

**ASIAN DEVELOPMENT BANK**

**PPA: THA 26307**

**PROJECT PERFORMANCE AUDIT REPORT**

**ON THE**

**SECOND RURAL TELECOMMUNICATIONS PROJECT  
(Loan 1239-THA)**

**IN**

**THAILAND**

**June 2001**

## CURRENCY EQUIVALENTS

Currency Unit – Baht (B)

		<b>At Appraisal</b> (15 May 1993)	<b>At Project Completion</b> (1 July 1997)	<b>At Evaluation</b> (9 March 2001)
B1.00	=	\$0.03956	\$0.0388	\$0.02297
\$1.00	=	B25.28	B25.79	B43.54

## ABBREVIATIONS

ADB	–	Asian Development Bank
EB	–	economic benefit
EIRR	–	economic internal rate of return
FIRR	–	financial internal rate of return
OECD	–	Overseas Economic Cooperation Fund
OED	–	Operations Evaluation Department
PCR	–	project completion report
PPAR	–	project performance audit report
TA	–	technical assistance
TDMA	–	time division multiple access
TOT	–	Telephone Organization of Thailand

## NOTES

- (i) The fiscal year of the Government and the Telephone Organization of Thailand ends on 30 September.
- (ii) In this report, "\$" refers to US dollar.

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**BASIC DATA**  
**Second Rural Telecommunications Project**  
**(Loan 1239-THA)**

**A. Key Project Data**

Item	Currency	As per ADB Loan Documents	Actual
Total Project Cost	\$ million	373.3	160.3
Foreign Exchange Cost	\$ million	172.5	91.7
Local Currency Cost	\$ million	200.8	68.6
ADB Loan Amount/Utilization	\$ million	84.1	46.6
Foreign Exchange Cost	\$ million	84.1	46.6
Local Currency Cost	\$ million	0.0	0.0
ADB Loan Amount /Cancellation	\$ million		37.5

ADB = Asian Development Bank.

**B. Key Dates**

Item	Expected	Actual
Fact-Finding		15 Sep-2 Oct 1992
Appraisal		25 Jan -5 Feb 1993
Loan Negotiations		1-3 Jun 1993
Board Approval		29 Jun 1993
Loan Agreement		20 Sep 1993
Loan Effectiveness	19 Dec 1993	17 Dec 1993
First Disbursement		10 Jun 1994
Project Completion	31 Dec 1996	30 Jun 1998
Loan Closing	31 Dec 1997	1 Jul 1998
Months (effectiveness to completion)	36	54

**C. Key Performance Indicators (%)**

Item	Appraisal	PCR	PPAR
Financial Internal Rate of Return	8.8	5.9	-5.0
Economic Internal Rate of Return	16.9	29.0	43.1

PCR = project completion report; PPAR = project performance audit report.

**D. Borrower** Telephone Organization of Thailand

**E. Executing Agency** Telephone Organization of Thailand

## F. Mission Data

Type of Mission	No. of Missions	Person-Days
Reconnaissance	1	28
Fact-Finding	1	90
Appraisal	1	66
Project Administration:		
Review	3	39
Special Project Administration	1	8
Project Completion	1	33
<b>Subtotal Project Administration</b>	<b>5</b>	<b>80</b>
Operations Evaluation <sup>1</sup>	1	30
<b>Total</b>	<b>9</b>	<b>294</b>

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<sup>1</sup> The Operations Evaluation Mission comprised P. Choynowski, Senior Evaluation Specialist and mission leader, and a staff consultant, M. Lopianowski.

## EXECUTIVE SUMMARY

Thailand's rapidly growing economy (at an annual average of 7.7 percent during 1986-1995) put increasing demands on the country's infrastructure, including telecommunications. Although access to telephones improved from 1 telephone per 100 persons in 1981 to 2.7 in 1991, it was still considerably lower than that in some other countries in the region. Moreover, the distribution of telephone lines in the country was uneven; in the Central Region, including the Bangkok Metropolitan Area, the telephone density was 11.1 telephones per 100 people, but it was only 1.3 in rural areas. Of Thailand's 6,905 *tambon* (subdistricts), about half, representing about 12 million people, had no access to telephone facilities. The nearest telephone or telecommunications service for rural people was an average of 17 kilometers away, requiring users to spend much time traveling to the facilities.

The main objective of the Second Rural Telecommunications Project (Loan 1239-THA) was to provide basic telephone service to all *tambon* without it and to tourist facilities and along highways in remote rural areas. Each *tambon* was to have one metered telephone at a village leader's residence, which would serve as a public call office, and four easily accessible public coin-box telephones near temples or markets, for example. In *tambon* where satellite stations were installed, the facilities were to serve one public call office and up to two coin-box telephones. The project cost was estimated to be \$373.3 million. The Asian Development Bank (ADB) approved a loan of \$84.1 million to finance the foreign exchange cost of some of the telecommunications equipment. The Overseas Economic Cooperation Fund was to finance \$41.6 million for foreign exchange costs, and the Telephone Organization of Thailand (TOT) the balance of \$247.6 million equivalent, comprising \$46.8 million in foreign exchange costs and \$200.8 million equivalent in local currency costs. The actual project cost was \$160.3 million equivalent, with a foreign exchange cost of \$91.7 million (57 percent) and a local currency cost of \$68.6 million equivalent (43 percent). The actual cost was about 57 percent lower than the appraisal estimate as substantial savings were realized because land and buildings were not required for the Project, and prices of transmission, switching, and subscribers' equipment components were lower than envisaged at appraisal. As a result, ADB financed only \$46.6 million of the Project's foreign exchange cost (29 percent of the actual project cost). The Project was expected to have been implemented over four years and nine months, from April 1992 to December 1996. The Project was actually completed by August 1997, and the loan was closed in June 1998.

The Project was in line with ADB's country operational strategy to assist Thailand in developing balanced long-term economic growth and equitable development by promoting rural development and regional dispersal of economic activity. The Project was highly relevant to ADB's overarching strategy to reduce poverty. The Project aimed to link people in remote areas with the cash economy through better communications and access to information on commodity and labor markets. It also helped to maintain social ties and to facilitate the provision of government and other social services. The Project was technically satisfactorily prepared. The technology employed was appropriate and properly designed and integrated into the existing network, although several technological advances made parts of the Project's technology obsolete. The development of the wireless local loop resulted in replacing copper wire with a radio signal as the medium of transmission between subscribers and the remote station. The rapid expansion of the mobile telephone network, precipitated by falling mobile telephone prices, deregulation of the telecommunications sector, and the granting of licenses to private sector fixed-line operators created competition for TOT's rural telecommunications facilities. Revenues were thus not as high as envisaged.

Basic telecommunications services were extended to all tambon as proposed at appraisal. The telecommunications facilities installed under the Project are generally in good order and operate satisfactorily. The Project's objective was essentially achieved, and about 1 million–1.5 million more rural people now have access to telephone services. The Project's economic internal rate of return is estimated at 43.1 percent, and the Project is rated as successful. TOT also maintained an overall sound financial performance over the past nine years. Rates of return on net fixed assets (both historical and revalued) exceeded 10 percent annually. Accounts receivable were kept below three months of sales, and the debt-equity ratio fell from 2.2 in 1992 to 0.5 in 2000. The debt-service ratio has been maintained well above the covenanted level of 1.5. Nevertheless, the Project did not contribute to TOT's sound financial position. Revenues are insufficient to meet the cost of providing rural telephone service because of competition from mobile telephone operators and other private sector telephone service providers. The financial internal rate of return of the Project is estimated to be –5.0 percent.

Sustainability is a key issue. Project facilities are being maintained by TOT, and the rural telephone facilities are expected to operate satisfactorily. Although the project facilities have had a negative impact on TOT's financial position, maintenance is funded through an implicit cross-subsidy in the telephone tariff. Under these circumstances and with TOT's continued commitment to rural telecommunications, the Project should be sustainable. However, privatization of TOT may pressure it to minimize costs to the detriment of the rural telephone service. Increased competition in the telecommunications sector may bring the tariff more in line with costs and reduce the cross-subsidy, thus eliminating a source of finance for the maintenance of project facilities.

The Project highlighted two lessons:

- (i) Technology has advanced considerably over the past few years and more options are available for providing rural telephone service. Decision makers, however, may not be fully aware or appreciative of the new technologies. It may therefore be preferable to prepare functional specifications for procurement of equipment and allow the vendors to propose solutions. Procurement may also take the form of build-own-operate (-transfer) arrangements, offers of service on a concession basis, or leases. Evaluation of bids on this basis would be more complex, but may also encourage the discovery of innovative and cost-effective solutions.
- (ii) Deregulation of the telecommunications sector and the introduction of a mobile telephone service have had a profound effect on rural telecommunications. Growth in the mobile telephone service industry grew rapidly in rural areas beginning in the mid-1990s as prices of mobile telephone handsets fell. Thus, mobile telephones offer an alternate mode of voice communication in rural areas and compete with TOT's fixed-line service. Mobile telephone companies have shown that they are willing and able to service rural areas and at a lower cost than TOT. In the future, rural telecommunications should be left to the least-cost provider.

## I. BACKGROUND

### A. Rationale

1. Thailand's rapidly growing economy (at an annual average of 7.7 percent during 1986-1995) put increasing demands on the country's infrastructure, including telecommunications. Although access to telephones improved from 1 telephone per 100 persons in 1981 to 2.7 in 1991, it was still considerably lower than that in other countries in the region, such as Malaysia (7.3) and Singapore (36.6). The expressed unmet demand for telephone services was about 100 percent of capacity at the time, while the suppressed demand was thought to be several times higher. Moreover, the distribution of telephone lines in the country was uneven, with about 67 percent of the lines in 1990 installed in the Central Region, including the Bangkok Metropolitan Area, although it contained only 21 percent of the country's population. The resulting telephone density was 11.1 telephones per 100 persons, while in the rural areas it was only 1.3. Out of Thailand's 6,905 *tambon* (subdistricts), about half, representing about 12 million people, had no telephone facilities. The nearest telephone or telecommunications service for rural people was an average of 17 kilometers away, requiring them to spend much time traveling to the facilities.

2. Under the Seventh Economic and Social Development Plan (1992-1996), the Government of Thailand attached priority to further improving telecommunications' availability and quality. The overall goal was to increase access to 10 telephones per 100 persons by 1996, which meant extending rural long-distance telephone services to all *tambon*. The Government designated the Telephone Organization of Thailand (TOT) as the rural telecommunications program's implementing agency.

### B. Formulation

3. The Government requested financing from the Asian Development Bank (ADB) for the Second Rural Telecommunications Project in early 1992. The Project was formulated during the Reconnaissance Mission in April. The Mission continued the policy dialogue begun during the first rural telecommunications project.<sup>2</sup> No project preparatory technical assistance (TA) was provided. The second project was appraised in early 1993, and ADB approved a loan out of its ordinary capital resources on 29 June 1993.<sup>3</sup> The loan became effective on 17 December 1993.

### C. Purpose and Outputs

4. The Project's main objective was to provide basic telephone service to all *tambon* without such facilities and to tourist facilities and along highways in remote rural areas. All *tambon* were to be served regardless of size, population, or location. The Project had five components: (i) installation of about 4,000 time division multiple access (TDMA) stations<sup>4</sup> and about 500 satellite stations and related equipment, (ii) installation of about 20,000 coin-box telephones and about 20,000 telephone booths, (iii) installation of about 4,500 standard telephone sets, (iv) provision of consulting services, and (v) training of TOT staff. Each TDMA

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<sup>2</sup> Loan 718-THA: *Rural Telecommunication Project*, for \$72.6 million, approved on 11 December 1984.

<sup>3</sup> Loan 1239-THA: *Second Rural Telecommunications*, for \$84.1 million, approved on 29 June 1993.

<sup>4</sup> Time division multiple access is a means of transmitting multiple conversations on a single digital transmission path.

station was to serve one metered telephone at a village leader's residence, which would serve as a public call office, and four easily accessible public coin-box telephones near temples or markets, for example. Each satellite station was to serve one public call office and up to two coin-box telephones.

#### **D. Cost, Financing, and Executing Arrangements**

5. ADB approved Loan 1239-THA, in the amount of \$84.1 million, to finance the foreign exchange cost of the TDMA equipment (see Basic Data Sheet and Appendix 1). The Overseas Economic Cooperation Fund (OECF) was to finance \$41.6 million of the foreign exchange costs of the coin-box telephones, and TOT was to finance the balance of \$247.6 million equivalent, comprising \$46.8 million in foreign exchange costs and \$200.8 million equivalent in local currency costs. The ADB loan had a term of 25 years, including a grace period of 5 years, at an interest rate determined from time to time in accordance with ADB's pool-based variable lending rate for dollars. ADB and OECF financing covered 23 and 11 percent, respectively, of the total project cost of \$373.3 million as estimated at appraisal. The Borrower was TOT and the loan was guaranteed by the Kingdom of Thailand.

6. The Project's Executing Agency was TOT. Within TOT, the Project was managed by the Rural Public Long Distance Telephone Project Office of the Department of Project Management. The Project was supervised by a project manager who reported to the department director. The Project was also implemented with the assistance of 40 TOT staff members in Bangkok and 1 or 2 staff members in the regions intermittently.

#### **E. Completion and Self-Evaluation**

7. The project completion report (PCR), prepared in June 1998, discussed the Project's design, scope, implementation, and operational aspects, and provided detailed project information. The PCR was well prepared and rated the Project as "generally successful". However, the PCR did not identify any major issues and should have discussed the developing mobile telephone industry that now competes with TOT's rural telecommunications service.

#### **F. OED Evaluation**

8. This project performance audit report (PPAR) focuses on pertinent aspects of the Project and presents the findings of the Operations Evaluation Mission to Thailand from 26 February to 9 March 2001. The PPAR assesses the Project's effectiveness in terms of objectives achieved and benefits generated, and of the operations' sustainability.

9. The PPAR is based on a review of the PCR, the Report and Recommendation of the President, material from ADB files, a report by a consultant engaged by the Operations Evaluation Mission, and discussions with the Borrower. Copies of the draft PPAR were provided the Borrower and ADB staff concerned for review and comments. Comments received were considered in finalizing the PPAR.

## II. PLANNING AND IMPLEMENTATION PERFORMANCE

### A. Formulation and Design

10. The strategic focus of ADB's country operational strategy was to assist Thailand in developing the basis for long-term competitiveness to support sustained and balanced long-term economic growth, and to help the Government achieve equitable development by promoting rural development and regional dispersal of economic activity. The strategy stressed developing physical infrastructure and the private sector to support long-term economic development. Although the Project contained no policy initiatives regarding privatization of the telecommunications sector, it was generally in line with this strategy. The privatization of the telecommunications sector issue was addressed under a separate TA approved in 1993.<sup>5</sup> The Project was highly relevant to ADB's overarching strategy to reduce poverty. The Project aimed to strengthen the ties between people in remote areas and the cash economy through better communications and access to information on commodity and labor markets. It also helped maintain social ties. The Project also aimed to facilitate the provision of government and other social services.

11. The Project's preparation was satisfactory. The TDMA remote stations were configured to provide up to nine telephone lines. The technology employed was appropriate and properly designed and integrated into the existing network. The only design fault concerned the use of batteries for backup power supply in the TDMA facilities. The batteries tended to overheat as the ambient temperature rose during the day and to explode, leaving the TDMA facilities without backup power. Several technological advances made parts of the Project's technology obsolete. The development of the wireless local loop resulted in replacing copper wire with a radio signal as the medium of transmission between subscribers and the remote station. The wireless local loop technology is now being used under ADB's third project in the sector.<sup>6</sup> The rapid expansion of the mobile telephone network, precipitated by falling mobile telephone prices, deregulation of the telecommunications sector, and the granting of licenses to private sector fixed-line operators created competition for TOT's rural telecommunications facilities. Today, it is possible to make calls at competitive prices between virtually any two points in Thailand through the mobile telephone network. The appropriate choice of telecommunications technology for rural areas will be a major issue in the future.

12. The project components were generally implemented as envisaged at appraisal, with only three design changes:

- (i) A detailed engineering survey recommended leasing rather than buying land for the remote station sites, thus reducing land and building purchases. The recommendation was based on some landowners' unwillingness to sell their land and TOT's desire to avoid making large upfront payments.
- (ii) It was more economical to purchase the services of satellite earth stations through a build-operate-transfer arrangement than through the originally planned direct purchase because the facilities would be built faster and because the arrangement reduced TOT's need to operate and maintain the facilities.

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<sup>5</sup> TA 1877-THA: *Telecommunications Restructuring and Privatization*, for \$600,000, approved on 29 April 1993.

<sup>6</sup> Loan 1489-THA: *Third Rural Telecommunications (Sector)*, for \$100 million, approved on 26 November 1996.

- (iii) Loan savings financed 16,012 additional coin-box telephones to be connected to the TDMA remote stations (para. 13).

## B. Achievement of Outputs

13. Basic telecommunications services were extended to all tambon as envisaged at appraisal. TDMA remote stations were installed at 4,003 locations (Table 1). On average, the TDMA stations had one public call office and 3.5 coin-box telephones, with 16,012 more coin-box telephones installed later. Five hundred satellite stations were installed, each with one public call office and one coin-box telephone. A total of 34,907 telephone lines were installed, comprising 4,503 standard telephones and 30,404 coin-boxes.

**Table 1: Telecommunications Equipment Installed under the Project**

Item	TDMA	Satellite	Total
A. Remote Stations	4,003	500	4,503
B. Telephone Lines			
1. Public Call Offices	4,003	500	4,503
2. Coin-box Telephones			
a. Original	13,892	500	14,392
b. Additional	16,012	0	16,012
<b>Subtotal</b>	<b>29,904</b>	<b>500</b>	<b>30,404</b>
<b>Total Telephone Lines</b>	<b>33,907</b>	<b>1,000</b>	<b>34,907</b>

TDMA = time division multiple access.

## C. Cost and Scheduling

14. The actual Project cost was \$160.3 million equivalent, with a foreign exchange cost of \$91.7 million (57 percent) and a local currency cost of \$68.6 million equivalent (43 percent). The actual cost was about 57 percent lower than the appraisal estimate. Substantial savings were realized because land and buildings were not required for the Project and because prices of transmission, switching, and subscribers' equipment components were lower than envisaged at appraisal because of technological advances. As a result, ADB financed only \$46.6 million of the Project's foreign exchange costs (29 percent of the actual project cost).

15. The Project was expected to have been implemented from April 1992 to December 1996 (Appendix 2). It was completed in August 1997, and the loan was closed in July 1998. The implementation schedule was reasonable. Some minor project delays occurred because of bad weather and contractor inexperience.

#### **D. Procurement and Construction**

16. Procurement of the TDMA component was carried out according to ADB's *Guidelines for Procurement*. Procurement of the coin-box telephones was conducted according to guidelines of the Overseas Economic Cooperation Fund and the other components according to TOT procurement guidelines. Performance of the suppliers of the equipment and associated services under the Project was generally satisfactory. The equipment supplied was of an adequate standard and was satisfactorily installed. Delays occurred in two cases: the supplier of the TDMA equipment responded slowly when requested to rectify defects in the software and power supplies; and the supplier of the telephone booths failed to deliver the booths because of extensive flood damage at its factory during the rainy season, and this component had to be retendered. The use of a single turnkey contract to install the telephones across the country did not cause any coordination or supervision difficulties.

#### **E. Organization and Management**

17. The Rural Public Long Distance Telephone Project Office in the Department of Project Management was organized to discharge its responsibilities and functions. The project manager was suitable for the position and had the necessary skills to supervise the implementation. He was assisted by able, appropriately qualified personnel.

18. The substantial experience TOT accumulated in the installation and maintenance of TDMA equipment under the first ADB-financed project (footnote 1) meant that few consulting services were needed at the planning stage. TOT financed these consulting services.

19. Several financial covenants were included in the Loan Agreement in addition to the standard covenants required by ADB for reporting requirements and the use of loan proceeds (Appendix 3). The Project required that TOT (i) earn not less than 10 percent on net revalued assets; (ii) maintain net revenues at least 1.5 times the debt service requirement; (iii) maintain accounts receivable no higher than three months of billing; and (iv) revalue its fixed assets each year. The covenants also required TOT to ensure that the equipment manufacturers train 50 engineers and that TOT train 150 local staff members. TOT complied with these covenants.

### III. ACHIEVEMENT OF PROJECT PURPOSES

#### A. Operational Performance

20. The TDMA and satellite facilities installed under the Project are generally in good order and operate satisfactorily. However, there is no backup power supply at some of the TDMA facilities because the batteries overheat (para. 10), resulting in the lack of telephone service during a power outage. This problem is still unresolved and TOT is searching for a solution. The regular power supply from the grid is unreliable in the rural areas because of voltage fluctuations. Voltage fluctuations that exceed specified tolerance levels sometimes burn out the back plane printed circuitry of the TDMA equipment. Repairs can take up to six weeks. As a temporary measure, TOT has installed isolation transformers at TDMA equipment facilities.

21. The rate of completed calls using project facilities in 2000 was about 45 percent (Table 2), compared with about 60 percent for TOT as a whole. The quality of service in TOT's rural telecommunications must be raised to TOT's general level.

**Table 2: Project Operational Data**

	1999	2000
Number of Telephone Calls	58,771,935	52,241,720
Number of Telephone Call Minutes	200,706,158	187,652,258
Revenue (in baht)	401,259,348	342,004,356
Average Length of Telephone Call (in minutes)	3.4	3.6
Average Revenue per Telephone Call (in baht)	6.8	6.5
Percentage of Completed Calls	43.6	44.8

22. The number of telephone calls made using project facilities, the number of telephone call minutes, and revenues fell from fiscal year FY1999 to FY2000. The two main reasons for this are the (i) 1997 Asian economic crisis, and (ii) the deregulation of the telecommunications sector. The Asian economic crisis had a negative impact on economic growth and economic activity throughout the country, particularly in rural areas. Reduced rural incomes thus decreased demand for telephone services. With better economic performance beginning in 2001 and a more competitive pricing strategy, demand for telephone services should increase.

23. Deregulation of the telecommunications sector saw the introduction of a mobile telephone service in 1990. Growth in the mobile telephone service industry was slow at first and occurred primarily in urban areas but grew rapidly in both urban and rural areas in the mid-1990s as prices of mobile telephone handsets fell. The mobile telephone service covers about 90 percent of the population, and the mobile telephone industry estimates that about 25 percent can afford a mobile telephone. Thus, mobile telephones offer an alternate mode of voice communication in rural areas and compete with TOT's fixed-line service. TOT also faces competition from private companies licensed to provide fixed-line telephone service. One company competes directly with TOT in some rural areas. To regain its rural market share, TOT must promote its telephone services and develop new services to better utilize project

facilities.<sup>7</sup> However, TOT is reluctant to expand into the rural market because it has been unable to recover its cost of service in this market segment.

24. Maintenance of project facilities is usually carried out by TOT's customer service office in the area or by local people on a cost-plus (10 percent) basis. The Government requires TOT to repair telephone facilities within 24 hours of breakdown and, 93 percent of the time, TOT does so. However, maintenance of project facilities presents some difficulties for TOT:

- (i) The remoteness of many of the coin-box telephones increases maintenance and collection cost, which often exceeds the revenue collected. Many provincial offices do not have sufficient staff and vehicles to adequately carry out maintenance.
- (ii) Larger inventories of spare parts are needed to adequately service the project facilities because rural telecommunications are so dispersed. This increases the cost of service. Often, quantities of spare parts are insufficient, thus delaying repairs.
- (iii) Vandalism, mainly the destruction of coin boxes to steal the money, is more pervasive in rural than urban areas.

TOT needs to develop a more efficient means of maintaining project facilities to maximize the economic benefits of rural telecommunications facilities. If the cost of maintenance is not lowered or revenues from the Project increased, the sustainability of the project facilities will be at risk.

## **B. Performance of the Operating Entity**

25. TOT maintained an overall sound financial performance over the past nine years (Appendix 4). Revenues grew at a faster rate than expenses as the market for telecommunications expanded, despite the absence of any tariff increase from 1985 to 1999.<sup>8</sup> This indicates that TOT successfully exploited the available economies of scale. Rates of return on net fixed assets (both historical and revalued) exceeded 10 percent annually. Earnings in every year except 1999 were sufficient to pay a dividend to the Government treasury. Accounts receivable were kept below three months of sales, thus maintaining TOT's liquidity. The debt-equity ratio fell from 2.2 in 1992 to 0.5 in 2000, thus reducing TOT's debt burden and financial risk. The debt-service ratio has been maintained well above the covenanted level of 1.5.

26. Nonetheless, market pressures and changes in TOT's cost structure required a tariff increase in 2000. Because of the 1997 Asian economic crisis and the ensuing economic slowdown and the rapid growth in mobile telephone service, TOT's revenue growth stagnated in 1998 and 1999. Depreciation charges rose by about 50 percent between 1997 and 2000 because of large capital investments in telecommunications equipment (including those for rural telecommunications), and nonoperating expenses increased seven-fold. Nonoperating expenses were largely nonrecurring and comprised foreign exchange losses and settlement of

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<sup>7</sup> TDMA equipment is easy to relocate and TOT should do so if market conditions dictate, especially if mobile telephone service is more cost effective in the area. Moreover, TDMA equipment can be used for data transmission, not only voice, with the addition of a modest amount of equipment. The Government recently introduced a policy to bring Internet service to rural areas, and TOT, along with other telecommunications companies, will be expected to provide this service. The TDMA facilities installed under the Project could be used for this purpose.

<sup>8</sup> TOT's tariffs were last modified on 1 May 2000.

disputes with concessionaires. Depending on the rate of growth of sales of telecommunications services, tariffs may need to be raised more often in the future for TOT to maintain its good financial position. This will likely be difficult with the current intensity of competition in the marketplace, and TOT will thus need to focus more on reducing costs.

27. The Project did not contribute to TOT's sound financial position. Revenues are insufficient to meet the cost of providing rural telephone service because of competition from mobile telephone operators and other private sector telephone service providers (para. 22). The Project's financial internal rate of return is estimated to be -5.0 percent (Appendix 5).

28. To meet the competition from mobile telephones, TOT introduced on 12 August 2000 an additional tariff for long-distance telephone calls that use the Internet protocol. The tariff offers a 50 percent discount on long-distance telephone calls at a cost of a modest reduction in voice quality. The Internet protocol is an innovation not yet found in most countries, indicating that TOT is prepared to respond to market changes. In addition to the tariff, TOT should also consider offering "bundled" services, as is done in some developed countries, to compete more effectively and to maintain market share.<sup>9</sup>

29. One apparent weakness in TOT is the organization of its provincial offices that are responsible for the administration and maintenance of rural telecommunications facilities. TOT provincial offices are not organized as a separate business unit or as a profit center but are basically extensions of headquarters operations. The lack of autonomy at the provincial level has restricted TOT's ability to tailor its operations to the region's particular circumstances, thus reducing operational efficiency. TOT introduced performance measures in 1999 to monitor performance of the provincial offices, which it manages from its Bangkok headquarters. However, this initiative may not be adequate.

### **C. Economic Reevaluation**

30. The Project's objective of providing basic telephone service to all tambon currently without such facilities and to tourist facilities and along highways in remote rural areas was essentially achieved. About 1 million-1.5 million more rural people now have access to telephone services. The Project's economic internal rate of return is estimated at 43.1 percent. Appendix 5 discusses the valuation of the economic benefits of telephone calls and provides details of the economic reevaluation. The economic internal rate of return is higher than that estimated at appraisal (16.9 percent) and project completion (29.0 percent) because of lower prices of plant and equipment and a higher level of economic benefits generated by the Project due to the methodology used.

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<sup>9</sup> Bundling of services comprises offering a customer a package of telecommunications services at attractive rates. A potential competitor in any one of these services would find it difficult to compete because of the other services included in the package, services that the competitor may not always be able to offer.

#### **D. Sustainability**

31. Project facilities are maintained by TOT, and the rural telephone facilities are expected to operate satisfactorily. Although the project facilities have had a negative impact on TOT's financial position, maintenance is funded through an implicit cross-subsidy in the telephone tariff. Under these circumstances and TOT's continued commitment to developing rural telecommunications, the Project should be sustainable. However, privatization of TOT may put pressure on it to minimize costs to the detriment of the rural telephone service. Increased competition in the telecommunications sector may bring the tariff more in line with costs and reduce the cross-subsidy, thus eliminating a source of finance for the maintenance of project facilities.

## **IV. ACHIEVEMENT OF OTHER DEVELOPMENT IMPACTS**

### **A. Socioeconomic Impact**

32. Telecommunications is an important element in the economic development of a country. In rural Thailand, access to telephone services is essential for a broad range of economic production and distribution activities, delivery of health and other social services, public administration, and national security. Telephone services have improved marketing and production links and stimulated resource mobilization—especially in tourism, for which Thailand is noted—employment, and regional trade.

33. Telephone services have noticeably improved the quality of rural life. The two main socioeconomic impacts have been savings on transportation costs (travel for business and personal reasons) and improved contacts among family members in Thailand and overseas. The high social and economic returns from telephone services are reflected in the Project's economic internal rate of return (para. 29 and Appendix 5).

### **B. Environmental Impact**

34. The Project had a negligible impact on the environment. The microwave power output of the satellite stations is low and not a hazard. Much of the project equipment comprised simple tower structures and antennas that were usually placed adjacent to existing buildings, and erecting cables installed along existing power-line routes.

### **C. Impact on Institutions and Policy**

35. TOT is a well-managed, financially sound organization. Staff is skilled and well trained. Training of staff on the new equipment was adequate. TOT's accounting and financial systems are well developed. There was little need to provide for institutional strengthening of TOT under the Project. The policy issues regarding TOT and the telecommunications sector as a whole are being adequately addressed within the Government's agreement with the World Trade Organization.<sup>10</sup>

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<sup>10</sup> The Government agreed with the World Trade Organization on a program that would liberalize and deregulate the telecommunications sector in Thailand. The agreement with the World Trade Organization is expected to lead to the privatization of TOT by 2006.

## **V. OVERALL ASSESSMENT**

### **A. Relevance**

36. The Project was generally consistent with the ADB's country operational strategy. It assisted the Government to achieve equitable development by promoting rural development and regional dispersal of economic activity. The Project is highly relevant to ADB's poverty reduction strategy. The Project has had a significant social and economic impact on the rural poor.

### **B. Efficacy**

37. The Project was implemented satisfactorily and brought telephone service to 1 million–1.5 million rural people. The project facilities are adequately maintained and are used by the intended beneficiaries. Therefore, the Project's main objective was achieved in an efficacious way.

### **C. Efficiency**

38. The Project generates substantial economic benefits, even though some may not be quantifiable. Its economic rate of return is high, estimated at about 43 percent. However, the private sector can now provide basic rural telecommunications at a lower cost, although this fact only recently became apparent because of rapid advances in mobile telephone technology and falling prices of mobile telephones. Nevertheless, the technology for rural telecommunications was appropriate at the time the choice was made. The Project is considered to be efficient.

### **D. Sustainability**

39. There is some concern about the Project's sustainability over the long term. Although staff is well trained in maintaining the project facilities, maintenance is currently routinely carried out, and TOT is financially sound, competition in the telecommunications sector may pressure TOT to minimize losses in rural telecommunications and thus not allocate sufficient resources to maintain the facilities.

### **E. Institutional Development and Other Impacts**

40. TOT is a financially well-managed company with staff whose training is institutionalized and whose skills are kept up to date. TOT should continue to develop institutionally as it faces more competition in the market and responds accordingly. There was no pressing need to engage in institutional strengthening under the Project.

### **F. Overall Project Rating**

41. Based on the above five key evaluation criteria, the Project is rated as successful.

## **G. Assessment of ADB and Borrower Performance**

42. ADB undertook three review missions and one special project administration mission to guide and support project staff. Given the absence of any major problems and the Project's relatively smooth implementation, ADB staff provided adequate supervision. The performance of ADB, the Government, and TOT was satisfactory. TOT gained substantial experience with ADB procedures during implementation of the first project and thus avoided potential problems.

## **VI. ISSUES, LESSONS, AND FOLLOW-UP ACTIONS**

### **A. Key Issues for the Future**

43. Project sustainability is a key issue. The Project has had a negative financial impact on TOT (para. 26). TOT may be pressured to minimize losses from the rural telecommunications component as the time approaches for TOT's privatization, which will bring about increased emphasis on minimizing costs, competing with other private sector telecommunications companies, and maximizing shareholder value. Competition will likely lead to a reduction in the implicit cross-subsidy in TOT's tariff structure that finances the maintenance of rural telephone facilities. If the project facilities are to operate for the duration of their expected economic life, TOT needs to develop more efficient means of maintaining them. These means may include (i) contracting out maintenance to individuals in rural areas, (ii) improving TOT's organizational structure to encourage independent action and solutions at the local level, and (iii) increasing revenues by improving availability of facilities and marketing efforts. Project facilities' services should also include data transmission, for example, Internet access for schools.

44. Technology has advanced considerably over the past few years and more options are now available for providing rural telephone service. It is also possible that awareness of new technologies is not complete or fully appreciated. To minimize the effects of incomplete information, it may be preferable for TOT to prepare functional specifications during procurement of equipment and allow the vendors to propose solutions. Procurement may also take the form of (i) build-own-operate (-transfer) arrangements, (ii) offers of service on a concession basis, or (iii) leases. Evaluation of bids on this basis would be complex, but the approach might be worthwhile to encourage innovative and cost effective-solutions.

### **B. Lessons Identified**

45. Deregulation of Thailand's telecommunications sector and the introduction of a mobile telephone service has had a profound effect on rural telecommunications. The mobile telephone service industry has grown rapidly in the rural areas since the mid-1990s as prices of mobile telephone handsets fell. Thus, mobile telephones offer an alternate mode of voice communication in rural areas and compete with TOT's fixed-line service. Mobile telephone companies have demonstrated that they are willing and able to provide telephone services in rural areas and at a lower cost than TOT. In the future, rural telecommunications should be left to the least-cost provider.

46. The scope for making the rural telephone service more profitable is limited as cost recovery for basic rural telephone service will likely be only partial and some form of subsidy will be necessary. However, cross-subsidization by other consumers is not efficient; implicit cross-subsidies also make privatization more difficult and put rural telephone operations at risk during cost reduction exercises. If the public sector needs to provide rural telecommunications, it would be preferable for it to provide an explicit government subsidy to the company providing the rural telephone service.

### **C. Follow-Up Actions**

47. No follow-up actions are required.

## APPENDIXES

<b>Number</b>	<b>Title</b>	<b>Page</b>	<b>Cited on (page, para.)</b>
1	Project Costs at Appraisal and Actual Expenditures	13	2, 5
2	Implementation Schedule	14	4, 15
3	Compliance with Loan Covenants	15	5, 19
4	Financial Statements	17	7, 25
5	Economic and Financial Reevaluation	20	7, 27

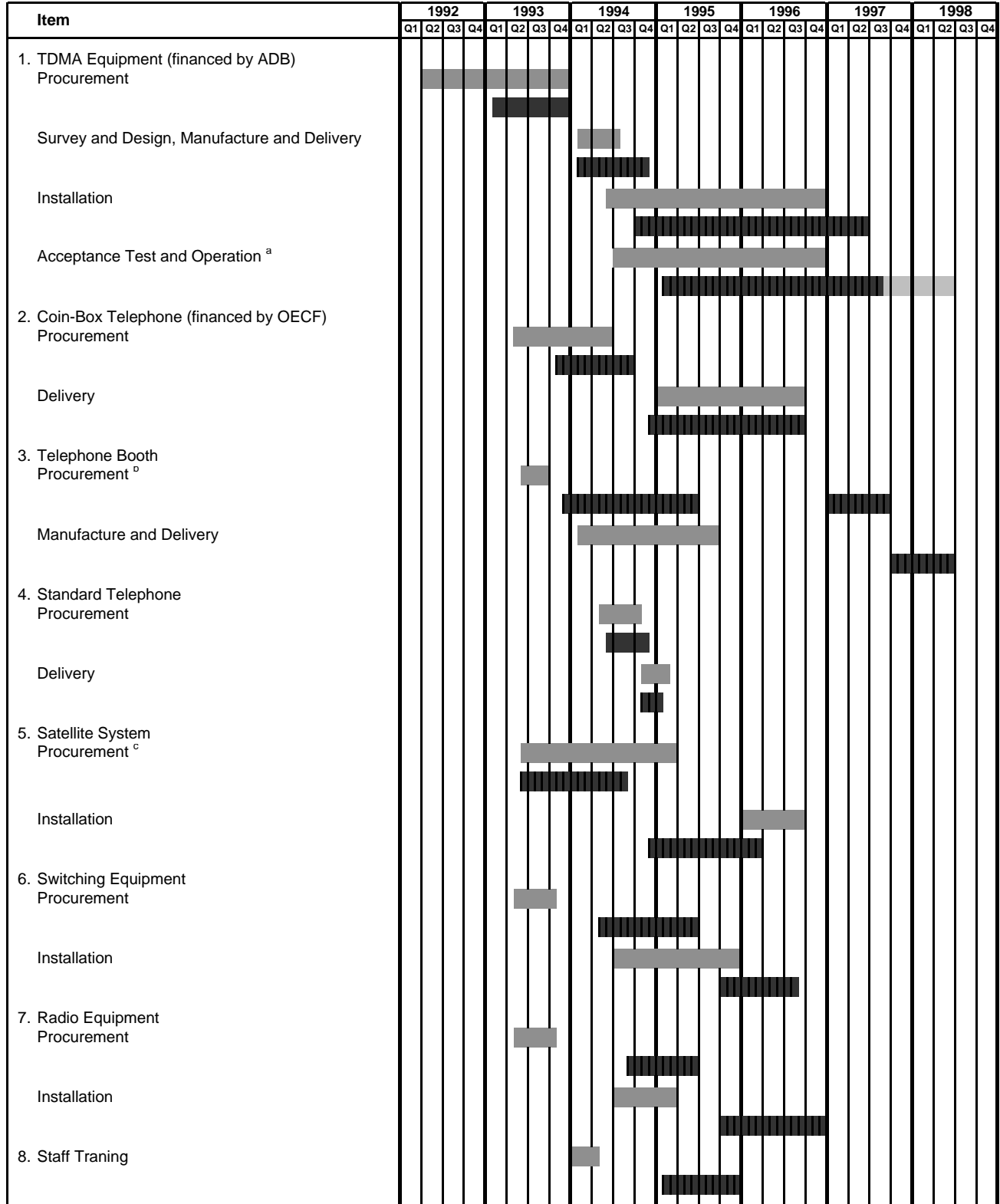
**PROJECT COSTS AT APPRAISAL AND ACTUAL EXPENDITURES**  
(\$ million)

Item	Appraisal Estimate			Actual Cost		
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost
A. Land and Building	0	88.1	88.1	0	0	0
B. Transmission and Switching Equipment						
1. TDMA Transmission Equipment						
a. Bank portion	74.7	0	74.7	46.6	0	46.6
b. TOT portion	16.5	28.2	44.7	4.8	41.5	46.3
<b>Subtotal (1)</b>	<b>91.2</b>	<b>28.2</b>	<b>119.4</b>	<b>51.4</b>	<b>41.5</b>	<b>92.9</b>
2. Satellite Transmission Equipment	11.2	3.5	14.7	0	0	0
3. Switching Equipment <sup>a</sup>	—	—	—	9.5	2.2	11.7
4. Radio Equipment <sup>a</sup>	—	—	—	0	7.6	7.6
<b>Subtotal (B)</b>	<b>102.6</b>	<b>52.2</b>	<b>154.8</b>	<b>60.9</b>	<b>51.3</b>	<b>112.2</b>
C. Consulting Services	0.2	0	0.2	0.1	0	0.1
D. Subscriber Equipment						
1. Coin-box telephones						
a. OECF portion	34.5	0	34.5	19.0	0	19.0
b. TOT portion	0	0	0	5.0	4.8	9.8
<b>Subtotal (1)</b>	<b>34.5</b>	<b>0</b>	<b>34.5</b>	<b>24.0</b>	<b>4.8</b>	<b>28.8</b>
2. Standard Telephone Sets <sup>a</sup>	—	—	—	0	0.2	0.2
3. Telephone Booths <sup>a</sup>	—	—	—	0	11.3	11.3
<b>Subtotal (D)</b>	<b>34.5</b>	<b>41.7</b>	<b>76.2</b>	<b>24.0</b>	<b>16.3</b>	<b>40.3</b>
E. Project Management	0	2.7	2.7	0	1.0	1.0
F. Contingencies						
1. Physical	10.2	5.2	15.4	0	0	0
2. Price	12.0	10.9	22.9	0	0	0
<b>Subtotal (F)</b>	<b>22.2</b>	<b>16.1</b>	<b>38.3</b>	<b>0</b>	<b>0</b>	<b>0</b>
G. Interest During Construction	13.0	0	13.0	6.7	0	6.7
<b>Total</b>	<b>172.5</b>	<b>200.8</b>	<b>373.3</b>	<b>91.7</b>	<b>68.6</b>	<b>160.3</b>

— = not available; OECF = Overseas Economic Cooperation Fund; TMDA = time division multiple access;  
TOT = Telephone Organization of Thailand.

<sup>a</sup> At appraisal, subtotal amount was estimated, but breakdown estimate was not available.

**IMPLEMENTATION SCHEDULE**



[Light Gray Bar] - Estimate at the time of appraisal      [Dark Gray Bar] - Actual      [Medium Gray Bar] - Inspection and contract amendment

<sup>a</sup> Upon completion of acceptance test in August 1997, the contract was amended to enable preparation of detailed bill of quantity for finalization of contract amount.

<sup>b</sup> First contract was terminated due to failure of the original contractor to perform.

<sup>c</sup> On concession basis.

ADB = Asian Development Bank; OECF = Overseas Economic Cooperation Fund; TDMA = time division multiple access.

## COMPLIANCE WITH LOAN COVENANTS

Covenant	Reference to Loan Agreement	Status of Compliance
<b>Project Implementation</b>		
1. The Project shall be implemented by the Rural Public Long Distance Telephone Project Office (RTPO) established within the Borrower. The RTPO shall be assisted by internationally experienced consultants.	Loan Agreement (LA), Schedule 5, para. 1	Complied with
2. The project manager shall be assisted by adequate, qualified staff.	LA, Schedule 5, para. 2	Complied with
<b>Financial</b>		
3. TOT shall take all such measures as required to produce an annual return of not less than 10 percent of the average current net value of TOT's revalued fixed assets in operation.	LA, Section 4.13 (a)	Complied with
4. TOT shall maintain its net revenues at least 1.5 times the debt-service requirements.	LA, Section 4.14 (a)	Complied with
5. TOT shall maintain its average accounts receivable at a level not higher than the equivalent of three months of billing.	LA, Schedule 5, para. 3	Complied with
6. TOT shall ensure that valuation or revaluation of its fixed assets is carried out yearly.	LA, Schedule 5, para. 4	Complied with
<b>Training</b>		
7. TOT shall ensure training for 50 engineers on the manufacturer's premises. Local training shall be provided for about 150 staff members.	LA, Schedule 5, para. 5	Complied with
8. TOT shall make adequate provisions for (i) staff members receiving both local and foreign training to train other staff members, and (ii) implementing bonding arrangements to be applicable to staff members receiving local and foreign training.	LA, Schedule 5, para. 6	Complied with
<b>Environment</b>		
9. TOT shall ensure that no significant adverse environmental impact occurs or that such impact is minimized. Any proposed location that has an expected adverse impact shall not be included in the Project unless approved by ADB.	LA, Schedule 5, para. 7	Complied with

Covenant	Reference to Loan Agreement	Status of Compliance
<b>Reporting</b>		
10. TOT shall furnish ADB with semiannual reports on the execution of the Project and on the operations and management of Project facilities.	LA, Section 4.06 (b)	Complied with
11. TOT shall prepare and furnish ADB with a report on the execution and initial operation of the Project within three months after the Project's physical completion.	LA, Section 4.06 (c)	Complied with
12. TOT shall furnish ADB with unaudited copies of its accounts and financial statements within 6 months after the end of the fiscal year, and certified copies of such audited accounts and financial statements within 12 months after the end of the fiscal year.	LA, Section 4.07 (a)	Complied with
13. TOT shall (i) inform ADB of landmark events, (ii) submit to ADB semiannual reports on the overall progress of the Telecommunications Master Investment Plan, and (iii) provide ADB with copies of draft terms of reference for consultants.	LA, Schedule 5, para. 9	Complied with
<b>Midterm Review</b>		
14. TOT shall carry out a comprehensive midterm review of project implementation during 1995.	LA, Schedule 5, para. 8	Complied with
<b>External Financing</b>		
15. TOT shall ensure that external financial assistance is obtained to provide funds required for the coin-box telephones.	LA, Schedule 5, para. 10	Complied with
<b>General</b>		
16. TOT shall ensure that the coin boxes, telephone booths, and telephone sets shall be procured and installed in a timely manner.	LA, Schedule 5, para. 11	Complied with

**FINANCIAL STATEMENTS**  
**Telephone Organization of Thailand**  
**Income Statement**  
(in B million, year ending 30 September)

Item	1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>Revenue</b>									
Local	10,911	12,640	14,384	15,027	15,203	15,346	15,125	15,479	16,540
Trunk	9,316	11,643	13,863	14,567	14,862	13,854	12,706	11,967	11,851
Franchise and Joint Ventures	222	947	2,092	4,806	6,088	9,195	9,361	9,339	10,610
Other	2,056	1,985	2,001	1,730	4,588	7,142	9,948	8,266	8,378
<b>Total Operating Revenue</b>	<b>22,505</b>	<b>27,215</b>	<b>32,340</b>	<b>36,130</b>	<b>40,741</b>	<b>45,537</b>	<b>47,140</b>	<b>45,051</b>	<b>47,379</b>
<b>Operating Expenses</b>									
Staff Remuneration	2,928	4,712	5,185	6,638	8,212	8,920	7,894	7,985	7,758
Operation and Administration	1,382	1,599	2,265	2,934	3,768	4,400	7,316	7,603	7,117
Lease Circuit Expenses	0	1,570	3,251	3,352	4,017	4,615	5,479	5,382	5,262
Repair and Maintenance	673	1,036	1,426	1,312	1,209	1,584	2,275	2,329	2,728
Depreciation	3,505	4,303	5,569	6,535	6,991	8,064	9,088	10,301	12,260
<b>Total Operating Expenses</b>	<b>8,488</b>	<b>13,220</b>	<b>17,696</b>	<b>20,771</b>	<b>24,197</b>	<b>27,583</b>	<b>32,052</b>	<b>33,600</b>	<b>35,125</b>
Operating Income	14,017	13,994	14,644	15,359	16,546	17,954	15,088	11,451	12,254
Nonoperating Income	831	903	1,106	1,917	5,107	6,256	5,480	2,311	1,860
Nonoperating Expense	1,134	1,404	3,380	1,825	1,236	1,355	6,613	11,383	9,133
Interest Expense	1,851	1,907	1,805	1,439	1,160	1,264	1,554	1,536	1,511
<b>Net Income</b>	<b>11,863</b>	<b>11,586</b>	<b>10,565</b>	<b>14,012</b>	<b>19,257</b>	<b>21,591</b>	<b>12,401</b>	<b>843</b>	<b>3,470</b>
Remittance to Treasury	5,767	6,410	6,442	7,725	10,523	11,892	8,988	2,326	3,024
Operating Ratio (%)	37.7	48.6	54.7	57.5	59.4	60.6	68.0	74.6	74.1
Return on NFA (%)	23.1	17.0	16.0	13.0	12.8	10.0	10.0	14.0	12.0
Return on Revalued NFA (%)	19.1	14.0	12.0	10.0	10.0	10.0	10.0	13.6	11.6

NFA = Net Fixed Assets.

**Telephone Organization of Thailand  
Balance Sheet**

(in B million, year ending 30 September)

Item	1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>Assets</b>									
<b>Current Assets</b>									
Cash	5,694	4,584	6,993	11,291	19,092	22,368	11,928	5,487	10,384
Accounts Receivable	4,262	4,701	4,957	6,410	6,844	10,105	11,030	9,832	9,194
Inventories	2,695	2,633	3,089	3,868	4,364	4,201	3,933	3,884	2,468
Other	573	863	1,290	2,422	7,307	10,448	11,823	11,754	7,053
<b>Total Current Assets</b>	<b>13,224</b>	<b>12,781</b>	<b>16,329</b>	<b>23,991</b>	<b>37,607</b>	<b>47,122</b>	<b>38,714</b>	<b>30,957</b>	<b>29,099</b>
<b>Fixed Assets</b>									
Fixed Assets in Operation	59,674	82,723	124,019	159,995	190,016	231,469	243,895	266,045	301,533
Less Accrued Depreciation	17,720	22,406	29,452	37,555	45,900	58,437	71,985	89,615	105,542
Net Fixed Assets in Operation	41,953	60,317	94,567	122,440	144,116	173,032	171,910	176,430	195,991
Work in Progress	22,060	18,364	5,649	2,192	5,108	11,034	22,424	24,227	13,435
<b>Total Fixed Assets</b>	<b>64,013</b>	<b>78,681</b>	<b>100,216</b>	<b>124,632</b>	<b>149,224</b>	<b>184,066</b>	<b>194,334</b>	<b>200,657</b>	<b>209,426</b>
Sinking Fund	3,676	0	0	0	11,555	12,397	14,466	10,757	11,156
Other Assets	1,061	6,670	7,655	8,441	6,001	6,536	6,212	8,914	10,879
<b>Total Assets</b>	<b>81,973</b>	<b>98,132</b>	<b>124,200</b>	<b>157,064</b>	<b>204,387</b>	<b>250,121</b>	<b>253,726</b>	<b>251,285</b>	<b>260,560</b>
<b>Liabilities</b>									
<b>Current Liabilities</b>									
Accounts Payable	1,050	1,045	739	656	2,257	4,507	8,129	6,606	2,551
Long-Term Debt (Current Maturity)	3,940	2,286	5,143	2,694	3,301	2,105	2,157	2,609	2,658
Other Current Liabilities	8,291	10,015	11,980	14,326	21,541	29,943	28,799	19,546	21,827
<b>Total Current Liabilities</b>	<b>13,281</b>	<b>13,346</b>	<b>17,862</b>	<b>17,676</b>	<b>27,099</b>	<b>36,555</b>	<b>39,085</b>	<b>28,761</b>	<b>27,036</b>
Customer Deposits	5,557	6,482	7,889	10,197	12,724	14,097	14,554	14,934	15,686
Other Liabilities	2,539	2,728	2,396	0	5,517	5,237	4,888	4,539	4,201
Long-Term Debt	35,102	35,946	30,471	28,577	23,586	34,482	32,376	37,537	37,142
<b>Equity</b>									
Government Contribution	516	516	516	516	516	516	516	516	516
Franchise and Donation Capital	2,495	13,317	35,602	63,286	88,636	118,340	120,401	121,517	127,986
Capital Reserves	1,518	1,518	1,518	1,518	1,518	1,518	1,518	1,518	1,518
Revenue Reserves	20,966	24,279	27,946	35,291	44,790	39,376	40,388	41,963	46,475
<b>Total Equity</b>	<b>25,494</b>	<b>39,630</b>	<b>65,582</b>	<b>100,611</b>	<b>135,460</b>	<b>159,750</b>	<b>162,823</b>	<b>165,514</b>	<b>176,495</b>
<b>Total Liabilities and Equity</b>	<b>81,973</b>	<b>98,132</b>	<b>124,200</b>	<b>157,061</b>	<b>204,386</b>	<b>250,121</b>	<b>253,726</b>	<b>251,285</b>	<b>260,560</b>
Debt-Equity Ratio (%) <sup>a</sup>	221.54	147.62	89.38	56.11	50.88	56.57	55.83	51.82	47.63
Current Ratio	1.00	0.96	0.91	1.36	1.39	1.29	0.99	1.08	1.08
Accounts Receivable (months) <sup>b</sup>	2.27	2.07	1.84	2.13	2.02	2.66	2.81	2.62	2.33

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<sup>a</sup> Debt-Equity ratio = (total current liabilities + customers deposits+other liabilities + long-term debt)/total equity

<sup>b</sup> Accounts receivable (months) = accounts receivable x 12/(revenue from trunk, local, franchise + other).

**Telephone Organization of Thailand**  
**Source and Application of Funds Statement**  
(in B million, year ending 30 September)

Item	1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>Sources of Funds</b>									
Net Income	6,097	5,176	4,123	6,287	8,734	9,699	3,413	(1,483)	446
Interests on Long-Term Debt	1,851	1,907	1,805	1,439	1,160	1,264	1,554	1,536	1,511
Net Income before Interest	7,948	7,083	5,928	7,726	9,894	10,963	4,967	53	1,957
Depreciation	3,505	4,303	5,569	6,535	6,991	8,064	9,088	10,301	12,260
Exchange Loss Write-Off	751	759	2,875	1,179	(1,508)	796	1,268	8,495	1,299
<b>Total Internal Sources</b>	<b>12,204</b>	<b>12,145</b>	<b>14,372</b>	<b>15,440</b>	<b>15,377</b>	<b>19,823</b>	<b>15,323</b>	<b>18,849</b>	<b>15,516</b>
Borrowings	3,663	397	1,139	820	714	3,874	124	379	1,380
Customer Deposits	988	925	1,407	2,355	2,527	1,373	457	380	752
Franchise Contribution	620	10,581	21,962	27,048	25,188	29,244	596	(615)	6,277
Other Sources	318	1,089	492	(273)	6,783	11	1,842	1,556	280
<b>Total Sources</b>	<b>17,793</b>	<b>25,137</b>	<b>39,372</b>	<b>45,390</b>	<b>50,589</b>	<b>54,303</b>	<b>18,342</b>	<b>20,549</b>	<b>24,205</b>
<b>Application of Funds</b>									
Capital Expenditure	8,648	8,041	7,388	5,057	6,808	13,211	14,698	17,036	15,226
Debt-Service Interest	1,851	1,907	1,805	1,439	1,160	1,264	1,554	1,536	1,511
Debt-Service Principal	3,443	2,379	3,652	1,965	1,773	1,727	2,433	2,349	2,509
Working Capital Increase (Decrease)	1,090	10,020	21,858	27,266	29,658	33,993	9,117	9,778	(337)
Sinking Fund	969	3,900	2,258	5,366	3,389	842	2,070	(3,709)	399
<b>Total Application</b>	<b>16,001</b>	<b>26,247</b>	<b>36,961</b>	<b>41,093</b>	<b>42,788</b>	<b>51,037</b>	<b>29,872</b>	<b>26,990</b>	<b>19,308</b>
Increase (Decrease) in Cash	1,793	(1,110)	2,410	4,298	7,800	3,267	(11,530)	(6,441)	4,738
Debt-Service Ratio (times)	2.9	2.2	4.3	5.4	5.5	5.0	4.2	4.8	3.6

## ECONOMIC AND FINANCIAL REEVALUATION

### A. Willingness to Pay for Telephone Services in Rural Thailand

1. The measurement of an individual's willingness to pay for goods or services for which there is a saturation point or finite demand even at zero price, such as telephone services, requires a reliable estimate of a demand function. However, standard microeconomic theory falls short in providing a plausible framework for making such an estimation. Empirical work to date has generally tended to assume that the demand for goods or services has no saturation point. Many demand models assume a constant price elasticity, which implies infinite demand at prices approaching zero. Moreover, some single-equation and demand-system models do not allow for the possibility of goods at zero price because the price variable is in logarithmic form for which zero is undefined. It is intuitive that, even at zero price, the demand for some goods and services is finite.

2. In general, the demand for telephone services is finite, even at zero price. Consumers are physically bound by the number of hours in any time period that can be devoted to making telephone calls. Even in regions such as North America, where there is no charge for local telephone calls, consumers limit the number of their telephone calls. A socioeconomic study in the mid-1990s found several other characteristics of demand for telephone services in rural Thailand.<sup>1</sup> More than 80 percent of telephone calls are for personal reasons such as keeping in touch with relatives; the rest are for business-related matters such as banking and dealing with government agencies. The average length of a telephone call is five minutes. Rural telephones are also perceived as a new service and not a substitute, to any great extent, for traditional forms of communication such as letter writing and travel. Therefore, the demand for rural telephone calls is primarily incremental.

3. These characteristics provide a guide for a functional form for the demand for telephone calls by an individual in a rural area. First, a quasilinear utility function ( $U$ ) for a representative individual may be assumed, the form of which is

$$U = V(q) + \lambda M \quad \dots(1)$$

where  $V$  is a utility function for telephone calls only,  $q$  is the quantity of telephone calls demanded,  $M$  is a composite commodity called "money," and  $\lambda$  is the marginal utility of money. The quasilinear utility function is separable and strongly additive and is appropriate because the demand for telephone calls is usually independent of the demand for other goods and services. This functional form also assumes that the marginal utility of money is constant or, equivalently, that the income effect is zero, an assumption that is reasonable for an individual whose demand for telephone calls is relatively small compared to that for other goods and services.

4. The utility function for telephone calls  $V$  selected for the analysis is

$$V = (\ln q - \alpha - 1)q/\beta \quad \dots(2)$$

<sup>1</sup> TA 2381-THA: *Socioeconomic Impact Study of Rural Telecommunications in Thailand*, for \$200,000, approved on 22 August 1995.

where  $\ln$  is the natural logarithm,  $\alpha > 0$  and  $\beta < 0$ . This utility function has the desirable property of diminishing marginal utility. It also has a point where satiation occurs ( $\ln q = \alpha$ ), that is, a point of demand where marginal utility is zero.

5. The constrained maximization of utility leads to the following demand function:

$$\ln q = \alpha + \beta \lambda p \quad \dots(3)$$

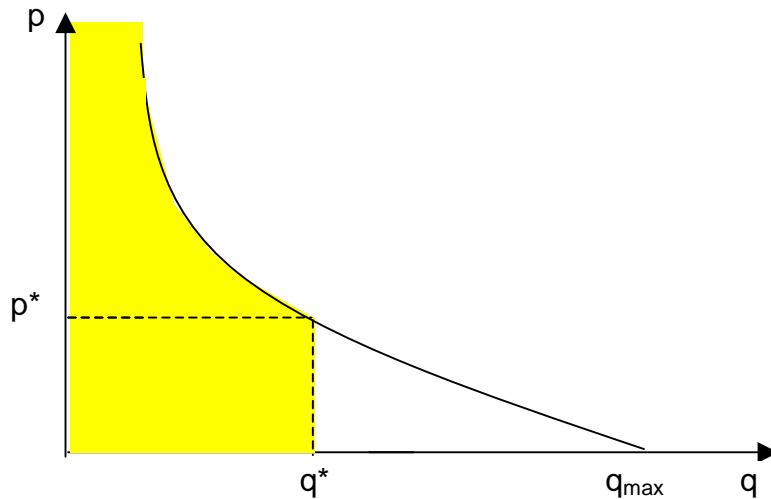
The upper bound of the demand function for telephone calls (when the price is zero) is given by  $e^\alpha$ , and  $\beta \lambda$  is the price semielasticity of demand. The price elasticity is given by

$$\eta_p = (dq/dp)(p/q) = \beta \lambda p \quad \dots(4)$$

which varies with the price level, as may be expected. The demand function also has the desirable property that willingness-to-pay rises exponentially as demand falls, as suggested by economic theory. Thus, the functional form incorporates three characteristics: (i) it is negatively sloped with respect to price, as economic theory suggests for a normal good; (ii) it is a smooth and continuous function; and (iii) it intercepts the abscissa to allow for the finiteness of the demand for telephone calls.

6. The economic benefit (*EB*) derived from a new telephone service is the area beneath the demand curve (Figure 1). The quantity of telephone calls demanded is  $q^*$  at the given price of  $p^*$ .

**Figure 1**



The demand curve (3) readily lends itself to calculating the economic benefit of telephone calls, namely,

$$EB = \int_0^{q^*} p \, dq \quad \dots(5)$$

Integrating with respect to  $q$  results in

$$EB = q^*(p^* - 1/\lambda\beta) \quad \dots(6)$$

## **B. Estimation of the Demand Function for Telephone Calls**

7. The parameters of the demand function for telephone calls (3) were estimated from data collected in March 2001 by a survey of 23 rural residents within reasonable access to the rural telecommunications network. The individuals were asked about their current telephone usage and about two hypothetical scenarios: (i) on telephone usage if no telephone service was available nearby and the nearest telephone was in another village; and (ii) on telephone usage if telephone calls were free. The responses revealed a distinct pattern in telephone usage. If no telephone were available nearby, on average, rural people would make four telephone calls per month at an average cost of B62 per five-minute call, primarily to relatives and friends and sometimes for business purposes. If telephone calls were free, survey responders said they would likely make 1 call a day, or about 30 per month, indicating that the parameter  $\alpha$  has a value of 3.4012 while  $\beta\lambda$  has a value of  $-0.0325$ , or the following demand for telephone calls function:

$$\ln q = 3.4012 - 0.0325p \quad \dots(7)$$

The accuracy of the demand model (7) for telephone calls was verified by comparing actual telephone usage and the price paid with that predicted by (7). The comparison concluded that the demand model for telephone calls is reasonably accurate.

## **C. Calculation of the Project's Economic and Financial Internal Rate of Return**

8. Economic benefits were based on the actual number of telephone calls made in 1999 and 2000, and estimated for 1997 and 1998 from revenue data. From 2001, economic benefits were based on the assumption that the market for telephone calls would not grow because of increasing competition from mobile telephone operators. Economic benefits were estimated using equation (6) on the basis of average monthly telephone calls made by each household. The resultant average monthly economic benefit was annualized and brought to an aggregate figure by multiplying it by the number of households using the telephone service. The economic benefits were valued in 2001 prices and adjusted by a standard conversion factor of 0.9.

9. The Project's capital costs were valued in 2001 prices (adjusted by the consumer price index); the nontradable-goods component of the capital cost was adjusted by the standard conversion factor of 0.9. The capital cost includes the satellite stations provided under a build-operate-transfer arrangement. Duties, taxes, interest during construction, and commitment charges were excluded from the capital cost. No opportunity cost of the land rented for the remote stations was assumed. Incremental operations and maintenance (O&M) costs were based on actual figures for 2000 provided by Telephone Organization of Thailand (TOT). From 2001, operation and maintenance costs were assumed to grow by 2 percent per annum in real terms and were also adjusted by the standard conversion factor. The Project's economic internal rate of return was estimated at 43.1 percent in real terms. Details of the calculation are found in Table A5.1.

**Table A5.1: Calculation of the Economic Internal Rate of Return**  
(B million in constant 2001 prices)

Year	Capital Cost	O&M Cost	Economic Benefit	Net Economic Benefit
1992	0.23			(0.23)
1993	0.46			(0.46)
1994	261.43			(261.43)
1995	1,928.46			(1,928.46)
1996	1,291.17			(1,291.17)
1997	877.82	20.00	1,935.66	1,037.84
1998	544.54	27.00	3,116.91	2,545.37
1999	318.37	35.00	2,753.70	2,400.33
2000	18.93	42.75	2,447.74	2,386.06
2001		43.61	2,342.70	2,299.09
2002		44.48	2,342.70	2,298.22
2003		45.37	2,342.70	2,297.33
2004		46.27	2,342.70	2,296.43
2005		47.20	2,342.70	2,295.50
2006		48.14	2,342.70	2,294.56
2007		49.11	2,342.70	2,293.59
2008		50.09	2,342.70	2,292.61
2009		51.09	2,342.70	2,291.61
2010		52.11	2,342.70	2,290.59
2011		53.15	2,342.70	2,289.55

EIRR = 43.1%

O&M = operation and maintenance; EIRR = economic internal rate of return.

10. The estimation of the financial internal rate of return used accounting data for the project capital costs. The capital costs excluded the cost of the satellite stations, which were accounted for by the installation charge and annual rental payments made by TOT to the firm that undertook the build-operate-transfer arrangement. Interest during construction and commitment charges were also excluded. The cost of the land used for the remote stations was based on the rental lease agreements. Incremental O&M costs were based on actual figures for 2000. From 2001, O&M costs were assumed to grow by 2 percent per annum in real terms. Revenues from 1997 to 2000 were actual sales made in those years. From 2001 onward, revenues were based on the 2000 tariff adjusted for inflation and for no growth in the number of telephone calls. All costs and revenues are in 2001 prices. The financial internal rate of return for the Project was estimated to be -5 percent in real terms. Table A5.2 provides details.

**Table A5.2: Calculation of the Financial Internal Rate of Return**  
(B million in constant 2001 prices)

Year	Capital Cost	Satellite Station Payment	Land Rental	O&M Cost	Revenue	Net Revenue
1992	0.26					(0.26)
1993	0.46					(0.46)
1994	274.79					(274.79)
1995	792.88	88.98	1.05			(882.91)
1996	1,490.04	138.95	2.14			(1,631.13)
1997	1,048.80	171.59	14.49	22.22	332.40	(924.70)
1998	449.28	168.59	17.25	30.00	495.39	(169.73)
1999	318.37	158.47	17.21	38.89	425.97	(106.97)
2000	1.80	154.53	16.78	47.50	354.04	133.43
2001		149.28	16.21	48.46	340.00	126.05
2002		144.93	15.74	49.42	340.00	129.91
2003		140.71	15.28	50.41	340.00	133.60
2004		136.61	14.83	51.41	340.00	137.15
2005		132.63	14.40	52.44	340.00	140.53
2006		128.77	13.98	53.49	340.00	143.76
2007			13.58	54.57	340.00	271.16
2008			13.18	55.66	340.00	271.16
2009			12.80	56.77	340.00	270.43
2010			12.42	57.90	340.00	269.68
2011			12.06	59.06	340.00	268.88

FIRR = -5.0 %

O&M = operation and maintenance; FIRR = financial internal rate of return.