Some Tasks of the IBTE

Paper read by Mr. Herman Ruud, General Manager of the Imperial Board of Telecommunications of Ethiopia, at the Meeting of the Assomiation held on November 6, 1964.

BACKGROUND

One of the interesting aspects of telecommunications in addition to the technique applied is the development of the demand, as this reflects with great fidelity the changes in the human living circumstances at large, during the same periods of time.

This year we can celebrate the 70th anniversary of telecommunications in Ethiopia. When Emperor Menelik in 1894 ordered the establishment of a telephone line between Harrar and Entotto, the main purpose might have been to check the administration of the recently reconquered town of Harrar. A decade later came the desire to be able to send news telegrams abroad and the corresponding facilities were installed.

To-day most of the members of the Association have a telephone at home, by means of which we may be desirous to speak to our relatives or friends in another part of Addis Ababa or in another town or in another country or in another continent even and, preferably, without delay. The greatest users to-day are, however, not the persons who speak to friends, but the business-men and the pressmen who make telephone calls, send telegrams, telex messages, etc.

Another use of telecommunications, which has developed enormously during the last twenty years all over the world, is the radio for broadcasting of sound and television programmes to the public at large. For sure, these services will develop also in Ethiopia at a very rapid pace.

Telecommunications in various appearances form such an integrated part of our modern community that their being and function is a must. Together with road and some other facilities telecommunications make the infrastructure for the development of the country.

Its importance from that aspect was realized by the Imperial Government in the very hard way, as the shortage of facilities became a great hamper in the efforts to reconstruct the country after the period of wars. Due to shortage of funds and specialists, not very much could be achieved during the 1940's.

After surveys by officials of the International Bank and by specialists from the ITT concern and after lengthy discussions, the Imperial Board of Telecommunications of Ethiopia was instituted by a Proclamation at the end of 1952.

MAIN FEATURES OF THE IBTE

The Board assumed its responsibilities as from January 1, 1953. Its Charter is an interesting document and I will therefore devote a few minutes to it.

The main features are the following:

The Board was established in cooperation between the Imperial Government and the International Bank for Reconstruction and Development.

It was established as a separate entity with the tasks to improve, maintain and extend the telecommunication facilities.

It was given the monopoly right to handle all national and international matters concerning telecommunications, including the issue of regulations with legal force.

It was instructed to work on a profit basis thereby generating funds needed for extension.

It is a share company, with all shares owned by the Government.

It is led by a Board of Directors for all policy decisions with a General Manager as the Chief Executive.

The Board tries to take its right of monopoly more as a responsibility and an obligation than mere right; this responsibility and obligation promotes a sound and orderly development and use of telecommunication in the interest of the Government and of the public, even though this might sometimes seem to conflict with the interests of individuals, at least on a short term basis.

When empowered with right to issue regulations and at the same time charged with the obligation to operate on profit, one could think that the Board might have been tempted to fix very high rates. On its policy the Board has, however, not followed that

line. It does believe that high rates would not promote a rapid development of the public's use of the services and would therefore not foster a telecommunication-minded public. In the long run high rates would, therefore, not have been in the interest either of the country in general or of the Board in particular. The Board's rates have thus been fixed on a relatively moderate level as compared to most countries.

The obligations to operate on profit might also have induced the Board to concentrate on such services which are directly profit-making.

The obligation to operate on profit might also vices which are direcly profit-making. In this respect the Board has also shouldered its responsibility towards the country by estblishing many facilities which are run either at a loss or where the income barely covers the cost, the need of the facilities in quction for the country's development being our jusification. Of course we hope that as such a facility is integrated in the development of a certain sector, it would in time give a reasonable return. It goes, however, without saying that until such a time comes, not only the investment cost but also the operation cost has to be taken from the profit of other services. Not too many facilities of "low-return" services can thus be esatbilshed without making the rates of the "good-return" services exorbitant and prohibitive.

I would not like to tire you with too many figures but would just indicate here that the profit has been steadily increasing throughout the years as could be gathered from the fact that the Board operated at a loss of about a quarter of a million Ethiopian dollars during the first year as compared to a net return of just above 2 million during 1963. The latter figure corresponds approx. to 10% return on net fixed assets and 8% return on net worth; these figures are reasonable.

The capital stock of the Board is Eth. $ 7.71 million. In addition Eth. $ 8.7 million worth of assets was transferred to the Board from the Ministry of Posts, Telegraphs and Telephones at the inception of the Board. Another net value of Eth. $ 8.4 million has been generated by the Board as fund for expansion. This has, however, not sufficed and in order to im prove the situation somewhat, the Board has taken a loan of Eth. $ 7¼ million in 1962.

The main tasks during the first year of the Board's existence were to rehabilitate the existing facilities, to make detailed specifications for initial extensions, to make a programme for the training of Ethiopian staff and to establish rates and administrative regulations and procedures.

The initial investments comprised automatic exchanges in Addis Ababa subscriber network, radio facilities, some rural exchanges and various vehicles and other auxiliaries. They were mainly completed in the middle of 1956.

The training was performed by our Training Institute, which was established in the middle of 1953 with the assistance of the International Telecommunications Union (ITU). Under the auspices of the United Nations Technical Assistance, the ITU has supplied the Director of the Institute and one or two specialist teachers since then. Our Training Institute is considered one of the most successful undertakings of this kind in which the ITU has been engaged.

Approximately 100 courses have so far been given with a total participation of some 2,400 students. The courses have covered around 9,000 student - months.

INVESTMENTS

As to investments, much work was carried out from 1953 up to the end of 1956. Then the activities were slowed down, until the end of 1961, and the reason for this was mainly shortage of funds and a consequential uncertainty as to how the meagre funds available should best be utilized. Anyhow, some significant items from that period may be mentioned, such as the radio station of the coast of Assab for communication with ships at sea, the telephone line between Modjo and Dilla, etc.

In 1962 investment activity on a large scale basis started again. A programme of Eth. $ 15 million was prepared and comprised the following:

Increase of the automatic exchanges in Addis Ababa.

New automatic exchanges in Asmara, Dire Dawa and Dessie.

Increase of the cable network for some 6,000 subscribers and installations for some 4,000 new subscribers.

Construction of 2,000 km. of new pole lines and reconstruction of 1,600 km. old pole lines.

Interurban cable Addis Ababa - Debre Zeit.

About 10 carrier systems of 12 channels and 10 of 3 channels.

Two 30 kW ISB transmitters and about 10 lower power ISB transmitters plus receiver, antenna, etc.

Various equipment for telex, telephoto and for error correction on telegraph circuits.

About 1 million dollars worth of buildings and slightly less for motor-vehicles.

The programme contained such an amount of new facilities that a more systematic approach to the problems of implementation was desirable and even necessary. I would like to refer here to some of the administrative and technical measures taken.

The main issues on the administrative side were

the improvements in the organizational set-up and in the project planning procedure.

At this occasion, the technical considerations may be of greater interest and therefore I would like to deal with them somewhat more elaborately. Just *on passant* I would, however, like to state that according to my opinion a fault which is often made by engineers is to underrate the importance of good and well regulated administration and of the regulation of the utilization of technical facilities.

The greater portion of our investment funds are spent on the extension of the telephone network. Among its various constituents one can distinguish the following:

Firstly, the subscriber installations, the local cables etc., and the urban exchanges.

The three we characterize as the urban network.

Secondly, we have the interurban network consisting of: pole lines, multichannel carrier systems, radio facilities, interurban exchange, etc.

If we first look at the subscriber installations, we offer an abundance of variations from normal single apparatus to very complicated branch-exchanges with hundreds of extensions. The variations offered satisfy normally the demand, and additional types are asked for in exceptional cases only.

Due to the fact that we have to keep spare parts and trained maintenance staff for all our facilities, we have to restrict ourselves somewhat as to the types we can offer.

In order to increase the quality of installations, we have devoted much work to improvements hy the standardization of material and procedures and by schooling of our staff. For bigger houses, intended for offices, apartments, etc., we have introduced a system of ducts and tubes, through which the cables can be pulled and thus less destruction and disturbance caused. For the application of such a system we co-operate with the designers at an early stage, and such co-operation is normally very good benefitting all parties involved.

Cable network extension in Addis Ababa is a very difficult task, mainly due to the fact that the city is very extended, having a low figure of actual or prospective telephone subscribers per km^2 and, above all, due to the difficulty to fix detailed plans for the near-future and the long-term utilization of the city area. One must remember that for the purpose of telephone, one pair of wires is needed for each subscriber, all the way from the telephone apparatus and up to the exchange. In order to economize, the pairs are taken together to cables of various sizes on the greater part of the route; thicker near the exchange and narrower further out. To increase the flexibility, cabinets with termination arrangements are used at some of the branching points.

The attenuation of an audio signal increases with the length of the transmission medium and decreases as the area of the wires increase. These characteristics are taken care of in such a way that thinner wires can be used for subscribers close to the station than for more remote subscribers. The price of a cable is very substantial and varies more or less directly with the amount of copper used. It is therefore possible to make substantial economizing by the arrangements described, but it requires careful planning and would have been much eased if plans of the city's development were known in detail at an early stage.

Because of the circumstances described we have often to lay down new cables and we have often to cut the pavement of the streets of Addis Ababa. It is true that during the last years a great extension of our cable facilities has been made, due to our desire to satisfy the extended demand and to clean the central parts from pole lines thereby contributing to the city's embellishment. For main streets that will be stabilized, for instance for the new Churchill Road, we are going to put in ducts so that future extensions may be made without excavation works. Such ducts are, however, very costly and can therefore, be used only to a limited extent.

Earlier, the last part of the distribution network up to the subsrriber's house was, to a large extent, made by open-wires of bronze or iron. This is mostly abolished to-day in favour of self-supporting, neoprene insulated cables. In the same way, the advantages of modern material are considered in all fields of our work.

The reference to the network of Addis Ababa, as described above, applies also to the network of other cities and towns of Ethiopia.

The automatic exchanges are rather expensive gadgets, between 200 and 300 $ per subscriber including the necessary premises, etc. It is therefore of importance that the planning is made carefully. We have devoted much time to this problem, to get equipment which is long-lasting, versatile and demanding little maintenance only. Even though the components are simple, the machinery of an automatic exchange is very complicated and there are often possibilities to economize and improve by adapting to local traffic demand and to other local circumstances.

In 1953, when the Board took over telecommunication tasks, Addis Ababa was served by an old exchange of 1,500 numbers capacity, but it was so poorly functioning that it had to be taken out of traffic and be replaced by a manual exchange until new automatic exchanges could be installed in 1955

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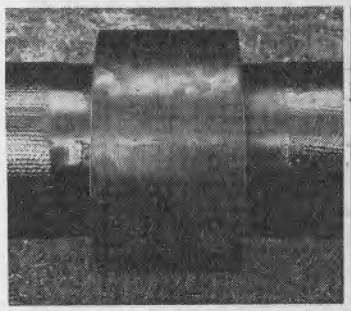
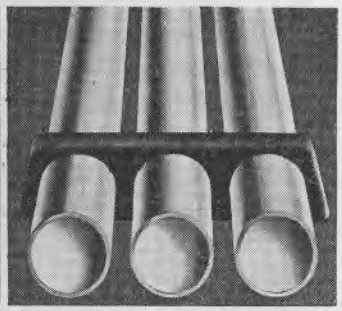
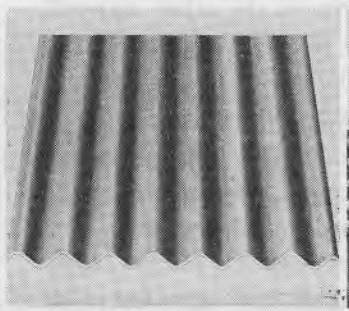
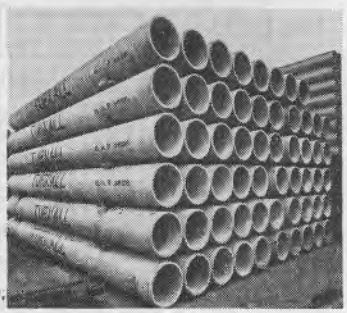

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and 1956. The new ones had initially a total capacity of 3,000 numbers. To-day the Addis Ababa exchange can connect more than 10,000 subscribers and after about two and a half years the number will have increased to about 20,000.

In Asmara the old 1,500 number exchange was replaced in the beginning of this year by a modern one of 3,000 numbers. The demand is, however, great and already during next year we have to increase the capacity of that exchange.

These days we start the installation of an automatic exchange in Dire Dawa and thereafter will follow Dessie, Nazareth, Massawa, etc.

The number of subscriber's apparatuses was about 4,500 all over the country in 1953 and to-day it is around 20,000.

In 1953 there were only 10 so called "private branch exchanges" with altogether 188 extensions. To-day, there are 260 such facilities with some 5,000 extensions.

Except for a recently installed 60-pair cable between Addis Ababa and Debre Zeit, the two systems we use for connection between different towns and villages are pole-lines and radio circuits. The pole-lines are rather expensive, from Eth. $ 1.— and upwards per meter, but they are more reliable than radio circuits and they function 24 hours a day.

A radio circuit is relatively cheap to install. It has, however, limitations in that its performance is depending on atmospheric conditions, on interference from other transmissions, etc., and it is expensive to operate due to the greater need of qualified staff. In general, radio circuits are therefore used for remote stations, especially where roads are missing, whereas pole lines are used as the central backbone of our network, with spurs to many outlying places.

The pole-line network has been extended substantially during the last few years. About 2500 km of new line have been constructed since the beginning of 1962. Thereby connections have been provided for such places as Assab, Asbe Teferi, Wollamo-Soddo, Kibre Mengist, Juhur, Bonga and many more. In addition, reconstruction of almost 2,000 km of lines has been carried out during the same time.

Before such a heavy programme was launched, careful method-study and planning had to be made. Some of the problems taken up were the following:

What sort of poles should be used? What sort of wire should be used? How should the wires be spaced and arranged?

Should the construction be made by own staff or by contractors?

About the poles, the main competition was between imported steel poles and local wooden poles. If wooden poles should be used, they had first to be impregnated to protect them from rotting and from attack by termites which are available in abundance in most parts of the country, at least where our lines were built and are to be built. Calculations showed that an impregnated wooden pole would cost between 6 and 10 dollars, whereas a steel pole draws 10 times that price. After having considered that a woden pole may have to be changed 2 or maximum 3 times during the life of a steel pole, and also the different capital costs of the two, we came to the definite conclusion that well impregnated eucalyptus poles are as a rule more favourable than steel poles.

As to the wire we considered mainly 3mm copper or bronze wire versus a composite wire of the same diameter having a steel core, surrounded by a copper layer, constituting the main conductor. The composite wire is somewhat more expensive but we use that one on the main routes, because the attenuation for higher frequencies is lower than for the copper wire. A contributing reason was that it is stronger and also more difficult to steal. For secondary routes copper wire is more favourable.

After lengthy discussions on pole distance and method of transposition we standardized on 50 metres distance in case of both long lines and short routes and on point transposition system J2 on most routes.

One means to economize on the pole lines is to utilize them for multi-channel transmission by means of super-imposed carrier systems. We use systems having 12,3 and 1 channel capacity. For distances of more than a few ten's of kms the multiplexing and transmission devices of carrier systems are cheaper than the corresponding number of pairs of open wire. Thus it is very economic to use carrier systems on the longer routes. The disadvantages are that the lines have to be kept in better repair than in case of audio transmission and that several circuits disappear if one wire is out for some reason or other.

Lately, stackable, so called rural carrier systems have been developed by means of which it is possible to drop channels at various stations as the need may be. We have been installing such systems on the Shashamenne-Dilla and Nazareth-Asella routes but so far our experience has been rather mixed and therefore it is too early to say if that should be introduced on a larger scale or not.

In the field of radio telephony great improvements have been made by the installations of single-sideband and independent side-band facilities, that is transmission with suppressed carrier. For the same signal to noise ratio, such transmissions are cheaper to operate than double side-band transmissions. Also they involve such in improved efficiency in the utili-

cation of the frequency spectrum, that the International Telecommunication Union has recommended to abolish all double side-band point-to-point HF (short wave) transmission by 1970.

Radio telephony is more tricky to run than line transmission. The former is affected by changes of atmospheric conditions, i.e. by the regular variation dependent on the hours of the day, on the season of the year and on the faces of the sunspot cycle and the irregular variations dependent on circumstances which are not sufficiently known. Furthermore the crowdedness of the frequency spectrum speaks in favour of line transmission. The main use of radio telephony is for stations far away from the central road network and for foreign countries. For the international transmissions two 50 kW and one 20 kW ISB transmitters were installed last year which together with corresponding improvements on the receiver side meant not only an extended capacity but also a substantial improvement of the average quality of the circuits.

Turning to the telegraph, the most significant improvement in addition to betterment of radio transmission and receiving facilities, is the introduction of equipment for automatic error correction on telegram circuit. This equipment is of a very complicated and remarkable design.

The basis is a space-mark alphabet of such a constitution that all signs have a certain volume criterion in common. As soon as a sign received deviates from that criterion, a repetition is immediately and automatically asked for from the sending end by equipment at the receiving end.

The original materials were mechanical and extremely difficult to handle. Nowadays electronic apparatuses are mostly used, and the ones we have installed, have transistors instead of vacuum tubes; thereby the reliability of operation is much improved.

The error correction equipment we use has another interesting feature. By means of this equipment it is possible to transmit either one full speed channel or two half speed independent channels or four quarter speed independent channels. All these channels may be used for quite different purposes.

We have thus been able to introduce:

(i) teleprinter operation of high quality between our own telegraph offices and foreign correspondents;

(ii) leased circuits (for instance from EAL's Addis Ababa office to their Frankfurt office);

(iii) telex serrvice.

TELEX

For the public the telex service may be the most interesting. As most of the readers may know, telex is a telegraph service arranged on the same principle as the public telephone network. The subscribers are mostly offices. They get a teleprinter with a typewriter keyboard installed. By means of this teleprinter they can establish connection with other subscribers in Ethiopia or abroad. The message is written down by the calling subscriber directly on the teleprinter of the called subscriber, irrespective of whether the latter is attending or not. The connection can be established without delay and independent on time differences between the places of the two offices, and furhtermore a written evidence is always delivered, which can be filed for record and can be replied to at convenience. We have telex connections to three foreign countries and via them practically any telex subscriber in the world can be reached with a minimum of delay. On the domestic field telex is so far established in Addis Ababa and Asmara only, but our plans are to extend the facility to all important towns of the country. The telex has a very bright future, not least on the domestic field, where it may compete favourably with the telephone network.

BROADCASTING

One field, where much remains to be done is broadcasting. Due to various circumstances on which the Board has little or no influence, broadcast facilities have been very much delayed. It is only last year that the first decent station has began to be constructed. It is at Gedja Dehra, some 30 km south of Addis Ababa, near Abba Samuel power station. The building was ready at the beginning of this year. Installation of a 100 kW shortwave transmitter is completed and at present the move of some facilities from the old station at Jimma Road is going on. During the next year a 100 kW medium wave transmitter will be added together with a mast of half a wavelength's height, i.e. about 200 metres. In the same year high power medium wave stations will also be erected at Harrar and at Addi Ugri in Eritrea. Therehy, at the end of 1965 most of the densely populated areas would have reasonable means of being covered for the greater part of the day.

SUBSTANTIAL INVESTMENT

For its investments during the next three years, the Board is at present putting a final polish on an investment programme of about Eth. $ 30 million. This would provide for expanded facilities in almost all fields of our activity: subscriber facilities, long lines, international connections, telex.

In may also be interesting to look a few more

years ahead and see what would be the most probable development.

The number of telephone subscribers may after 5 years have increased from 15,000 to-day to 35,000 and after 10 years to almost 100,000.

Within 10 years it will be possible for subscribers to dial automatically between the important places of Ethiopia and also to get telephone connection of good quality and without appreciable delay with most countries of the world.

To make this possible, a substantial extension of the domestic and international transmission facilities has to be made.

We hope, after three or maximum four years, to be able to start the operation of a medium capacity link between Addis Ababa and Asmara. The system would have some 120 channels. Just a little thereafter similar systems would have to be established towards Dire Dawa, and towards the southern, southwestern and western provinces. At the same time we have to start the construction of a microwave network, whirh can take a higher number of channels and which may also be used to distribute television programmes over the country.

For linking Ethiopia with other countries the conventional means of open wire lines, shortwave circuits, radio systems, etc. will certainly countinue to be of great importance. Besides those, great hope is, however, placed on the possibilities for us to participate in satellite communication systems, and after two or three years it might be possible theoretically to get access to communication satellites. We would probaly not be able to dispose over a ground station so soon, but on the other hand we believe the possibility would not be too distant.

The satellite system seems to be a most sophisticated one. It is a synchronous satellite system, in which a country like Ethiopia may subscribe on a certain number of channels, say 4 or 8, out of which some may be fixed for certain addresses, whereas the other can be switched in within microseconds to selected destinations, which can be neighbouring countries or countries on other continents. The system seems to be very promising for the future.

Our planning of the domestic telephone network will include extension of the open wire lines by some 500-1,000 km every year in various parts of the country. In addition we will have to install many new carrier systems of 12,3 and 1 channel capacity, especially in those areas which are contributing to the country's development.

I have already said that the telex service is due to develop rapidly and I would just like to emphasize this. After 5 years we would certainly have several hundreds of telex subscribers and after 10 years there may be 2,000 or 3,000. This development of telex will contribute very much to the development of business in Ethiopia and would of course play greater importance in the political correspondence between Ethiopia and other countries.

FUTURE PROSPECTS

The volume of the total Ethiopian telecommunication facilities may be rather modest for many years to come, but the quality and the design is quite up-to-date; in fact it is more modern than that of many African countries. It is true that to-day much of the discussions on telecommunication technique in Europe and in North America circle around direct subscriber dialling in intercontinental traffic, around data transmission, around electronic automatic telephone exchanges, around colour television and around systems for simultaneous transmission of a few hundred thousand telephone channels and some fifty TV programmes. Such facilities are not actual here for the next years, except for devices for data transmission which might soon be needed for flight reservation, for weather prognoses, for banking operations, etc

The plans and ideas which have just been elaborated could not be implemented first unless the Board gets funds needed to acquire and install the equipment and second unless it gets the staff needed for installation and maintenance of the facilities.

For the movement we are investing at a rate of Eth. $ 8-10 million a year. That figure has to be increased by some 12 to 15% every year as an average. We are at present discussing the possibilities of financing the investments during the next 3 years and my impression is that serious difficulties might not be encountered. The Authorities of the Imperial Government have already approved in principle our 1964 - 1965 Investment Programme. However, before the expiry of those three years some additional means of financing have to be found, such as increasing the Boards capital stock.

For the training of increased number of staff new premises for our Training Institute would soon be ready, and we are going to intensify the training there with emphasis on directly applicable, vocational training. Much of our work needs unfortunately more of experience than of pre-service training. As we are at present short of staff with proper training combined with sufficient experience, we are facing some difficulties, but we expect to over-come them in time.

Telecommunisations in Ethiopia could certainly improve in all aspects and even help in boosting the develophent of the country if financing and staffing problems could be overcome.