Approximately one third of the existing optical fiber systems are planned to be rehabilitated in each phase during the long-term period as shown in Table 13.2-11.

Table 13.2-11 Optical Fiber System Replacement Plan

(Unit: DTI, Cost Unit: Million Baht)

Span	Phase-1	Phase-2	Phase-3
Metropolitan Area	560	560	560
Percentage	33.3%	33.3%	33.3%
Construction Cost	1,510	1,510	1,510

Note: Unit Price : 269.6 thousand Baht.

CHAPTER 14 OPERATION AND MAINTENANCE

14.1 Operation and Maintenance Work

1) Transmission

The centralization of the supervisory systems will be completed by FY 1992. All the transmission systems will be integrated in the Phase-2. The transmission networks will be also expanded in the future. The O & M work efficiency will be enormously improved by using this centralized operation system.

2) Switching

SPC switches will take the place of the existing XB switches before FY 2000. The centralization of night-time and holiday maintenance jobs are completed, therefore, from now on. The centralization of day-time maintenance jobs will be also completed.

3) Outside Plant

In the near future, outside plant facilities will increase by a large amount. Therefore, it is necessary for TOT to establish a more effective maintenance system. The telephone installation work will increase until the target year of eliminating waiting applicants. Accordingly the telephone installation work should be carried out under contract by private firms. Quick repair work is very important to keep the confidence of customers on TOT. However, temporary repairs must be avoided because they are one of the major causes of the frequent faults. It is very important to reduce the fault rate by executing preventive maintenance activities on the basis of the present conditions.

14.2 Manpower Policy Guideline

Figure 14.2 shows a manpower policy guideline in the future. This guideline is estimated by using the number of subscribers in each year and the past growth rate of the subscriber lines per employee. That is termed MEI (Annual Manpower Efficiency Index Increase Rate).

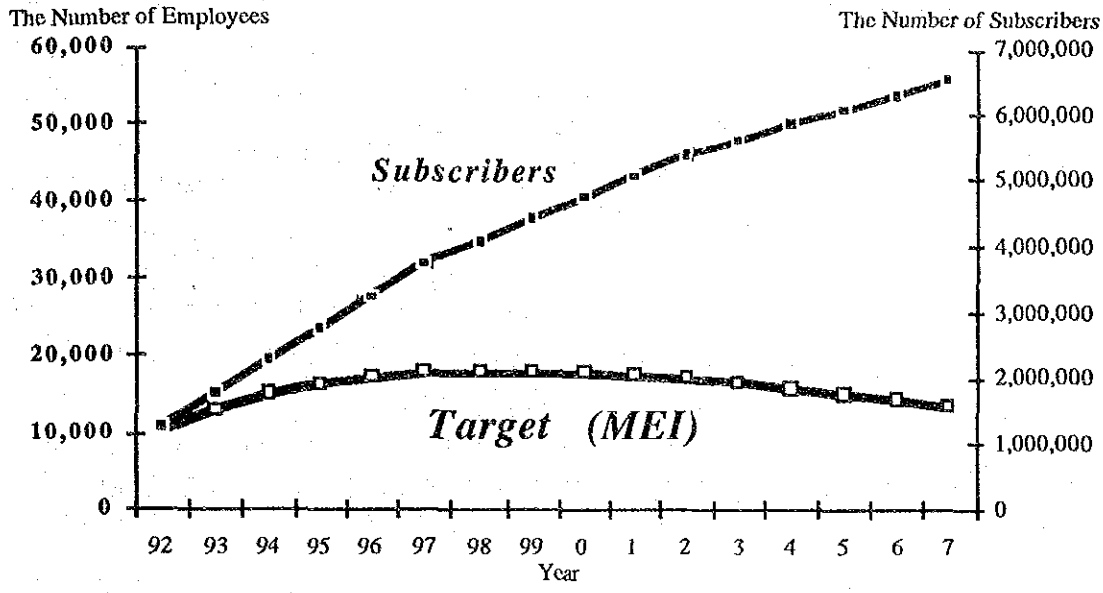

Figure 14.2 Manpower Policy Guideline

This guideline is certainly challenging. It can be observed that the target MEI tends to decrease after FY 2000.

14.3 Necessary Number of Employees by Microscopic Estimation

This section presents the estimated results of the necessary number of employees during the study period on the basis of the "O & M Work Plan" of Section 14.1 and "Telecom Variables" in each O & M Work Field".

Note: Telecom variables means "Number of Subscriber Lines", "Number of Switching Line units" and "Number of Faults" etc.

Figure 14.3-1 shows the estimated necessary number of employees of two cases. The two cases are the efficient O & M work scheme and the ordinary O & M scheme. If TOT employs the efficient O & M work scheme, it can cut about 5,000 employees at the end of FY 2007.

Note: The efficient O & M work scheme adopts efficient policies such as "Centralization of Maintenance Work in Switching Exchange Office", "Contract of Installation Work" and "Improvement of Administration Work" etc.

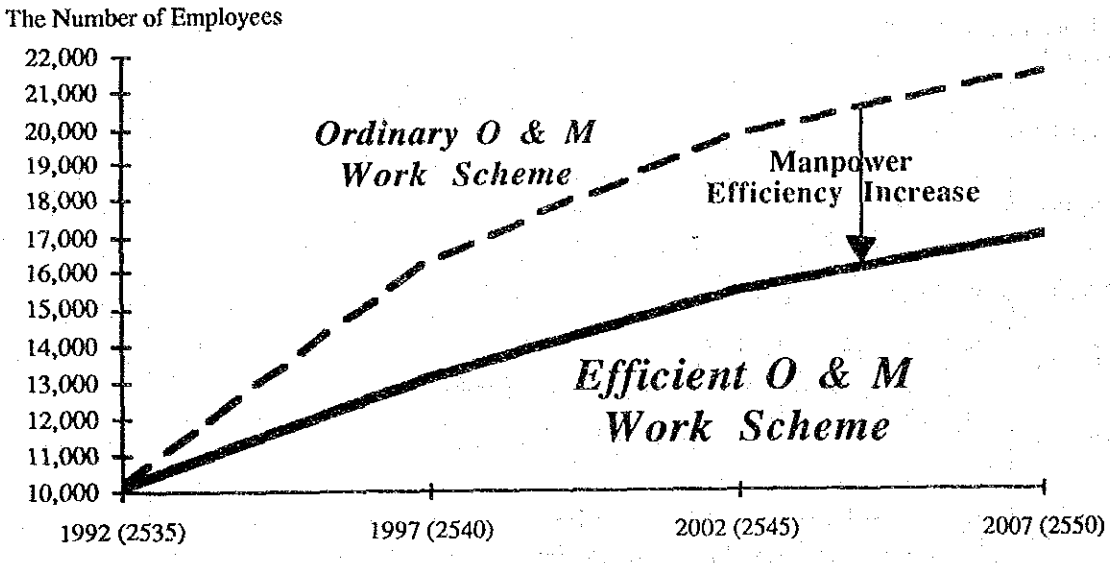

Figure 14.3-1 Necessary Manpower Forecast in the Future

Figure 14.3-2 shows the target derived from the manpower policy guideline and the necessary number of employees estimated by the microscopic forecasting method.

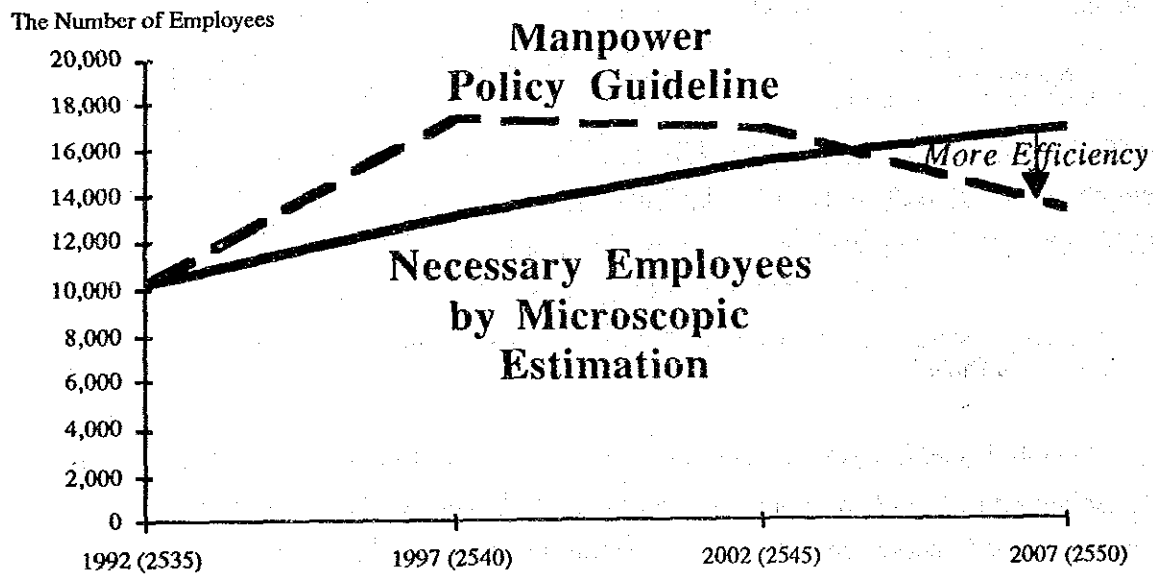

Figure 14.3-2 Manpower Policy Guideline and the Necessary Number of Employees

In the Phase-3, the necessary number of employees are expected to become higher than the manpower policy guideline. This is because the microscopic forecasting method employees the efficiency increase policies and measures within the present business scheme. More drastic

policies and measures to improve the efficiency and productivity should be employed to follow the manpower policy guideline. Further, utilization of external resources is indispensable to reduce simple and labor concentrated jobs in TOT.

14.4 Human Resource Development

It is expected the works in the Study Area will become larger and more complicated in order to improve the telecommunications networks and to provide new telecommunications services, therefore , TOT must develop skills and abilities of its employees up to a sufficient level so that they can operate complex, massive and sophisticated facilities. Figure 14.4 shows an ideal human resource development system. This describes that a method of human resource development which dynamically links to the business and work systems of TOT in the future.

The training center of TOT performs important roles in teaching O & M work methods. Without proper training programs for the O & M work systems, The O & M works cannot be properly performed.

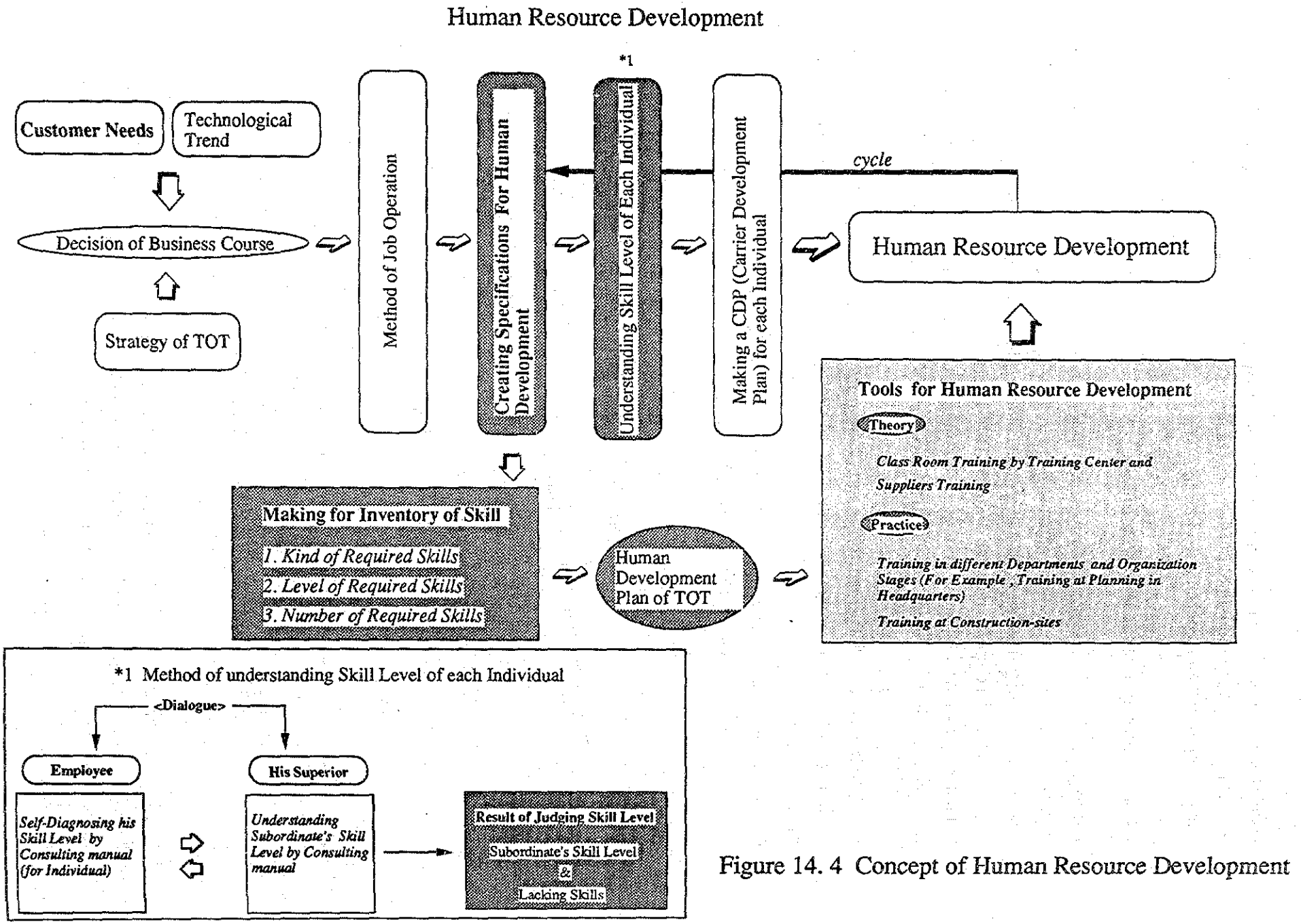

Figure 14. 4 Concept of Human Resource Development

CHAPTER 15 IMPLEMENTATION OF THE LONG-TERM PLAN

According to the objectives and strategies in Chapter 9, the long-term project implementation programs in the BMA and the Surrounding Area are shown in Figure 15.1 and Figure 15.2 respectively.

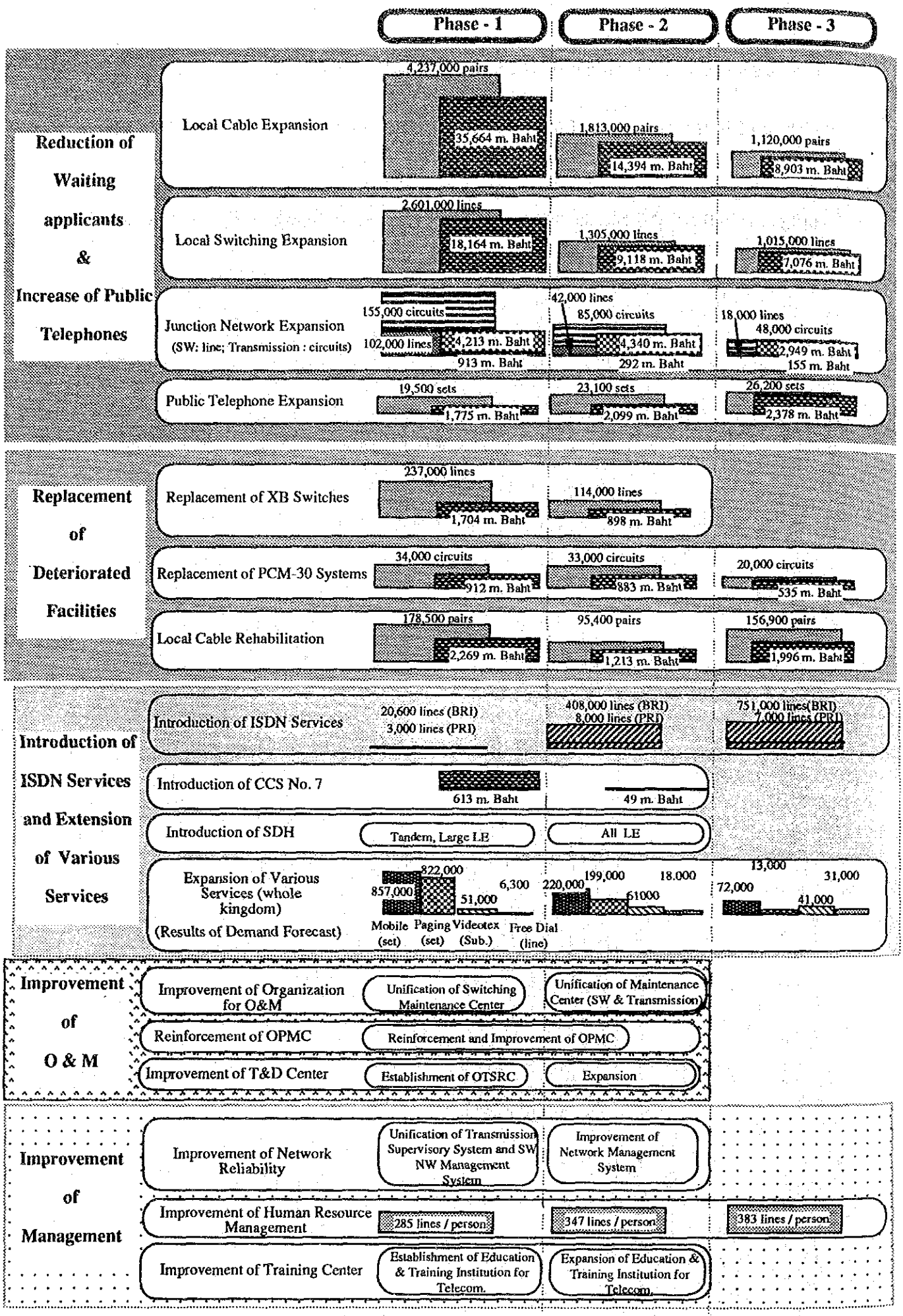

Figure 15.1 Implementation Programs in the BMA

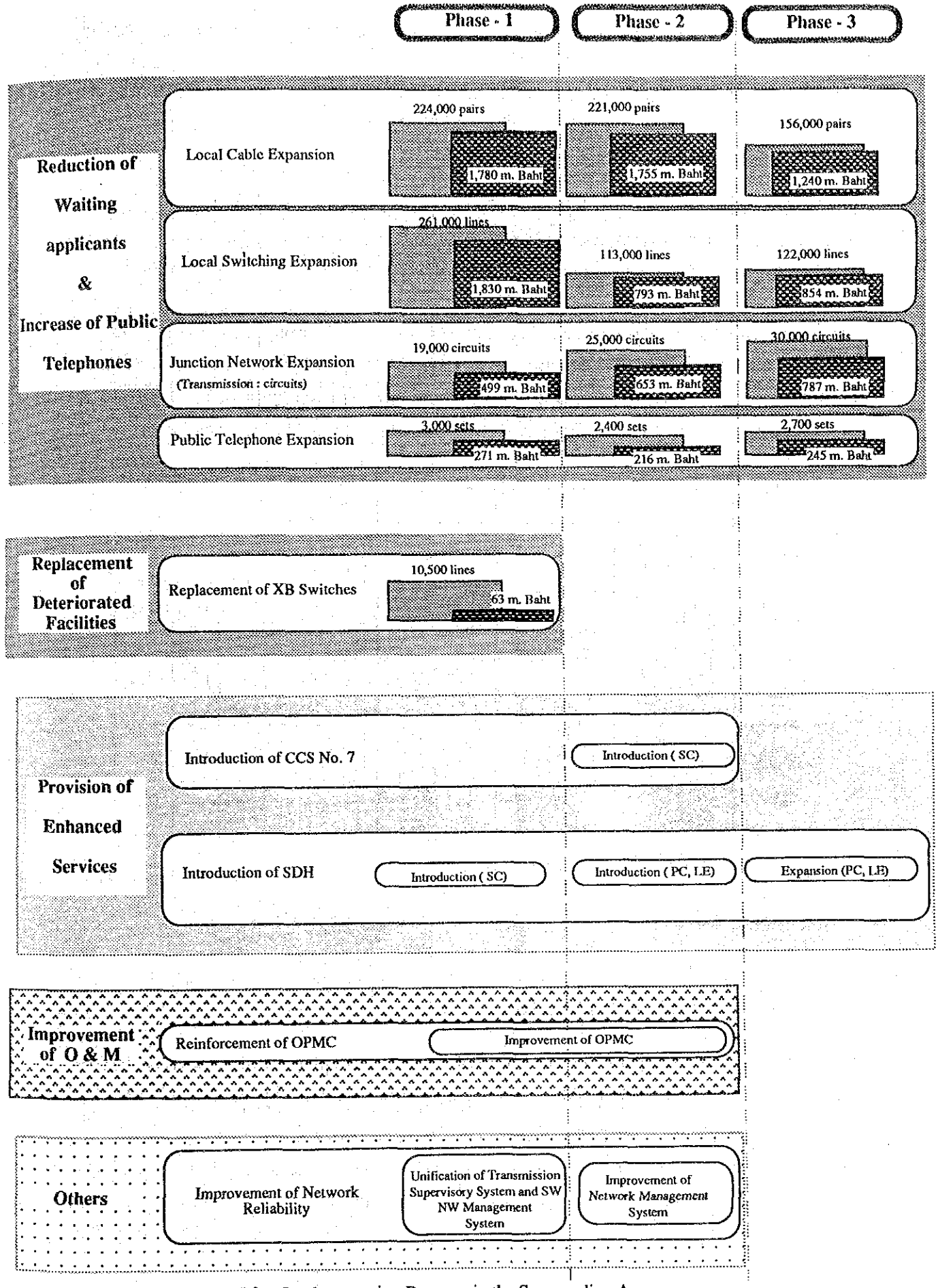

Figure 15.2 Implementation Program in the Surrounding Area

CHAPTER 16 FINANCIAL ANALYSIS

16.1 Basic Assumptions of Financial Analysis

The BTO scheme is not taken into consideration in the study. The whole expansion and development of the telecommunications networks and facilities in the Study Area is assumed to be implemented by one operating entity. The project life is set to be 35 years from FY 1993.

The present tariff system as of December of 1991 is used for the revenue estimation. For the revenue and cost estimation, the historical data of TOT are taken into consideration. The initial investment cost for the project is estimated as shown in Figure 16.1.

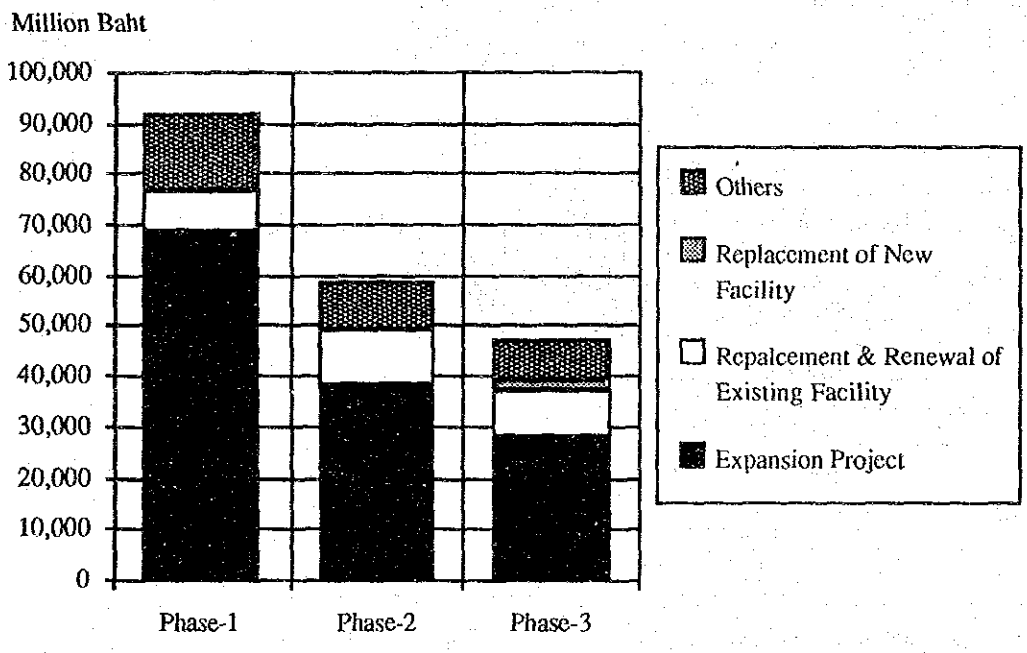

Figure 16.1 Estimated Capital Expenditure by type of Construction

16.2 Result of Financial Analysis

The Financial Internal Rate of Return (FIRR) of the long-term plan is estimated to be 10.05%. Figure 16.2-1 shows the estimated annual net cash flow of the Project and accumulated net cash flow.

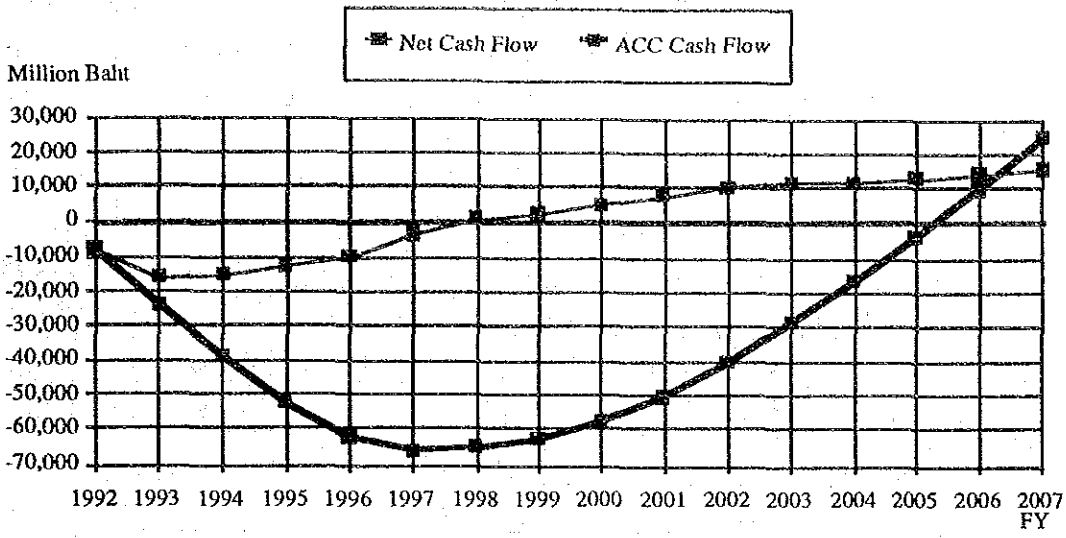

Figure 16.2-1 Annual Net Cash Flow and Accumulated Cash Flow without Finance

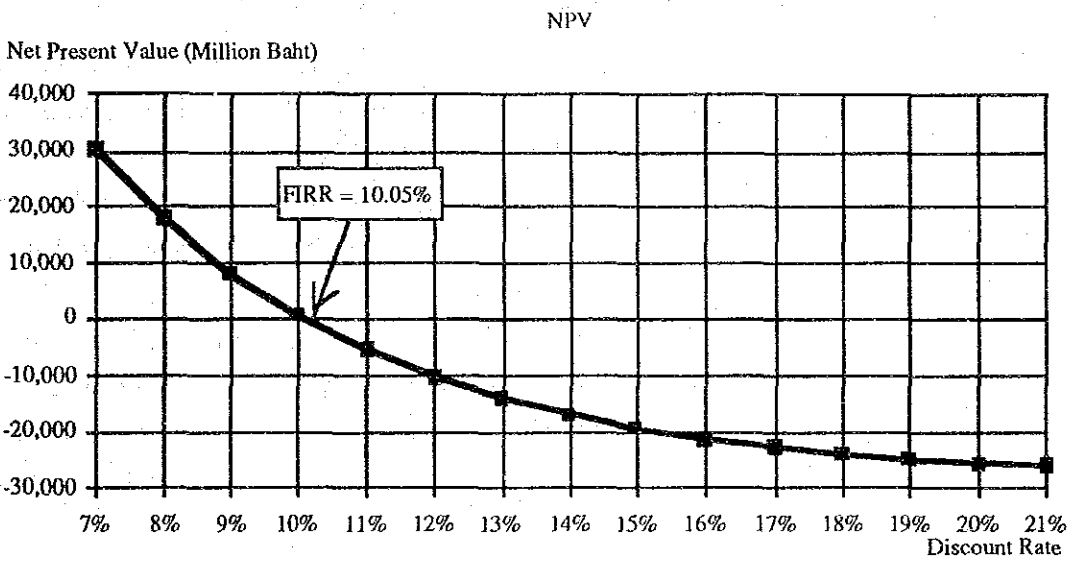

Figure 16.2-2 Net Present Value of the Project

Figure 16.2-2 shows the net present value of the Project with the discount rate between 7% and 21%.

Table 16.2 shows the result of the sensitivity analysis of the Project. While the investment cost increase case has the smallest negative effect on the project FIRR, the demand decrease case has the largest negative effect. When the demand decreases 20%, the Project FIRR goes down to 5.48% from 10.05% and the accumulated net cash flow turns to be positive 18 years after the Project starts.

This analysis indicates that the good coordination of the investment and installation plan with the actual subscription demand is the most essential for the investment efficiency and avoiding over-investments and repetitive debt refinancing.

Table 16.2 Result of Sensitivity Analysis of the Project

Case	Condition	FIRR	Net Cash Flow turns to positive at	Accumu. NCF turns to be positive at	Total Loan (Million Baht)
Base Case		10.05%	FY 1998	FY 2006	73,100
Case 1-A	Demand 10% Down	7.83%	FY 1999	FY 2008	105,000
Case 1-B	Demand 20% Down	5.48%	FY 2000	FY 2011	174,000
Case 2-A	Revenue 10% Down	8.25%	FY 1998	FY 2007	87,600
Case 2-B	Revenue 20% Down	6.25%	FY 2000	FY 2009	114,950
Case 3-A	Cost 10% Up	8.72%	FY 1998	FY 2007	107,500
Case 3-B	Cost 20% Up	7.57%	FY 1999	FY 2008	161,000

CHAPTER 17 PRIORITY PROJECTS

17.1 Selection of the Priority Projects

Three priority projects are selected by the Study Team on the condition that they are to be selected from projects excluding those already decided to be carried out with the BTO scheme. They are as follows:

1) Replacement of deteriorated facilities
2) Establishment of Outside Plant Technical & Research Supporting Centers (OTRSC)
3) Reinforcement of Outside Plant Maintenance Centers (OPMC)

In a telecommunication development plan, it is indispensable to consider a telecommunications network plan; and expansion, replacement, rehabilitation, and modernization, operation and maintenance of telecommunications facilities because telecommunications services can not be provided without telecommunications networks and facilities.

Since the next telephone expansion project will be executed by the BTO scheme during the seventh TOT ESDP project period, TOT can and must utilize most of their resources to modernize their networks and facilities, to establish better network and facility management systems, and to develop future cores of engineers, professionals and management personnel during the seventh TOT ESDP period.

Therefore, the replacement of deteriorated and out-of-date facilities is to be selected as the top priority project. The replacement and rehabilitation of deteriorated subscribers cables and wires will contribute greatly to reduce the outside plant faults and to improve the telecommunications service quality.

17.2 Replacement of Deteriorated Facilities

1) *Outline of Replacement Plan*

a) Outside Plant

Paper insulated cables installed more than 20 years ago are replaced in the Phase-1 by taking account of the strategic target areas.

b) Switching System

The XB switches are replaced in the Phase-1 by taking the following conditions into consideration: space requirement for facility expansion, staff relocation from

XB switching system operation and maintenance, new services introduction and operation starting years of the XB switches.

c) Transmission System

Out-of-date PCM-30 systems are to be replaced in the Phase-1 in accordance with the XB switching system replacement plan.

2) Investment Cost

The investment cost of the replacement projects is shown in Table 17.

Table 17 Investment Cost of Replacement Projects

(Unit : Million Baht)

Section	Volume	Cost
1. Outside Plant	179,000 pairs	2,269
2. Switching	247,000 lines	1,786
3. Transmission	34,320 circuits	912
Sub Total		4,967
4. Project Implementation (10% on Sub Total)		497
Grand Total		5,464

17.3 Selection of the Top Priority Project

During the Work in Thailand-II, the JICA Study Team made a presentation of the Interim Report for the long-term plan. Through the meetings and discussions between TOT and the JICA Study Team, the top priority project to be studied for the second phase of the Study was decided. The title of the feasibility study is "An Implementation Plan to Upgrade the Telecommunications Services Quality".

While there are various aspects in terms of telecommunications service quality, the following two items have been selected as the study objectives:

1) Improvement of Fault Rate, and
2) Improvement of Call Completion Rate.

Improvement of the fault rate and the call completion rate is essential because they directly affect the quality of the customer services, performance of the telecommunications networks, the utilization rates of the facilities, and the operating revenue. Therefore, for the second phase of the Study, these two objectives have been selected to upgrade the telecommunications service quality and concrete measures to achieve them will be established.

Toward upgrading the service quality, concrete measures which directly contribute to the two objectives are studied from the following viewpoints:

1) replacement of deteriorated facilities,
2) maintenance management standards, and
3) installation and construction methods.

This study analyzes the present situation of the faults and the call completion rate; and finds the major causes of the high faults rate and the low call completion rate. The Study Team proposes various measures and selects the priority projects among them as the action plan. The proposed projects are planned to be implemented during the period from 1993 to 1997 (Phase-1). The results of the second phase of the Study are described in the main report titled "Draft Final Report for a Feasibility Study on Implementation Plan to Upgrade the Telecommunications Service Quality".

CHAPTER 18 EVALUATION OF THE LONG-TERM PLAN

18.1 Significance of the Long-term Plan

Today is in the midst of drastic telecommunications technology revolution. Mobile telecommunications systems have been taking place of existing local wired telecommunications. Satellite communications systems have been playing a greater role in both broadcasting and telecommunications. Fiber optical transmission systems have been breaking through transmission limits in both distance and capacity. Plain old telephone services (POTS) are giving way to ISDN services. "Fiber to the Home" will realize visual information telecommunications services instead of normal voice telecommunications services.

The demand for the telecommunications services, not only for POTS but also for the enhanced ones in the Bangkok Metropolitan area and its Surrounding Area, has been increasing more than ever before because of the special socioeconomic position that the BMR has now in Thailand. As Alvin Toffler writes in his latest book[2],"it is hard for those accustomed to decent telephone service to imagine operating an economy or a business without it, or to function in a country where the telephone company (usually the government) can deny even basic phone or delay its installation for years".

Taking geographical, economical, and political surroundings of Thailand into account, its significance will increase as the gateway to Laos, Kampuchea, and Viet Nam. Thailand will play a leading role for assisting the economic recoveries of the Indochina countries. Thailand becomes a production base for what they need for their economic recoveries. The Baths based trading zone will penetrate into the Indochina countries. The Bangkok Metropolitan region is expected to become an telecommunications and info-communications hub of the Indochina region if it has sufficient and efficient telecommunications services.

The long-term telecommunications network development plan formulated in this study covers coming fifteen (15) years up to the year of 2007 and the areas of the Bangkok Metropolitan Telecommunications Area (BMA) and its Surrounding Area, i.e. Nakhon Pathom, Samut Sakhon, and Ayutthaya in order to develop their telecommunications services. The Study Team believes that the materialization of the long-term plan and its projects contributes greatly to the growth of not only the Study Area but also the whole Kingdom from not only the improvement of telecommunications but also both economic and social development.

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[2] Alvin Toffler, POWER SHIFT, (New York: Bantam Books, 1990), p. 111

In order to achieve the objectives and targets of the long-term plan, the Study Team proposes the telecommunications network and facility expansion projects as well as replacement, renewal, rehabilitation, reformation, and modernization of the existing networks and facilities as high priority projects.

The proposed projects should be implemented completely during the long-term plan period because the provision of sufficient, efficient, and better quality telecommunications services becomes indispensable for the information-oriented society.

18.2 Benefit and Effect of the Long-term Plan

1) Financial Benefit of the Long-term Plan

The investment cost for the long-term plan is estimated to be approximately 198,000 million Baht in total: 92,000 million Baht for the Phase-1, 59,000 million Baht for the Phase-2, and 47,000 million Baht for the Phase-3. The investment programs of the long-term plan include not only the network and facility expansion projects to meet the increasing demand for the telecommunications services, but also rehabilitation, replacement, renewal, reformation, and modernization of the existing telecommunications networks and facilities, which are essential to provide better quality of the services.

The financial internal rate of return (FIRR) of the long-term plan is estimated to be 10.05% on the assumption that the plan is carried out by one operating entity, i.e. TOT.

The estimated FIRR indicates that the plan is feasible from the financial viewpoint of the state-owned operating entity when the required amount of investment cost is financed according to the financing assumptions.

The financing assumptions and conditions to implement the long-term plan, which are employed in the financial analysis, are as follows:

a) total 42,000 million Baht are equity financed during the first eleven (11) years,
b) total 73,100 million Baht are debt financed during ten (10) years with the 12% loan interest and the 10 year repayment including the 3 year grace period,
c) the remaining portion of the required fund will be covered by the internal cash generation from the Project, i.e., the revenues from subscribers.

The soft-loan financing[3], such as ADB (Asian Development Bank) loan, OECF (The Overseas Economic Cooperation Fund) loan, and EXIM Bank (Export-Import Bank) credits should be considered at least for the Phase-1 period, because the largest amount of investment is necessary to expand the networks and facilities for fulfillment of the telephone demand and elimination of the waiting applicants; and to rehabilitate and renew the deteriorated telecommunications systems and facilities to modernize out-of-date systems and facilities for upgrading the services quality during the Phase-1 period.

The estimated call revenues for the financial analysis takes only the revenues from the subscribers in the Study Area into consideration. Although the long-term plan provides subscriber line installation projects only for the Study Area, the revenue increase with the projects can be expected not only from the Study Area but also from all other areas in the Kingdom. The international call revenue is also expected to increase for both incoming and outgoing international calls from the Study Area.

The revenue increase for both domestic and international telecommunications operators indicates that the FIRR must be higher than the estimates and the implementation of the long-term plan is not only feasible from the financial viewpoint of the operating entity, i.e. TOT but also beneficial to the whole Kingdom from the economic viewpoint.

2) Socioeconomic Effect of the Long-Term Plan

a) Realization of ISDN Era

Providing sufficient POTS (Plain Old Telephone Service) is the first objective of the long-term plan. With the implementation of the long-term plan, the increasing telephone demand is expected to be fulfilled during the Phase-1 and the waiting applicants in the Study Area will be eliminated. Thailand is able to participate in the ISDN era in earnest after the completion of sufficient and efficient POTS. The long-term plan contributes to the society which needs enhanced info-communications method. Therefore, the implementation of the proposed projects in the BMA during the Phase-1 has the key to enter into the ISDN era.

[3] The long-term soft-loan conditions applied to TOT are as follows:

	Term Period	Grace Period	Interest Rate
ADB :	23 year	4 year	10.25%
OECF	30 year	10 year	3.00%
EXIM Bank:	13 year	5 year	5.00%

b) Realization of Information Society

Telecommunications systems can become strategic resources in every business practices to increase competitive advantages in market, to improve managerial efficiency, and to discover innovations. Telecommunications systems will become critical strategic management resources in every industry.

In the implementation course of the long-term telecommunications development plan, the telecommunications sector is expected to change from "Plain Simple Voice Messages Transmission Business" to more complex and value-added "Information Carrier Business" and "Coordination and Integration Support Service Business" to support the above mentioned business practices and industries.

The long-term plan also requires that telecommunications operating entities should change their management style from "engineering oriented management" to "customer service oriented management". In case of "engineering oriented management", the management policy is to develop the most technologically adequate system and to utilize them in the most efficient manner to fulfill the social responsibilities of public enterprise. In case of "customer service oriented management", the management policy is to provide services in competitive prices that customers demand and to become a leader to create an intelligent society.

Figure 18.2 illustrates social development stages and the relationship between development stages and the roles of telecommunications.

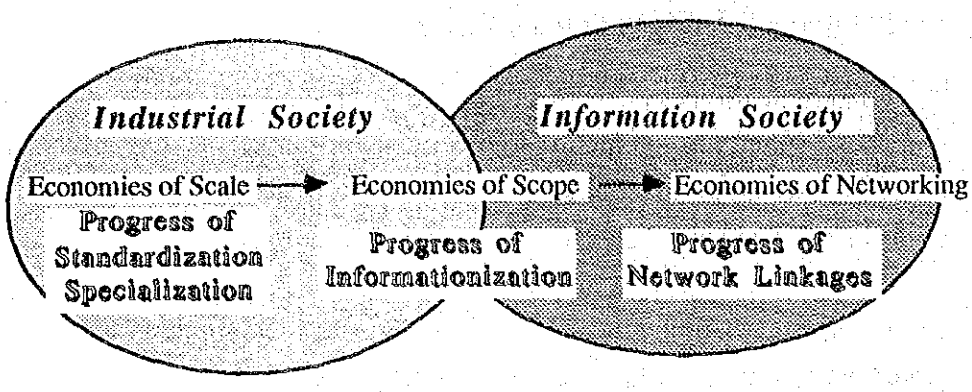
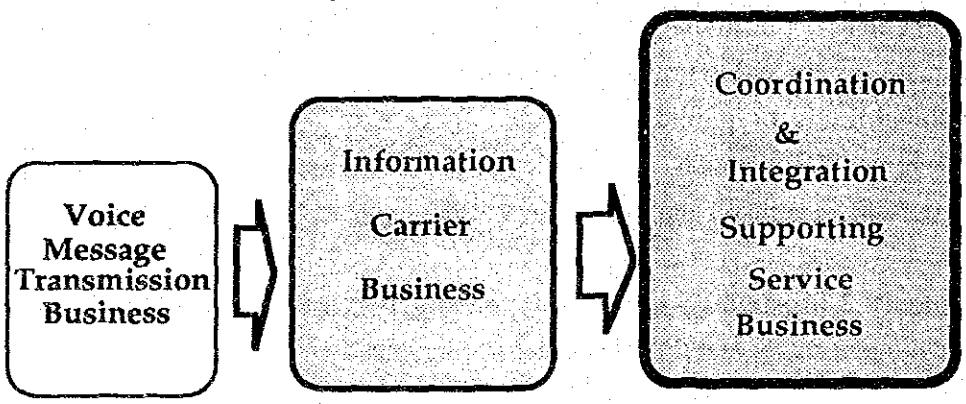


Figure 18.2 Social Development Stages and the Roles of Telecommunications (1/2)

From the Perspectives of a Telecommunications Operating Entity

Industrial Society ➡ **Information Society**

Main Features of Telecommunications Businesses



Management Policies

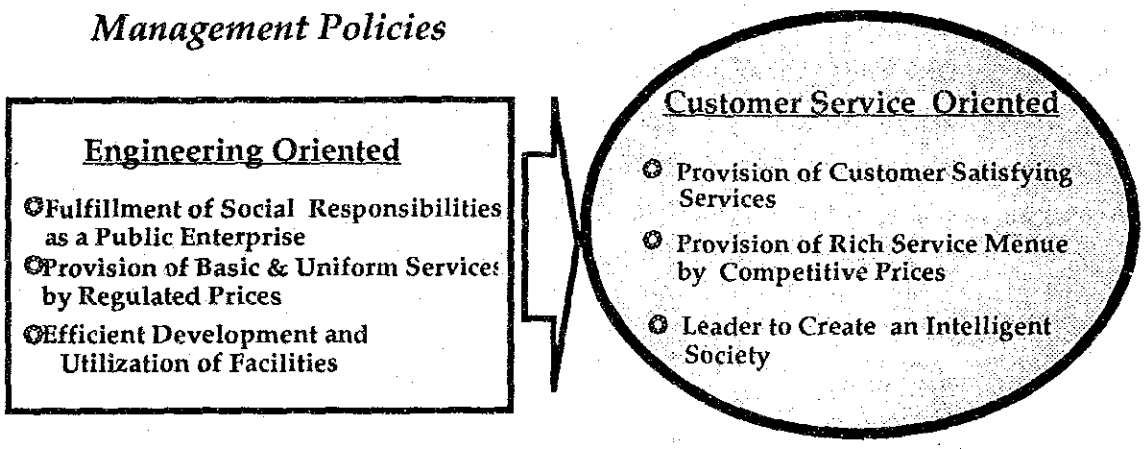


Figure 18.2 Social Development Stages and the Roles of Telecommunications (2/2)

c) Effect on Socioeconomic Development

As mentioned in Chapter 2, the most likely scenario in the future development of Thailand can be summarized from the viewpoint of socioeconomic outlook as follows:

Industrial and regional development will progress in a moderate speed. The Thai economy can expect the real average annual GDP growth rate of 8% for the next 20 years. The government will increase public sector investment to 7% in 1992 and maintain that level thereafter. The real effective exchange rate will be kept unchanged.

However, if the proposed long-term plan and projects are not carried out respectively, the scenario will become quite different from the expected. It also will not be able for Thailand to support the economic recoveries of neighboring Indochina counties such as Laos, Kampuchea, and Viet Nam.

The telecommunications development is expected to support the whole socioeconomic development as to info-communications infrastructure.

18.3 Issues to be Considered for the Implementation of the Long-term Plan

1) Outlook of Projects Implementation

TOT has already decided to adopt a new project implementation and management scheme Build, Transfer and Operation (BTO), during its seventh ESDP period for its local network and facility expansion project in order to fulfill the increasing telephone demand and eliminate waiting applicants . Under this scheme, TOT grants an operational right to a private firm by letting them install two million subscriber lines in the BMA during its seventh ESDP period. Further more, it is considered that other projects in the long-term plan may be carried out by private firms in the TOT seventh ESDP period.

However, it should be required for TOT to perform the over-all management of the domestic telecommunications networks including those operated by the private firms. TOT is expected to carry out the network planning, traffic management, numbering plan, signaling systems, etc. as the leading government enterprise in the telecommunications field. Therefore, the Study Team expects that these projects will be entirely coordinated and managed by TOT during the long-term plan period.

Every plan and project needs three kinds of resources, i.e. funds, facilities and materials, and human resources, to be controlled and managed efficiently. Every effort is required to implement the plan and projects with efficient network and facility management, proper staff allocation and human resource development, and the systematic cost control and financial management.

2) Financial Capability

TOT adopted the BTO scheme in the seventh TOT ESDP period. It is pointed out that one reason for TOT to adopt this method is the limitation of foreign loan allocation for governmental enterprises. In order to escape from the tight fund availability which TOT should follow, TOT may consider again to apply the BTO scheme in the future projects as long as TOT operates its business as a state-owned enterprise.

There are already many private telecommunications services providers under the concession basis in Thailand, who operate mobile telecommunications services such as paging and cellular mobile services, satellite communications services, data communications services, and various value added services (VAN).

There is no guarantee for TOT to be able to maintain its position as a state enterprise monopolizing the domestic telecommunications networks and services in the future. Therefore, it is essential for TOT to improve its financial capability to compete with the private operators and provide better quality and more efficient services for its customers with economical prices.

3) Construction and Installation Capacity

In the long-term plan period, TOT is required to install the largest number of subscriber telephones during the Phase-1. The seventh TOT ESDP expansion projects will be carried out with the BTO scheme to meet the telephone demand; approximately two (2) million subscriber lines for the BMA and one (1) million for the provincial areas. For the efficient and smooth implementation of the long-term plan and its large-scale installation projects, the following construction and installation capacity should be considered.

a) active appliance of new technology and techniques for construction and installation,
b) normalization and leveling of construction and installation work volume,
c) total project management,
d) Promotion of contractors for telecommunications systems and facilities construction and manufacturing,
e) simplification of various permission and approval procedures.

4) Follow-up the Project Implementation (Operation & Maintenance)

a) Operation & Maintenance Systems and Structure

In this study, the Study Team proposed the establishment of the Integrated network management system in the switching and transmission section and reinforcement of the out side plant maintenance centers (OPMC), which are expected to improve performance of the maintenance and operation activities and increase their efficiency.

b) Human Resource Management and Development

The human resource development is required not only for implementing the long-term plan and projects but also for following up the plan. Both human resource management and human resource development are key factors for the successful implementation of the long-term plan.

5) Consideration on Project Implementation

The proposed projects can be classified into a few technical and administrative fields. To implementation these projects, the following matters should be taken into consideration.

a) *Effective Implementation*

Telecommunications services and networks should be expanded efficiently from the viewpoints of rendering better services and also effective investment.

For this reason, some projects aiming at the same purpose in the same area should be coordinated to be carried out in the same period. For example, implementation period of a switching facility expansion project and an outside plant facility expansion project should be coordinated to the same time as much as possible.

Both expansion projects and rehabilitation projects should be well coordinated to avoid double construction works and save construction period and investment costs.

As described in Chapter 9 and Chapter 17, the Study Team puts priority on the proposed projects and puts a ranking on the Study Area for implementing the projects efficiently.

b) Coordination with National Development Policies

Reinforcement of telecommunications services in appropriate time will bring a great impact for sound development of socioeconomic sector. Therefore, implementation of the projects should be carried out not only in the developed areas but also the developing areas in accordance with the National Economic and Social Development Plan.