzi	Manual	44	4
Wopu	Manual	32	2
Mishazi	Manual	60	4
Wambao	Automatic	52	3
Sansheng	Manual	30	1

3.2 Telecommunications Development Plan

3.2.1 Targets and Results of the Seventh 5-Year Plan and Targets of the Eighth 5-Year Plan

Table 3.2.1-1 shows targets and results of the seventh 5-year plan, implemented during 1986 to 1990 and the outline of the eighth 5-year plan (1991-1995).

Table 3.2.1-1 Targets and Results of the Seventh 5-year Plan and Targets of the Eighth 5-year Plan

Targets of the seventh 5-year plan	Results of the seventh 5-year plan	Targets of eighth 5-year plan
Increase the number of telephone sets: 10.51 million sets	<ul style="list-style-type: none"> • Number of telephone sets: 12.44 million • Telephone sets density: nationwide: 1.1 (sets/100 persons) provincial cities: 5 (sets/100 persons) 	<ul style="list-style-type: none"> • No. of telephone sets: 23.8 million • Telephone sets density: nationwide: 2 (sets/100 persons) provincial cities: 10 (sets/100 persons)
Expanding local switching facilities <ul style="list-style-type: none"> • Increasing 6.22 million lines • Introducing stored program control (SPC) exchange 	<ul style="list-style-type: none"> • 20.47 million lines nationwide (Local: 8.25 million lines) • SPC rate: 46.8% • Automatization rate: 96% 	Add 14 - 15 million lines (Local: 8 - 9 million)
<ul style="list-style-type: none"> • Increasing long-distance telephone circuits: 98,000 • Circuits long-distance automatic exchange • Expanding satellite communications * constructing over 20 earth stations • Expanding long-distance network 	<p>Completing nationwide automatized network</p> <ul style="list-style-type: none"> • Between provincial cities: over 60% • International phones: over 90% • No. of trunk lines: 108,000 • Long-distance automatic exchange lines: 165,000 lines • Over 658 counties join the network • No. of cities and provinces - cities capable of international communications: more than 300 	<p>Long-distance automatic exchange</p> <ul style="list-style-type: none"> • Add 300,000 lines <p>Long-distance circuits</p> <ul style="list-style-type: none"> • Add 150,000 circuits <p>Constructing large-capacity optical transmission network</p> <ul style="list-style-type: none"> • total length: 25,000 km <p>Improving domestic satellite communication</p> <ul style="list-style-type: none"> • Constructing 12 earth stations
Improving coastal areas	Improving rural areas Introducing SPC, MAS	Constructing rural communication facilities at an early stage <ul style="list-style-type: none"> • Add 1 million lines

3.2.2 Targets for the Year 2000

The Ministry of Posts and Telecommunications, China and the Posts and Telecommunications Administration of Jilin Province are drawing up telecommunications development plan projecting the year 2000. The basic targets of the plan are to prepare the fundamental facilities in the 1980s, and improve the level of quality, efficiency, and service in the 1990s. Table 3.2.2-1 shows major targets devised by the Ministry of Posts and Telecommunications, and Table 3.2.2-2 shows targets for the year 2000 devised by the Posts and Telecommunications Administration of Jilin Province.

Table 3.2.2-1 Main Development Targets in the Year 2000

Items	Nationwide targets
(1) Expansion of telecommunications facility capacity	(1) Eight-fold increase of telecommunication capacity over 1980
(2) Diffusion of telephone services	(1) Number of telephone sets — 33.6 million sets (ordinary: 12 million sets; rural: 10 million sets; others: 11.6 million sets) (2) Telephone set density: 2.8 (sets/100 persons) (3) Automatic dialing between cities, larger than county capitals
(3) Promotion of new services and technology	(1) Promotion of constructing digital network (2) Construction of a computer network

Table 3.2.2-2 Targets of The Posts and Telecommunications Administration of Jilin Province in the Year 2000 (Related to Rural Telecommunications)

Item	Target in 1980s	Target in 1990s
(1) Basic Targets	Increase communication capacity to 4 to 8 times over 1980	
(2) Major items		
• No. of telephones	85,000 sets	190,000 sets
• Telephone density of rural telephone	—	1.3 (subscribers/100 persons)
• No. of exchanges	1,647 exchanges	3,647 exchanges
• Automatic switching units	Install in 100 townships	Install in 500 townships
• Exchange capacity (no. of automatic switching line units)	132,000 lines (30,000 lines)	300,000 lines (80,000 lines)
• Trunk cable	6,500 circuits	18,000 circuits
• Ratio of automatization in county	30% of townships	50% of township

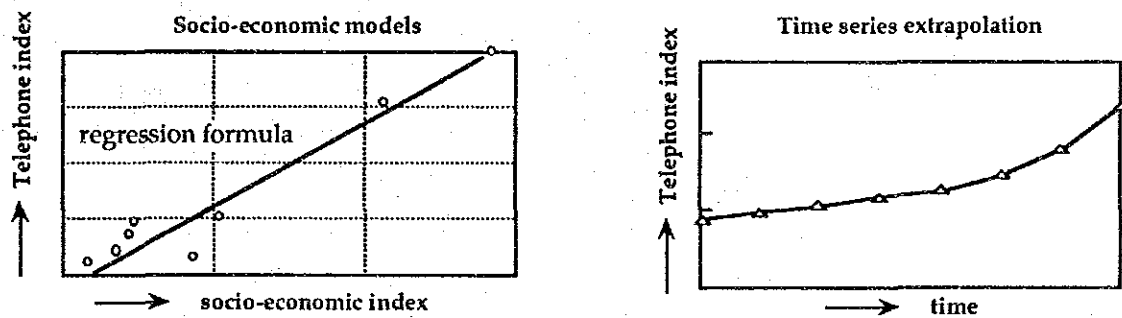
Chapter 4 Demand Forecast

4.1 Concept of Demand Forecast

Demand forecast aims at estimating telephone demand to those who already have telephones installed; those who wish to have telephones installed and are waiting to have them installed (waiting applicants); and those who wish to have telephone installed for the first time (new applicants).

First, demand forecast within Dehui County until the year 2000 is conducted, after which demands in each township of Dehui County are estimated. The following two forecasting methods are adopted and after then compared: forecast with the regression formula using socio-economic indicators of various cities and counties in Jilin Province, and forecast with time series extrapolation method from past subscriber demands.

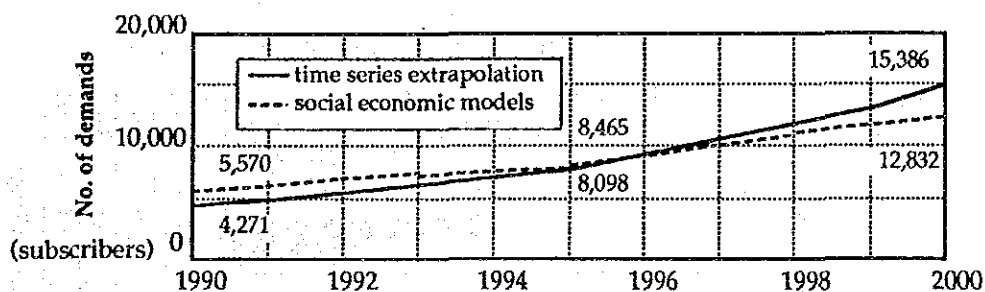
Figure 4.1-1 Image of Demand Forecast Method



4.2 Estimation Results of Demand Forecast

Figure 4.2-1 shows the results of forecast using the socio-economic models and time series extrapolation method.

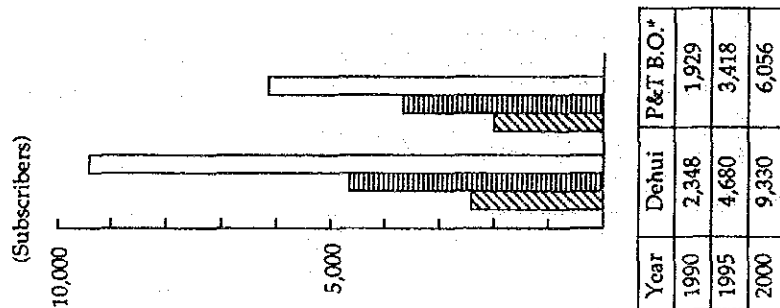
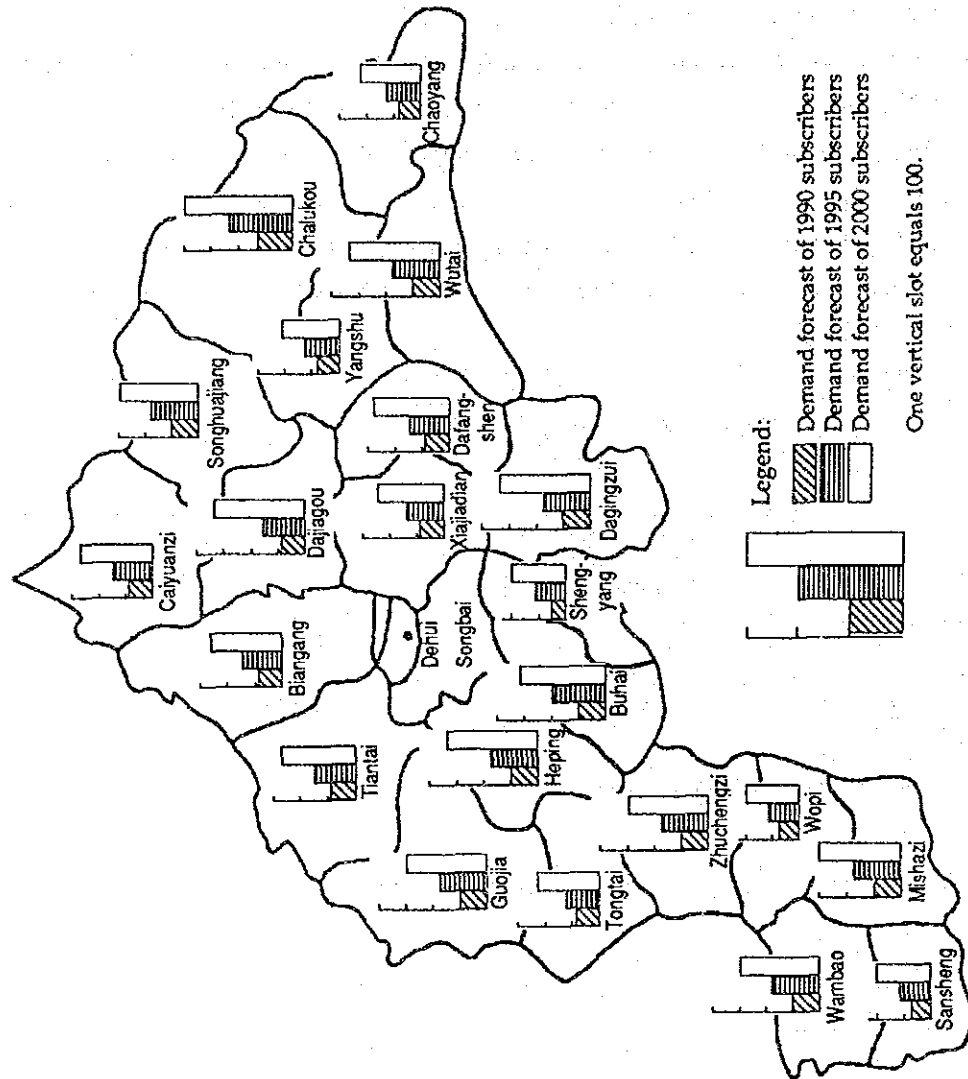
Figure 4.2-1 Dehui County's Telephone Demand Forecast



Since the demand forecast term covers a relatively short period in this estimation, the time series extrapolation method, reflecting the current condition, is adopted. Based on the findings, the

number of telephone demands in various townships is forecasted from the current demand ratio of various townships. Figure 4.2-2 shows the results of the demand forecast in various townships.

Figure 4.2-2 Number of Telephone Demands by Township



*Branch Office of Posts and Telecommunications

Chapter 5 Setting up Targets of Telephone Network Automatization Plan

5.1 Issues of Telephone Network in Dehui County

In recent years, the economy of Dehui County has been developing rapidly. To carry out economic activities more efficiently, there is strong desire for better, high-quality telephone services. The telecommunications services in the region have not been able to adequately respond to local requests, both in terms of quality and quantity. Development of a telecommunications setup as an industrial infrastructure is thus urgently required. Some issues to be taken up are as follows:

(1) Low Telephone Main Line Density and a Large Number of Waiting Applicants

At the end of 1989, the telephone set density in Dehui County was 1.9 for local telephone, and 0.12 for rural telephone, which are lower when compared with the average telephone set density of Jilin Province's 4.5 for local telephone and 0.49 for rural telephone. The number of waiting applicants within the county at the end of 1989 was 420 for local telephone, and 1,997 for rural telephone. The latter figure shows a high ratio against the number of existing subscribers.

(2) Inadequate Telephone Services in Rural Areas

Rural telephones using open-wire system are installed in most villages within Dehui County. However, due to inferior facilities, there are many faults. In case of faults, telephone users must visit the nearest Branch Office of Posts and Telecommunications, but the inadequate transportation of the area and the harsh natural conditions, especially in the winter months, make it extremely difficult for residents to visit there. In hamlets, no telephones are installed, and residents are unable to use telecommunication services.

(3) Outdated Facilities Unable to Respond to Local Requirements

Telecommunications facilities at the Branch Offices of Posts and Telecommunications are manual switchboards which are unable to transmit or receive information promptly. Residents must usually wait for a long time to make long-distance calls, especially during busy hours. The SXS automatic exchange installed at Dehui County Office of Posts and Telecommunications is often defective and cannot provide adequate telephone services.

5.2 Significance of Automatizing Rural Telephone

The Chinese government has decided on a basic policy which consists of invigorating the national economy and a foreign policy of opening to the outside world, and agricultural products in rural areas are increasing, as a result of the introduction of "the responsibility system for agricultural production", hike of government's purchase price of agricultural products, and other measures. Surplus labor which has been generated therefrom is passed on to local enterprises, whose output growth has been rising sharply.

Thus, providing an indispensable and efficient industrial infrastructure in the form of telecommunication services, along with roads and electric power, to an agricultural economy where industry and agriculture are developing rapidly, will most likely play a vital role in its future economic development.

The significance of telephone automatization and promotion of telephone diffusion under such circumstances is as follows:

(1) Economic Significance

The automatization and promotion of telephone diffusion make it possible to obtain various information easily, and in larger quantities. Agricultural or corporate productivity can be greatly improved, and administrative efficiency is greatly enhanced by making use of accessible information and by saving costs and reducing unproductive time loss caused by moving or waiting to use telephone.

(2) Social and Cultural Significance

The natural environment surrounding Dehui County is extremely harsh, experiencing temperature below zero during six months of the year. Roads in rural areas are not adequately set up; public transportation is still underdeveloped. It is thus extremely difficult to exchange information between different regions. Under the circumstances, providing communication means in rural areas can greatly contribute to local communities from a humanitarian standpoint, since it makes people's lives more convenient and facilitates information exchange with other areas and emergency contact to medical institutions.

By providing means of communication to educational institutions such as schools, the rural residents will have the opportunity to come in contact with a variety of information, thus the implementation of the automatization plan will contribute to education, social welfare, and culture.

5.3 Targets of Telephone Network Automatization Plan of Dehui County

5.3.1 Development Targets

This automatization plan designates 1995 as the target of telephone development of Dehui County's telephone network.

5.3.2 Service Targets

The plan targets automatization of Dehui County's telephone network and incorporation with the nationwide subscriber trunk dialing network. Specific service targets are as follows:

(1) Types of Telephones

(a) Ordinary telephone

Magneto telephone sets are used in rural areas. In this plan, however, rotary dialing or push-button dialing telephones will be adopted along with the introduction of automatic exchanges.

(b) Public telephone

After automatization, the following types of public telephone could be used: operator-assisted method using ordinary telephones; coin telephone; and card telephone. Of these, operator-assisted public telephone using ordinary telephone sets will be adopted, since they can be used by anybody.

(2) Types of Communication Services

(a) Ordinary telephone services

A direct distance dialing call will be made possible within various townships in Dehui County as well as between nationwide automatic destinations. Manual destinations outside the county will be connected via manual switchboards using special service codes (IXY).

(b) Public telephone service

Public telephone will provide the same level of services as ordinary telephone.

(3) Switching System

(a) New-established switching facilities

Currently, an optical fiber communication system is planned to be adopted between Changchun and Dehui in accordance with the introduction of an optical fiber communication system between Beijing and Harbin. By connecting it with the exchange at Dehui County Office of Posts and Telecommunications, national subscriber trunk dialing service will be made available to subscribers within Dehui County, and Dehui County will be able to take advantage of the good quality digital transmission systems. As small-scale demands are concentrated in the areas where the local government offices of the township are located, installation of remote switching unit must be considered. Digital SPC exchange will be introduced in the county since it has excellent compatibility with digital transmission line, and can easily respond to the advanced telephone network in future.

(b) Existing switching facilities

The existing SXS automatic exchange becomes faulty frequently and suffers from poor-quality service. In addition, since it is no longer in production, procurement of maintenance parts is expected to become difficult. Thus, the SXS automatic exchange will be removed. Mangetic manual switchboards and small-size automatic exchanges installed in various Branch Offices of Posts and Telecommunications will also be removed since they have limited capabilities and cannot respond to direct distance dialing.

5.3.3 Telephone Installation Plan

Telephone installation plan will be set up as follows, taking into consideration various issues of rural telephone network, results of demand forecasting, existing long-term telephone network development plan, and local conditions.

(1) Demand Forecast and Existing Long-Term Development Plan

Since the telephone demand forecast of Dehui County in the year 2000 conforms with the long-term development target, the telephone installation plan will be set up based on the demand forecast. Table 5.3.3-1 shows Dehui County's telephone demand forecast as well as long-term development targets.

Table 5.3.3-1 Dehui County's Telephone Main Line Density Forecast and Long-term Development Targets

Items \ Classification	Dehui County		Nationwide	
	Local	Rural	Local	Rural
Telephone main line density in 2000	5.69	0.84	5.00	1.00

(2) Telephone Installation Objectives

(a) Local telephones

Dehui Town, where the county office is located, serves as the administrative, economic and cultural center of the county. Its telephone installation plan, therefore, is made so as to cope with the demand until 1995.

(b) Rural telephones

The telephone installation plan in rural areas is designated as follows in view of the administrative function, development of socio-economy, and the distribution of communities, among other factors.

(i) Telephone installation plan for the areas where local government offices are located

Since such areas are the administrative, socio-economic, educational, and medical center of townships where active economic activities take place, telephone demand is expected to grow. Thus, the telephone installation plan is such that can cope with the demand until 1995.

(ii) Telephone installation objectives for hamlets where village committees are located

Five telephone sets will be installed in each village for such official institutions as local government offices, schools, medical facilities, etc. in order to improve services for rural residents.

(iii) Telephone installation objectives for other hamlets

One telephone set will be installed for every five hamlets in order to guarantee minimum telephone service to those hamlets whose harsh environmental conditions make them unable to obtain adequate telephone services.

(c) Public telephones

Public telephones will be set up to provide telephone services to areas where telephones have not adequately spread.

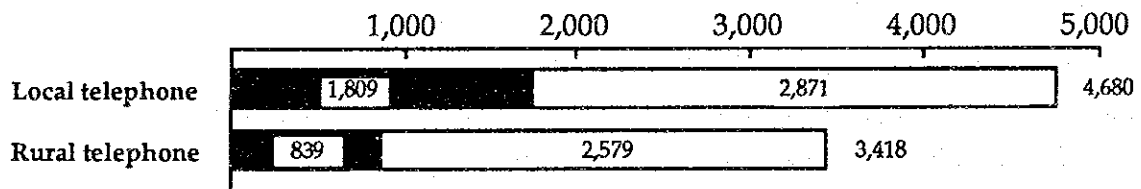
(i) Population in Dehui Town is dense, and public telephones are used frequently. Thus, a total of nine public telephones will be set up: one unit will be installed in each of the six local Branch Offices of Dehui Town, and one unit in each of the three villages.

(ii) Public telephone will be set up in each of the 23 townships with the exception of Dehui Town.



(3) Telephone Installation Plan

Through the abovementioned telephone installation plan, the telephone main line density until 1995 will be 3.38 for local telephone, 0.48 for rural telephone, and 0.95 for the entire Dehui County. Figure 5.3.3-1 shows the number of telephones which are expected to increase as a result of the telephone installation plan.

Figure 5.3.3-1 Telephone Installation Plan



Legend:

-  No. of telephones at the end of 1989
-  No. of telephones expected to increase until 1995

Chapter 6 Traffic Forecast

6.1 Concept of Traffic Forecast

Traffic forecast is based on the results of telephone demand forecast, future trends and amount of increase of traffic density and calling rate. The following factors are taken into consideration in the estimation: the relationships between various townships within Dehui County, their characteristics, and the actual conditions in China. By following the procedures mentioned below, a traffic matrix is formulated for three alternative plans (Plan A, B and C) on local service area.

First, an initial traffic matrix is formulated based on the basic data obtained from the existing network. Then a future traffic matrix (23x23) is created by extrapolating the following factors to the initial traffic matrix: forecasted demand within existing exchange service area, traffic increase ratio expected through telephone network automatization, and traffic growth rate. Finally, through a summation of related elements of the future traffic matrix, a traffic matrix for each alternative plan (Plan A, B and C) is formulated.

6.2 Calculation of Traffic

(I) Preconditions in Formulating a Traffic Matrix

(a) Formulation of an initial traffic matrix

(i) Concentration ratio to busy hour

- Uniformly 0.16 for local and out-of-county long distance calls
- Uniformly 0.35 for rural calls

(ii) Average holding time

- Intra-office calls: 180 sec.
- Calls to other townships: 270 sec.
- Calls to other counties: 270 sec.

(iii) The initial distribution of outgoing traffic is expected to be maintained in the future.

(b) Formulation of future traffic matrix

(i) Increase of traffic due to telephone network automatization

The increase multiplication rate of outgoing/incoming calling rate per subscriber accompanying telephone network automatization is set at 1.5.

(ii) Traffic growth rate

Growth rate of total outgoing/incoming traffic accompanying increased subscribers is set at 0.7.

(iii) Outgoing/incoming calling rate per subscriber

Successive diminution rate of outgoing/incoming calling rate per subscriber accompanying increased subscribers is set at 0.3.

(2) Results of Traffic Forecast

As a result of traffic calculation, the total intra-office traffic within Dehui County, total inter-office traffic between townships, and total traffic with other counties undergo changes such as shown in Table 6.2-1.

Table 6.2-1 Results of Traffic Forecast

(unit: erlang)

Forecasting year	Intra-office	Other townships	Other counties	Total
*base	500.674	100.302	47.779	648.755
1995	1,573.995	335.928	139.971	2,049.894
1996	1,721.953	366.434	153.819	2,242.206
1997	1,883.412	399.586	169.032	2,452.030
1998	2,060.572	435.896	185.754	2,682.222
1999	2,254.551	475.542	204.170	2,934.263
2000	2,467.013	518.818	224.399	3,210.230

Note: The base* mentioned above refers to when the initial traffic matrix was formulated in 1990.

(3) Formulation of a Traffic Matrix Based on Multiple Local Service Area Plans

When the entire Dehui County has been divided into 7 (Plan A), 10 (Plan B) and 12 (Plan C) local service areas, respectively, based on the multiple local service area plans, the inter-office traffic matrices from 1995 to 2000 are formulated through a summation of elements from the original 23x23 traffic matrices which have already been calculated. As a result of traffic calculation, the total intra-office traffic within Dehui County, total inter-office traffic with townships, and total traffic with other counties undergo changes such as shown in Table 6.2-2.

Table 6.2-2 Results of Traffic Calculations

(unit: erlang)

Forecasting year	Multiple plans	Intra-office	Other townships	Other counties	Total
1995	Plan A	1,603.135	306.788	139.971	2,049.894
	Plan B	1,593.839	316.084		
	Plan C	1,588.621	321.302		
1996	Plan A	1,752.569	335.818	153.819	2,242.206
	Plan B	1,742.775	345.612		
	Plan C	1,737.295	351.092		
1997	Plan A	1,915.420	367.578	169.032	2,452.030
	Plan B	1,905.132	377.866		
	Plan C	1,899.444	383.554		
1998	Plan A	2,094.046	402.422	185.754	2,682.222
	Plan B	2,083.272	413.196		
	Plan C	2,077.326	419.142		
1999	Plan A	2,289.481	440.612	204.170	2,934.263
	Plan B	2,278.207	451.886		
	Plan C	2,272.007	458.086		
2000	Plan A	2,503.363	482.468	224.399	3,210.230
	Plan B	2,491.607	494.224		
	Plan C	2,485.173	500.658		

Chapter 7 Fundamental Telephone Network Plan

Taking the automatization of the telephone network in Dehui County as an opportunity, the fundamental telephone network plan is studied, including local service area, network configuration, and numbering plan, in order to reconstruct an efficient and economic telephone network.

7.1 Setting Up Local Service Area

7.1.1 Basic Concept in Setting Up Local Service Area and Location of Exchanges

Table 7.1.1-1 shows the basic items to be considered when setting up the local service areas and location of exchanges.

Table 7.1.1-1 Basic Items to Be Considered

	Basic items	Reason/objectives
Setting up local service areas	① The existing local service areas will not be divided.	The existing local service areas conform to administrative districts.
	② Use *ordinary measures to unify local service areas.	Demand density for telephones is low with the exception of areas covered by Dehui County Office of Posts and Telecommunications.
	③ Even off the demand and population within local service area.	So as to equalize the quality of telephone services.
	④ As a general rule, use cables for subscriber network facilities.	So as to make it possible to use domestic products when installing additional subscriber telephones in the future.
	⑤ Ordinary measures in subscriber transmission performance will be applied for areas in which local government offices are located.	Most subscriber telephone demands are concentrated in areas in which local government offices are located, which makes it possible to reduce investment in facilities.
	⑥ The Yinma River will be the boundary for the local service area.	Subscribers' lines across the river are difficult to construct.
Setting up location of exchanges	① Use existing Branch Offices of Posts and Telecommunications as new exchanges.	They are located in areas in which local government offices are located, which are the economic and social centers.
	② New exchanges location will be decided in a manner where the area satisfying subscriber transmission performance by using ordinary measures becomes the largest.	So as to reduce investment in facilities.

Note: *Ordinary measures mean the use of loading coil for the subscriber's line (with a conductor diameter of 0.7 mm.) and booster batteries for the subscriber's circuit.

7.1.2 Study of Local Service Areas

Table 7.1.2-1 and Figure 7.1.2-1 ~ 7.1.2-3 show the outline of local service areas (three plans) selected on the basis of the basic concept in setting up local service areas and the location of exchanges.

Table 7.1.2-1 Outline of Local Service Areas (Three Plans)

Plans	Plan A	Plan B	Plan C
Items			
Number of exchanges	7 exchanges	10 exchanges	12 exchanges
Name of townships in which exchanges are set up	Dehui • Xiajiadian Chalukou • Dajiagou Tiantai • Buhai Mishazi	Dehui • Xiajiadian Yangshu • Chalukou Biangang • Dajiagou Guojia • Buhai Wopi • Wanbao	Dehui • Xiajiadian Yangshu • Chalukou Daqingzui • Dajiagou Songhuajiang • Biangang Guojia • Buhai Wopi • Wanbao
Unification of areas	On average, four townships are unified.	On average, three townships that are adjacent to one another and separated by roads are unified.	On average, two townships that are adjacent to each other and separated by roads are unified.
Proportion of villages that need improvements on transmission performance	20%	10%	5%
Map of local service areas	Figure 7.1.2-1	Figure 7.1.2-2	Figure 7.1.2-3

Figure 7.1.2-1 Map of Local Service Areas for Plan A (7 exchanges)

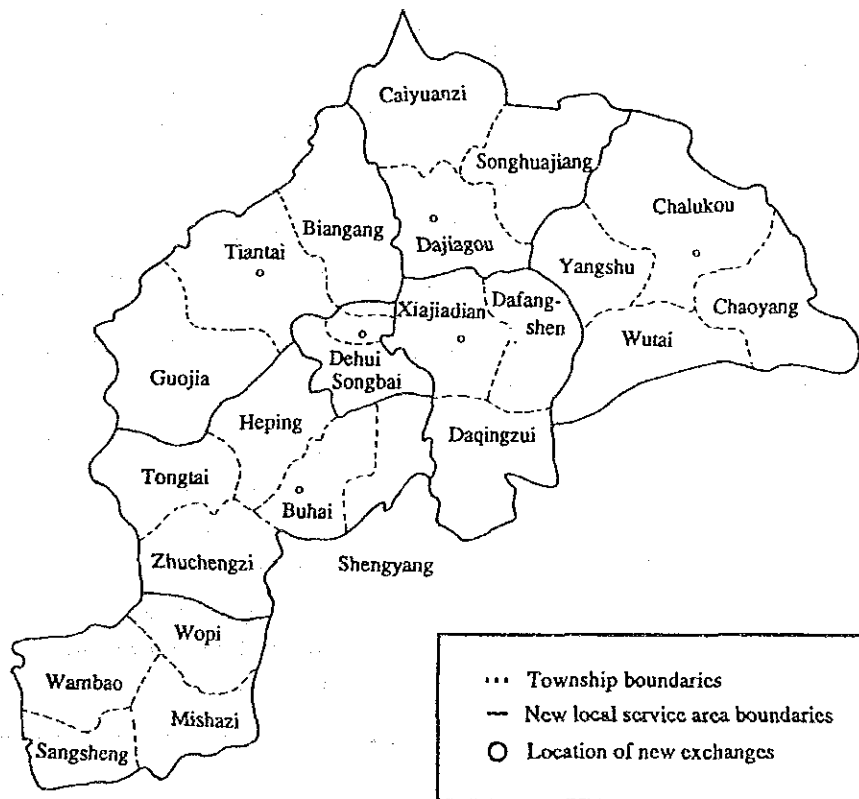


Figure 7.1.2-2 Map of Local Service Areas for Plan B (10 exchanges)

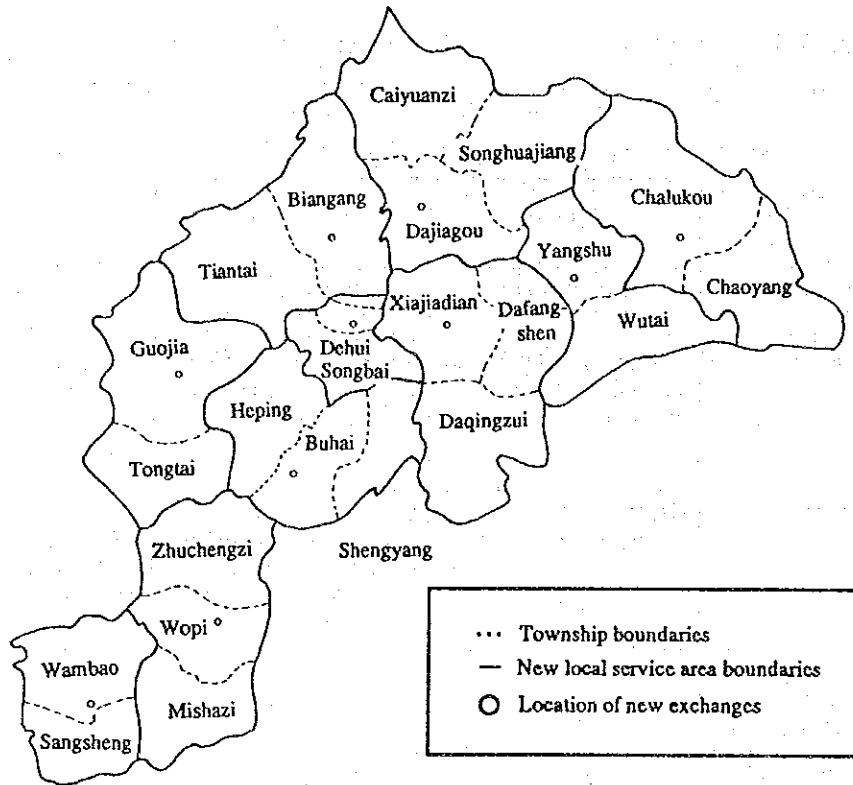
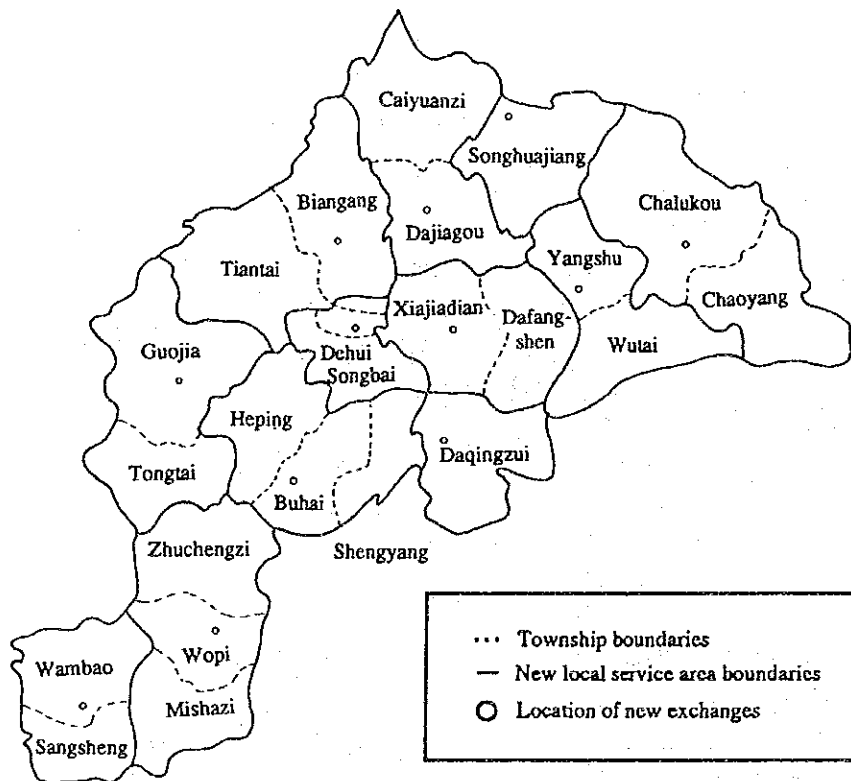


Figure 7.1.2-3 Map of Local Service Areas for Plan C (12 exchanges)



7.2 Network Configuration

7.2.1 Selection of Switching System

As can be seen in the comparisons shown in Table 7.2.1-1, the exchange to be used in the proposed automatization plan will be digital SPC exchange.

Table 7.2.1-1 Selection of Switching System

Switching system Conditions of selection	Digital SPC exchange	Crossbar exchange
① It can record detailed billing of charges for all subscribers.	Possible.	It is difficult in the case of national trunk dialing for subscribers accommodated to the exchange with the exception of Dehui County Office of Posts and Telecommunications.
② It does not take up much space when installed and does not involve construction of a new building. (Dehui County Office of Posts and Telecommunications)	It is possible to set up in existing building.	It requires about four times as much space as the digital SPC exchange and involves construction of a new building.
③ It conforms to the digital transmission plan.	Conforms.	It necessitates the installment of an A/D converter.
④ It can provide telephone services that allow for future socio-economic development.	It is possible to deal with future development by changing the software since it is the SPC type.	Since it works on the wired logic control system, changes in hardware will be extensive.

7.2.2 Circuit Network Configuration

According to the present condition and forecasting results of inter-office traffic in Dehui County, there is much traffic for Dehui County Office of Posts and Telecommunications, although traffic among the Branch Offices is small. Since Dehui County Office of Posts and Telecommunications is located almost in the center of the county and since it acts as a relay point as the county central office for traffic outside the county as well as to each townships, it has characteristics suited to the star network. Therefore, the star network will be used for the network configuration of the proposed automatization plan.

7.3 Numbering Plan

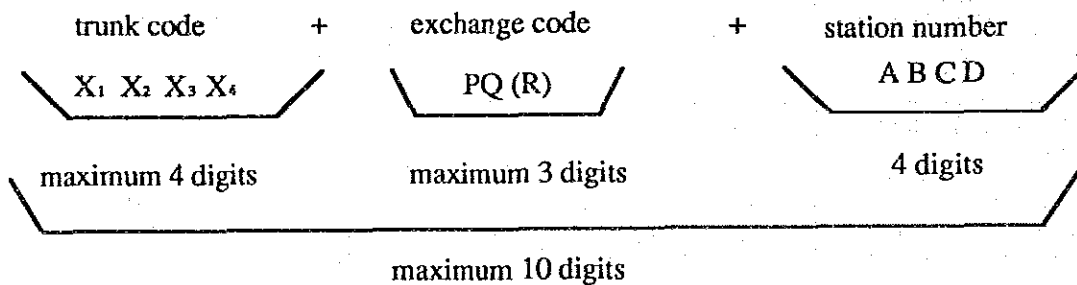
7.3.1 Basic Items in the Numbering Plan

The followings are the basic items in formulating the numbering plan that are studied based on the prerequisites of a national subscriber trunk dialing service:

- ① Numbering capacity must have plenty of capacity to cope with the expected future increase in subscribers so that no changes will be required for a long time;
- ② The telephone number for a specified telephone set must be the same for any call from any place;
- ③ The number must be simple, easy to remember, and convenient for the subscribers; and
- ④ The method of translation of route identification and charging identification, which is one of the switching function, must not be complicated.

7.3.2 National Number Configuration

National number configuration is shown as below:



7.3.3 Numbering Plan for Dehui County

(1) Conditions for the Numbering Plan

The conditions required in considering the numbering plan for Dehui County are as follows:

- ① Conforming to the domestic numbering system in China, the trunk code will be 4412;
- ② Exchange code will be in two digits in view of future demand increase;
- ③ The number of the subscriber of Dehui County as well as other townships will be taken into account; and

(2) Numbering Plan by Each Local Service Area Plan

Table 7.3.3-1 shows the allocation of exchange code in Dehui County.

Table 7.3.3-1 Exchange Code

Plan A			Plan B			Plan C		
Exchanges	Townships	Exchange code	Exchanges	Townships	Exchange code	Exchanges	Townships	Exchange code
Dehui	Dehui	20	Dehui	Dehui	20	Dehui	Dehui	20
	Songbai			Songbai			Songbai	
Dajiagou	Songhuajiang	31	Dajiagou	Songhuajiang	31	Songhuajiang	Songhuajiang	31
	Caiyuanzi			Caiyuanzi		Dajiagou	Caiyuanzi	33
	Dajiagou			Dajiagou		Dajiagou		
Chalukou	Chalukou	30	Chalukou	Chalukou	30	Chalukou	Chalukou	30
	Yangshu			Chaoyang			Chaoyang	
	Chaoyang		Yangshu	Yangshu	32	Yangshu	Yangshu	32
	Wutai			Wutai			Wutai	
Xiajiadian	Dafangshen	32	Xiajiadian	Dafangshen	33	Xiajiadian	Dafangshen	34
	Xiajiadian			Xiajiadian			Xiajiadian	
	Daqingzui			Daqingzui		Daqingzui	Daqingzui	35
Buhai	Shengyang	34	Buhai	Shengyang	35	Buhai	Shengyang	37
	Buhai			Buhai			Buhai	
	Heping			Heping			Heping	
	Tongtai		Biangang	Tiantai	34	Biangang	Tiantai	36
	Zhuchengzi			Biangang			Biangang	
Tiantai	Guojia	33	Guojia	Tongtai	36	Guojia	Tongtai	38
	Tiantai			Guojia			Guojia	
	Biangang		Wopi	Zhuchengzi	37	Wopi	Zhuchengzi	39
Wopi	Wopi	Wopi						
	Mishazi	Mishazi		Mishazi				
Wanbao	Wanbao	Wanbao		38			Wanbao	Wanbao
Sansheng		Sansheng	Sansheng					

7.4 Signalling System

Signalling system can be roughly divided into ① subscriber line signalling system which is used between the telephone set and the exchange, and ② inter-office signalling that is used between exchanges. The following deals with both signalling systems.

(1) Subscriber Line Signalling System

The following two methods will be used for subscriber line signalling:

- ① Dial pulse (DP) signals
- ② Dual tone multi-frequency (DTMF) signals

(2) Inter-office Signalling System

Digital circuit signalling will be adopted between the host exchange and the remote switching unit.

7.5 Charging System

7.5.1 Charging System

Table 7.5.1-1 shows the charging method for calls within and without Dehui County.

Table 7.5.1-1 Charging Method

Type of call		Charging method
Within county	Local calls	Charged every three minutes (no reference to distance)
	Rural calls	① Local service area: charged every three minutes (no reference to distance) ② Between local service areas: charged by fixed time interval charging method (initial one min. succeeding one min.)
Out of county	Automatic calls	Charged by fixed time interval charging method (initial one min. succeeding one min.) and automatic message accounting
	Manual calls	Charge based on call order tickets

7.5.2 Charging Areas

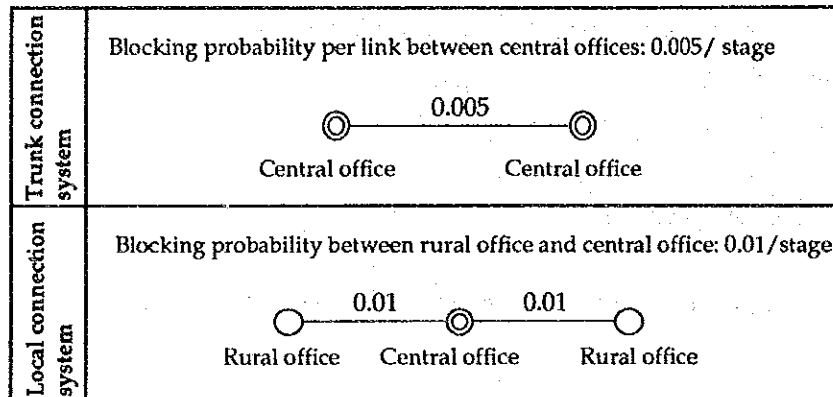
Charging areas will be the same as local service areas.

7.6 Technical Standards

7.6.1 Switching Performance

Figure 7.6.1-1 shows the blocking probability under normal load.

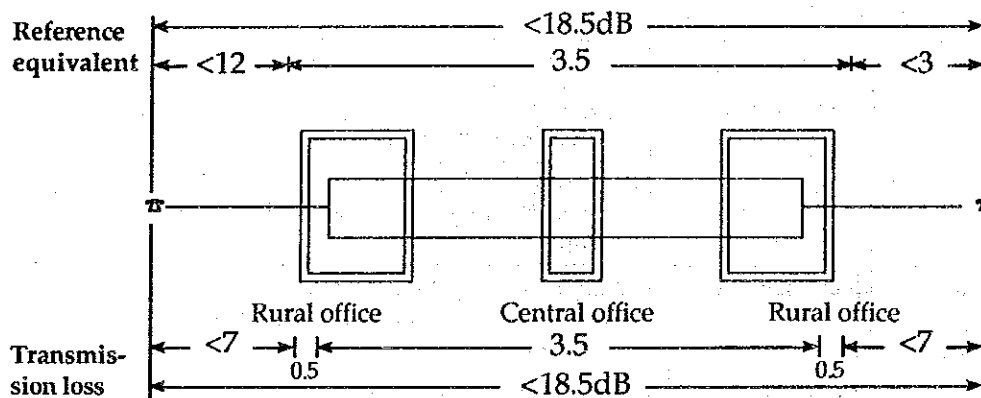
Figure 7.6.1-1 Blocking Probability



7.6.2 Transmission Loss

Figure 7.6.2-1 shows the distribution of transmission loss in digital network of rural telephone.

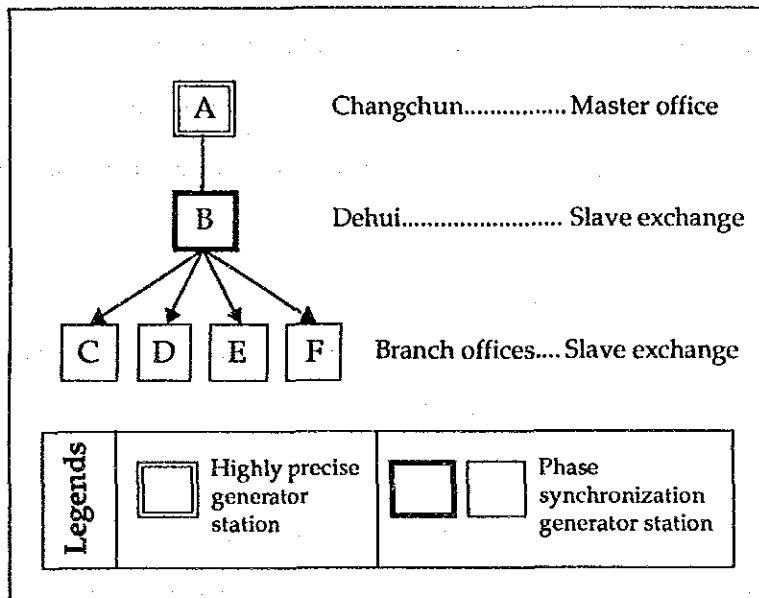
Figure 7.6.2-1 Distribution of Transmission Loss in Digital Network of Rural Telephone



7.7 Synchronization Plan

The synchronization system of telephone network in Dehui County, when the long distance transmission system between Dehui County Office of Posts and Telecommunications and digital exchanges higher than the Dehui County Office of Posts and Telecommunications adopts digitals, will be slave synchronization system with the upper digital exchange as the master office, since the synchronization system for all China uses four stage slave synchronization system. Figure 7.7-1 shows the synchronous network image when the long distance transmission system between Changchun and Dehui adopts digitals.

Figure 7.7-1 Synchronous Network Image for Dehui County



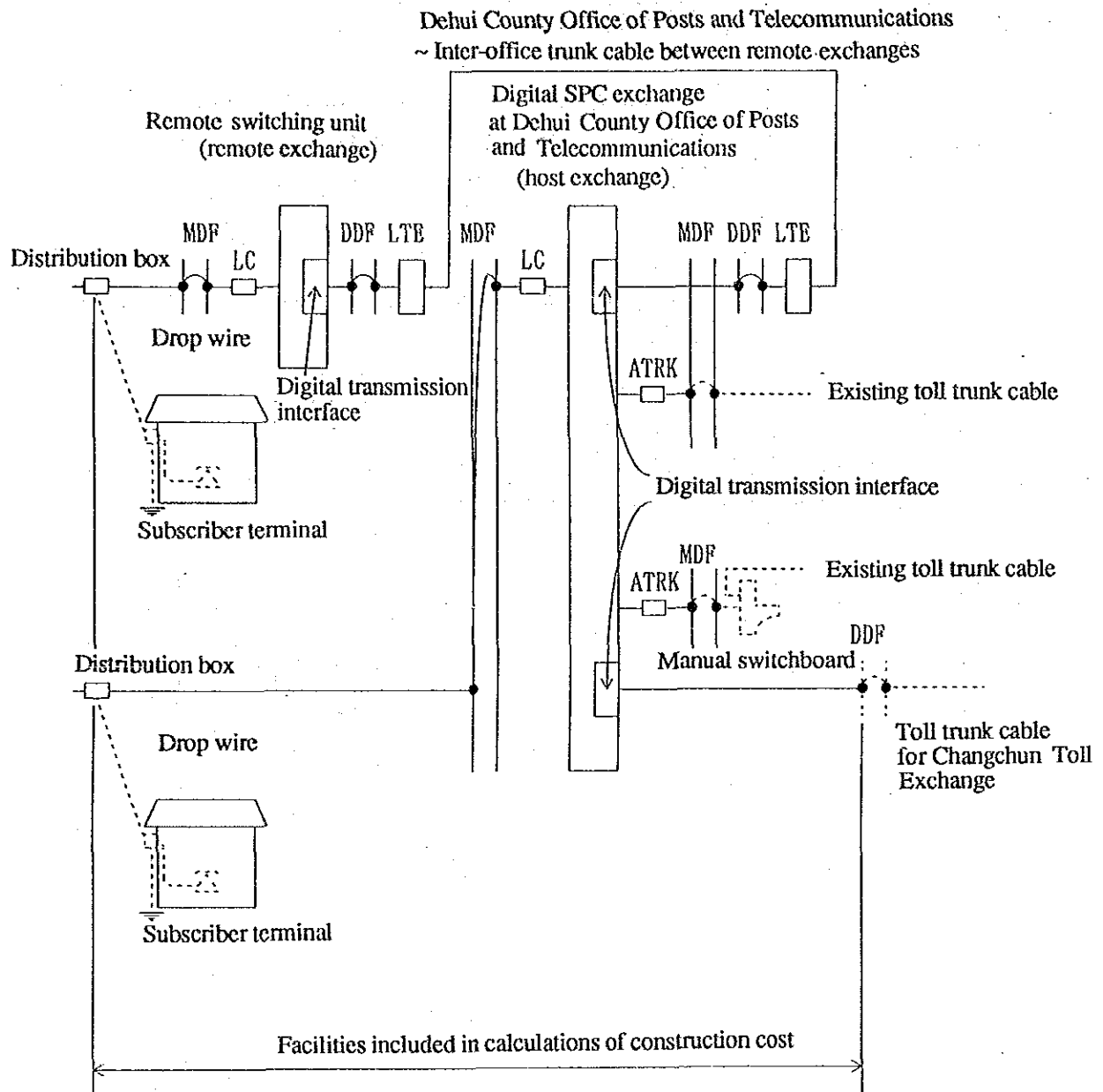
Chapter 8 Telephone Network Facility Plan

8.1 Principles of Facility Plan

Facility plan proceeds along the following principles:

- ① As a general rule, the scope of study of this facility plan is from the outlet of the transmission interface equipment for Changchun Toll Exchange in the digital SPC exchange to be installed at Dehui County Office of Posts and Telecommunications to the subscriber's line distribution box. Figure 8.1-1 shows the scope included in the estimation for construction costs.
- ② Existing facilities, as a general rule, is to be renewed with the exception of the subscriber's line within Dehui Town and the manual switchboard at Dehui County Office of Posts and Telecommunications; however, the removing and transfer of existing facilities are not subject to this condition;
- ③ Facility capacity, as a general rule, conforms to the telephone demand and the number of public telephones to be installed by the year of 1995;
- ④ The digital SPC exchange system will be adopted as the switching unit, because digitization of telecommunications network is the worldwide trend and also because digital SPC exchanges are used in Jilin Province and that digital transmission lines are planned to be adopted between Changchun and Dehui; and
- ⑤ In estimating the capacity of facilities, appropriate consideration is paid to refer Chinese standards.

Figure 8.1-1 Facilities Included in Calculations of Construction Cost



Legend:

- : Facilities included in calculation of construction cost
- : Facilities excluded from calculation of construction cost
- MDF : Main distribution frame
- DDF : Digital distribution frame
- LC : Line circuit
- ATRK : Analog trunk
- LTE : Line terminal equipment
- ⤿ : Jumper

8.2 Calculation of Number of Trunk Circuits

8.2.1 Concept on Calculation of Circuit Number

In accordance with the network configuration and traffic engineering standard, the erlang B formula is applied and the number of circuits is calculated from the traffic offered.

(1) Network configuration

Star network is applied with Dehui County Office of Posts and Telecommunications as its center.

(2) Switching performance

- ① Blocking probability between Dehui and Changchun is 0.005.
- ② Blocking probability between Dehui and other townships is 0.01.

(3) Application of erlang B formula

The number of circuits is calculated from the traffic offered based on the erlang B formula with blocking probability as 0.01 and 0.005.

8.2.2 Calculation Results of Circuit Number

Table 8.2.2-1 shows the results of the calculated circuit number for Plans A, B, and C in 1995.

Table 8.2.2-1 Calculation Results of Circuit Number (1995)

Section	Plan A (7 Exchanges)				Section	Plan B (10 Exchanges)				Section	Plan C (12 Exchanges)			
	Outgoing circuit		Incoming circuit			Outgoing circuit		Incoming circuit			Outgoing circuit		Incoming circuit	
	Traffic (erl)	Number of circuits	Traffic (erl)	Number of circuits		Traffic (erl)	Number of circuits	Traffic (erl)	Number of circuits		Traffic (erl)	Number of circuits	Traffic (erl)	Number of circuits
Dehui - Changchun	78.25	98	61.72	79	Dehui - Changchun	78.25	98	61.72	79	Dehui - Changchun	78.25	98	61.72	79
Dajiagou - Dehui	13.94	23	18.15	28	Dajiagou - Dehui	13.94	23	18.15	28	Dajiagou - Dehui	10.86	19	11.85	20
Chalukou - Dehui	18.75	29	24.38	35	Chalukou - Dehui	10.35	18	15.30	24	Chalukou - Dehui	10.35	18	15.30	24
Xiajiadian - Dehui	14.76	24	15.39	25	Yangshu - Dehui	9.86	18	10.55	19	Yangshu - Dehui	9.86	18	10.55	19
Buhai - Dehui	15.52	25	18.84	29	Xiajiadian - Dehui	14.76	24	15.39	25	Xiajiadian - Dehui	10.62	19	9.45	17
Tiantai - Dehui	13.98	23	16.10	25	Buhai - Dehui	8.69	16	12.97	22	Buhai - Dehui	8.69	16	12.97	22
Mishazi - Dehui	13.86	23	9.80	18	Guojia - Dehui	7.97	15	8.03	15	Guojia - Dehui	7.97	15	8.03	15
					Biangang - Dehui	9.95	18	11.52	20	Biangang - Dehui	9.95	18	11.52	20
					Wopi - Dehui	10.09	18	11.32	20	Wopi - Dehui	10.09	18	11.32	20
					Wanbao - Dehui	9.85	18	4.09	10	Wanbao - Dehui	9.85	18	4.09	10

8.3 Switching Facilities

8.3.1 Principles of Switching Facilities Plan

Principles of switching facilities plan are shown below.

(1) Switching System

- (a) The switching unit will be the digital SPC exchange.
- (b) In consideration of economy and the present situation of Dehui County, combined local and toll exchange will be installed at Dehui County Office of Posts and Telecommunications and remote switching unit at other Branch Offices of Posts and Telecommunications.

(2) Service Conditions

For destinations where it is possible to connect with automatic dialling, the subscriber direct dialling system will be adopted, and the necessary manual and semi-automatic call services will be kept as present.

(3) Capacity of Facility Plan

Number of line units meets the demand for ordinary telephones and the number of public telephones to be installed as defined in the plan objectives in 1995.

(4) Operation and Maintenance Conditions

As a general rule, the host exchange will monitor and control the remote exchanges, and the host exchange will be attended, while the remote exchanges unattended.

8.3.2 Main Construction Items

The main construction items for switching facilities are as follows:

- (1) Combined local and toll exchange will be newly installed at the Dehui County Office of Posts and Telecommunications, and at other exchanges, remote switching units will be newly installed which can be controlled from Dehui County Office of Posts and Telecommunications. Table 8.3.2-1 shows the number of line units at exchanges in 1995.
- (2) Facility capacity of the combined local and toll exchange and the trunk circuit units of the remote switching unit corresponds to the calculated number of circuits. Also, in order to secure the

minimum amount of traffic required for manual destinations outside Dehui County, analog trunk for 60 circuits will be installed in the digital SPC exchange at the Dehui County Office of Posts and Telecommunications.

Table 8.3.2-1 Number of Line Units at Exchanges (1995)

Name of exchange	Plan A	Name of exchange	Plan B	Name of exchange	Plan C
Dehui	4,695 (0.258)	Dehui	4,695 (0.258)	Dehui	4,695 (0.258)
Dajiagou	459 (0.293)	Dajiagou	459 (0.293)	Dajiagou	299 (0.323)
				Songhuajiang	160 (0.236)
Chalukou	676 (0.243)	Chalukou	367 (0.243)	Chalukou	367 (0.243)
		Yangshu	309 (0.244)	Yangshu	309 (0.244)
Xiajiadian	491 (0.226)	Xiajiadian	491 (0.226)	Xiajiadian	308 (0.237)
				Daqingzui	183 (0.208)
Buhai	733 (0.195)	Buhai	420 (0.238)	Buhai	420 (0.238)
Tiantai	532 (0.225)	Guojia	335 (0.157)	Guojia	335 (0.157)
		Biangang	327 (0.269)	Biangang	327 (0.269)
Mishazi	571 (0.291)	Wopi	468 (0.231)	Wopi	468 (0.231)
		Wanbao	286 (0.280)	Wanbao	286 (0.280)
Total	8,157 (0.251)	Total	8,157 (0.251)	Total	8,157 (0.251)

Note: The upper figures in the table indicate the number of line units and the figures in parentheses the outgoing/incoming calling rate.

8.4 Transmission Facilities

8.4.1 Basic Items in the Transmission Facilities Plan

(1) Adopted Transmission System

The pulse code modulation (PCM)-30 system is adopted as the transmission system for the trunk transmission line between the digital SPC exchange installed at Dehui County Office of Posts and Telecommunications and the remote switching unit. The system has been selected from among the PCM-30 system, 2M and 8M type optical fiber cable system, after giving overall evaluation on its economy, area characteristics, connecting conditions with the exchange, and ease of maintenance.

(2) Required Number of Systems

The required number of systems is estimated by using the number of circuits in 1995 calculated from the traffic data and setting the circuit accommodation ratio as 75 percent.

(3) Selection of Routes for Inter-office Trunk Transmission Lines

Selection of routes for inter-office trunk cable is based on the following points:

- (a) The routes are set up along roads so that inter-office trunk cable can be readily repaired in case of accidents, since trunk transmission lines are very important;
- (b) As a general rule, roads that are passable for vehicles even in heavy rain are selected as routes; and
- (c) The shortest route is selected in consideration of economy and ease of maintenance.

(4) Securing a Stand-by System

The term, stand-by system, includes the line terminal equipment, and it is secured in the following manner:

- (a) It is installed within the same cable;
- (b) The standard for the stand-by system is the $(n + 1)$ method ($n =$ required number of systems); and
- (c) One stand-by system is installed to every unit trunk transmission line, and the switchover of the transmission lines is done between the unit trunk transmission lines.

8.4.2 Main Construction Items

The main construction items for transmission facilities involved in the telephone network automatization plan are shown below.

(1) Inter-office Trunk Routes

The inter-office trunk routes are shown in Figures 8.4.2-1, 8.4.2-2, and 8.4.2-3.

(2) Main Construction Items for Trunk Cables and the Required Number of Systems for Transmission Facilities

Table 8.4.2-1 shows the main construction items for trunk cables and the required number of systems for transmission facilities.

Table 8.4.2-1 Main Construction Items for Trunk Cables and the Required Number of Systems for Transmission Facilities

Main construction items		Unit	Plan A (7 exchanges)	Plan B (10 exchanges)	Plan C (12 exchanges)
Trunk cable		pair-kilometer	2,700	4,200	4,800
Transmission facility	Number of sections	Sections	6	9	11
	Required number of systems	System	23	29	33

Figure 8.4.2-1 Inter-office Trunk Routes (7 Exchanges - Plan A)

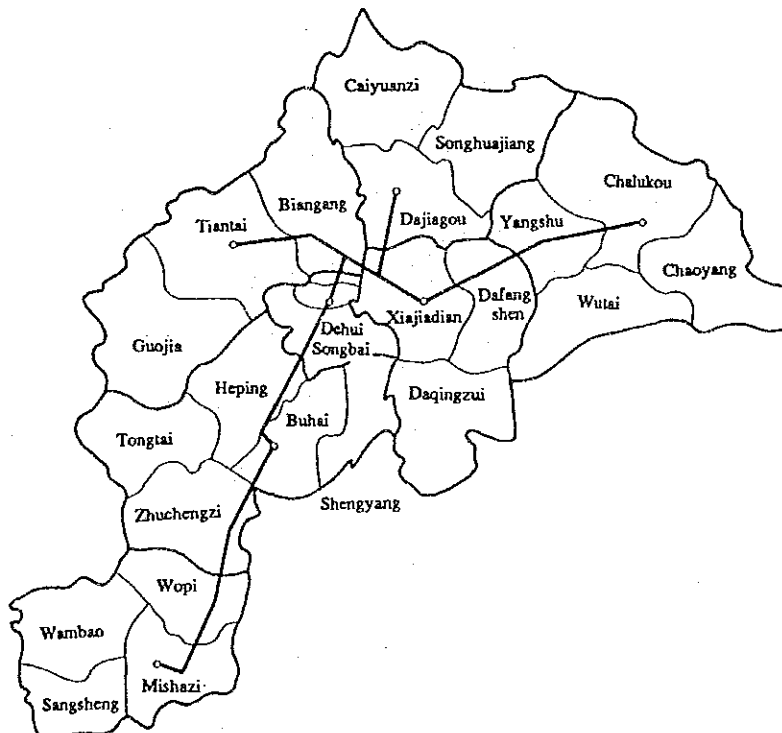


Figure 8.4.2-2 Inter-office Trunk Routes (10 Exchanges - Plan B)

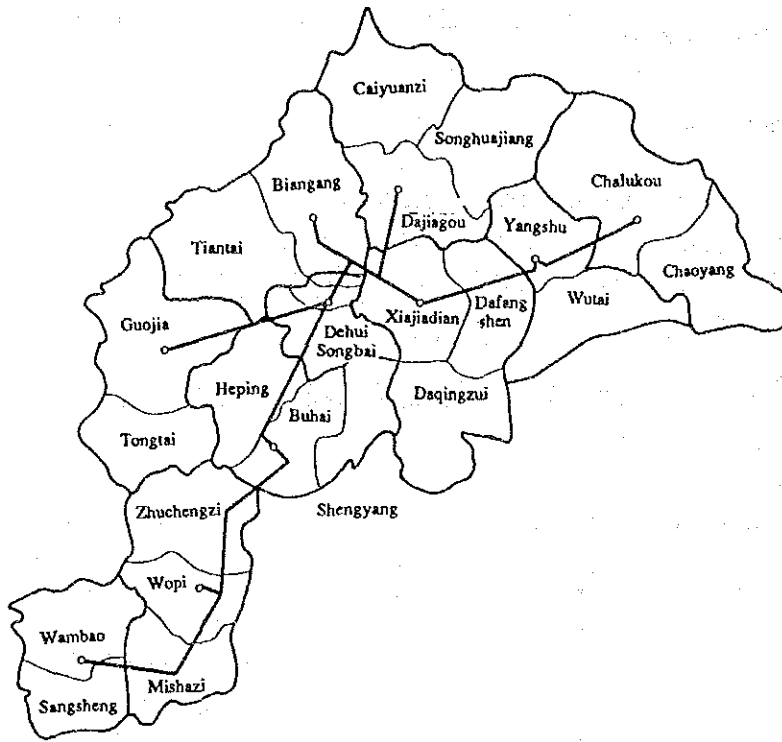
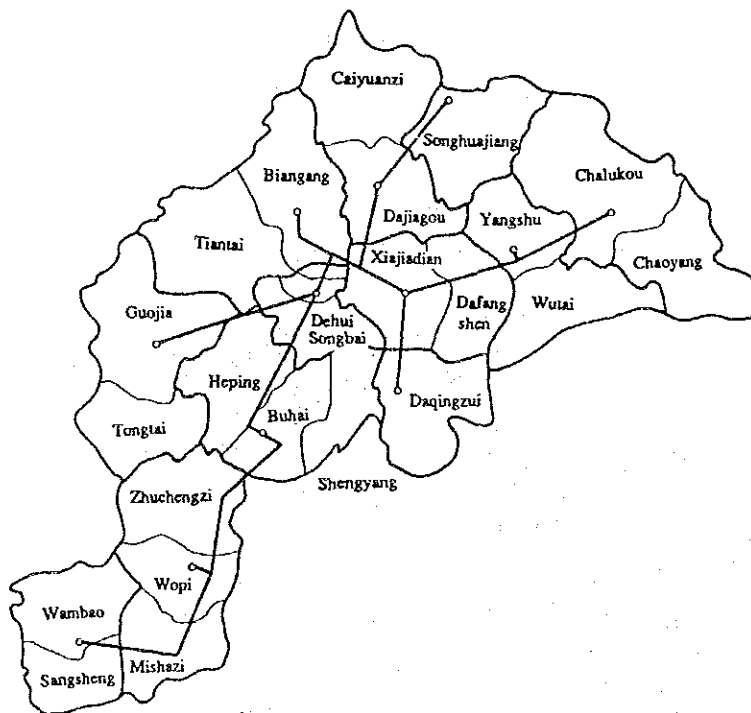


Figure 8.4.2-3 Inter-office Trunk Routes (12 Exchanges - Plan C)



8.5 Subscriber Network Facilities

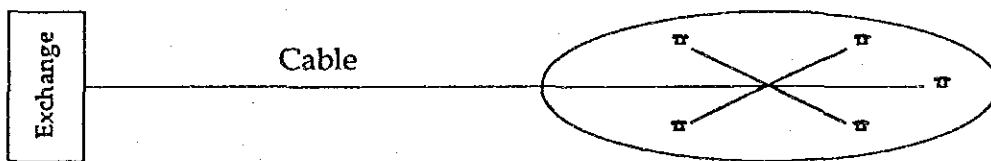
8.5.1 Selecting Subscriber Network System

(1) Study of the Optimal Subscriber Network System

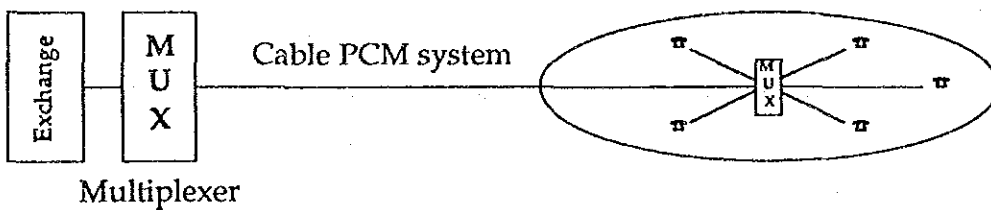
In consideration of the regional characteristics of Dehui County, out of various subscriber network systems such as the metallic subscriber line system, cable PCM system, digital MAS (TDMA radio system), analog MAS (FDMA radio system), digital multi-channel radio system, and single channel radio system, ① metallic subscriber line system, ② cable PCM system + metallic subscriber line system, and ③ digital MAS + metallic subscriber line system, are compared and studied. Figure 8.5.1-1 shows the various subscriber network systems.

Figure 8.5.1-1 Various Subscriber Network Systems

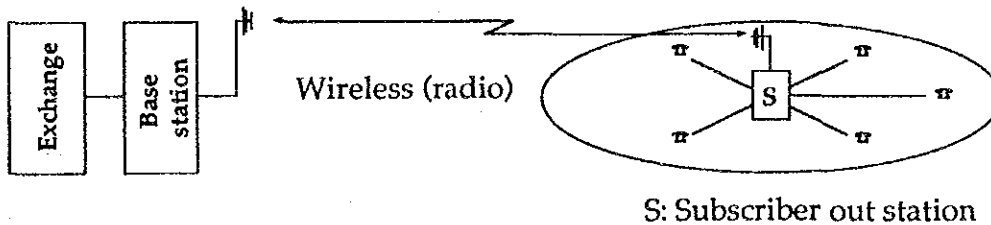
① Metallic subscriber line system



② Cable PCM system + metallic subscriber line system



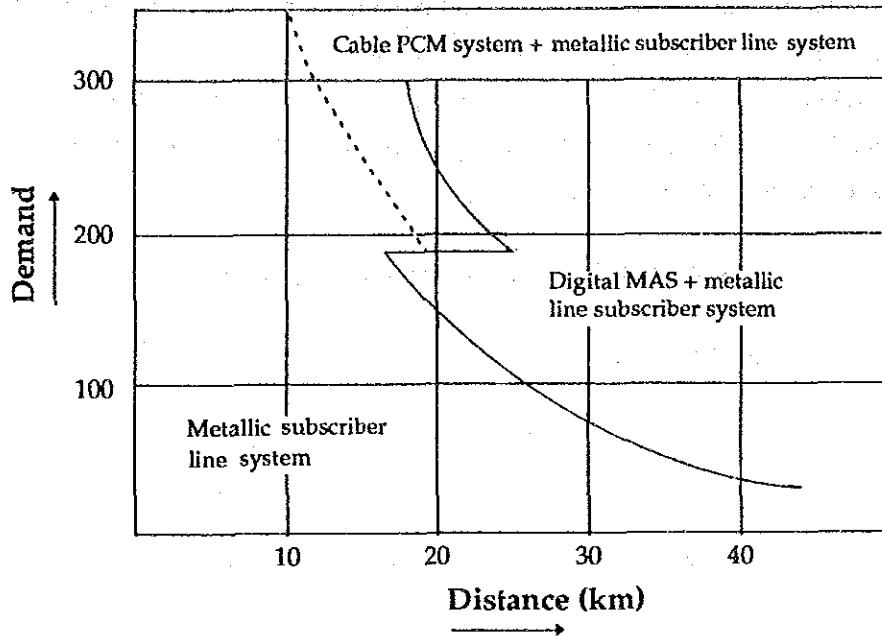
③ Digital MAS + metallic subscriber line system



Further, conditions for a model as shown below, based on the results of a field survey, are set up, and the optimal transmission system for the subscriber network is studied under the conditions that distribution point, multiplexer, and subscriber out station of each system be installed in the center of demand.

Figure 8.5.1-2 shows the areas that each subscriber network system are to be applied.

Figure 8.5.1-2 Applied Areas of Subscriber Network Systems



(2) Adopted Transmission Facilities

The metallic subscriber line system will be adopted as the result of the study for the optimal subscriber network system, based on the demand and distance from the exchanges using the above figure for subscriber network applied areas.

8.5.2 Main Construction Items

Table 8.5.2-1 shows the main construction items involved in the subscriber's line.

Table 8.5.2-1 Main Construction Items for Subscriber's Line

Main construction items	Unit	Plan A (7 exchanges)	Plan B (10 exchanges)	Plan C (12 exchanges)
Subscriber's line	pair·km	65,400	59,700	55,500

8.6 Power Facilities

8.6.1 Principle of Power Facilities Plan

Principles of power source are as shown below.

- ① To use commercial power as the primary energy source.
- ② To install a stand-by engine generator as the stand-by power for commercial power.
- ③ To install batteries as auxiliary power.

(1) Rectifier

- ① To install a rectifier as the direct current supply facility to the telecommunication facility.
- ② The floating system will be adopted when using the batteries.
- ③ As a load compensation method, end battery (EN) method will be adopted for Dehui County Office of Posts and Telecommunications, and silicon dropper (SID) method for the remote switching unit.

(2) Batteries

- ① The enclosed type battery will be adopted.
- ② Battery capacity is calculated based on the facility capacity of the exchanges and other factors.
- ③ Three hours is the standard of sustenance time for the batteries in view of the breakdown of commercial power in the area.

(3) Stand-by Engine Generator

- ① To install two stand-by engine generators at Dehui County Office of Posts and Telecommunications (It is not suggested to operate the generator in use and the stand-by system simultaneously) and one at each remote switching unit. As for offices in which stand-by engine generators have already been installed, the generating capacity is reviewed and they will be replaced and/or improved if necessary.
- ② The stand-by engine generator will have the capacity for supplying the power for the telecommunication facility and the air-conditioning facilities in the telecommunication machinery room.

8.6.2 Main Construction Items

Table 8.6.2-1 shows the main construction items involved in power facilities.

Table 8.6.2-1 Main Construction Items for Power Facilities

Main construction items	Unit	Plan A (7 exchanges)	Plan B (10 exchanges)	Plan C (12 exchanges)
Rectifier	Set	7	10	12
Batteries	Set	7	10	12
Stand-by engine generator	Set	7	10	12

8.7 Building Facilities

8.7.1 Principles of Building Facilities Plan

Buildings necessary for the installment of the telecommunication facilities as well as air-conditioning facilities required for the said buildings will be constructed, extended and/or altered in line with the telephone network automatization plan.

(1) Newly Constructing, Extending, and/or Altering Buildings

The existing buildings are used as a general rule; however, alterations will be made if necessary. If it is difficult to secure the space necessary for the installation of the telecommunication facilities in existing buildings, extending or newly constructing a building are considered.

(2) Environment of the Various Machinery Rooms

Environmental conditions of the various machinery rooms are based on the standard regulated by the Ministry of Posts and Telecommunications.

8.7.2 Main Construction Items

Table 8.7.2-1 shows the main construction items involved in the building facilities.

Table 8.7.2-1 Main Construction Items for Building Facilities

Main construction items	Unit	Plan A (7 exchanges)	Plan B (10 exchanges)	Plan C (12 exchanges)
Alterations to buildings	Exchange	1	1	1
Alterations to and extension of buildings	Exchange	6	9	11
Air-conditioning facilities	Set	7	10	12

Chapter 9 Operation and Maintenance Plan

The daily operation work of Dehui County Office of Posts and Telecommunications and Branch Offices will undergo great changes with the introduction of new technologies and facilities involved in the automatization of the telephone network. In order to cope with such changes, existing operation and maintenance should be reviewed. Also a training plan for those to be in charge of operation and maintenance should be devised in an effort to teach new technologies and improve skills involved in the use of new facilities.

9.1 Operation and Maintenance Plan

9.1.1 Principles in Laying Out A Plan

(1) Maintenance Setup by Existing Organization

- ① As a general rule, a new maintenance organization will not be established with the automatization, but the existing organization will be continued.
- ② Integration and abolishment of organizations will not be conducted except when it is unreasonable and impossible to maintain the existing organization in view of the composition of the new facilities.

(2) Establishment of Efficient Operational Setup

Since operation, including maintenance work, are expected to change greatly with the introduction of new facilities, the existing operation will be reviewed and adjustments in the organization will be made in order to establish an efficient operational setup suited to the automatization.

(3) Appropriate Allotment of Personnel

Appropriate personnel allotment within the organization will be studied in a manner suited to facility size and volume of maintenance work.

9.1.2 Background and Review Results

(1) Background in Reviewing Maintenance Organization and Operation

With the automatization of the telephone network, the operation of the organizations will differ greatly from the existing ones, and the background factors leading to the changes are shown below.

- ① The abolition of manual switchboard operation for rural telephones.
- ② Changes in the maintenance and operation setup of the switching section owing to the introduction of combined local and toll exchange and remote switching unit.
- ③ Changes in the maintenance setup of fault repair section owing to the introduction of PCM system and the replacement of open wires with cables.

Table 9.1.2-1 shows the organizations which must be reviewed and the background of review.

Table 9.1.2-1 Organizations to Be Reviewed and Background

Name of organization		Major background factors for review
Posts section	Branch offices subsection	• Abolition of manual switchboard operations at the Branch Offices of Posts and Telecommunications owing to automatization.
Rural telephone section	Rural telephone subsection	• Replacement of line facilities with cable. • Unification of maintenance (maintenance of trunk cable to be transferred to local lines subsection). • Promotion of complex jobs at remote switching unit.
	Rural transmission subsection	• Modernization of transmission facilities.
Local telecommunications section	Operating services subsection	• Curtailment of manual switchboard operation at Dehui County Office of Posts and Telecommunications.
	Local line subsection	• Unification of line maintenance (maintenance of trunk cable transferred from rural telephone section). • Strengthening of support for rural telephone section.
	Power supply subsection	• Modernization of power facilities and unification of maintenance.
	Long distance switching subsection	• Modernization of switching facilities and concentration and unification of maintenance.
	Local switching subsection	• Modernization of switching facilities and concentration and unification of maintenance.

(2) Results of Reviewing Maintenance Organization and Operation

The review results based on the principle stated above and the background factors are as follows. Table 9.1.2-2 shows major operational works before and after the automatization.

- ① Switching facilities
Demarcation between toll, local, and rural divisions will be abolished due to the change

from the step by step (SXS) switching system to the digital SPC switching system, and operation will be concentrated and unified.

② Line facilities

Since both subscriber and trunk transmission lines are to be replaced by cable, maintenance of trunk cable facilities will be transferred to local lines department. At the same time, the local line department will strengthen its support setup for rural line facilities. Some of line maintenance personnel will be stationed at the remote switching unit, and complex operation will be promoted, which include subscriber facilities and telephone installation works, etc.

③ Transmission

Maintenance of trunk transmission facilities will be concentrated at Dehui County Office of Posts and Telecommunications. Incidentally, since less faults are expected to occur, day operating shift will be adopted.

④ Power supply

Maintenance will be unified and concentrated to Dehui County Office of Posts and Telecommunications owing to the introduction of new apparatus.

⑤ Operator service

Manual switchboard operation for rural telephones will be abolished, but manual connecting operation for toll calls and directory service will remain, so personnel will be reduced to a minimum number that can maintain the required operation.

Table 9.1.2-2 Major Operational Works Before and After Automatization

Name of organization		Before automatization	After automatization
Posts section	Branch offices subsection	<ul style="list-style-type: none"> • Manual switchboard operations of rural telephones. • 24-hour shift. 	<ul style="list-style-type: none"> • Abolition of manual switchboard operations.
Rural telephone section	Rural telephone subsection	<ul style="list-style-type: none"> • Maintenance of subscriber line facilities in villages where township governments are located. • Maintenance of trunk cable. • Maintenance of facilities at Branch Offices of Posts and Telecommunications (manual switchboard, power facilities, etc.) • Day operating shift. 	<ul style="list-style-type: none"> • Maintenance of subscriber line facilities, except those of Dehui Town and Songbai Village. • Complex operations including installation of subscriber facilities at remote switching units. • Day operating shift.
	Rural transmission subsection	<ul style="list-style-type: none"> • Maintenance of trunk transmission facilities (open wire system). • 24-hour operating shift. 	<ul style="list-style-type: none"> • Maintenance of trunk transmission facilities (PCM system). • Day operating shift.
Telecommunications section	Operating services subsection	<ul style="list-style-type: none"> • Manual switchboard operations (for toll and rural calls). • Directory service. • 24-hour shift. 	<ul style="list-style-type: none"> • Manual switchboard operations (for toll calls). • Directory service. • 24-hour shift.
	Local lines subsection	<ul style="list-style-type: none"> • Maintenance of subscriber line facilities for local telephone. • Large-scale construction works for lines in county. • Day operating shift. 	<ul style="list-style-type: none"> • Maintenance of subscriber line facilities for local telephone. • Large-scale construction works for lines in county. • Trunk cable facilities. • Day operating shift.
	Power supply subsection	<ul style="list-style-type: none"> • Maintenance of power facilities (at Dehui County Office of Posts and Telecommunications). • 24-hour operating shift. 	<ul style="list-style-type: none"> • Maintenance of power facilities (of Dehui County Office of Posts and Telecommunications and remote switching unit). • 24-hour operating shift.
	Long distance switching subsection	<ul style="list-style-type: none"> • Maintenance of manual switchboard at Dehui County Office of Posts and Telecommunications. • Maintenance of trunk connection apparatus at Dehui County Office of Posts and Telecommunications. • 24-hour operating shift. 	<ul style="list-style-type: none"> • Integrated to "switching subsection". • Maintenance of switching facilities in the county (digital SPC exchange and remote switching unit). • Monitoring and controlling of remote switching unit. • 24-hour operating shift.
	Local switching subsection	<ul style="list-style-type: none"> • Maintenance of S X S switching facility. • 24-hour operating shift. 	

(3) Estimation of the Required Number of Personnel

The number of personnel necessary for efficient operations is estimated in line with the abolishment and reallocation of certain operations. The estimation is done through overall account of facility volume, nature of operational works, and the Chinese standard for calculating required personnel. Table 9.1.2-3 shows the number of personnel before and after automatization.

Table 9.1.2-3 Number of Personnel Before and After Automatization

Name of organization and subsection	Number of personnel before automatization	Number of personnel after automatization						Remarks
		Plan A (7 exchanges)		Plan B (10 exchanges)		Plan C (12 exchanges)		
Rural telephone	22	12		12		12		
Rural transmission	10	7		7		9		
Operating services	34	12		12		12		
Local line	14	29		29		29		
Power supply	12	7		9		10		
Long distance switching	13	Switching	14	Switching	14	Switching	14	Switching: tentative organizational name after integration
Local switching	14							
Rural telephone operation	44	0		0		0		44: Present number of operators in charge
Total	163	81		83		86		
Number of reduced personnel	—	- 82		- 80		- 77		

As a result of the review on personnel allotment caused by the implementation of the telephone network automatization plan, the number of subscriber per staff of Dehui County Office of Posts and Telecommunications is expected to increase from 11 subscribers at the end of 1990 to 43 subscribers at the end of 1995; therefore, a more efficient management of operation, compared with that before automatization, is expected.

9.2 Training Plan

9.2.1 Principles of Training Plan

The proposed telephone network automatization plan involves the introduction of digital SPC switching system, PCM transmission system, and other new technologies. These facilities differ greatly from existing ones in both technical standard and quality, so it is necessary to prepare a training plan for the smooth management of maintenance and operational works, based on the principles shown below.

(1) Training for Leaders

Training for senior engineers on switching, transmission, and power facilities is planned at training center of facility suppliers (outside the country).

(2) Training on Maintenance and Operational Works

Training for engineer and technician on switching, lines, transmission, and power facilities is planned in China.

(3) Practical On-the-Job Training

On-the-job training is planned for those that finished the training programs for leaders and on maintenance and operational works by having them participate in the construction works.

(4) Others

The training programs for leaders and on maintenance and operational works will be finished before the commencement of construction works, enabling the trainees to participate in on-the-job practical training in the construction works.

9.2.2 Training Schedule

The following training program is planned according to the principle for the training plan. Tables 9.2.2-1 and 9.2.2-2 show the training outline and the plan for training program on newly introduced skills.

Table 9.2.2-1 Training Outline

Division	Training outline
Switching	Maintenance and operation for digital SPC exchange (including remote switching unit).
Transmission	Maintenance and operation for cable PCM system.
Power	Maintenance and operation for power facilities incidental to switching units and transmission facilities.
Lines	Training on line tests involved in the introduction of cable PCM system.

Table 9.2.2-2 Training Program on Newly Introduced Skills

Place of training	Types of training	Trainees	Training for leaders	Training on maintenance and operation		On-the-job practical training
			Senior engineers	Engineers	Technicians	Participants in training programs
Within the country	Exchange		—	2 x 3	10 x 1	4 x 3 * 10 x 1
	Transmission		—	2 x 1	5 x 1	9 x 1
	Power		—	1 x 1	1 x 1	10 x 1
	Lines		—	3 x 1	3 x 1	40 x 0.3
	Total		—	12 (person month)	19 (person month)	53 (person month)
Outside the country	Exchange		2 x 3	—	—	—
	Transmission		2 x 1	—	—	—
	Power		1 x 1	—	—	—
	Total		9 (persons per month)	—	—	—

Note 1: "2 x 3" indicates "persons times months"
 Note 2: * indicates senior engineers and engineers.

Chapter 10 Implementation Plan

10.1 Setup for Implementation Systems for Automatization Plan

The following are the basic items to take into consideration during construction works so as to smoothly carry out the automatization plan.

- ① Posts and Telecommunications Administration of Jilin Province and Dehui County Office of Posts and Telecommunications are requested to establish a construction implementation setup within Dehui County.
- ② Posts and Telecommunications Administration of Jilin Province is requested to, with the cooperation of the Ministry of Posts and Telecommunications, give advice and guidance necessary for technical assistance and general adjustments.
- ③ Construction works in foreign currency are to be implemented and supervised by the apparatus supplier.
- ④ Technical collaboration with the consultant is considered for checking the detailed design, factory inspection, construction progress management and completion inspection.
- ⑤ The participation in the construction works by those to be in charge of maintenance is planned in order to improve skills in maintenance and operation incident to automatization facilities.

10.2 Implementation Schedule for Automatization Plan

10.2.1 Basic Principles

The following are taken into account when compiling the schedule for implementation of the automatization plan:

- ① To standardize and concentrate construction works, with the target of commencing service three years after the start of construction works.
- ② To be especially careful in the selection of the season to construct buildings and erect poles for subscriber lines and trunk cable, since it is difficult to dig in paddies, fields, roads, etc. during winter.
- ③ To implement the construction works in two terms: construction work for areas where local government offices are located and more developed areas are to be implemented in the first term since the areas are expected to be more profitable; construction works for subscribers' lines for the remaining villages and hamlets are to be implemented in the second term.
- ④ To consider the conformity of this implementation plan with the construction plan of long distance transmission line

10.2.2 Implementation Schedule

Construction works for building, electric power, exchange, transmission, trunk cable in all townships, and for subscriber lines for areas in which local government offices are located and more developed areas are allotted to the first term; those for subscriber lines for villages and hamlets are allotted to the second term. Table 10.2.2-1 shows the areas where construction works are to be implemented for the two terms for each of the three plans. Table 10.2.2-2 shows the implementation schedule for the construction works. The said schedule has been described from the time after detailed designs and tender transaction are finished and the contract drawn up with the apparatus supplier.

Table 10.2.2-1 Areas for Construction Works for Plans A, B, and C by Term

Plan \ Term	First term	Second term
Plan A (7 exchanges)	Facilities for building, power, switching, transmission, trunk cable in the seven local service areas, and subscriber line facilities for areas in which local government offices are located.	Subscriber line facilities for villages and hamlets in the seven local service areas.
Plan B (10 exchanges)	Facilities for building, power, switching, transmission, trunk cable in the ten local service areas, and subscriber line facilities for areas in which local government offices are located.	Subscriber line facilities for villages and hamlets in the ten local service areas.
Plan C (12 exchanges)	Facilities for building, power, switching, transmission, trunk cable in the twelve local service areas, and subscriber line facilities for areas in which local government offices are located.	Subscriber line facilities for villages and hamlets in the twelve local service areas.

Table 10.2.2.2-2 Implementation Schedule

Items	Fiscal year		First fiscal year				Second fiscal year				Third fiscal year		
	First term	Second term	1	2	3	4	1	2	3	4	1	2	
Plan A (7 exchanges)	First term	Manufacture and transport											
		Alterations to buildings											
		Construction works and tests											
	Second term	Manufacture and transport											
		Alterations to buildings											
		Construction works and tests											
		Construction works and tests											
Plan B (10 exchanges)	First term	Manufacture and transport											
		Alterations to buildings											
		Construction works and tests											
	Second term	Manufacture and transport											
		Alterations to buildings											
		Construction works and tests											
		Construction works and tests											
Plan C (12 exchanges)	First term	Manufacture and transport											
		Alterations to buildings											
		Construction works and tests											
	Second term	Manufacture and transport											
		Alterations to buildings											
		Construction works and tests											
		Construction works and tests											

Note: The manufacture and transport in first term in the table indicates facilities imported from overseas.

10.3 Investment for Automatization Plan

10.3.1 Preconditions in Estimating Investment

The preconditions in estimating the investment for automatization plan are shown below.

- ① Construction costs are for the facilities involved from the outlet of the transmission interface equipment for Changchun's Toll Central Office in the digital SPC exchange to be installed at Dehui County Office of Posts and Telecommunications to the subscriber distribution box.
- ② Construction costs do not include the expenses involved in removing and/or in transfer of existing facilities.
- ③ Construction costs are estimated based on the broad design or by modeling.
- ④ Construction costs take into account the present situation of China and are calculated at the exchange rate of 1 yuan = ¥27.(Yen)
- ⑤ Construction costs take into account the Chinese standards and include testing equipment for maintenance, measuring equipment, and spare parts expected to be required for one year.
- ⑥ Investments are estimated separately in local currency and foreign currency. Table 10.3.1-1 shows what is to be paid in local currency and foreign currency.
- ⑦ The price of imported goods is the CIF (cost insurance and freight) price from Japan.
- ⑧ Consultant's fee is estimated at 7 percent of the construction costs in foreign currency.
- ⑨ Contingencies are estimated at 5 percent of the construction costs in foreign currency and 10 percent of those in local currency.
- ⑩ The costs for implementation of this plan are estimated based on the schedule shown in Table 10.2.2-2.

Table 10.3.1-1 Distinction between Local or Foreign Currency in Paying for Major Facilities

Items	Construction costs			
	Material expenses		Labour expenses	
	Foreign currency	Local currency	Foreign currency	Local currency
Switching facilities	○	—	—	○ *1
Transmission facilities	○	—	—	○ *1
Trunk cable facilities	—	○	—	○
Subscriber line facilities	—	○	—	○
Civil facilities	—	○	—	○
Power facilities	—	○ *2	—	○ *1
Building facilities	—	○	—	○

Note: *1 Supervisor fees are appropriated in foreign currency.
 *2 Rectifier is appropriated in foreign currency.

10.3.2 Main Construction Items

Table 10.3.2-1 shows the main construction items for the automatization plan.

Table 10.3.2-1 Main Construction Items for Automatization Plan

Main construction items		Unit	Plan A (7 exchanges)	Plan B (10 exchanges)	Plan C (12 exchanges)
Digital SPC exchange	Combined local and toll exchange (host exchange)	Exchange	1	1	1
		Number of lines	4,695	4,695	4,695
	Remote switching unit (remote exchange)	Exchange	6	9	11
		Number of lines	3,462	3,462	3,462
Subscribers' lines		pair/kilometers	65,400	59,700	55,500
Trunk cable		pair/kilometers	2,700	4,200	4,800
Transmission facilities		Section	6	9	11
		System	23	29	33
Power facilities	Rectifiers	Set	7	10	12
	Batteries	Set	7	10	12
	Stand-by engine generators	Set	7	10	12
Buildings	Alterations to buildings	Exchange	1	1	1
	Alterations to and extension of buildings	Exchange	6	9	11

10.3.3 Estimated Investments

Table 10.3.3-1 shows the estimated investments by item.

Table 10.3.3-1 Estimated Investments by Items

(In units of million yen for foreign currency and wan yuan for local currency)

Items	Plan A (7 exchanges)		Plan B (10 exchanges)		Plan C (12 exchanges)	
	Foreign currency	Local currency	Foreign currency	Local currency	Foreign currency	Local currency
Switching facilities	296	31	366	31	412	31
Transmission facilities	76	6	96	6	109	6
Trunk cable facilities	0	224	0	340	0	386
Subscriber's line facilities	0	5,760	0	5,057	0	4,648
Civil facilities	0	5	0	5	0	5
Power facilities	79	45	105	63	123	75
Building facilities	0	44	0	52	0	59
① Subtotal I	451	6,115	567	5,554	644	5,210
② Consultant's fee	32	0	39	0	45	0
③ Contingencies	23	611	28	555	32	521
④ Subtotal II Σ ① - ③	506	6,726	634	6,109	721	5,731
⑤ Training costs	6	4	6	4	6	4
Total	512	6,730	640	6,113	727	5,735
④ + ⑤						
Grand total	2,329 million yen (8,626 wan yuan)		2,291 million yen (8,483 wan yuan)		2,275 million yen (8,428 wan yuan)	

Note: 1 wan yuan = 10,000 yuan

Chapter 11 Financial and Economic Analysis

11.1 Precondition

The preconditions of financial analysis are as follows:

- (1) Project life is 20 years.
- (2) The exchange rate is 1 yuan = ¥27 since \$1 = 5.22 yuan = ¥141.
- (3) Sunk cost and inflation are not taken into account.
- (4) The incremental revenues and costs between before and after automatization are taken into account.
- (5) Interest rate and depreciation are not taken into account.
- (6) Automatization is to be completed in 1994 for local telephones and in 1995 for rural telephones.

11.2 Revenue Estimation

Revenue estimation is based on the tariff before (current tariff) and after automatization. Estimated project revenues are shown below.

(1) Revenues from Installation Charge, Monthly Charge, and Outside Area Surcharge

Installation and monthly charges are calculated by multiplying the number of pay subscribers with the corresponding charges.

- ① Transition in the number of subscribers follows the current trend before automatization, and is based on the telephone installation plan (for until 1995) at the time of automatization and afterwards.
- ② The charges are calculated based on the followings:
 - Installation charge is based on the current tariff;
 - Monthly charge is based on the tariff after automatization; and
 - Outside area surcharge is based on the current tariff.

(2) Revenue from Call Charge

There are three types of call charges, intra-office call charge, inter-office call charge within the county, and long distance call charge. Estimated revenues from call charges are calculated by multiplying the call charge per one subscriber (hereinafter referred to as "CCPS") by the number of pay subscribers. However, as for revenue from long distance calls, 9.5 percent of it shall be incorporated

as the project revenue.

Revenues from public telephone calls are estimated on the same basis as ordinary telephones (by multiplying the call charge per one public telephone by the number of public telephones).

Transition in CCPS is as follows:

- Before automatization, it grows at a certain rate based on past trend.
- When the network is automatized, the following influences caused by automatization and tariff changes shown in Table 11.2-1 are taken into account: the effects of transition to the fixed time interval method (initial 1 min. succeeding 1 min.), abolition of the urgent call surcharge, rate increase, traffic increase ratio accompanying automatization, and the changes in traffic per subscriber owing to the sudden increase in the number of subscribers.
- After automatization, it is expected to grow at a rate of 3 percent a year.

Table 11.2-1 Changes in Tariffs Owing to Automatization

Place of outgoing calls \ Types of calls	Local	Rural
Intra-office	Same as current rates	Free ⇒ 0.1 yuan per 3 minutes
Inter-office within county	Uniform rate increase of 40 percent. Initial 3 min. succeeding 3 min. ⇒ initial 1 min. succeeding 1 min. Abolishment of urgent call surcharge.	
Long distance	Same as current unit call charge. Initial 3 min. succeeding 3 min. ⇒ initial 1 min. succeeding 1 min. Abolishment of urgent call surcharge.	Same as current unit call charge. Initial 3 min. succeeding 3 min. ⇒ initial 1 min. succeeding 1 min. Abolishment of urgent call surcharge. Same as current local surcharge. Abolishment of fixed call surcharge.

(3) Revenues from Local Surcharge and Fixed Call Surcharge

They are expected to be in proportion to the revenues from long distance calls before and after automatization, and in proportion to the changes in the number of calls at the time of automatization. Fixed call surcharge, however, is to be abolished with automatization.

(4) Other Revenues

As for other revenues, relocation charges are taken into account, which are 1.4 percent of the combined revenues of the above (1) to (3).

11.3 Cost Estimation

Project costs of this automatization plan are as shown below.

(1) Construction Costs

Figures shown in Chapter 10 are used for facilities and equipment costs, construction costs, consultant's fee, training fee, contingencies, etc. Facilities and equipment that exceed their durable years during the project life are to be replaced one by one; residual value, however, is not taken into account as it is not expected to have more value than the removal costs.

(2) Working Capital

It consists of cash, uncollected revenues, other current assets, etc. which correspond to fund in hand, and is estimated to be 10 percent of the revenues.

(3) Operating Costs

- ① Personnel costs are estimated by multiplying the personnel costs per employee (2,500 yuan) with the number of employees, which is based on the maintenance and operation plan in Chapter 9.
- ② Maintenance and repairs costs are as follows:
 - Number of existing subscribers multiplied by 175 yuan, before automatization as based on past cases; and
 - 1 percent of facility investment, after automatization.
- ③ Operation and administration costs are as follows:
 - 25 percent of the revenues, before automatization as based on past cases; and
 - After automatization, 22.5 percent of the revenues since there will be reduction in personnel and other measures to improve efficiency.

(4) Tax

Tax takes up 5.1 percent of the revenues.

11.4 Financial Analysis

11.4.1 Financial Internal Rate of Return

The financial internal rate of return (FIRR) for the three plans is as follows:

- Plan A (7 exchanges) --- FIRR = 2.27%
- Plan B (10 exchanges) --- FIRR = 2.52%
- Plan C (12 exchanges) --- FIRR = 2.64%

11.4.2 Sensitivity Analysis

Table 11.4.2-1 shows the results of the sensitivity analysis.

Table 11.4.2-1 Sensitivity Analysis

Plans		FIRR	FIRR	FIRR
		Plan A	Plan B	Plan C
Various conditions		(7 exchanges)	(10 exchanges)	(12 exchanges)
Financial analysis (basic case)		2.27%	2.52%	2.64%
Sensitivity analysis	When no contingency is involved	3.17%	3.40%	3.52%
	When contingency is doubled	1.48%	1.74%	1.86%
	When call charge per subscriber does not increase	-0.05%	0.15%	0.24%
	When call charge per subscriber increases at 5 percent every year	3.91%	4.18%	4.33%
	When 1 yuan = ¥30	2.52%	2.85%	3.03%
	When 1 yuan = ¥25	2.07%	2.26%	2.35%

11.5 Economic Analysis

11.5.1 Precondition

Plan C is taken up due to the highest FIRR. The main conditions on which the calculation is based are as shown below.

(1) Tax

Tax is excluded from costs.

(2) Increase in Long Distance Call Charge Revenues from Other Counties

Long distance calls from other counties are expected to increase. Outgoing/incoming calling ratio of long distance calls is 1 to 0.8. Therefore, 80% of the incremental revenues owing to automatization from long distance calls are estimated as economic benefit of the project.

(3) National (County's) Economic Benefits

The following two items are considered as the economic benefits to telephone users.

① Saved time

Time saved through automatization are calculated as follows:

- Value of time is 1.00 yuan/hour per person, based on labor productivity.
- Average waiting time for a call is 15 minutes for inter-office calls within the county and 30 minutes for long distance calls outside the county.
- Estimated number of calls are calculated by the following formula:

Number of calls in 1996 = (Number of calls in 1990) x (Total increase ratio of call charge per subscriber)
x (Traffic increase ratio by automatization)

$$\times \left(\frac{\text{Average holding time before automatization}}{\text{Average holding time after automatization}} \right) \times \left(\frac{\text{1996 average number of existing subscribers}}{\text{1990 average number of existing subscribers}} \right)$$

Number of calls after 1997 = (Number of calls in 1996) x (Revenues from call charge of the year
/ revenues from call charges in 1996)

Number of calls from rural areas in 1995 is estimated with the automatization ratio since some of rural areas are automatized in 1995.

Therefore, Σ (number of calls x Average waiting time x 1.00) is the value of time saved through automatization.

② Consumers' surplus

Consumers' surplus at the time of telephone installation is calculated by the following formula:

Consumers' surplus = (Average willingness to pay – average installation cost) x (Number of
installed subscribers from waiting list)

11.5.2 Economic Internal Rate of Return

Based on the above precondition, the economic internal rate of return (EIRR) is calculated as 8.85 percent. Therefore, the project can be considered to be fairly beneficial to the society from the viewpoint of overall economic benefit.

Chapter 12 Overall Evaluation and Proposals for The Telephone Network Automatization Plan

12.1 Defining Local Service Areas

Three plans as for local service area have been considered in the fundamental telephone network plan, facility plan, maintenance and operation plan, implementation plan, and financial analysis. The optimal local service area plan is selected by comparing and examining the three plans from various viewpoints.

12.1.1 Comparison of The Three Plans

(1) Services

Plan A (7 exchanges), Plan B (10 exchanges) and Plan C (12 exchanges) are able to provide the same level of service in both ordinary telephone and public telephone services. There is not much difference in the managerial aspect since operation is continued at the existing Branch Offices of Posts and Telecommunications.

(2) Facility Plan

Plan C (12 exchanges) involves the lowest construction costs. It is more flexible compared with the other plans since it will be possible to implement construction work for extension with a smaller investment and in a shorter term.

Each Branch Office of Posts and Telecommunications is under the control of both Dehui County Office of Posts and Telecommunications and local government office, and the arrangement is required between these organizations when the additional expansion works will occur in future. Considering the above, Plan C (12 exchanges) makes it easier to reach a consensus with local government office since it integrates the fewest administrative districts into a local service area.

(3) Maintenance and Operation

Plan C (12 exchanges) has been found desirable as a result of comparing the three plans from the viewpoints of facility management, repair setup of faults, and faults occurrence in Dehui County.

(4) Finance

Plan C (12 exchanges) involves the lowest project costs and the largest revenue from telecommunications. Its FIRR is therefore the best.

12.1.2 Selection of Optimal Plan

Through a comparison study among three plans, Plan C (12 exchanges) has been selected as optimal for the local service area since it provides the same level of service as the other two plans and is superior in aspects of facility plan and maintenance and operation, and from the financial viewpoint as well.

12.2 Overall Evaluation of Telephone Network Automatization Plan

12.2.1 Benefit Evaluation of Telecommunications System

In general, it is said that there are large indirect benefits from a telecommunications system. This clause examines the benefits that could not be evaluated quantitatively in the financial and economic analysis.

12.2.2 Effects and Social Impacts of Telephone Network Automatization and Promotion of Telephone Defusion

The indirect benefits derived from the improvement of telecommunication facilities are studied in the following.

(1) Agricultural Sector

The improvement of telecommunication facilities will contribute to increasing agricultural production by improving the function of conveying information such as weather, the introduction and usage of agricultural skills, as well as by bettering the function to gather information about the situation of each townships. It will also contribute to improving farmers' income and giving them an incentive by enabling them to acquire more advantageous market information.

(2) Other Industrial Sectors (Manufacturing, Service Industry, etc.)

The inconvenience and inadequacy of telephone is one of the major factors that have hindered the economic development of Dehui County. Since the county has a geographically advantageous

position, with the highway road from Changchun to Harbin running across the center of the county, the improvement in efficiency in business activities and the reduction in information costs to be brought about by the establishment of a telecommunication network as well as the acquisition of market and commercial information from nearby cities will lead to increased profits and create job opportunities in the district.

(3) Administrative Sector

Administrative functions will become more efficient and active by the improvement of telecommunication facilities. The medical and educational fields will also be improved.

(4) Social and Cultural Sector

Introduction of efficient telecommunication facilities will be very beneficial from the humanitarian point of view since it will provide a means of communication in case of emergency, which will minimize damage to be brought about by accidents, disasters, sudden illnesses, etc. Also the difference in the amount of available information between urban and rural areas will be reduced, which in turn will lead to lessening other various gaps.

(5) Overall Impact

Figure 12.2.2-1 shows the mutual relation among the various impacts to be brought about by the automatization and diffusion of the above telecommunication facilities. As a whole, the improvement of telecommunication facilities will contribute to regional socio-economic development and stability through their catalytic function to vitalize economic activities and offer a means of emergency communication that will protect human lives and properties.

12.2.3 Significance as a Pilot Plan

(1) Pilot Plan as Planning Method

The planning method used for the telephone network automatization in this plan can be utilized for the development and improvement of telephone facilities in rural districts all over China to promote their economy. Therefore, this plan can contribute to the efficient and prompt development of rural telephones.

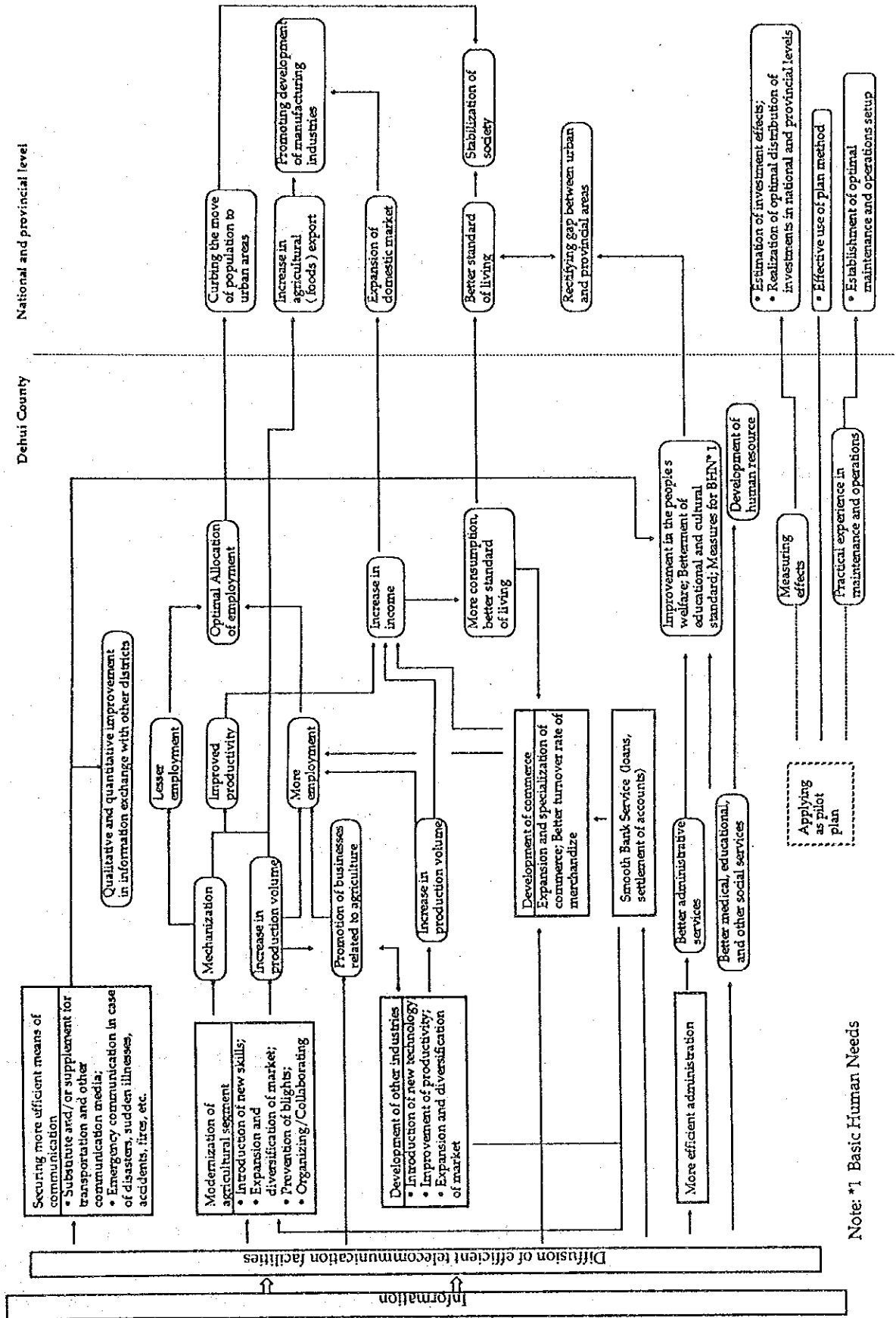
(2) Pilot Plan as a Model for Maintenance and Operation for Rural Telephone

The project can serve as a model for establishing an optimal maintenance and operational setup for other similar rural districts when automatization facilities are adapted there.

(3) Pilot Plan as a Model for Economic Development and its Verification

By measuring socio-economic effects brought about by the implementation of this plan in Dchui County, it becomes possible to estimate the investment effects of telecommunication facilities in other similar regions in China and to contribute to the realization of the optimal distribution of investment in national and provincial levels through the estimation.

Figure 12.2.2-1 Mutual Relation of Impacts Brought About by Expansion and Automatization of Telecommunication Facilities



Note: *1 Basic Human Needs

12.2.4 Overall Evaluation

When the telephone network automatization plan is implemented, automatic switching facilities are installed at the county center and other main townships and automatic telephone calls will become possible in all of Dehui County as well as long distance calls toward outside of the county where telephone facilities have already been automatized. The automatization plan will not only contribute to the economic and industrial development of the Dehui County, but also exert a great influence on the social, economic, and cultural effects, such as providing the local population with better conveniences and improved administrative services by installing telephone facilities to the area where no telephone service has been provided yet due to lack of the facilities. On the other hand, more improvement of the regional telephone services is expected through simultaneously executing both plans, the telephone automatization plan and the optical fiber cable construction plan between Beijing and Harbin.

As described before, implementation of this automatization plan will bring about favorable effects not only to the telecommunication organization but also to social, economic and cultural sectors of whole Dehui County. In other words, the direct benefit caused by the automatization plan was estimated quantitatively through the financial and economic analysis, and the indirect benefit which cannot be evaluated through quantitative method, was clarified qualitatively through the impact flow.

When looking into direct benefit, FIRR which explains the financial situation derived from the implementation of the telephone network automatization plan becomes 2.64%. Examining this from the annual revenue and cost, it will be possible to furnish the operational costs of each fiscal year with its own revenues after inauguration of this project. Moreover, if a long-term and low-interest construction fund is applied, the telecommunication organization will be able to afford to manage the project without financial difficulties. This financial study justifies the realization of this project.

When the object of the study on evaluation of effects derived from the improvement of telephone services is expanded more widely to the whole society to which the telephone organization belongs, the considerable economic benefit is recognized in the form of saving waiting time of telephone and consumers' surplus when installing telephones. And EIRR which indicates a magnitude of the economic benefits in the society becomes 8.85%. This shows the project will promise appropriate benefits to the whole society from the economic viewpoint.

The indirect benefit of telephone, which cannot be quantitatively measured but are generally considered to be quite large, should be studied intensively and extensively. The benefit is examined and illustrated in impact flow charts in such sectors as agricultural sector, other industrial sector, administrative sector, and social and cultural sector, etc. And as a result of the study, it has been found out that the project greatly contributes to the development of the area and the betterment of the residents'

living standards through industrial development, mainly in agriculture and local enterprises, and through providing various conveniences to the community where they hitherto had not had the benefits of telephones for spreading education, culture, etc. Thus, the indirect benefit is quite large and is recognized in various sectors in the society.

In addition to the various benefit mentioned above, the plan has a important role to play as a pilot plan for formulating a telephone network automatization plan economically and appropriately to meet the area's actual circumstances, when a similar rural telephone network automatization plan is studied in Jilin Province and in whole of China in further. This plan also plays a role as a model for formulating a optimal maintenance and operation plan of telephone automatization plan in rural areas similar to Dehui County.

And more, the plan has a role as a pilot plan to verify the social and economic indirect effects of telephone development, which cannot be measured quantitatively, through comparing the changes in various socio-economic indicators before and after the automatization.

The Chinese government has projected the strengthening of the agricultural sector as one of the important items in the eighth 5-year plan. Since this telephone automatization plan is formulated aiming at promoting the regional agriculture through improvement of distribution of agricultural products and making information exchange easier for new agriculture technology, it is in line with the national economic management policy.

Dehui County is located near Changchun City and has a great advantage with respect to the locality for industrial development, due to good provision of main road and railway transportation. In addition, implementation of the telephone automatization plan will contribute both to the improvement of the above locality advantage and to the development of the regional industries including agriculture as a principal part. And the importance of implementation of this plan will increasingly be recognized as it should play a key role for vitalizing the regional socio-economic activities.

This plan has appropriate direct benefits in finance and economic aspects, and has also ample indirect benefits for socio-economic activities of the area. This plan will also play a role as a pilot plan for future similar development plans to be implemented in accordance with the national economic development policy.

On the basis of the overall examination described above, the necessity of implementation of this plan is justified, and the effects by implementing the plan is considered to be very advantageous.

12.3 Proposals

The telephone network automatization plan will greatly contribute to vitalizing socio-economic activities of the area through providing economic benefits to the Dehui County communities and through giving a strong impact on a wide range of sectors including social services, administration, commercial activities, etc. Further, it will contribute to the local population by providing telephone services anew to the areas that have hitherto been unable to enjoy the convenience. It also has an important role as a pilot plan in the future promotion of the telephone network automatization in the rural districts of whole China.

Since there is sufficient justification of the implementation of the project based on its various effects on the overall development, the study team proposes the points as in the following.

12.3.1 Development Priority

According to the financial analysis of the project, EIRR becomes 8.85 percent indicating the economic benefits to the society as a whole, which are brought through saving waiting time of telephone and in the form of consumers' surplus at the time of telephone installation. Implementation of the project can be considered necessary and effective since it has ample benefits to be brought to the society as a whole, and since it will have a great impact on vitalizing the socio-economic activities of the area.

Therefore, the study team proposes that the Chinese government, the Ministry of Posts and Telecommunications, and the Posts and Telecommunications Administration of Jilin Province and other organizations concerned should take the required measures to rank up the development priority of the investment and implementation of the project.

12.3.2 Introduction of New Tariff System

Telephone services in Dehui County and toward outside destinations where the calls can be connected automatically, will greatly be improved through the implementation of this plan, and users will be able to fully enjoy the instantaneity of telephones in conveying information. Therefore, it is necessary to ask the users to bear a portion of the costs due to the improvement of services, on the basis of the principles that beneficiaries should pay for part of the project cost.

It will be necessary to maintain well-balanced revenues and expenses over a long period of time for the sound management of telecommunications operations in Dehui County. The new tariff system to be applied after automatization, designated while discussing the automatization plan, enables it to furnish operational expenses for each fiscal year by adopting fixed time interval charging method for the rural telephones. If the project is implemented without adopting the new tariff system, revenues and

expenses will become unbalanced, hindering the management of Dehui County Office of Posts and Telecommunications.

Therefore, the study team proposes that the Posts and Telecommunications Administration of Jilin Province should make coordinations with the related divisions and adopt appropriate measures for the smooth introduction of the new tariff system.

12.3.3 Establishment of Construction Work Setup

The project aims at proceeding with the automatization work of the telephone network for the whole of Dehui County within a short time. To do so, it is important to implement without delay the construction and installation work for buildings, exchange, transmission, power, and subscribers' lines as well as the installation of telephones. Consequently, it is necessary for the divisions concerned to solve the problems speedily and adequately, which may occur during construction. It will also involve a considerable manpower since there will be a great amount of construction work to be done. On the other hand, it will be necessary to obtain the support and cooperation of provincial administrative organizations etc. in the implementation of construction work that covers the whole Dehui County.

The study team therefore proposes that the Posts and Telecommunications Administration of Jilin Province should ensure the necessary manpower and establish a construction work setup to manage progress control of the construction work as well as to make necessary measures when problems arise so as to implement smoothly the project taking account of the above conditions.

12.3.4 Promotion of Efficient Personnel Allotment Plan to Improve Productivity

With the implementation of the project, it will become necessary to assign the other jobs to the present 77 operators who are currently engaged in manual switchboard operation and other sections. The project has the advantage for establishing the efficient operation system of the Dehui County Office of Posts and Telecommunications. The project has a plan of abolishment of manual switchboard operation at the Branch Offices, concentration of maintenance work for the switching facilities by adopting remote switching units, and integration of other operations.

The study team proposes that the divisions concerned, when arranging acceptance conditions of these personnel by other divisions, should devise to increase the number of subscribers per employee and promote policies to achieve higher productivity through integration of operation and a more efficient personnel allotment.

12.3.5 Evaluation Study on Economic, Social and Cultural Effects of Telephone Automatization and Facility Expansion

When the plan is implemented, expansion and automatization of the telecommunication systems can be expected to bring about various economic, social, and cultural improvements in Dehui County. Although it is difficult to measure directly the anticipated all impacts, it will be possible to verify the developmental effects by comparing the changes in various socio-economic indicators before and after the automatization. The results will provide valuable material which will be utilized to give higher priority to the development of rural telephones when considering the priority of many kinds of development plans. The project's assignment as a pilot plan for the whole of China will be ensured if it plays the role of verifying the developmental effects, which would deepen the significance of implementing the automatization plan.

The study team therefore proposes that the Posts and Telecommunications Administration of Jilin Province should realize the importance of an evaluation study on the effects of rural telephone development, and the study should be conducted in an appropriate time after implementation of the plan.

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