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EVALUATION OF TELEPHONE PROJECTS
IN LESS DEVELOPED COUNTRIES

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Energy, Water and Telecommunications Department

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ABSTRACT

This paper addresses the problem of determining the appropriate size and composition of telecommunications investment in less developed countries with special reference to an objective of supplying telephone facilities in remote or economically deprived areas. It concludes that the most useful evidence the decision maker will usually have at his disposal will be observations of subscriber willingness to pay, supplemented by qualitative information about subscriber and public telephone user characteristics, and system usage. A first step in the generation of such data relates to pricing policy where efforts should be made to derive a tariff structure reflecting economic and social costs which will force subscribers to make their preferences known. At the same time, telecommunications authorities should endeavor to learn more about the nature of telecommunications usage, the characteristics and communications needs of existing and potential users, and the specific government objectives and programs which telecommunications can most effectively serve.

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Introduction: Some Relevant Characteristics of Less Developed Countries

This paper addresses the problem of determining the appropriate size and composition of telecommunications investment programs in less developed countries (LDCs) with special reference to an objective of supplying telephone facilities in remote or economically deprived areas. For LDCs the general level of economic development is usually reflected in the magnitude of per capita income, and in most cases lower per capita income is associated with a skewed distribution of income, both within and between urban and rural areas. The phenomena of low average income and a skewed income distribution suggest that the problems of providing telephone access to low-income groups—and specifically to low-income rural communities—are especially complex. Ability and/or willingness to pay for the full costs of service may not be demonstrated, and thus there is no simple test of project justification.

In many instances investment must be based primarily on unquantifiable economic or social objectives. One such objective, which is frequently observed in LDCs, is the goal of stemming rural-to-urban population movement. Whether or not the provision of telephones and other infrastructure in villages and small towns actually helps to stem such movements—or even whether to do so is desirable—are issues which will not be debated here, but it is certainly the case that many governments see the improvement of public services, including telecommunications, as legitimate means of assisting in the achievement of this goal.

Another characteristic of LDCs, particularly where there is a substantial subsistence sector, and where the industrial base is weak, is the ever present problem of raising funds for public sector purposes. The shadow value placed upon public funds in LDCs is often considerable, reflecting a central

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2/ Shail Jain, Size Distribution of Income, a compilation of data, World Bank, Washington, DC, 1975.

government administrative structure that is financially deprived, and unable
to act as an effective instrument for carrying out a range of government objec-
tives. In this regard, LDCs are caught in a vicious circle: the lack of a
substantial tax base partly results in weak public institutions, including
internal revenue authorities which are not equipped to propose and administer
the necessarily complex tax structures. Hence, the large income transfers
required to promote significant rural development programs are typically
beyond the fiscal capacity of most LDCs.

In light of this, it appears that public enterprises such as telecommu-
nications authorities, which can levy charges on beneficiaries, and which by
means of their pricing and investment programs have the ability to influence
the type and location of economic activity, have a potential role in the con-
duct of public policy that extends well beyond the financial and technical
horizons which normally circumscribe telecommunications authorities. Indeed,
the telecommunications sector may be the vehicle for the achievement of govern-
ment policies which, because of inadequate government fiscal and administrative
machinery, may not be achievable by other means.

Policy with regard to rural telecommunications is illustrative of this
general principle, but in this regard two important points must be made. First,
the need to distinguish between rural and urban areas is matched by the need to
distinguish between higher-income business, government, and residential tele-
phone subscribers on the one hand, and lower-income business and casual public
telephone users on the other, irrespective of their location. Thus, with regard
to providing access to service by means of public call offices, backward rural
areas and low-income urban squatter settlements present similar economic and
financial problems on the demand side, even though the technical facilities and
costs of providing service may be very different. The second point is that the
issues involved in providing telephone service in rural areas of developing
countries cannot be dealt with in isolation from the rest of the sector. Poli-
cies adopted relating to the provision of rural telecommunications facilities
have financial, technical, managerial, and economic implications for the rest
of the sector, and for the national economy as a whole. This paper, therefore,
focuses first on the broad investment and resource-allocation issues in the
sector, outlining the implications of these issues for rural telecommunication
policies.

The Telecommunications Investment Decision

Analysis of the trade-offs between the various qualitative and quanti-
tative development objectives of an LDC, and the allocation of resources which
follows, involves a peculiar set of problems as far as investment in telecommun-
ications is concerned. When measured in terms of financial returns, investments
in national telecommunications programs (although not necessarily the rural com-
ponent) are usually an outstanding success. Thus, conservative estimates of
the internal financial rate of return on the latest dozen telecommunications
programs which were partly financed by the World Bank show a range of between
13 percent and 22 percent. Were economic efficiency the only criterion, such
evidence would typically be sufficient to justify rapid expansion of the sector.
However, numerous instances can be observed in which, despite such evidence,
national planning authorities determine that need. elsewhere should command
priority. Such decisions can often be explained by the view that telecommunications investments, while profitable in a financial sense, confer direct benefits only upon a relatively narrow—and privileged—sector of the community. Such opinions, however, are usually based upon intuition rather than upon substantive analysis, and in fact the poorer the country, the greater the relative importance of government and business telecommunications needs. Clearly, the ultimate incidence of the benefits of such government and business usage cannot be determined by casual observation.

Any precise scientific allocation of funds between competing sectors in LDCs is, of course, precluded by the difficulty of measuring the benefits which stem from alternative investments. With regard to the telecommunications sector the solution to the benefit measurement problem does not appear to lie in the aggregate international comparison of input-output tables, or in the analysis of relationships between GNP and telephone availability or usage, although statistical measure of such relationships may have a useful descriptive role. 1/ Rather, it appears that there is no real alternative to a case-by-case microeconomic approach; in order to address the peculiar problems encountered by the telecommunications sector in achieving an optimum rate and mix of expansion, the economic and social benefits of investments in the sector require more detailed country-specific analysis than is usually given to them.

Problems of Benefit Measurement

Estimation within countries of the economic benefits of investments in the telecommunications sector has relied primarily upon two approaches. The first of these, involving conventional econometric demand analysis, attempts to isolate the response of subscribers to actual changes or variations in the price of the service they obtain. The other approach attempts to impute the demand curve for telecommunications services by direct observation of how and for what purpose telecommunications are used and what expenditures are actually incurred. Both approaches are used in attempts to quantify the "consumer surplus" arising from telecommunications investments, this concept being roughly defined as the difference between the value of service as perceived by a telephone user and the lesser measurable amount which he actually pays.

Conventional demand analysis. In view of the wealth of data on telephone prices and traffic, it is not surprising that numerous attempts have been made to apply standard econometric demand analysis to the problem of determining price elasticities, 2/ and by inference, the consumer surplus implicit in


various pricing schemes. Unfortunately, there are several reasons why such price-change or price-differential exercises tend to be unsuccessful. First, cross-sectional comparisons of price-consumption relationships can generally be ruled out on grounds of the nonhomogeneity of telephone calls and telephone users, since they are so location-specific. Time series analysis also has particular difficulties in an LDC context, and is usually rendered infeasible by (a) a history of unsatisfied demand which implies that telephone usage is dominated by service availability and quality considerations, and which often results in increases in price being accompanied by increases in telephone usage, since price increases often are introduced only after service quality has been improved; and (b) the presence of the large consumer surplus that is assumed to result from providing access to service to a person or community for the first time. These shortcomings are, of course, compounded by the general difficulties associated with making predictions from historical evidence, and by the fact that it is usually only feasible to attempt to estimate short-term elasticities. Long-term price elasticity is a more useful concept, but attempts at measurement are invariably swamped statistically by a large number of collinear variables.

Direct benefit measurement. Attempts have also been made to impute the demand curve for telephone service by estimation of the various forms of other expenditures which are associated with inadequate telecommunications facilities. Among these are the examination of cost savings when compared with alternative means of communication, the commercial losses resulting from inadequate communications facilities, the black market or other private market indicators of willingness to pay, and so on. 1/ In general it can be said that while such exercises may or may not be statistically valid for the particular comparisons which are being made, it is rare that this kind of information does much more than reinforce one's intuition that in LDCs there is indeed significant consumer surplus associated with the provision of telecommunications facilities. For example, the difference in the quality of service supplied by telecommunications as compared with alternative means of communication is usually so great that the value of generated traffic dominates the benefit calculation; cost saving therefore becomes a somewhat irrelevant concept. Studies showing the commercial benefits accruing to particular sectors of the economy, such as the benefits to tourism because hotel and airline bookings can be confirmed, are likely to be so sector-specific that economy and regionwide generalizations cannot be made. The same applies to the analysis of black market or private market indicators of willingness to pay; in addition, given the nature of such transactions, reliable data are hard to obtain.

Some Examples of Benefit Estimation

Some of the difficulties encountered in benefit identification and measurement are illustrated below in the context of efforts that have recently

been made in three different developing countries. The first example relates to a rural public call office program in a Latin American country. In this example, both conventional demand analysis (i.e., a price-change approach) and direct benefit estimation of alternative expenditures were used. The second example is from a Middle Eastern country where another variant of the alternative expenditure approach was tried. The third example is in a different Latin American country where a modification of the price-change approach is illustrated.

Rural public call office (PCO) program. Estimates of the consumer surplus resulting from calls made from rural PCOs in a Latin American country were found to vary widely depending on the estimation technique used and on the assumptions adopted. Estimates derived from a price-change approach (i.e., using conventional demand analysis) were based on measures of the short-run price elasticity of demand for rural PCO telephone calls. The elasticity estimate was based on observed changes in the quantity of calls attempted in a number of rural villages before and after a 25 percent tariff increase, and was found to be in the neighborhood of -0.5, i.e., a village which generated an average of 100 call impulses per day prior to the 25 percent increase in price, would generate approximately 87.5 pulses per day for the several months immediately following the price increase. Hence, before the price increase telephone users would have been willing to pay a price of at least 15 cents2/ for each of the first 87 pulses, but in fact, were being asked to pay a price of only 12 cents at that time. As a result, they had incurred a consumer surplus of at least 262.5 cents (3 x 87.5).

Given this, it can be concluded that the benefits which telephone users in the village derived each day from using the telephone were at least equal to (a) their revealed willingness to pay the market price (12 cents per pulse x 100 pulses = 1,200 cents), and (b) the consumer surplus of 262.5 cents which they received on the first 87 impulses. Hence, this price-change estimate of consumer surplus increases the measurable amount of rural telephone benefits by almost 22 percent. This is a conservative estimate for two reasons: (a) there is no reason to believe that total consumer surplus is captured for the first 87 impulses, and (b) there is no quantification of consumer surplus for calls between 87.5 and 100 impulses. Furthermore, since the price elasticity for only a small segment of the demand curve is estimated, no allowance is made for the fact that the demand curve probably becomes more inelastic the fewer the number of calls which are made.

The second approach used to examine consumer surplus for rural PCO usage was based upon the notion that people who live close to a PCO and make more use of it than those living further away obtain a consumer surplus for at least some portion of their calls. An estimate was made by analyzing the expenditures in terms of both time and transport that all telephone users incurred in traveling to a telephone, and then comparing the distribution of costs with the distribution of calls.

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1/ Although for purposes of confidentiality the countries must remain unnamed, the circumstances described and the data presented are thought to be factual.

2/ Cents are used for illustrative purposes only, and do not represent the actual unit of local currency.
Unfortunately, it was found that, even concentrating efforts on one small group of rural villages, the assumptions which had to be made were so arbitrary that there could be little confidence in the results of the analysis. Given data limitations no adequate means was found to control for the different employment, income and social characteristics of those living within and outside the villages: almost by definition there is a systematic bias built into the analysis. Further, there are uncertainties in determining the value of time required to journey to make a phone call, and in sorting out the multiple purposes of some of the trips during which a call was made.

Table 1 summarizes the results of the consumer surplus exercises which were carried out for one of the villages. Two estimates for the direct benefit-expenditure approach are presented and are based on two different sets of assumptions, which are noted in the table. The estimates of consumer surplus are seen to be highly sensitive to the assumptions made, and as a result there is little reason to have confidence in the overall accuracy of the outcome. The implication is that if the results of this kind of exercise, which analyzes in depth small, reasonably homogenous communities, are unreliable, such an approach used to evaluate a regional or national telecommunications program serving a vast array of different industrial, commercial, government and residential users, is even less likely to succeed.

A Middle Eastern country. An exercise carried out for a national telecommunications project in a Middle Eastern country made use of a variant of the expenditure approach, although this time unrelated to travel costs. This exercise was based on the fact that some telephone subscribers were incurring higher costs for telephone service than were revealed in official telephone tariff schedules. These additional costs were of two types corresponding both to call charges and monthly rentals.

Official call charges underestimated the actual costs of making calls since, given a high percentage of call failures and interruptions, peak period delays while waiting for dial tones, and the necessity to repeat sentences because of noise on the line, the otherwise productive time of employed persons was wasted when attempting to make a telephone call. An estimate of the value of that wasted time was made using the following assumptions. (a) The average working urban caller earned a wage equal to an estimated $6.00 per week in 1976,1/ and assuming he works an average of 45 hours per week, his time is worth approximately $0.00222 per working minute. (b) The average time spent during business hours waiting for a dial tone and trying to make a call which, for technical or traffic congestion reasons is unsuccessful, (or for recalling when the connection terminates in mid conversation) is at least 1.5 minutes per unsuccessful call attempt. (c) Ninety-five percent of all calls made during business hours are business or government related.

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1/ Based on available information this was considered to be a conservative estimate. The currency units are expressed in $'s for presentational purposes only.
Table 1: THREE ALTERNATIVE ESTIMATES OF RURAL TELEPHONE CONSUMER SURPLUS FOR A VILLAGE IN A LATIN AMERICAN COUNTRY

<table>
<thead>
<tr>
<th></th>
<th>Expenditure Method</th>
<th>Expenditure Method</th>
<th>Price-Change Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High Estimate</td>
<td>Low Estimate</td>
<td></td>
</tr>
<tr>
<td>(Currency)</td>
<td></td>
<td>(Currency)</td>
<td></td>
</tr>
<tr>
<td>(1) Average call charge</td>
<td>4.41</td>
<td>4.41</td>
<td>-</td>
</tr>
<tr>
<td>(2) Average transportation cost per call(^a)/</td>
<td>19.02</td>
<td>2.54</td>
<td>-</td>
</tr>
<tr>
<td>(3) Average travel time in hours</td>
<td>.59</td>
<td>.59</td>
<td>-</td>
</tr>
<tr>
<td>(4) Average monthly income of caller</td>
<td>422.90</td>
<td>422.90</td>
<td>-</td>
</tr>
<tr>
<td>(5) Average number of hours worked during a week</td>
<td>39.31</td>
<td>39.31</td>
<td>-</td>
</tr>
<tr>
<td>(6) Opportunity cost of time(^b)/</td>
<td>1.51</td>
<td>.38</td>
<td>-</td>
</tr>
<tr>
<td>(7) Consumer surplus per call(^c)/</td>
<td>20.53</td>
<td>2.92</td>
<td>-</td>
</tr>
<tr>
<td>(8) Ratio of consumer surplus per call to average call charge</td>
<td>4.65</td>
<td>.66</td>
<td>.22</td>
</tr>
</tbody>
</table>

\(^a\)/ Of the 404 calls used to tabulate the information in this table, only 54 of the callers were able to offer information on transportation costs. It was therefore assumed that for the high estimate transportation costs for the missing observations are equal to the average of those responding, and for the low estimate it was assumed that the nonrespondents incurred zero transportation cost.

\(^b\)/ For the high estimate it was assumed that the value of time for all callers was equal to the average income for that time in the village, i.e.,

\[
(6) = (3) \times (4)/[(5) \times 4.2].
\]

For the low estimate it was assumed that many of the calls were made during periods when real resource costs in terms of time were minimal and therefore the low estimate was arbitrarily set equal to one-fourth of the high estimate.

\(^c\)/ \((7) = (2) + (6)\)

\(^d\)/ Units of local currency.
Given these assumptions, which were thought to reasonably reflect the situation in the country, and the facts that (a) unsuccessful calls due to technical faults or traffic congestion during prime business hours were estimated to be approximately 75 percent of all local call attempts made in the capital city and 55 percent in the second largest city; (b) that approximately 1,820,000 and 560,000 calls are completed respectively in the two cities during the six peak hours per working day when networks are highly congested; and (c) that an unsuccessful call attempt rate during peak business hours of 25 percent would be considered good; an estimate was made of the value of time wasted through unsuccessful local call attempts in the two cities. Reliable estimates were not available for the proportion of unsuccessful calls in other cities, or for the long distance network, so no attempt was made to quantify the total national consumer willingness to incur the costs of time wasted trying to make telephone calls.

A second attempt to estimate a portion of consumer surplus reflected the fact that some telephone consumers in the country also revealed a willingness to incur a telephone-related cost greater than that reflected in the official telephone tariff schedule by paying higher monthly rental charges, or incurring higher costs each month just to have a telephone. Local businessmen and middle- and upper-income foreigners sometimes obtained telephones by renting furnished offices or residences in which, legally, the telephone could be transferred as one of the furnishings. It was common in local newspapers to see apartment or office advertisements in which one of the few prominent attributes listed was the presence of a telephone.

Estimates of the extent of the monthly rent differentials for representative offices and apartments which were identical except for the existence of a telephone showed a range of between $50 and $150 per month. These estimates were somewhat imprecise due partly to the variety of other factors involved in finding identical facilities, and partly due to sampling problems. It was also found that rental facilities which had a telephone that was only one of several extensions on one line, or rental facilities located in areas with very high daytime telephone traffic congestion tended to command less of a premium than facilities with private or semiprivate lines, or in exchange areas where congestion is less of a problem. It was further observed that the larger and more luxurious apartments or business offices tended to command the largest telephone rental premiums since presumably higher-income businessmen and larger business firms with their more complex communication problems tend to categorize a telephone as more of a necessity. Given these findings, an estimate of consumer surplus for the monthly rental of a telephone was made using the following assumptions:

(a) the demand curve for telephone rentals is downward sloping and is shaped in such a way that a relatively small proportion of the total population is effectively willing to pay high monthly rentals for telephone service ($50), while the majority of population would be effectively willing to pay only much lower telephone rental charges; as such the demand curve is represented as being convex to the origin of the price and quantity axis; mathematically, the demand curve was specified as a rectangular hyperbola with an elasticity of minus one which is thought to be a conservative estimate;
(b) two points on that demand curve are--4,000 telephones (less than one percent of total connections) at a price of $51.50 per month (the official rental fee for automatic message rate exchanges of $1.50 per month plus $50 representing a typical rent differential payment) \(^1\) and 745,000 telephones (the approximate number of telephones at the end of 1976 plus the number of people on the official waiting list requesting to be allowed to pay at least $1.50 per month for the presence of a telephone) at the most common official rental price of $1.50 per month.

Computing the area under the demand curve above a monthly price of $1.50 and below a monthly price of $51.50 and between the quantities zero and 745,000 telephones, and dividing by total telephones, gives an average of $4.21 per telephone per month, or $50.52 per telephone per year. Hence, for purposes of benefit estimation, the value of renting a telephone may be taken to be an average of $50.52 per year more than the average rental actually paid to the telephone company. \(^2\)

Given the above estimate of (a) part of the costs incurred in making a telephone call which consumers willingly pay (official call charge plus time wasted), and (b) the yearly value of having a telephone connection (average monthly telephone rental charge plus estimate of rent differential consumer surplus) based on the observed willingness of consumers to pay, a new stream of project benefits was estimated. Using this revised benefits stream and the stream of project costs appropriately shadow priced, the economic rate of return on the project was estimated to be a minimum of 23 percent as compared with the initial internal financial rate of return on the project of 10 percent. \(^3\)

A Latin American country. The third consumer surplus exercise demonstrates a variant of the price-change approach. In this case real telephone tariffs have fallen through time. In the Latin American country involved, there were long waiting lists of potential telephone subscribers, and because telephone tariffs remained unchanged during a period of general price inflation, consumers had in the recent past been asked to pay considerably higher prices in real terms for telecommunications services, and had demonstrated a willingness to do so. Thus, a partial estimate of consumer surplus could be made by tabulating the prices in real terms which existing consumers had actually demonstrated a willingness to pay at the time in the past when they acquired telephone service,

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\(^1\) The $50 per month rent differential was considered to be reasonably representative for modest one- or two-bedroom second- or third-floor walk-up apartments or offices with three-party lines occupied by visiting or expatriate businessmen and upper-middle income local businessmen.

\(^2\) If the demand curve for telephone rentals was assumed to be linear instead of convex to the origin, the consumer surplus per telephone would be $25.13 per month or $301.56 per year.

\(^3\) Ten percent was the initial rate of return on the project at the time of appraisal. However, before the new investment program was commenced, substantial tariff increases were implemented.
and by assuming that in this constrained supply situation new consumers will be
similar to the average existing consumer. Since the rate of increase in the
national telecommunications investment program roughly corresponded to the
increase in per capita GNP, the assumption that new telephone subscribers will
have similar characteristics to existing ones was considered to be acceptable.

In this country, with one minor exception, telecommunications tariffs
had not changed since 1964. Over the 1964-77 period, however, domestic consumer
price inflation of approximately 80 percent had taken place. As a result, those
subscribers who were connected in 1964 had demonstrated in real terms that they
were willing to pay at least 80 percent more for a lower quality and more limited
access telephone service than current subscribers were being asked to pay. To
estimate the prices in real terms which all existing telephone subscribers had
demonstrated a willingness to pay during the period between 1964 and 1977, the
average price paid in real terms, and the quantity of services supplied was
taken to represent a point on the telecommunications supply curve at the end of
each year. As such it reflected a point somewhat below the demand curves which
existed in the past since even at the higher historic real tariff levels, excess
demand (waiting lists and traffic congestion) existed at each past point in time.
Given the historic real price-quantity tabulations, a weighted average price
which was paid by present consumers at the point in time when they joined the
network was calculated. Given the assumptions that new subscribers also would
be willing to pay (in terms of 1977 prices) what present subscribers have in
the past on average demonstrated a willingness to pay, the quantifiable rate of
return on the program was 36 percent. In contrast, the initial internal financial
rate of return in the absence of the consumer surplus exercise was estimated
at 16 percent. It should be noted that these rates do not explicitly take
into account the fact that newer subscribers receive a better quality of service
(less traffic congestion and noise) and an improved quantity of service (a much
larger number of connected subscribers who can be contacted by telephone) than
did existing subscribers when they joined the network.

Necessary Supplemental Analysis

The foregoing examples illustrate some of the approaches and the
accompanying difficulties of evaluating a portion of the economic benefits of
telecommunications programs as perceived by the beneficiaries. Even if we
could accurately estimate such benefits, however, this would only solve part of
the problem, for particularly in LDCs the willingness to pay of individual sub-
scribers may not be indicative of the true economic benefits to society that
may result. For example, the introduction of a PCO in an area in which there
is a large rural unemployment may facilitate improved marketing by several
farmers; this in turn may lead to increased employment, and a local multiplier
effect that creates net benefits far in excess of the value of service as per-
ceived by the few telephone users. Analysis of such effects is extremely com-
plex: even in areas in which one would suppose the impact of investments would
be more dramatic, such as rural electrification, we know of no case in which
multiplier effects have been successfully quantified.1/

1/ For an in depth analysis of a particular case see, Dennis Anderson, Costs and
Benefits of Rural Electrification - A Case Study in El Salvador, RES 5, Energy,
Another problem, of course, is that many of the goals of telecommunications programs are not subject to quantification in economic or monetary terms. In instances such as these, it is necessary to supplement the financial and economic analysis by collecting qualitative or descriptive information about telephone users and telephone usage. Such information can be used to verify if the project is reaching the high-priority target groups and if the investment is being used for government program-specific purposes such as promoting regional health clinics; facilitating the provision of basic needs by water supply and nutrition agencies; assisting emergency and security programs; helping to foster national unity; etc. Several countries have begun to undertake surveys designed to provide such information and the results in many cases are surprisingly similar. For example, Table 2 shows highly summarized results of three surveys taken in countries which are thousands of miles distant from one another.

Table 2: REASONS FOR PCO TELEPHONE USAGE

<table>
<thead>
<tr>
<th>Purpose of Call</th>
<th>Calls at Village or Small Town Public Call Office</th>
<th>Subscriber Application for Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>South Asian Country /a</td>
<td>Latin American Country</td>
</tr>
<tr>
<td></td>
<td>(percent)</td>
<td>(percent)</td>
</tr>
<tr>
<td>Emergency, health</td>
<td>5 /c</td>
<td>6</td>
</tr>
<tr>
<td>Business, agriculture, public service</td>
<td>72.5</td>
<td>36</td>
</tr>
<tr>
<td>Maintain contact with relatives or friends</td>
<td>22.5</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

/a Data for the South Asian Country are for the most recent call made by users of the PCO. The towns in which the sample PCOs in this country were located generally had a population of over 5,000 and are therefore considerably larger than the PCO towns and villages in the other two countries for which data are presented.

/b Data are only for the 82 percent of the sample group which responded to the survey.

/c Emergencies only.

The first three columns show the reasons for calls made at public call offices. In all instances emergency or health-related calls were a surprisingly high five to six percent. The relatively high usage of PCOs for business and public service purposes in the South Asian Country is probably due to the fact
that the sample towns there were quite large, usually exceeding 5,000 in population, and as such these towns presumably had a relatively large group of commercial and government administrative interests which, of course, had no access to subscriber telephones. A comparison of columns 3 and 4 is also illuminating. In the Melanesian country, while only five percent of PCO calls were for emergency reasons, 22 percent of those survey respondents registering on telephone subscriber waiting lists stated that the reason they wanted a telephone was so that they could make emergency calls. A reasonable interpretation of this is that the consumer surplus (or value) associated with emergency, and to a lesser extent, business calls, is much higher than that associated with calls to relatives or friends even though in the Melanesian and Latin American countries, calls to relatives and friends are the ones most frequently made.

The Feedback to Pricing Policy

A characteristic of telecommunications facilities in LDCs is a massive backlog in unsatisfied demand reflected in large waiting lists for service and extensive business hour traffic congestion. In contrast, in most developed countries telecommunications services are supplied within a reasonably short time to anyone who is willing to pay some publicly regulated average of the financial costs of connection and calls. In the developed-country case, the problems of achieving an efficient telecommunications pricing and investment policy are well known. Hence, the application of marginal cost pricing, which works reasonably well for other utilities such as electric power or water supply, is rather complicated for telephone systems. Two major problems are the financial losses which in many cases would result from setting price equal to marginal system cost, and the presence of external benefits arising either from connections to a network or from actual calls, which implies that marginal social cost (the theoretical basis for pricing) is unknown, but, if it were, would probably point to a price somewhat less than marginal system cost.

Fortunately, in developed countries where the supply of telecommunications services roughly equals demand, it is possible to reconcile theory with practice in that a two-part tariff can be devised which is a reasonable compromise between financial and economic efficiency objectives; one possibility being a fixed monthly charge that does not vary with telephone usage plus a charge per call equal to marginal system cost. To some extent the externality problem is reduced by virtue of the fact that other forms of communication have similar characteristics, e.g., the recipient of letters does not pay; face-to-face communication is usually at the expense of the traveler, and so on. Hence, "second best" theory suggests that in determining optimal pricing of telecommunications services the externality issue is less dominant than generally believed; marginal system cost is therefore a reasonable compromise for pricing.\^1

In developing countries the presence of daytime traffic congestion and waiting lists suggests that the marginal opportunity cost (in terms of frustrating the demands of others) of making calls or being connected to the network is in excess of the marginal system cost of so doing. In such an instance, where at existing prices, demand for service exceeds the available supply, the choice lies between rationing by price, by some conscious administrative device, or simply by default. In most LDCs, existing administrative forms of rationing, such as attribution of priority to certain selected groups, tend to be arbitrary and cumbersome, and they invite management irregularities. Even such an apparently nondiscriminatory form of rationing as queuing, or meeting demands in order of application, usually is too rigid to allow an economy with any degree of dynamism to function efficiently. On the other hand, the use of price to help allocate the limited supply of telecommunications services has the critical advantage of leaving the decision as to the importance of telecommunications service relative to other goods and services in the hands of the beneficiaries themselves, and it helps encourage highly valued uses of telecommunications to replace those that are relatively less valuable to beneficiaries.

The externality problem also seems to be less important in the developing-country context. With certain exceptions, it seems to be a reasonable assumption that for most uses of telephones, there is a close direct correlation between the value placed upon subscriber connection to a network by an individual or firm and the magnitude of the external benefits that result, so that a market clearing pricing policy for connection and rental allocates priorities fairly efficiently. Further, since in the short term there are many instances where excess demand exists, there seems to be no feasible alternative to price rationing (including peak period call charge pricing) in attempting to deal with daytime traffic congestion. Finally, in many developing countries where the shadow value of public sector funds is greater than one, an additional advantage of raising price to ration demand for telephone services is that it mobilizes financial resources which can either be used for expansion of the telephone system in both rural and urban areas or, should such expansion still be artificially limited through government policy, the revenue can be utilized for general government purposes.

Clearly, however, just as benefit analysis should in principle go beyond the concept of value of service as perceived by the subscriber, price rationing is not a panacea. Hence, there are a number of cases in which exceptions to the high entry fee or monthly rental may be required; education, health, police, and other emergency services could be favored with lower connection fees and rentals, and possibly on income distributional or regional development grounds, higher system connection fees and rentals might be set for the larger cities than for smaller towns and rural communities. Subsidization of public call offices, wherever they are located, might also be justified. This, of course, is currently done in several countries which have instituted significant subscriber connection fee requirements.

Implications for Project Evaluation

Analysis of pricing policy for telecommunications in LDCs should be conducted in a very different way from the traditional public utility approach
employed in a developed country. Generally, there are four levels or stages of tariff policy analysis.

(1) The financial approach, some variant of which is typically used in developed countries, in which the objective is to assure the financial viability of the utility with as little political trouble as possible. It implies, inter alia, charging prices significantly higher than costs to allegedly higher value uses such as business and long distance calls.

(2) A slightly broader approach, which is not inconsistent with the above, which uses utility financial viability as a constraint, but in the interest of economic efficiency seeks where possible to equate prices with marginal system cost. This is probably sufficient for most purposes in a developed-country context.

(3) A still broader approach, which applies where there is unsatisfied demand. The financial viability of the telecommunications entity remains a constraint, but price is equated to a rough market clearing price estimate of marginal social cost, e.g., reflecting congestion costs in call charges and excess demand for connections.

(4) The fourth approach, which specifically analyzes the scope for divergence between price and identifiable marginal social cost in order to achieve a number of national development objectives, or to be consistent with a number of publicly ordained constraints.

While stage four is obviously the one which is the key to realizing the full potential of telecommunications investment in LDCs for achieving broader government goals such as rural or regional development, telephone pricing and investment policies and national government investment policies are rarely analyzed together. Those concerned with rural or regional development or agricultural extension issues generally focus on a cost-benefit approach in which somewhat arbitrary estimates (both qualitative and quantitative) of expected benefits are derived. In turn telecommunications pricing and investment policy is largely dictated by traditional utility financial criteria.

In practice a broader approach is needed. As a minimum in developing countries, national decision makers should attempt to be aware of the economic costs of all feasible alternative courses of action. For telecommunications, this implies the use of shadow values in costing increments to systems and attempting to estimate the economic and social costs of congestion, unsatisfied demand, and inadequate penetration into rural or provincial areas. These costs should then be weighed against the perceived economic and social benefits which a feasible investment program would be expected to generate. Such benefits should include the shadow-priced value of public sector funds which might be generated by using telecommunications tariffs to ration limited capacity.
The most useful evidence that the decision maker will usually have at his disposal will be observations of subscriber willingness to pay, supplemented by qualitative information about subscriber and PCO user characteristics and system usage. Systematic generation of this type of data is clearly required. The first step is on the pricing side where efforts should be made to derive a tariff structure reflecting economic and social costs which will force subscribers to make their preferences known. At the same time, telecommunications authorities should endeavor to learn more about the nature of telecommunications usage, the characteristics and communications needs of existing and potential users, and the specific government objectives and programs which telecommunications can most efficiently serve.

It is our view that the result of a stage four type of analysis in those developing countries in which there are large telephone waiting lists and system traffic congestion during daytime business hours will be to point to a pricing and investment strategy which includes relatively high connection fees and monthly rentals for urban area subscribers, and accompanying high busy hour call charges. The resulting increase in revenue could assist in financing increased expansion of subscriber telephones in urban areas, and help finance a significant "public access" program designed to provide public call offices in urban slums, unserved towns, and remote provincial villages. Additionally, if government priorities dictate, some of the surplus revenue might be made available to government for general expenditure purposes. Of course it is of major importance that the departure from a strict market test which this strategy suggests should be justified by extensive supplementary qualitative analysis.

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1/ Ideally, monthly rentals should be the primary means for attempting to allocate telephones to high value users since rentals can influence existing subscribers as well as new ones. Politically, however, it is usually much easier to increase access charges to those who are demanding connections, than rental charges to those who already have service.