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UNIDO WORKSHOP FOR REGIONAL COOPERATION IN TELECOMMUNICATIONS INDUSTRY IN SOUTH ASIA & PACIFIC COUNTRIES

A COMPENDIUM OF POSSIBLE ILLUSTRATIVE PROJECTS

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UNIDO WORKSHOP FOR REGIONAL COOPERATION IN TELECOMMUNICATIONS INDUDTRY IN SOUTH ASIA & PACIFIC COUNTRIES A COMPENDIUM OF POSSIBLE ILLUSTRUATIVE PROJECTS

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Chapter 1
Role of Telecommunication services and industry and scope of the paper

1.1 Introduction

1.1.1 The role of telecommunications and informatics as a catylist and an important infrastructure for industry, business, administration and social institutions is by now well recognized. Telecommunications and informatics services, apart from providing very substantial economic returns to the society/nations, have been found to be highly remunerative financially as well. The operating administrations, whether in the public or private sector, world over, have been flush with cash after an initial dose of heavy investment. Telecommunications service sector therefore deserves priority in any plan of socio-economic deveopment in any country.

1.1.2 Keeping this in view it has but been right that UNIDO has chosen to create a unit with a specific mandate to increase the industrial efficiency through the application of informatics technology and place emphasis on assistance in the field of telecommunications equipment production and maintenance. UNIDO had earlier organized a Workshop in December 1991, to help identify the issues and possible areas of cooperation in regard to telecommunication industry in Asia and the Pacific Region. UNIDO has now planned a further Workshop for the representatives of the region to take the process of cooperation a step further.

1.1.3 Public Telecommunications networks now support a vide variety of communications services, voice and non-voice. Telephone, FAX, data communications, electronic mail, voice mail, videotex, slow scan TV etc. They can now all be supported on the basic telecommunication network with ISDN facility. The basic network uses a very wide variety of industrial products, most based on electronics, but certain others in the nature of hardware, cables etc., besides a large volume of computer software. Telecommunication industry is thus an important element in the development of telecommunications networks. An analysis of some of the major products and components going into the network and the products was presented in the earlier paper," A survey of Telecommunication Services & Industry: Inputs required by a National Public Switched Network and for their production-Potential for regional cooperation" at the Bangalore workshop in December 1991.

1.1.4 The present paper picks up the threads from the earlier workshop, and attempts to identify a few typical concrete industrial projects which could be taken up initially and become models for further regional cooperation to promote self reliance in the field of telecommunications industry.

1.2 Motivations for a national Telecommunications Industry

1.2.1 Almost all nations, large and small, generally aspire to build up telecommunication industry of their own. What are the motivations? These generally relate to:

- Need for a feeling of self reliance.
- A feeling, often justified, that one has to pay exhorbitantly high prices to import from abroad.
- Technical competence for maintenance & servicing that indigenous industry provides.
- Generation of local employment in place of supporting the same elsewhere.

1.3 Factors inhibiting growth of telecommunication industry in developing countries

Inspite of the keen aspiration of most nations to develop their own telecommunication industry, not many developing countries have successfully done so. Most developing nations continue to be dependent even for some of the simplest equipment on imports. What are the reasons for the same?

- The telecommunication industry can generally be divided into two major components:
  - The basic components and raw material industry.
  - The system industry based on assembly from standard bought out components.
- Both call for a very large R&D effort for development of products and processes, and for standarization, testing and certification. These activities call for massive investment, which only very large organizations are able to afford. Truth is that the cost of R&D effort in Telecommunications has become so prohibitive that many of the traditional multinational giants in the field, arch competitors till only a few years back, have had to merge or enter into strategic alliances.
- In addition the basic components and raw material industries have become highly capital intensive and are economical only at very high levels of production. This has again meant that these industries are also gradually getting concentrated into fewer and fewer hands.

1.4 What then are the prospects of developing telecommunications industry in developing countries?

Fortunately, given the availabilty of basic designs, and standard components and raw materials, there is still a large scope for producing telecommunication equipment economically by way of assembly and testing, even at modest levels of production, particularly in developing countries where manpower costs are still comparatively low. Thus industries based on local assembly and testing from bought out components internationally or regionally, can still be economical and meet some of the basic objectives and aspirations of the different countries for self reliance. Success of such industries would however call for a considerable support by way of R&D, standardization, procurement, testing and certification of components, and products etc. This calls for some form of organizational networking with either the major multinational organizations working in this field, or building up of alternative regional institutions.

Apart from these, some of the discrete components, electronic, and mechanical, also offer a good scope for small scale production. Some of these were touched upon in the earlier paper presented in December workshop.

1.5 Scope of this paper

In the light of above scenarios, this paper:

(1) makes a brief survey, in chapter 2, of the status of national public telecommunication networks in the region, and attempts to project the likely status in the year 2000. It further attempts a projection of the countrywise demand for some of the products discussed at annexes 1 to 5. These projections are necessarily highly subjective and speculative and can only provide a framework for further studies.

(2) based on these projections, explores the economics of production of a few of the important products going into the telecommunication networks at different levels of annual output. These are presented at annexes 1 to 5.

(3) suggests a possible strategy for regional cooperation for a few projects in this field, by either creating or using existing organizations/institutions for standardization, testing, certification, R&D support etc. This is presented in Chapter 3.

Chapter 2
A review of telecommunications development scenario and a projection of likely demand for Some major Telecom Network Components in countries of the Asia and Pacific Region

2.1 Introduction: Telecom Scenario in the region

2.1.1 The Asia and pacific region consists of about 40 countries with a very wide variety of topology and population densities. It has in it two of the most populous countries, China and India, with combined population of about 2 billion. It also has some of the smallest island states with populations of a few thousand, the smallest one having less than 10,000 inhabitants.

2.1.2 The state of development of telecommunications similarly varies very widely. Newzealand, Australia, Japan, Hongkong, Singapur, Korea and Taiwan have very high telephone densities of over 30 main lines per 100 population. On the other hand as many as 14 countries have less than 1 per hundred, among these are some of the most populous ones like China, India, Indonesia, Pakistan, and Bangladesh.

2.1.3 Table 1 presents data about the population, the main telephone lines, and the density per 100 population as on 1.1.91 and the main telephone lines on 1.1.1988, drawn from the annual publication of M/s Siemens Ltd, 'International Telecom Statistics'. The data is not complete in respect of some of the countries and as explained in the original publication is based on estimates rather than specific statistics in case of many of the countries. The table also presents calculated annual exponential rate of growth in main lines achieved during the three year period 1.1.88 to 1.1.91. Table 1 presents the data for 39 countries of the region, arranged in alphabetical order.

2.1.4 To obtain a better comparative insight into the data, tables 2 to 5 present the same basic figures, with countries arranged in descending orders of population, number of main telephone lines working, the telephone density, and the exponential rate of growth achieved in the three year period 1988-90.

2.2 Projections for the future

2.2.1 Using this basic data, an attempt has been made to make some projections for the future growth and likely annual demands for some of the major inputs for public networks in the year 2000. With the very limited data, the projections are necessarily highly subjective and speculative. However they do give a very rough idea of the potential and hopefully will encourage further studies. They can also provide a tentative basis for some preliminary planning and certain provisional decisions for further work towards development of telecommunication industry in the region.

2.2.2 The projections have been arrived at by assuming a certain exponential rate of growth for each country for the period 1991-2000. The exponential rate of growth assumed varies from 4% p.a. for the countries with already high telephone density increasing to 16% p.a. for countries with very low telephone densities at present.

2.2.3 Based on the these rates of growth an estimate has been made of main lines likely to be working on 1.1.2000 and thereafter the number of main lines likely to be added during the year 2000. The latter has been used to estimate the likely demand for telephone exchange equipment at 133% of the new lines likely to be added, telephone cables (mostly

jelly filled) at 5 conductor kilometers (CKm) per connection, and PABX capacity for very small PABX's (2+4 to 6+30) at 20% of the exchange capacity. The results are indicated in table 7.

2.2.4 It is hoped that the figures in table 7, together with the figures about the economical viability of projects for production of some of the equipment, presented in annexes, will provide a useful basis for a preliminary decision as to what types of telecommunication industry may prove economically viable in different countries of the region. This could be the beginning of a serious study to be undertaken by different countries in the region for possible regional cooperation and networking of industrial, standardization, test, calibration and certification organizations.

2.3 Telecommunications industry status in the region

2.3.1 Just as in the telecommunication services, the region provides a very variable state of development in regard to telecommunications industry. On the one hand there is Japan with a very dynamic and vibrant telecommunications industry, both for components and systems, not only fully meeting the very considerable internal demand but also undertaking very large exports to all corners of the world. Then there are Korea, and Australia who have established a very healthy telecommunications industry started largely as subsidiaries of some of the multinational giants but gradually becoming fairly autonomous. These industries have been the major suppliers for the very substantial national telecommunication development. Korea has further started its own R&D programme and has also established a highly vigorous component industry. The country has now become a fairly important player on the export market for some of the products in particular the telephone cables and some transmission equipment.

2.3.2 China and India are two of the world's most populous countries. They are also now the world's largest potential markets for telecommunication industry products. Both have established a substantial R&D programme and have developed significant competence, both for hardware and software design and production for telecommunications. India has established a whole range of telecommunications industry, Switching, Telephone & optical fibre cables, transmission equipments, subscriber terminals- telephnoes, PABX's, Teleprinters, FAX's, Modems etc. Some of the industry is based on transfer of knowhow from MNC's, some on indigenous R&D. The emphasis in all cases has been on mastering the knowhow. Many of these industries are now in a position to transfer this knowhow, though with a large market at home have probably not paid adequate attention to this. The position in China appears to be very similar.

2.3.3 Indonesia, Pakistan, and Phillipines are other countries who have set up a number of industries. Taiwan, Honkong, Malaysia besides Korea have also emerged as important producers of components, as also of suppliers of some of the capital equipment, either from local production or from third countries. Efforts have been on for establishment of industries in some of the other countries like Bangladesh, Nepal, Sri Lanka, Vietnam and others.

2.3.4 There is thus significant activity in regard to telecommunication industry even among the developing countries in the region. There is clearly significant competence and complimentarity which could be of mutual advantage to different countries in the region. There is however no authentic and comprehensive data bank or facilty for exchange of information. A survey of the industry in the region and compilation of a directory would be useful. This perhaps needs priority attention. However initiation of regional cooperation in this regard need not and should not wait for such a survey. A parallel action could be taken on some of the projects as suggested in Chapter 3.

Chapter 2, Table 1

Telephone Density in main lines per hundred population as on 1.1.91 and annual rate of growth of main lines 1988-1990 Countries of South Asia & the Pacific

	Country	Population 1.1.1991	Main lines 1.1.1991	Density 1.1.1991	Main lines 1.1.1988	Growth Rate % per annum
	(a)	(b) (000)	(c)	(d) per 100	(e)	(f) 1988-90
	Countries Arranged Alphabetically					
1	Afghanistan*	16,120	35,000	0.217	29,000	6.47
2	Australia	17,090	8,046,029	47.080	7,091,549	4.30
3	Bangladesh*	109,070	200,000	0.183	170,000	5.57
4	Bhutan*	1,520	1,700	0.112	1,400	6.69
5	Brunei*	270	35,000	12.963	24,612	12.45
6	Cambodia*	8,250	7,000	0.085	6,200	4.13
7	China PDR*	1,139,100	6,850,300	0.601	(7,566,000)	NA
8	China R :Taiwan	20,230	6,583,435	32.543	5,120,521	8.74
9	Cook Island	20	2,990	14.950	1,973	14.86
10	Fiji	760	42,425	5.582	34,001	7.66
11	Fr Polynesia	200	37,000	18.500	29,200	8.21
12	Guam(USA)	120	39,036	32.530	25,500	15.25
13	HongKong	5,800	2,474,998	42.672	2,021,394	6.98
14	India	827,000	5,074,734	0.614	3,798,779	10.14
15	Indonesia*	182,000	950,000	0.522	737,588	8.80
16	Japan	123,540	55,330,000	44.787	49,247,000	3.96
17	Kiribati*	70	1,200	1.714	910	9.66
18	Korea PDR*	21,770	800,000	3.675	(32,000)	NA
19	Korea Rep	42,790	13,513,523	31.581	8,785,165	15.44
20	Laos*	4,140	6,600	0.159	6,100	2.66
21	Malaysia	17,860	1,585,744	8.879	1,131,719	11.90
22	Maldives*	214	6,240	2.916	2,700	32.22
23	Micronesia*	93	1,600	1.720	1,400	4.55
24	Mongolia PDR*	2,120	40,000	1.887	37,000	2.63
25	Myanmar :Burma*	41,670	80,000	0.192	57,000	11.96
26	Nauru*	9	1,200	13.333	1,200	NA
27	Nepal*	18,920	55,000	0.291	30,404	21.84
28	New Caledonia	170	28,382	16.695	21,915	9.00
29	Newzealand	3,350	1,630,000	48.657	1,376,781	5.79
30	Pakistan*	112,050	870,000	0.776	636,000	11.00
31	Papua Newguinea*	3,700	30,187	0.816	(30,819)	NA
32	Philippines	61,480	668,311	1.087	546,017	6.97
33	Singapur	2,709	1,040,187	38.397	886,103	5.49
34	Soloman Island*	320	3,400	1.063	2,700	7.99
35	Sri Lanka	17,030	121,388	0.713	97,333	7.64
36	Thailand	57,200	1,324,522	2.316	901,622	13.68
37	Tonga*	120	3,700	3.083	3,000	7.24
38	Vanuatu*	152	2,600	1.711	2,200	5.73
39	Vietnam*	66,200	98,536	0.149	85,000	5.05
40	West Samoa*	166	5,500	3.313	5,000	3.22
	Total region	2,925,389	107,621,467	3.679	90,553,856	5.93

Notes:

1. The data has been taken from the Siemens annual compilation International Telecommunications statistics' 1989 & 1992.

2. The Siemens compilation indicates that figures of telephone main lines for countries marked by an *, are estimates for either 1.1.88 or 1.1.91 or both.

3. An exponential annual rate of growth of main lines has been assumed and has been calculated for the three years based on figures for 1.1.88 and 1.1.91.

4. NA in column for rate of growth 1988-1990, indicates that the same could not be calculated from the available data.

Chapter 2 Table 2

Telephone Density in main lines per hundred population as on 1.1.91 and annual rate of growth of main lines 1988-1990 Countries of South Asia & the Pacific

Country	Population 1.1.1991	Main Lines 1.1.1991	Density 1.1.1991	Main Lines 1.1.1988	Growth Rate % per annum
(a)	(b) (000)	(c)	(d) per 100	(e)	(f) 1988-90
Countries Arranged by population					
1 China PDR*	1,139,100	6,850,300	0.601	(7,566,000)	NA
2 India	827,000	5,074,734	0.614	3,798,779	10.14
3 Indonesia*	182,000	950,000	0.522	737,588	8.80
4 Japan	123,540	55,330,000	44.787	49,247,000	3.96
5 Pakistan*	112,050	870,000	0.776	636,000	11.00
6 Bangladesh*	109,070	200,000	0.183	170,000	5.57
7 Vietnam*	66,200	98,536	0.149	85,000	5.05
8 Philippines	61,480	668,311	1.087	546,017	6.97
9 Thailand	57,200	1,324,522	2.316	901,622	13.68
10 Korea Rep	42,790	13,513,523	31.581	8,785,165	15.44
11 Myanmar :Burma*	41,670	80,000	0.192	57,000	11.96
12 Korea PDR*	21,770	800,000	3.675	(32,000)	NA
13 China R :Taiwan	20,230	6,583,435	32.543	5,120,521	8.74
14 Nepal*	18,920	55,000	0.291	30,404	21.84
15 Malaysia	17,860	1,585,744	8.879	1,131,719	11.90
16 Australia	17,090	8,046,029	47.080	7,091,549	4.30
17 Sri Lanka	17,030	121,388	0.713	97,333	7.64
18 Afghanistan*	16,120	35,000	0.217	29,000	6.47
19 Cambodia*	8,250	7,000	0.085	6,200	4.13
20 HongKong	5,800	2,474,998	42.672	2,021,394	6.98
21 Laos*	4,140	6,600	0.159	5,100	2.66
22 Papua Newguinea*	3,700	30,187	0.816	(30,819)	NA
23 Newzealand	3,350	1,630,000	48.657	1,376,781	5.79
24 Singapur	2,709	1,040,187	38.397	886,103	5.49
25 Mongolia DR*	2,120	40,000	1.887	37,000	2.63
26 Bhutan*	1,520	1,700	0.112	1,400	6.69
27 Fiji	760	42,425	5.582	34,001	7.66
28 Soloman Island*	320	3,400	1.063	2,700	7.99
29 Brunei*	270	35,000	12.963	24,612	12.45
30 Maldives*	214	6,240	2.916	2,700	32.22
31 French Polynesia*	200	37,000	18.500	29,200	8.21
32 New Caledonia	170	28,382	16.695	21,915	9.00
33 West Samoa*	166	5,500	3.313	5,000	3.22
34 Vanuatu*	152	2,600	1.711	2,200	5.73
35 Tonga*	120	3,700	3.083	3,000	7.24
36 Guam(USA)	120	39,036	32.530	25,500	15.25
37 Micronesia*	93	1,600	1.720	1,400	4.55
38 Kiribati*	70	1,200	1.714	910	9.66
39 Cook Island	20	2,990	14.950	1,973	14.86
40 Nauru*	9	1,200	13.333	1,200	NA

Please see notes below table 1

Chapter 2 Table 3

Telephone Density in main lines per hundred population as on 1.1.91 and annual rate of growth of main lines 1988-1990 Countries of South Asia & the Pacific

Country	Population 1.1.1991	Main Lines 1.1.1991	Density 1.1.1991	Main Lines 1.1.1988	Growth Rate % per annum
(a)	(b) (000)	(c)	(d) per 100	(e)	(f) 1988-90
Countries Arranged by number of main lines					
1 Japan	123,540	55,330,000	44.787	49,247,000	3.96
2 Korea Rep	42,790	13,513,523	31.581	8,785,165	15.44
3 Australia	17,090	8,046,029	47.080	7,091,549	4.30
4 China PDR*	1,139,100	6,850,300	0.601	(7,566,000)	NA
5 China R :Taiwan	20,230	6,583,435	32.543	5,120,521	8.74
6 India	827,000	5,074,734	0.614	3,798,779	10.14
7 HongKong	5,800	2,474,998	42.672	2,021,394	6.98
8 Newzealand	3,350	1,630,000	48.657	1,376,781	5.79
9 Malaysia	17,860	1,585,744	8.879	1,131,719	11.90
10 Thailand	57,200	1,324,522	2.316	901,622	13.68
11 Singapur	2,709	1,040,187	38.397	886,103	5.49
12 Indonesia*	182,000	950,000	0.522	737,588	8.80
13 Pakistan*	112,050	870,000	0.776	636,000	11.00
14 Korea PDR*	21,770	800,000	3.675	(32,000)	NA
15 Philippines	61,480	668,311	1.087	546,017	6.97
16 Bangladesh*	109,070	200,000	0.183	170,000	5.57
17 Sri Lanka	17,030	121,388	0.713	97,333	7.64
18 Vietnam*	66,200	98,536	0.149	85,000	5.05
19 Myanmar :Burma*	41,670	80,000	0.192	57,000	11.96
20 Nepal*	18,920	55,000	0.291	30,404	21.84
21 Fiji	760	42,425	5.582	34,001	7.66
22 Mongolia DR*	2,120	40,000	1.887	37,000	2.63
23 Guam(USA)	120	39,036	32.530	25,500	15.25
24 Fr Polynesia*	200	37,000	18.500	29,200	8.21
25 Brunei*	270	35,000	12.963	24,612	12.45
26 Afghanistan*	16,120	35,000	0.217	29,000	6.47
27 Papua Newguinea*	3,700	30,187	0.816	(30,819)	NA
28 New Caledonia	170	28,382	16.695	21,915	9.00
29 Cambodia*	8,250	7,000	0.085	6,200	4.13
30 Laos*	4,140	6,600	0.159	6,100	2.66
31 Maldives*	214	6,240	2.916	2,700	32.22
32 West Samoa*	166	5,500	3.313	5,000	3.22
33 Tonga*	120	3,700	3.083	3,000	7.24
34 Soloman Island*	320	3,400	1.063	2,700	7.99
35 Cook Island	20	2,990	14.950	1,973	14.86
36 Vanuatu*	152	2,600	1.711	2,200	5.73
37 Bhutan*	1,520	1,700	0.112	1,400	6.69
38 Micronesia*	93	1,600	1.720	1,400	4.55
39 Nauru*	9	1,200	13.333	1,200	NA
40 Kiribati*	71	1,200	1.714	910	9.66

Please see notes below table 1

Chapter 2 Table 4

Telephone Density in main lines per hundred population as on 1.1.91 and annual rate of growth of main lines 1988-1990 Countries of South Asia & the Pacific

Country	Population 1.1.1991	Main Lines 1.1.1991	Density 1.1.1991	Main Lines 1.1.1988	Growth Rate % per annum
(a)	(b) (000)	(c)	(d) per 100	(e)	(f) 1988-90
Countries Arranged by telephone density					
1 Newzealand	3,350	1,630,000	48.657	1,376,781	5.79
2 Australia	17,090	8,046,929	47.080	7,091,549	4.30
3 Japan	123,540	55,330,000	44.787	49,247,000	3.96
4 Hong Kong	5,800	2,474,998	42.672	2,021,394	6.98
5 Singapur	2,709	1,040,187	38.397	886,103	5.49
6 China R :Taiwan	20,230	6,586,435	32.543	5,120,521	8.74
7 Guam(USA)	120	39,036	32.530	25,500	15.25
8 Korea Rep	42,790	13,513,523	31.581	8,785,165	15.44
9 French Polynesia*	200	37,000	18.500	29,200	8.21
10 New Caledonia	170	28,382	16.695	21,915	9.00
11 Cook Island	20	2,990	14.950	1,973	14.86
12 Nauru*	9	1,200	13.333	1,200	NA
13 Brunei*	270	35,000	12.963	24,612	12.45
14 Malaysia	17,860	1,585,744	8.879	1,131,719	11.90
15 Fiji	760	42,425	5.582	34,001	7.66
16 Korea PDR*	23,770	800,000	3.675	(32,000)	NA
17 West Samoa*	166	5,500	3.313	5,000	3.22
18 Tonga*	120	3,700	3.083	3,000	7.24
19 Maldives*	214	6,240	2.916	2,700	32.22
20 Thailand	57,200	1,324,522	2.316	901,622	13.68
21 Mongolia DR*	2,120	40,000	1.887	37,000	2.63
22 Micronesia*	93	1,600	1.720	1,400	4.55
23 Kiribati*	70	1,200	1.714	910	9.66
24 Vanuatu*	152	2,600	1.711	2,200	5.73
25 Philippines	61,480	668,311	1.087	546,017	6.97
26 Soloman Island*	320	3,400	1.063	2,700	7.99
27 Papua Newguinea*	3,700	30,187	0.816	(30,819)	NA
28 Pakistan*	112,050	870,000	0.776	636,000	11.00
29 Sri Lanka	17,030	121,388	0.713	97,333	7.64
30 India	827,000	5,074,734	0.614	3,798,779	10.14
31 China PDR*	1,139,100	6,850,300	0.601	(7,566,000)	NA
32 Indonesia*	182,000	950,000	0.522	737,588	8.80
33 Nepal*	18,920	55,000	0.291	30,404	21.84
34 Afghanistan*	16,120	35,000	0.217	29,000	6.47
35 Myanmar :Burma	41,670	80,000	0.192	57,000	11.96
36 Bangladesh*	109,070	200,000	0.183	170,000	5.57
37 Laos*	4,140	6,600	0.159	6,100	2.66
38 Vietnam*	66,200	98,536	0.149	85,000	5.05
39 Bhutan*	1,520	1,700	0.112	1,400	6.69
40 Cambodia*	8,250	7,000	0.085	6,200	4.13

Please see notes below table 1

Chapter 2 Table 5

Telephone Density in main lines per hundred population as on 1.1.91 and annual rate of growth of main lines 1988-1990 Countries of South Asia & the Pacific

Country	Population 1.1.1991	Main Lines 1.1.1991	Density Main Lines 1.1.1991	Main Lines 1.1.1988	Growth Rate % per annum
(a)	(b) (000)	(c)	(d) per 100	(e)	(f) 1988-90
Countries Arranged by telephone growth rate during 1988-90					
1 Maldives*	214	6,240	2.916	2,700	32.22
2 Nepal*	18,920	55,000	0.291	30,404	21.84
3 Korea Rep	42,790	13,513,523	31.581	8,785,165	15.44
4 Guam (USA)	120	39,036	32.530	25,500	15.25
5 Cook Island	20	2,990	14.950	1,973	14.86
6 Thailand	57,200	1,324,522	2.316	901,622	13.68
7 Brunei*	270	35,000	12.963	24,612	12.45
8 Myanmar :Burma	41,670	80,000	0.192	57,000	11.96
9 Malaysia	17,860	1,585,744	8.879	1,131,719	11.90
10 Pakistan*	112,050	870,000	0.776	636,000	11.00
11 India	827,000	5,074,734	0.614	3,798,779	10.14
12 Kiribati*	70	1,200	1.714	910	9.66
13 New Caledonia	170	28,382	16.695	21,915	9.00
14 Indonesia*	182,000	950,000	0.522	737,588	8.80
15 China R :Taiwan	20,230	6,583,435	32.543	5,120,521	8.74
16 French Polynesia*	200	37,000	18.500	29,200	8.21
17 Soloman Island*	320	3,400	1.063	2,700	7.99
18 Fiji	760	42,425	5.582	34,001	7.66
19 Sri Lanka	17,030	121,388	0.713	97,333	7.64
20 Tonga*	120	3,700	3.083	3,000	7.24
21 HongKong	5,800	2,474,998	42.672	2,021,394	6.98
22 Philippines	61,480	668,311	1.087	546,017	6.97
23 Bhutan*	1,520	1,700	0.112	1,400	6.69
24 Afghanistan*	16,120	35,000	0.217	29,000	6.47
25 Newzealand	3,350	1,630,000	48.657	1,376,781	5.79
26 Vanuatu*	152	2,600	1.711	2,200	5.73
27 Bangladesh*	109,070	200,000	0.183	170,000	5.57
28 Singapur	2,709	1,040,187	38.397	886,103	5.49
29 Vietnam*	66,200	98,536	0.149	85,000	5.05
30 Micronesia*	93	1,600	1.720	1,400	4.55
31 Australia	17,090	8,046,029	47.080	7,091,549	4.30
32 Cambodia*	8,250	7,000	0.085	6,200	4.13
33 Japan	123,540	55,330,000	44.787	49,247,000	3.96
34 West Samoa*	166	5,500	3.313	5,000	3.22
35 Laos*	4,140	6,600	0.159	6,100	2.66
36 Mongolia DR*	2,120	40,000	1.887	37,000	2.63
37 China PDR*	1,139,100	6,850,300	0.601	(7,566,000)	NA
38 Papua Newguinea*	3,700	30,187	0.816	(30,819)	NA
39 Korea PDR*	21,770	800,000	3.675	(32,000)	NA
40 Nauru*	9	1,200	13.333	1,200	NA

Please see notes below table 1

Chapter 2 Table 6
A projection of main lines likely to be working on 1.1.2000 in the Countries of South Asia & the Pacific

No.	Country	Main lines 1.1.1991	Density 1.1.1991 per 100 population	Growth Rate % per annum Actual 1988-90	Growth Rate % per annum Assumed 1991-99	Main lines 1.1.2000 projected
	(a)	(b)	(c)	(d)	(e)	(f)
A:	Countries Arranged in descending order of telephone density as on 1.1.91					
1	Newzealand	1,630,000	48.657	5.79	4.00	2,319,998
2	Australia	8,046,029	47.080	4.30	4.00	11,452,008
3	Japan	55,330,000	44.787	3.96	4.00	78,751,843
4	HongKong	2,474,596	42.672	6.98	6.00	4,181,457
5	Singapur	1,040,167	38.397	5.49	6.00	1,757,374
6	China R :Taiwan	6,583,435	32.543	8.74	7.00	12,103,377
7	Guam(USA)	39,036	32.530	15.25	8.00	78,033
8	Korea Rep	13,513,523	31.581	15.44	8.00	27,013,595
9	Fr Polynesia	37,000	18.500	8.21	9.00	80,360
10	New Caledonia	28,362	16.695	9.00	9.00	61,643
11	Cook Island	2,990	14.950	14.86	9.00	6,494
12	Nauru*	1,200	13.333	NA	9.00	2,606
13	Brunei*	38,000	12.963	12.45	10.00	82,528
14	Malaysia	1,585,744	8.879	11.90	10.00	3,739,101
15	Fiji	42,425	5.582	7.66	10.00	100,036
16	Korea PDR*	800,000	3.675	NA	12.00	2,218,463
17	West Samoa*	5,500	3.313	3.23	12.00	15,252
18	Tonga*	3,700	3.083	7.24	12.00	10,260
19	Maldives*	6,240	2.916	32.21	12.00	17,304
20	Thailand	1,324,522	2.316	13.68	14.00	4,307,277
21	Mongolia PDR*	40,000	1.887	2.63	14.00	130,078
22	Micronesia*	1,600	1.720	4.55	14.00	5,203
23	Kiribati*	1,200	1.714	9.66	14.00	3,902
24	Vanuatu*	2,600	1.711	5.73	14.00	8,455
25	Philippines	668,311	1.087	6.97	14.00	2,173,313
26	Soloman Island*	3,400	1.063	7.99	14.00	11,057
27	Papua Newguinea	30,187	0.816	NA	15.00	106,194
28	Pakistan*	870,000	0.776	11.01	15.00	3,060,552
29	Sri Lanka	121,388	0.713	7.64	15.00	427,028
30	India	5,074,734	0.614	10.13	15.00	17,852,286
31	China PDR*	6,850,300	0.601	NA	15.00	24,098,508
32	Indonesia*	950,000	0.522	8.80	15.00	3,341,982
33	Nepal*	55,000	0.291	21.85	15.00	193,483
34	Afghanistan*	35,000	0.217	6.47	16.00	133,104
35	Myanmar :Burma*	80,000	0.192	11.96	16.00	304,237
36	Bangladesh*	200,000	0.183	5.57	16.00	760,592
37	Laos*	6,600	0.159	2.66	16.00	25,100
38	Vietnam*	99,536	0.149	5.05	16.00	374,729
39	Bhutan*	1,700	0.112	6.69	16.00	6,465
	Total Region	**107,620,467**				**211,315,279**

Chapter 2 Table 7

A projection of likely annual requirements of
certain important network components
Countries of South Asia & the Pacific

No.	Country	Main Lines 1.1.2000 (lines) (b)	Main Lines added in 2000 AD (lines) (c)	Equipment needed in 2000 Exchange Capacity (lines) (d)	Telephone Cables (CKm) (e)	Small PABX's (lines) (f)
	(a)					
Countries reaaranged in order of projected annual addition of main lines in year 2000						
1	China PDR*	24,098,508	3,614,776	4,819,702	24,098,508	963,940
2	Japan	78,751,843	3,150,074	4,200,098	21,000,491	840,020
3	India	17,852,286	2,677,843	3,570,457	17,852,286	714,091
4	Korea Rep	27,013,595	2,161,088	2,881,450	14,407,251	576,290
5	China R :Taiwan	12,103,377	847,236	1,129,648	5,648,242	225,930
6	Thailand	4,307,277	603,019	804,025	4,020,126	160,805
7	Indonesia*	3,341,982	501,297	668,396	3,341,982	133,679
8	Pakistan*	3,060,552	459,083	612,110	3,060,552	122,422
9	Australia	11,452,008	458,080	610,774	3,053,869	122,155
10	Malaysia	3,739,101	373,910	498,547	2,492,734	99,709
11	Philippines	2,173,313	304,264	405,685	2,028,425	81,137
12	Korea PDR*	2,218,463	266,216	354,954	1,774,770	70,991
13	HongKong	4,181,457	250,887	334,517	1,672,583	66,903
14	Bangladesh*	760,592	121,695	162,260	811,298	32,452
15	Singapur	1,757,374	105,442	140,590	702,950	28,118
16	Newzealand	2,319,998	92,800	123,733	618,666	24,747
17	Sri Lanka	427,028	64,054	85,406	427,028	17,081
18	Vietnam*	374,729	59,957	79,942	399,710	15,988
19	Myanmar :Burma*	304,237	48,678	64,904	324,519	12,981
20	Nepal*	193,483	29,022	38,697	193,483	7,739
21	Afghanistan*	133,104	21,297	28,395	141,977	5,679
22	Mongolia PDR*	130,078	18,211	24,281	121,406	4,856
23	Papua Newguinea	106,194	15,929	21,239	106,194	4,248
24	Fiji	100,036	10,004	13,338	66,691	2,668
25	Brunei*	82,528	8,253	11,004	55,019	2,201
26	Fr Polynesia	80,360	7,232	9,643	48,216	1,929
27	Guam(USA)	78,033	6,243	8,324	41,618	1,665
28	New Caledonia	61,643	5,548	7,397	36,986	1,479
29	Laos*	25,100	4,016	5,355	26,773	1,071
30	Maldives*	17,304	2,076	2,769	13,843	554
31	West Samoa*	15,252	1,830	2,440	12,202	488
32	Soloman Island*	11,057	1,548	2,064	10,320	413
33	Tonga*	10,260	1,231	1,642	8,208	328
34	Vanuatu*	8,455	1,184	1,578	7,891	316
35	Bhutan*	6,468	1,034	1,379	6,896	276
36	Micronesia*	5,203	728	971	4,856	194
37	Cook Island	5,494	584	779	3,896	156
38	Kiribati*	3,902	546	728	3,642	146
39	Nauru*	2,406	235	313	1,564	62
	Total Region	211,315,279		21,729,535		4,345,907
		16,297,181		108,647,674		

Notes: 1. The projections above are necessarily highly speculative and are based on the forecast of likely main lines working on 1.1.2000 arrived at in table 6 and the assumed growth therein being continued in the year 2000.

2. The Exchange capacity required has been assumed at 133% of main lines to be added, telephone cables at 5 CKm per exchange line and small PABX capacity at 20% of exchange capacity required.

Chapter 3
Possible strategies for regional cooperation in telecommunications equipment production industry

3.1 Introduction

3.1.1 Chapter 2 presents projection, no doubt somewhat speculative, of likely demand for some of the essential inputs into public telecommunication networks. Annexes 1 to 5 give the economics of production of some of these products at different levels of annual production. It is apparent that there are significant economies of scale involved in all cases. In addition, there is need for considerable R&D, testing and other support which has a further bearing on the economies of scale.

3.1.2 The annual requirements in different countries vary fairly widely. Some of the larger countries can obviously support economically not one but a number of units of production for each product. Some of the others, cannot afford even one unit by themselves. Even in their cases, however there is a possibility of setting up some units by pooling their demand and sharing the R&D, and test, certification and standardization costs.

3.1.3 Such pooling and sharing, calls for certain essential steps. Some of these are:

a) Willingness to cooperate and use not only common standards but common equipment designs.

b) Willingness to pool and share the costs of R&D, standardization, testing and certification.

c) Willingness to share common organization for procurement and kitting of essential components and other inputs.

d) Willingness on the part of countries to agree on an allocation of production facilities for different products according to the special locational and technological advantages offered by different countries depending on the availability of raw materials, components or specialized manpower etc.

e) Willingness on the part of national operating administrations in these countries to buy from within the region from such regional cooperative sources even in the face of some competition from outside which can certainly be anticipated once such cooperative facilities are established.

3.1.4 All this will no doubt call for willingness at the political level for such cooperation and active support of the international organizations as catalysts.

3.2 A possible strategy to start the ball rolling

3.2.1 To illustrate a possible strategy one may consider the case of electronic telephone exchanges. The project profile at annexe 1 indicates that given suitable regional cooperation on R&D, testing, certification and procurement of components etc. manufacturing units to produce small and medium sized digital electronic exchanges on a purely assembly line basis can be economical even at an annual production level of 50,000 lines, though, naturally further economies are feasible at higher levels. Looking at the projection of demand for switching systems a fairly large number of countries in the region could support such industrial enterprises varying between the sizes 50,000 lines upto even a million lines a year.

Tnere are two alternative strategies that could be considered:

a) Each country could select its own switching technology from a number of them available from about 10 different companies, and link up for further support by way of R&D, component selection and their test and certification with the supplier of technology. This can be made a success in case of countries with large demand and a certain level of technical expertise already built up. Such suppliers of technology may however not be willing by themselves to help establish smaller units in countries with much smaller demand.

b) A number of small and large countries with a potential for setting up units with an annual production of 500,000 lines down to 20,000 lines could agree to cooperate and adopt a common technology again to be chosen from amongst the number available internationally.

3.2.2 In case of the latter, following strategies could be adopted:

(1) The countries could form a consortium of the operating administrations and the prospective entrepreneurs in the concerned countries. The consortium could take many different forms but perhaps an organization on the lines of Intelsat might be a good model, with a share capital and board of directors representing all the participating countries and their entrepreneurs. The role of consortium would be restricted to provide the necessary regional support by way of R&D, standardization, establishing sources of components and raw materials, their test and certification etc. The units to be set up in different countries will be owned , established and operated by the national enterprises who will call upon the regional support services as needed and pay for them on an agreed basis.

(2) The consortium would study and agree on certain basic criteria for the choice of technology to be adopted by all the participating countries, obtain proposals from various groups offering such technologies and choose one based on the agreed criteria.

(3) The consortium would study and agree at the size and capacity of production facilities to be set up in each participating country as well as the common support services to be established including R&D, standardization, test and certification, software and repair centers, training facilities and component and raw material procurement, testing and kitting centers etc.

(4) Various United Nations agencies and international and regional development financial institutions could act as catalysts and provide the necessary support e.g.

- ITU and APT could provide their support on the choice of technology and standardization
- UNIDO could provide support by way of preparation of feasibility studies for the different production and test & standardization facilities and services of management ex perts.
- The IBRD and ADB could provide soft loans for financing the production units.
- The UNDP could provide financial and expert manpower support for the standardization, R&D, test & certification, software and repair centres, through other UN agencies.

3.2.4 The emphasis will however be on regional/sub-regional cooperation at the initiative of the nations and their entrepreneurs themselves. The enterprises will have to be set up and operated strictly on a commercial basis, UN agencies being involved only as catalysts. Some economies may be feasible by supporting, augmenting and reserving facilities at some of the existing test & certification centres in a number of countries rather than set up new ones from scratch.

3.2.5 A third alternative would be establishment of networking between the entrepreneurs or their associations in different countries of the region at their own initiative for production of some of the simpler products like telephone instruments, small sized PABX's, modems, some of the line hardware, cables etc. However a formal consortium at subregional levels of participating countries may be useful even in these cases.

The above suggestions for possible strategies are necessarily meant for initiating a discussion towards a more concrete action at the workshop rather than a firm blue print for a specific strategy. A specific strategy can only emerge from a conviction among the participating developing countries that there is need for some such strategy for mutual benefit.

Chapter 4
A few projects for Telecommunications Industry for possible regional cooperation in the first instance

4.1 Introduction

In chapter 3, a number of possible alternative strategies have been suggested for regional/sub-regional cooperation for development of Telecommunications industry. To help identify the projects for initiating action for such cooperation an attempt has been made in chapter 2 to project demand for some of the telecommunications products in different countries of the region. The projections are no doubt subjective and somewhat speculative.

In this chapter and the 5 annexes that follow an attempt has been made to explore the economics of production of a few of these products. The projects considered are:

- Production of small and medium sized digital electronic exchanges.
- Production of telephone instruments.
- Production of small electronic Private Branch Exchanges (PABX's).
- Production of jelly filled telephone cables.
- Production of optical fibre digital transmission cables.

These projects have been chosen merely as an example to make a beginning. Others could be thought of and studied and feasibility reports prepared if there is an interest shown for regional/subregional cooperation in this field.

4.2 Scope and the methodology for preparation and presentation of the projects

4.2.1 Each of the projects has generally been conceived as either an assembly line operation from bought out components (Electronic Digital Exchanges, Telephones & PABX's) or Cabling from bought out materials (Jelly filled cables and optical fibre cables). In each of these cases the scope could be enlarged and financial viability further improved by in house production of some components. This could always be considered in a later phase or when detailed feasibility reports are prepared.

4.2.2 For each project, on the basis of certain assumed design parameters for the product, an attempt has been made to estimate:

(1) Requirements of components & raw material per unit of product and their likely costs on international market. No local import duties or other taxes have been assumed. The prices assumed are conservative and some savings are considered feasible through pooling of demand and entering into long term supply arrangements.

(2) Requirements and costs of basic plant and machinery, jigs and testers, and the infrastructure consisting of land, buildings, and services like power, water, environmental control etc. for various levels of annual production.

(3) Manpower requirements for various levels of annual production, generally working on a single shift basis, and their costs at the average of prevailing manpower costs in developing countries.

4.2.3 Using the above basic estimates, further calculations have been made to determine the economic viability of each project for different levels of production. These include:

(1) An estimate of working capital requirement based on a percentage of the annual material and manpower costs. For different projects figures of 15% to 25% have been used.

(2) Provision has been made for the capital recovery over an average period of 6 years for all the investment in fixed assets at an assumed internal rate of return of 12%. Based on the tables of capital recovery factors, a figure of 20% has been uniformly applied.

(3) An interest rate of 10% per annum has been assumed on the working capital.

(4) A factory overhead of 100% of the manpower costs has been assumed to cover the costs of maintenance and utilities like power, water etc.

(5) A provision has been made for regional support including royalty as a fraction, varying between 5% to 15%, of the cost of components and raw materials.

4.2.4 Based on the above together with the costs of materials and manpower, the basic production cost has been arrived at, in each case. This has been used as the basis of working out a desirable selling price to provide a surplus margin of 10% on the basic production cost. Provision has been made for following additional costs:

(1) Possible level of a value added tax as a percentage of the basic production costs. This has been applied at a graduated level from nil for very small annual production to about 15% for large volumes.

(2) Selling expenses as a fraction of the cost of production that is the ex factory costs. Generally a figure of 10% has been used except where stated otherwise.

4.2.5 Using the surplus margin assumed over the production costs, an annual rate of return on the fixed assets has been worked out. This together with the selling price arrived at above should permit each country to determine for itself the economic and financial viability of each project. Each nation could then decide consider whether this together with other intangible benefits such self reliance, build up of local expertise, and capability for maintenance and servicing, will justify participation in any scheme of setting up production units by regional/sub-regional cooperation.

Reference

Annexes 1 to 5

Chapter 5
Standardization, Quality control, Certification, Testing Repair and Calibration of Telecommunications Equipment

5.1 Introduction

Testing, certification, quality control, standardization, repair and calibration are important aspects of all modern industries, particularly so in case of Telecommunications. Each of these has many dimensions. These are briefly discussed in this chapter.

5.2 Standardization

5.2.1 Standardization in Telecommunications is a multi-level issue.

- At the highest level it relates to standards of performance, network interfaces, operating procedures etc. This work is already being done competently by the ITU and CCITT and to some extent by ISO. Most of the developing countries place highest reliance on the CCITT recommendations which ensures compatibility of their networks internationally.

- The next level involves standardization of designs and equipment practices, and components used in various equipments and products, used in the network. Internationally a number of manufacturers and their R&D groups are developing designs of equipment using different equipment practices and components but all designed to meet the CCITT recommendations. They are compatible but not necessarily interchangeable. Network operators can buy and install equipment from different suppliers and make them interwork. However if one wishes to launch into their production, to ensure economies, one has to standardize the designs, equipment practices and components etc. This becomes an important issue if close regional cooperation is to be introduced in production, maintenance, spare stocks etc. This work is being undertaken at present by national operating administrations for themselves in the larger countries. The smaller countries very often end up with equipment and products from a number of different sources with all the problems of different maintenance and operating needs and practices, spares stocks etc.

This level of standardization can only be feasible through formation of suitable regional/subregional organizations and a conscious decision by the participating countries to work together for their procurement programmes.

5.2.2 Quality control

Quality control is an intrinsic aspect of all modern industry. The whole purpose of the quality control is to ensure repeatability of performance, interchangeability, and agreed level of reliability. This is ensured by appropriate tests at various stages of production starting from the raw materials through components, assemblies and subassemblies. Tests cover a wide variety of parameters, electrical, mechanical, resistance to various types of stresses, temperature, humidity, shocks, vibration, impact, repeated use etc. These are specified as per the performance requirements of the finished equipment and the production processes through which a unit has to pass. In general any production unit has elaborate quality manuals which on one hand specify various tests at various stages and the results expected and on the other certain process control measures. In general considerable investment by way of capital and effort is involved in quality control during production of telecommunications equipment. This will be apparent from the list of capital equipment in each of the production projects presented. In general the test equipment will be found to form the single costliest block of investment.

This tends to push up the economic scales of production. Significant savings can be achieved by resort to testing and certification of th. bought out components in place of investing in large amounts for detailed inwards goods test laboratories. Similarly savings can be effected by pooling test facilities involving destructive life tests, and other performance tests requiring elaborate and costly test set ups, carried out only on representative samples from time to time.

5.2.3 Certification & Testing

A reference has been made to this aspect, in the above para with reference to quality control. Certification of various types of products as conforming to a given specification gives the buyer an assurance of quality without replication of the elaborate and often extremely costly test set ups. Laboratories undertaking this work have been set up in a number of countries including some of the developing ones in this region. They have been equipped to undertake comprehensive electrical, mechanical, reliability etc. tests. Common use of these facilities for testing of bought out components and life and other tests on representative samples will be an important aspect of regional cooperation in production of telecommunication equipmet and products.

Annexe 6, gives a typical list of test set ups required in a typical laboratory undertaking such work along with calibration of test instruments and standards. The investment would vary fairly widely. The test set ups listed in annexe 6 will typically cost about half a million dollars. There will be additional costs on infrastructure like land, buildings, utilitities, environmental control etc. Fairly large expert manpower will also need to be employed. Keeping this in view, it is suggested that in place of investing in a new facility, initially one or two of the existing facilities in the region be suitably strengthened, and facilities and time reserved for test and certification work for any regional cooperation project on payment basis.

5.2.4 Repair and calibration

Almost the entire modern telecommunication equipment has been designed around the concept of each system broken down into suitable functional blocks and modules usually mounted on a plug in type printed circuit board. The equipment and systems are further designed for continuous processor based self checking and diagnosis and automatic isolation of a faulty card and suitable alarm. The immediate maintenance calls for replacement of faulty card by a good one, the faulty one being sent to a centralized repair centre which can then be equipped with more sophisticated test and repair facilities. These facilities are generally identical to the test and rework facilities in regular production industry. This work can thus often be economically undertaken at such factories.

Reference: Annexe 6

Annexe 1

Project for possible regional cooperation manufacture of Small & Medium sized electronic telephone exchanges (100 lines to 10,000 lines)

1.1 Introduction

Digital electronic exchanges are one of the essential components of public telecommunication networks providing the basic telephone and integrated digital services like FAX, data transmission etc. Designs are now available which can provide for all possible applications local, transit and integrated local and transit, economically, in almost all sizes from the smallest to the largest. Some designs are particularly optimal for very small to medium sized exchanges. Such designs are of special interest to the developing countries with large number of rural and semi urban communities.

In this preliminary project profile an attempt has been made to explore the economics of production facilities for annual output levels of 20,000 to 500,000 lines a year of the small and medium sized exchanges.

1.2 Project data and calculations

The data, the assumptions and calculations for the project study are presented in the tables annexed as follows:

Tables 1 and 1A: Financial performance projections at different levels of annual production.

Table 2: The per line requirements of components and raw materials etc. and their cost.

Tables 3A to 3C: The plant, machinery, testing equipment and infrastructural requirements for different levels of annual production and the investment required.

Table 4: The manpower requirements and costs at the average annual remuneration in developing countries, for different levels of annual production.

1.3 Conclusions

The preliminary project study indicates that manufacturing units, down to annual production levels of 50,000 lines a year, set up in different countries on the basis of regional cooperation with organizational networking and sharing of knowhow and certain basic facilities, could produce and offer exchanges at selling prices comparable to the prevailing international prices and earn a reasonable return on fixed capital after providing for the interest on borrowed capital and amortization of the fixed assets. The basic financial performance could be summarised as below:

	Annual production level	Capital Reqd. Fixed + Working million US$	Projected Selling price per line US$	Rate of return on fixed plant after interest & amortization %
	(000) lines			
a)	20	2.11	129	11
b)	50	2.96	112	20
c)	100	4.71	104	26
d)	200	8,82	103	29
e)	500	17.26	100	42

Table 1

Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)
Financial performance
at different levels of annual production

No.	Particulars	Costs etc at different levels US$	US$	US$
Annual production level (lines)>>>		**20K**	**50K**	**100K**
A:	**Capital requirements**			
1.	Fixed assets	1,779,380	2,133,865	3,068,435
2.	Working Capital Required @ 25% of annual consumption of components & 15% of manpower expense	328,625	820,850	1,638,775
B:	**Production costs**			
3.	Cost of components	1,280,000	3,200,000	6,400,000
4.	Cost of manpower	57,500	139,000	258,500
5.	Capital amortization @ 12% ROR, 8 year average life (0.20)	355,876	426,773	613,687
6.	Interest @ 10% on working Capital	32,863	82,085	163,878
7.	Factory overheads @ 100% of manpower cost	57,500	139,000	258,500
8.	Cost of regional support including royalty, @ 5% for 200K 10% for 50 K and 15% for 10K, of cost of components	192,000	320,000	320,000
9.	Total cost of production	1,975,739	4,306,858	8,014,565
10.	**Cost of production per line**	**98.79**	**86.14**	**80.15**
C:	**Value added tax, selling expenses & profit margin**			
11.	Value Added Tax @ 10%	9.88	8.61	8.01
12.	Selling Expense @ 10% of cost of production	9.88	8.61	8.01

Table 1 (continued)
Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)
Financial performance
at different levels of annual production

No.	Particulars	Costs etc at different levels		
		US$	US$	US$
13.	Profit margin @ 10% of cost of production	9.88	8.61	8.01
14.	**Total selling price/line**	**128.42**	**111.98**	**104.19**
D:	**Profitability**			
15.	Total Gross profit	197,574	430,686	801,456
16.	Gross profit as % of fixed assets	11%	20%	26%

Table 1A

Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)

Financial performance
at different levels of annual production

No.	Particulars	Costs etc US$	US$
	Annual production level (lines)>>>	**200K**	**500K**
	A: Capital requirements		
1.	Fixed assets	5,546,798	9,105,790
2.	Working Capital Required @ 25% of annual consumption of components & 15% of manpower expense	3,272,825	8,145,800
	B: Production costs		
3.	Cost of components	12,800,000	32,000,000
4.	Cost of manpower	485,500	972,000
5.	Capital amortization @ 12% ROR, 8 year average life (0.20)	1,109,360	1,821,158
6.	Interest @ 10% on working Capital	327,283	814,580
7.	Factory overheads @ 100% of manpower cost	485,500	972,000
8.	Cost of regional support including royalty, @ 5% for 200K & 500 K 10% for 50 K and 15% for 10K, of cost of components	640,000	1,600,000
9.	Total cost of production	15,847,642	38,179,738
10.	**Cost of production per line**	**79.24**	**76.36**
	C: Value added tax, selling expenses & profit margin		
11.	Value Added Tax @ 10%	7.92	7.64
12.	Selling Expense @ 10% of cost of production	7.92	7.64

Table 1A (Continued)

Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)

Financial performance
at different levels of annual production

No.	Particulars	Costs etc US$	US$
13.	Profit margin @ 10% of cost of production	7.92	7.64
14.	Total selling price per line to achieve above	103.01	99.27
D:	**Profitability**		
15.	Total Gross profit	792,382	3,817,974
16.	Gross profit as % of fixed assets	14%	42%

Table 2

Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)

Component requirements per line

No.	Component particulars		Qty.	procurement cost		
				Rate		Total
				nos.	US$	per US$
1	Capacitors	Ceramic	9769	30	1000	293
2	Capacitors	Electrolytic	922	60	1000	55
3	Capacitors	Plastic metallised	565	60	1000	34
4	Capacitors	Tantulam	536	150	1000	80
5	Chokes		93	200	100	186
6	Connectors	RE 96	56	600	100	336
7	Connectors	RE64	252	500	100	1,260
8	Crystal Oscillators		2	500	100	10
9	Crystals		88	300	1000	26
10	Diodes	General Purpose	5330	20	1000	107
11	Diodes	LED	121	20	1000	2
12	Diodes	SCR	71	100	100	71
13	Displays		15	1000	100	150
14	Drives	Cartridge	2	100	1	200
15	Drives	Floppy	2	40	1	80
16	Drives	OMTI Contoller	2	80	1	160
17	Drives	Winchester	2	200	1	400
18	GDT		801	120	100	961
19	HMC	HMC	458	400	100	1,832
20	HMC	Resistor Networks	1383	300	1000	415
21	IC's	BRAM	16	175	100	28
22	IC's	Codec	458	250	100	1,145
23	IC's	DRAM	880	100	100	880
24	IC's	EPROM	104	550	100	572
25	IC's	I/o devices	300	690	1000	207
26	IC's	LS,HC,HCT	8018	300	1000	2,405
27	IC's	Microprocessors	26	700	1000	18
28	IC's	SRAM	184	175	1000	32
29	IO Devices	Printers	2	150	1	300
30	IO Devices	VDU	3	100	1	300
31	MDF	500 lines	1	5000	1	5,000
32	Mechanical	Cabinets BM/LM	1	150	1	150
33	Mechanical	Cabinets IOP	2	150	1	300
34	Mechanical	FRames	8	200	1	1,600
35	PCB	2-layer	117	15	1	1,755
36	PCB	4-layer	40	35	1	1,400
37	PCB	child	68	3	1	204
38	PCB	mother	8	50	1	400
39	Relays	2 C	671	800	1000	537
40	Relays	4C	464	180	100	835

Table 2 (continued)
Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)

Component requirements per line

No.	Component particulars		Qty.	procurement cost		
				Rate		Total
				nos.	US$	per US$
41	Resistors	Metal Film	9685	10	1000	97
42	Resistors	Wirewound	65	20	1000	1
43	Transformers	Line	522	200	100	1,044
44	Transformers	Others	125	200	100	250
45	Transistors	General Purpose	1279	150	1000	192
46	Transistors	Power	972	300	100	2,916
47	Transistors	Switching	39	100	100	39
48	Tranzil		137	400	1000	55
49	Voltage Regulators		197	350	1000	69
50	Cable assemblies		121	500	100	605
51	Miscellaneous items (set)		1	1000	1	1,000
		Total per system (420 lines + 64 trunks)				30,996
		Per line & trunk (distributed over 484 lines and 64 trunks)				**US$ 64**

Table 3A

Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)
Infrastructure, Plant & Machinery
Based on pure assembly & testing basis

No.	Particulars	Quantity 20	Quantity 50	Cost/ Unit US$	Total Cost US$	Total Cost US$
Annual production (lines)>>>		**20K**	**50K**		**20K**	**50K**
A.	**INCOMING INSPECTION**					
1.	RLC Meter	1	3	7,500	7,500	22,500
2.	Device testers for:					
a)	Active discrete devices	1	2	15,000	15,000	30,000
b)	Transformers	1	1	15,000	15,000	15,000
c)	Relays	1	1	5,500	5,500	5,500
d)	Hybrid Micro Circuits	1	1	1,300	1,300	1,300
e)	IC's TTL & CMOS	1	2	600	600	1,200
f)	IC's-Universal	1	1	60,000	60,000	60,000
g)	Codec (P)	1	1	25,000	25,000	25,000
h)	LSI's	1	1	3,500	3,500	3,500
i)	Memories	1	1	1,500	1,500	1,500
j)	Crystals	1	1	7,000	7,000	7,000
k)	Linear IC's	1	1	20,000	20,000	20,000
l)	IC handlers	1	2	7,000	7,000	14,000
3.	Miscellaneous	1	1	15,000	15,000	15,000
			Total		**183,900**	**221,500**
B.	**Card Assembly-Kitting**					
1.	Lead Forming Machines:					
a)	IC Preforming Machines	1	1	3,000	3,000	3,000
b)	Axial type comp. crop/ form machines	1	1	2,000	0 2,000	0 2,000
c)	Radial type comp. Crop/ Form machines	1	1	2,000	0 2,000	0 2,000
d)	Universal Comp Preparation Machines	1	1	3,000	0 3,000	0 3,000
e)	Radial super jig for (d)	1	1	1,000	1,000	1,000
2.	Comp. Counting M/c's	1	1	1,000	1,000	1,000
3.	Tape Dispensers	1	2	500	500	1,000
4.	PCB Offset Marking M/c's	1	1	1,000	1,000	1,000
5.	Others				500	1,000
			Total		**14,000**	**15,000**

Table 3A(continued)
Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)
Infrastructure, Plant & Machinery
Based on pure assembly & testing basis

No.	Particulars	Quantity no	Quantity no	Cost/ Unit US$	Total Cost US$	Total Cost US$
Annual production (lines)>>			**20K**	**50K**	**20K**	**50K**
C.	**Card Assembly & Wave soldering**					
1.	Semi Auto Machines	4	8	20,000	80,000	160,000
2.	Manual Stations	8	16	1,500	12,000	24,000
3.	Conveyor belt systems per 10 stations	1	2	2,000	2,000	4,000
4.	Loaded PCB Comparators	2	2	3,000	6,000	6,000
5.	Vacuum Forming Machines	1	1	7,000	7,000	7,000
6.	Wave Soldering Machines	1	1	15,000	15,000	15,000
7.	Aqueous cleaners	1	1	15,000	15,000	15,000
8.	Main Lead Trimming M/c's	1	1	7,000	7,000	7,000
9.	DI Water Plant	1	1	7,500	7,500	7,500
10.	Rework Station	2	4	1,200	2,400	4,800
11.	Others	Lot	Lot			
			Total		**181,900**	**280,300**
D.	**Final Card Assembly**					
1.	Automator Lever Press	1	1	200	200	200
2.	Rivetting Gun	1	1	250	250	250
3.	Insert Machine	1	1	200	200	200
4.	Power Screw Drivers	1	2	200	200	400
5.	Flat Cables/Connector crimps	1	1	150	150	150
6.	Thermal strippers	1	1	100	100	100
7.	Pneumatic vices	5	10	150	750	1,500
8.	Manual Torque Screw drivers	1	1	50	50	50
9.	Hot Air Blowers	1	1	100	100	100
10.	Others	Lot	Lot			
			Total		**2,000**	**2,950**

Table 3A(continued)
Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)
Infrastructure, Plant & Machinery
Based on pure assembly & testing basis

No.	Particulars	Quantity no	Quantity no	Cost/ Unit US$	Total Cost US$	Total Cost US$
	Annual production (lines)>>		**20K**	**50K**	**20K**	**50K**
E.	IN-PRODUCTION TESTING & SOFTWARE PROGRAMMING					
1.	Dedicated H/W Tester	8	16	3,000	24,000	48,000
2.	Logic Probes & Pulsers	4	8	725	2,900	5,800
3.	Oscilloscopes	4	8	3,000	12,000	24,000
4.	Multimeters	8	15	150	1,200	2,250
5.	Gang Programmers & Eraser	1	1	7,000	7,000	7,000
6.	Terminals	9	18	500	4,500	9,000
7.	PSU's	4	8	300	1,200	2,400
8.	BM Testers	2	3	10,000	20,000	30,000
9.	CM Testers	1	1	10,000	10,000	10,000
10.	BM Soak Testers	1	1	50,000	50,000	50,000
11.	Multi BM Soak Testers	1	1	50,000	50,000	50,000
12.	MICE	1	2	7,000	7,000	14,000
13.	MDS	1	1	30,000	30,000	30,000
14.	Rework Stations	2	2	1,500	3,000	3,000
15.	IBM PC's	12	25	1,200	14,400	30,000
16.	IBM PC/XT's	2	5	1,500	3,000	7,500
17.	IBM PC/AT's	2	4	4,000	8,000	16,000
18.	132 column printers	3	6	800	2,400	4,800
19.	80 column printers	3	6	400	1,200	2,400
20.	CAD stations & accessories	1	1	8,000	8,000	8,000
21.	IBM PC Software	1	1	5,000	5,000	5,000
22.	Micro Vax II cluster or equivalent	1	1	100,000	0 100,000	0 100,000
23.	Micro Vax accessories	1	1	12,000	12,000	12,000
24.	Micro VAX Software	1	1	75,000	75,000	75,000
25.	Televideo systems	1	2	20,000	20,000	40,000
26.	UPS (50 KVA)	1	1	30,000	30,000	30,000
27.	Miscellaneous (set)	1	1	100,000	100,000	100,000
			Total		**601,800**	**716,150**

Table 3A(continued)
Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)
Infrastructure, Plant & Machinery
Based on pure assembly & testing basis

No.	Particulars	quantity no	quantity no	Cost/ Unit US$	Total Cost US$	Total Cost US$
Annual production (lines)>>		**20K**	**50K**		**20K**	**50K**
F.	**Rack Assembly kitting**					
1.	Power cable cutter	1	1	250	250	250
2.	Pressfit inserting M/c's	1	1	1,000	1,000	1,000
3.	Insertion force controlle	1	1	500	500	500
4.	Retention force controller	1	1	500	500	500
5.	Connector repairing tool set	1	1	500	0 500	0 500
6.	Sleeve marking machine	1	1	250	250	250
7.	Wire prefeed system	1	1	250	250	250
8.	Auto twisted pair cut/ strip machines	1	1	500	0 500	0 500
9.	Crimping tool	1	1	100	100	100
10.	Crimping jaws	1	1	100	100	100
11.	Auto feeding crimping M/c	1	1	1,000	1,000	1,000
12.	Hot air blower Gun	1	1	250	250	250
13.	Others	Lot	Lot			
			Total		**5,200**	**5,200**
G.	**Final Assembly & Wire wrapping**					
1.	Power screw drivers of sorts	1	2	150	150	300
2.	Automator Lever presses	1	1	200	200	200
3.	Torque control device	1	1	250	250	250
4.	Rivetting gun	1	1	250	250	250
5.	Soldering gun	1	1	250	250	250
6.	Torque screwdrivers of sorts	1	1	150	0 150	0 150
7.	Air controlled wrapping guns	3	5	100	0 300	0 500
8.	Cable set testing machine	1	1	350	350	350
9.	Wrapping Pull off tester	1	1	200	200	200
10.	Test Unit for Pins & plugs	1	1	400	0 400	0 400
11.	Rack trolleys	2	4	400	800	1,600
12.	Others	Lot	Lot		500	500
			Total		**3,800**	**4,950**

Table 3A(continued)
Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)
Infrastructure, Plant & Machinery
Based on pure assembly & testing basis

No.	Particulars	Quantity nc	Quantity no	Cost/ Unit US$	Total Cost US$	Total Cost US$
	Annual production (lines)>>	**20K**	**50K**		**20K**	**50K**
	H. System integration, Simulation Tests, & Heat Runs of Critical Modules/blocks					
1.	System Integration Platforms	1	1	100,000	100,000	100,000
2.	Trunk Call generators	1	1	10,000	10,000	10,000
3.	Subscriber Call generators	1	1	10,000	10,000	10,000
4.	Burn-in equipment	1	1	10,000	10,000	10,000
5.	Interface cables & Misc Equipment	Lot	Lot			
6.	Test equipment, software, p.c.'s,printers etc	1	1	100,000	100,000	100,000
			Total		**230,000**	**230,000**
	I. INFRASTRUCTURE					
1.	Land (000 sq. m.)	10	10	1	10,000	10,000
2.	Building (000 sq. m.)	1	1	100	100,000	100,000
3.	Electrical Instn (FOR 000 SQ. M.)	1	1	20	20,000	20,000
4.	Environmental Control (FOR 000 SQ. M.)	1	1	20	20,000	20,000
5.	Compressed Air distribution system	Lot	Lot	lot	5,000	5,000
6.	Water Supply			lot	10,000	10,000
7.	Others including handling and transport equipment, overhead cranes etc			lot	25,000	50,000
			Total		**190,000**	**215,000**

Table 3A(continued)

Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)
Infrastructure, Plant & Machinery
Based on pure assembly & testing basis

SUMMARY

No.	Particulars	Total Cost US$	Total Cost US$
	Annual production (lines)>>	**20K**	**50K**
	A. Machines & Testers etc		
1.	Incoming Inspection	183,900	221,500
2.	Card Assembly-Kitting	14,000	15,000
3.	Card Assembly & Wave Soldering	181,900	280,300
4.	Final Card Assembly	2,000	2,950
5.	In-Production Testing & Software & Data Generation	601,800	716,150
6.	Rack Assembly Kitting	5,200	5,200
7.	Final Assembly & Wire Wrapping	3,800	4,950
8.	System Integration, Simulation tests etc	230,000	230,000
9.	Total Machines & Testers	1,222,600	1,476,050
	B. Incidental expenses, Erection & Test runs @ 30% of J	366,780	442,815
	C. Infrastructure, land, buildings etc	190,000	215,000
	Grand Total	**1,779,380**	**2,133,865**

Notes:

1. Above assumes international competitive prices with no local import duties and other tariffs.

2. For infrastructure comparatively lower costs prevailing in developing countries have been assumed.

3. Incidental & erection expenses include about 10% on account of freight, and 20% on account of erection, installation and trial runs, latter mostly carried by local workers under supervision of suppliers' engineers.

Table 3B

Project for possible regional cooperation

manufacture of

Small & Medium sized electronic telephone exchanges

(100 lines to 10,000 lines)

Infrastructure, Plant & Machinery

Based on pure assembly & testing basis

No.	Particulars	quantity		Cost/ Unit	Total Cost	
		no	no	US$	US$	US$
Annual production (lines)>>>		**100K**	**200K**		**100K**	**200K**
A.	**INCOMING INSPECTION**					
1.	RLC Meter	5	9	7,500	37,500	67,500
2.	Device testers for:					
a)	Active discrete devices	4	8	15,000	60,000	120,000
b)	Transformers	1	2	15,000	15,000	30,000
c)	Relays	1	2	5,500	5,500	11,000
d)	Hybrid Micro Circuits	2	3	1,300	2,600	3,900
e)	IC's TTL & CMOS	4	7	600	2,400	4,200
f)	IC's-Universal	1	1	60,000	60,000	60,000
g)	Codec (P)	1	1	25,000	25,000	25,000
h)	LSI's	2	3	3,500	7,000	10,500
i)	Memories	2	4	1,500	3,000	6,000
j)	Crystals	1	2	7,000	7,000	14,000
k)	Linear IC's	1	2	20,000	20,000	40,000
l)	IC handlers	4	7	7,000	28,000	49,000
3.	Miscellaneous	1	2	15,000	15,000	30,000
			Total		**288,000**	**471,100**
B.	**Card Assembly-Kitting**					
1.	Lead Forming Machines					
a)	IC Preforming Machines	1	2	3,000	3,000	6,000
b)	Axial type comp. crop/ form machines	1	2	2,000	2,000	4,000
c)	Radial type comp. Crop/ Form machines	1	2	2,000	2,000	4,000
d)	Universal Component Preparation Machines	1	2	3,000	3,000	6,000
e)	Radial super jig for (d)	1	2	1,000	1,000	2,000
2.	Comp. Counting M/c's	1	2	1,000	1,000	2,000
3.	Tape Dispensers	3	6	500	1,500	3,000
4.	PCB Offset Marking M/c's	1	2	1,000	1,000	2,000
5.	Others	Lot	Lot		2000	3,000
			Total		**16,500**	**32,000**

Table 3B(continued)

Project for possible regional cooperation

manufacture of

Small & Medium sized electronic telephone exchanges

(100 lines to 10,000 lines)

Infrastructure, Plant & Machinery

Based on pure assembly & testing basis

No.	Particulars	quantity		Cost/ Unit	Total Cost	
		no	no	US$	US$	US$
	Annual production (lines)>>>	**100K**	**200K**		**100K**	**200K**
	C. Card Assembly & Wave soldering					
1.	Semi Auto Machines	15	30	20,000	300,000	600,000
2.	Manual Stations	33	66	1,500	49,500	99,000
3.	Conveyor belt systems per 10 stations	5	9	2,000	10,000	18,000
4.	Loaded PCB Comparators	4	8	3,000	12,000	24,000
5.	Vacuum Forming Machines	3	6	7,000	21,000	42,000
6.	Wave Soldering Machines	1	2	15,000	15,000	30,000
7.	Aqueous cleaners	1	2	15,000	15,000	30,000
8.	Main Lead Trimming M/c's	2	4	7,000	14,000	28,000
9.	DI Water Plant	1	2	7,500	7,500	15,000
10.	Rework Station	8	15	1,200	9,600	18,000
11.	Others	Lot	lot		10,000	22,000
			Total		**496,600**	**990,000**
	D. Final Card Assembly					
1.	Automator Lever Press	2	3	200	400	600
2.	Rivetting Gun	1	2	250	250	500
3.	Insert Machine	1	1	200	200	200
4.	Power Screw Drivers	3	5	200	600	1,000
5.	Flat Cables/Connector crimps	1	1	150	150	150
6.	Thermal strippers	1	2	100	100	200
7.	Pneumatic vices	19	20	150	2850	3,000
8.	Manual Torque Screw drivers	1	2	50	50	100
9.	Hot Air Blowers	1	2	100	100	200
10.	Others	Lot	Lot		500	1,000
			Total		**5,200**	**6,950**

Table 3B

Project for possible regional cooperation

manufacture of

Small & Medium sized electronic telephone exchanges

(100 lines to 10,000 lines)

Infrastructure, Plant & Machinery

based on pure assembly & testing basis

No.	Particulars	Quantity		Cost/ Unit	Total Cost	
		nr	nr	US$	US$	US$
	Annual production (lines)>>>	**100K**	**200K**		**100K**	**200K**
	E. IN-PRODUCTION TESTING & SOFTWARE PROGRAMMING					
	1. Dedicated H/W Tester	32	64	3,000	96,000	192,000
	2. Logic Probes & Pulsers	16	35	725	11,600	25,375
	3. Oscilloscopes	16	35	3,000	48,000	105,000
	4. Multimeters	30	60	150	4,500	9,000
	5. Gang Programmers & Erasers	2	3	7,000	14,000	21,000
	6. Terminals	35	70	500	17,500	35,000
	7. PSU's	15	30	300	4,500	9,000
	8. BM Testers	5	9	10,000	50,000	90,000
	9. CM Testers	1	1	10,000	10,000	10,000
	10.BM Soak Testers	1	3	50,000	50,000	150,000
	11.Multi BM Soak Testers	1	1	50,000	50,000	50,000
	12.MICE	4	8	7,000	28,000	56,000
	13.MDS	1	1	30,000	30,000	30,000
	14.Rework Stations	3	6	1,500	4,500	9,000
	15.IBM PC's	50	100	1,200	60,000	120,000
	16.IBM PC/XT's	9	18	1,500	13,500	27,000
	17.IBM PC/AT's	8	16	4,000	32,000	64,000
	18.132 column printers	11	22	800	8,800	17,600
	19.80 column printers	11	22	400	4,400	8,800
	20.CAD stations & accessories	2	3	8,000	16,000	24,000
	21.IBM PC Software	1	1	5,000	5,000	5,000
	22.Micro Vax II cluster or equivalent	1	2	100,000	100,000	200,000
	23.Micro Vax accessories	1	2	12,000	12,000	24,000
	24.Micro VAX Software	1	1	75,000	75,000	75,000
	25.Televideo systems	3	6	20,000	60,000	120,000
	26.UPS (50 KVA)	1	1	30,000	30,000	30,000
	27.Miscellaneous (set)	1	1	100,000	100,000	100,000
				Total	**935,300**	**1,606,775**

Table 3B(continued)
Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)
Infrastructure, Plant & Machinery
Based on pure assembly & testing basis

No.	Particulars	quantity		Cost/ Unit	Total Cost	
		no	no	US$	US$	US$
Annual production (lines)>>>		**100K**	**200K**		**100K**	**200K**
F.	**Rack Assembly kitting**					
1.	Power cable cutter	1	1	250	250	250
2.	Pressfit inserting M/c's	1	1	1,000	1,000	1,000
3.	Insertion force controller	1	1	500	500	500
4.	Retention force controller	1	1	500	500	500
						0
5.	Connector repairing tool set	1	1	500	500	500
6.	Sleeve marking machine	1	1	250	250	250
7.	Wire prefeed system	2	3	250	500	750
						0
8.	Auto twisted pair cut/ strip machines	1	1	500	500	500
9.	Crimping tool	1	1	100	100	100
10.	Crimping jaws	1	1	100	100	100
11.	Auto feeding crimping M/c's	1	1	1,000	1,000	1,000
12.	Hot air blower Gun	2	2	250	500	500
13.	Others	Lot			1,000	2,000
			Total		**6,700**	**7,950**
G.	**Final Assembly & Wire wrapping**					
1.	Power screw drivers of sorts	4	6	150	600	900
2.	Automator Lever presses	1	2	200	200	400
3.	Torque control device	1	1	250	250	250
4.	Rivetting gun	1	1	250	250	250
5.	Soldering gun	1	1	250	250	250
6.	Torque screwdrivers of sorts	1	2	150	150	300
7.	Air controlled wrapping guns	10	20	100	1,000	2,000
8.	Cable set testing machine	1	1	350	350	350
9.	Wrapping Pull off tester	1	1	200	200	200
10.	Test Unit for Cords & plugs	1	1	400	400	400
11.	Rack trolleys	5	10	400	2,000	4,000
12.	Others	Lot	Lot		1,000	2,000
			Total		**6,650**	**11,300**

Table 3B(continued)
Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)
Infrastructure, Plant & Machinery
Based on pure assembly & testing basis

No.	Particulars	quantity		Cost/ Unit	Total Cost	
		no	no	US$	US$	US$
Annual production (lines)>>>		**100K**	**200K**		**100K**	**200K**
H.	**System integration, simulation tests, and heat runs of critical modules**					
1.	System Integration Platforms	1	2	100,000	100,000	200,000
2.	Trunk Call generators	1	2	10,000	10,000	20,000
3.	Subscriber Call generators	1	2	10,000	10,000	20,000
4.	Burn-in equipment	1	2	10,000	10,000	20,000
5.	Interface cables & Misc Equipment	Lot	lot		10,000	20,000
6.	Test equipment, software, p.c.'s, printers etc	1	2	100,000	100,000	200,000
			Total		**240,000**	**480,000**
I.	**INFRASTRUCTURE**					
1.	Land (000 sq. m.)	20	50	1	20,000	50,000
2.	Building (000 sq. m.)	2	4	100	200,000	400,000
3.	Electrical Instn (000 sq. m.)	2	4	20	40,000	80,000
4.	Environmental Control (000 sq. m.)	2	4	20	40,000	80,000
5.	Compressed Air distribution system	Lot	Lot	lot	10,000	20,000
6.	Water Supply	Lot		lot	15,000	25,000
7.	Others including handling and transport equipment, overhead cranes etc	Lot		lot	150,000	200,000
			Total		**475,000**	**855,000**

Table 3B(continued)
Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)
Infrastructure, Plant & Machinery
Based on pure assembly & testing basis

No.	Particulars	Total Cost US$	Total Cost US$
Annual production (lines)>>>	**100K 200K**	**100K**	**200K**
A. Machines & Testers			
1.	Incoming Inspection	288,000	471,100
2.	Card Assembly-Kitting	16,500	32,000
3.	Card Assembly & Wave Soldering	496,600	990,000
4.	Final Card Assembly	5,200	6,950
5.	In-Production Testing & Software & Data Generation	935,300	1,606,775
6.	Rack Assembly Kitting	6,700	7,950
7.	Final Assembly & Wire Wrapping	6,650	11,300
8.	System Integration, Simulation tests etc	240,000	480,000
9.	Total Machines & Testers	1,994,950	3,606,075
10.	Incidental expenses, Erection & Test runs @ 30% of J	598,485	1,081,823
11.	Infrastructure, land, buildings etc	475,000	855,000
	Total	**3,068,435**	**5,542,898**

Notes:

1. Above assumes international competitive prices with no local import duties and other tariffs.

2. For infrastructure comparatively lower costs prevailing in developing countries have been assumed.

3. Incidental & erection expenses include about 10% on account of freight, and 20% on account of erection, installation and trial runs latter mostly carried by local workers under supervision of suppliers' engineers.

Table 3C

Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)
Infrastructure, Plant & Machinery
Based on pure assembly & testing basis

No.	Particulars	Quantity no	Cost/ Unit US$	Total Cost US$
Annual production (lines)		**500K**		**500K**
A.	**INCOMING INSPECTION**			
1.	RLC Meters	18	7,500	135,000
2.	Device testers for:			
a)	Active discrete devices	14	15,000	210,000
b)	Transformers	5	15,000	75,000
c)	Relays	5	5,500	27,500
d)	Hybrid Micro Circuits	6	1,300	7,800
e)	IC's TTL & CMOS	16	600	9,600
f)	IC's-Universal	1	60,000	60,000
g)	Codec (P)	2	25,000	50,000
h)	LSI's	8	3,500	28,000
i)	Memories	4	1,500	6,000
j)	Crystals	3	7,000	21,000
k)	Linear IC's	3	20,000	60,000
l)	IC handlers	16	7,000	112,000
3.	Miscellaneous	3	15,000	45,000
			Total	**846,900**
B.	**Card Assembly-Kitting**			
1.	Lead Forming Machines			
a)	IC Preforming Machines	3	3,000	9,000
b)	Axial type comp. crop/ form machines	3	2,000	6,000
c)	Radial type comp. Crop/ Form machines	3	2,000	6,000
d)	Universal Comp Preparation Machines	3	3,000	9,000
e)	Radial super jig for (d)	3	1,000	3,000
2.	Comp. Counting M/c's	3	1,000	3,000
3.	Tape Dispensers	10	500	5,000
4.	PCB Offset Marking M/c's	2	1,000	2,000
5.	Others	Lot		5,000
			Total	**48,000**

Table 3C (continued)

Project for possible regional cooperation

manufacture of

Small & Medium sized electronic telephone exchanges

(100 lines to 10,000 lines)

Infrastructure, Plant & Machinery

Based on pure assembly & testing basis

No.	Particulars	Quantity nos	Cost/ Unit US$	Total Cost US$
Annual production (lines)		**500K**		**500K**
C.	**Card Assembly & Wave soldering**			
1.	Semi Auto Machines	38	20,000	760,000
2.	Manual Stations	72	1,500	108,000
3.	Conveyor belt systems per 10 stations	11	2,000	22,000
4.	Loaded PCB Comparators	10	3,000	30,000
5.	Vacuum Forming Machines	8	7,000	56,000
6.	Wave Soldering Machines	2	15,000	30,000
7.	Aqueous cleaners	2	15,000	30,000
8.	Main Lead Trimming M/c's	5	7,000	35,000
9.	DI Water Plant	2	7,500	15,000
10.	Rework Station	18	1,200	21,600
11.	Others	Lot		31,400
			Total	**1,235,000**
D.	**Final Card Assembly**			
1.	Automator Lever Press	5	200	1,000
2.	Rivetting Gun	3	250	750
3.	Insert Machine	2	200	400
4.	Power Screw Drivers	8	200	1,600
5.	Flat Cables/Connector crimps	2	150	300
6.	Thermal strippers	3	100	300
7.	Pneumatic vices	20	150	3,000
8.	Manual Torque Screw drivers	2	50	100
9.	Hot Air Blowers	2	100	200
10.	Others	Lot		1,500
			Total	**9,150**

Table 3C (continued)

Project for possible regional cooperation

manufacture of

Small & Medium sized electronic telephone exchanges

(100 lines to 10,000 lines)

Infrastructure, Plant & Machinery

Based on pure assembly & testing basis

No.	Particulars	Quantity nr	Cost/ Unit US$	Total Cost US$
	Annual production (lines)	**500K**		**500K**
	E. IN-PRODUCTION TESTING & SOFTWARE PROGRAMMING			
1.	Dedicated H/W Tester	110	3,000	330,000
2.	Logic Probes & Pulsers	50	725	36,250
3.	Oscilloscopes	75	3,000	225,000
4.	Multimeters	120	150	18,000
5.	Gang Programmers & Erasers	3	7,000	21,000
6.	Terminals	110	500	55,000
7.	PSU's	60	300	18,000
8.	BM Testers	18	10,000	180,000
9.	CM Testers	2	10,000	20,000
10.	BM Soak Testers	4	50,000	200,000
11.	Multi BM Soak Testers	2	50,000	100,000
12.	MICE	16	7,000	112,000
13.	MDS	1	30,000	30,000
14.	Rework Stations	12	1,500	18,000
15.	IBM PC's	160	1,200	192,000
16.	IBM PC/XT's	36	1,500	54,000
17.	IBM PC/AT's	26	4,000	104,000
18.	132 column printers	44	800	35,200
19.	80 column printers	36	400	14,400
20.	CAD stations & accessories	6	8,000	48,000
21.	IBM PC Software	1	5,000	5,000
22.	Micro Vax II cluster or equivalent	5	100,000	500,000
23.	Micro Vax accessories	5	12,000	60,000
24.	Micro VAX Software	1	75,000	75,000
25.	Televideo systems	6	20,000	120,000
26.	UPS (50 KVA)	1	30,000	30,000
27.	Miscellaneous (set)	1	100,000	100,000
			Total	**2,700,850**

Table 3C (conitnued)

Project for possible regional cooperation

manufacture of

Small & Medium sized electronic telephone exchanges

(100 lines to 10,000 lines)

Infrastructure, Plant & Machinery

Based on pure assembly & testing basis

No.	Particulars	Quantity nos	Cost/ Unit US$	Total Cost US$
Annual production (lines)		**500K**		**500K**
F.	**Rack Assembly kitting**			
1.	Power cable cutter	1	250	250
2.	Pressfit inserting M/c's	2	1,000	2,000
3.	Insertion force controller	1	500	500
4.	Retention force contoller	1	500	500
5.	Connector repairing tool set	1	500	0 500
6.	Sleeve marking machine	1	250	250
7.	Wire prefeed system	5	250	1,250
8.	Auto twisted pair cut/ strip machines	1	500	0 500
9.	Crimping tool	1	100	100
10.	Crimping jaws	1	100	100
11.	Auto feeding crimping M/c's	1	1,000	1,000
12.	Hot air blower Gun	2	250	500
13.	Others	Lot		4,000
			Total	**11,450**
G.	**Final Assembly & Wire wrapping**			
1.	Power screw drivers of sorts	10	150	1,500
2.	Automator Lever presses	2	200	400
3.	Torque control device	2	250	500
4.	Rivetting gun	2	250	500
5.	Soldering gun	2	250	500
6.	Torque screwdrivers of sorts	4	150	600
7.	Air controlled wrapping guns	40	100	4,000
8.	Cable set testing machine	1	350	350
9.	Wrapping Pull off tester	1	200	200
10.	Test Unit for Cords & plugs	1	400	400
11.	Rack trolleys	25	400	10,000
12.	Others	Lot		5,000
			Total	**23,950**

Table 3C (continued)
Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)
- Infrastructure, Plant & Machinery
Based on pure assembly & testing basis

No.	Particulars	quantity no	Cost/ Unit US$	Total Cost US$
	Annual production (lines)	**500K**		**500K**
	H. System integration, simulation tests, and heat runs of critical modules			
1.	System Integration Platforms	5	100,000	500,000
2.	Trunk Call generators	5	10,000	50,000
3.	Subscriber Call generators	5	10,000	50,000
4.	Burn-in equipment	3	10,000	30,000
5.	Interface cables & Misc Equipment	lot		50,000
6.	Test equipment, software, p.c.'s, printers etc	3	100,000	300,000
			Total	**980,000**
	I. INFRASTRUCTURE			
1.	Land (000 sq. m.)	50	1	50,000
2.	Building (000 sq. m.)	8	100	800,000
3.	Electrical Instn (000 sq. m. building)	8	20	160,000
4.	Environmental Control (000 sq. m. building)	6	20	120,000
5.	Compressed Air distribution system	lot		35,000
6.	Water Supply	lot		25,000
7.	Others including handling and transport equipment, overhead cranes etc	lot		300,000
			Total	**1,490,000**

Table 3C (continued)

Project for possible regional cooperation
manufacture of
Small & Medium sized electronic telephone exchanges
(100 lines to 10,000 lines)
Infrastructure, Plant & Machinery
Based on pure assembly & testing basis

SUMMARY

No.	Particulars	Quantity no	Cost/ Unit US$	Total Cost US$
Annual production (lines)		**500K**		**500K**
A:	Machines & Testers			
1.	Incoming Inspection			846,900
2.	Card Assembly-Kitting			48,000
3.	Card Assembly & Wave Soldering			1,235,000
4.	Final Card Assembly			9,150
5.	In-Production Testing & Software & Data Generation			2,700,850
6.	Rack Assembly Kitting			11,450
7.	Final Assembly & Wire Wrapping			23,950
8.	System Integration, Simulation tests etc			980,000
9.	Total Machines & Testers			5,855,300
B.	Incidental expenses, Erection & Test runs @ 30% of J			1,756,590
C.	Infrastructure, land, buildings etc			1,490,000
	Total fixed investment			**9,101,890**

Notes:

1. Above assumes international competitive prices with no local import duties and other tariffs.

2. For infrastructure comparatively lower costs prevailing in developing countries have been assumed.

3. Incidental & erection expenses include about 10% on account of freight, and 20% on account of erection, installation and trial runs latter mostly carried by local workers under supervision of suppliers' engineers.

Table 04

Project for regional cooperation
manufacture of
Small & Medium Sized Electronic Echanges
Estimate of manpower costs
for different levels of annual production
(At average of prevailing manpower costs in developing count

No.	Activity	Manpower requirements for plants with various levels of annual production				
1)	**Annual Production (lines)**	**20K**	**50K**	**100K**	**200K**	**500K**
a.	No. of cards produced					
	Mother Boards	160	800	1600	3200	8000
	Regular Boards	3140	15700	31400	62800	157000
	Child Boards	1360	6800	13600	27200	68000
	Total	4660	23300	46600	93200	233000
b.	Daily production of cards (250 working days a year)					
	Mother Boards	0.64	3.20	6.40	12.80	32.00
	Regular Boards	12.56	62.80	125.60	251.20	628.00
	Child Boards	5.44	27.20	54.40	108.80	272.00
	Total	18.64	93.20	186.40	372.80	932.00
3.	**Manpower Requirement**					
A:	Skilled Operatives					
	a) Preparation of Components					
	Mother Boards	0.04	0.20	0.40	0.80	2.00
	Regular Boards	0.79	3.93	7.85	15.70	39.25
	Child Boards	0.14	0.68	1.36	2.72	6.80
	Total	0.96	4.80	9.61	19.22	48.05
	b) Stuffing of Components					
	Regular Boards	3.14	15.70	31.40	62.80	125.60
	Child Boards	1.15	1.15	1.15	1.15	1.15
	Total	4.29	16.85	32.55	63.95	126.75
c)	Check loaded PCB's	0.10	0.25	0.50	1.00	2.00
d)	Wave soldering & cleaning	0.25	0.50	0.50	1.00	2.00
e)	Inspect & rework	0.25	0.50	0.50	1.00	2.00
f	Final card assembly	0.15	0.40	1.00	2.00	5.00

Table 04 (continued)
Project for regional cooperation
manufacture of
Small & Medium Sized Electronic Echanges
Estimate of manpower costs

for different levels of annual production

(At average of prevailing manpower costs in developing count

No.	Activity		Manpower requirements for plants with various levels of annual production				
A:	Skilled Operatives (continued)						
f)	Functional test of cards		0.25	0.50	1.00	2.00	5.00
g)	Rack assembly		0.20	0.50	1.00	2.00	5.00
h)	Rack wiring		2	5	10	20	50
i)	Functional testing		1	1	2	5	10
j)	Miscellaneous		2	4	6	12	20
		Total	10.951	34.305	64.66	129.17	275.8
		Say	11	34	65	129	276
Annual Cost at US 1500		US$	16500	51000	975000	193500	414000
B:	General help		1	3	5	10	20
	Annual cost @ US$ 1000		1000	3000	5000	10000	20000
C:	Testers & Supervisors		2	5	10	20	40
	Cost @ $ 2000 p.a.		4000	10000	20000	40000	80000
D:	Engineers		2	5	10	20	40
	Cost @ $ 5000 p.a.	US$	10000	25000	50000	100000	200000
E:	Sales & Buyers		2	4	8	16	32
	Cost @ $ 5000 p.a.	US$	10000	20000	40000	80000	160000
F:	Accounts		2	3	5	7	12
	Cost @ $ 4000 p.a.	US$	8000	12000	20000	28000	48000
G:	Managers		1	1	2	3	5
	Cost @ $ 8000 p.a.	US$	8000	8000	16000	24000	40000
H:	General Manager		0	1	1	1	1
	Cost @ $ 12000 p.a.	US$		12000	12000	12000	12000
	Total Manpower Cost	US$	57500	[illegible]	258500	485500	972000

Annexe 2
A Preliminary Project for possible regional cooperation for manufacture of Telephone Instruments

2.1 Introduction

A telephone instrument is an essential subscriber terminal equipment for telephone service and is used on all lines whether main lines from the public network or an extension from a private branch exchange. Modern electronic instruments are simple in design and given proper choice of components can give highly reliable service over long life. Till recently the signalling between the instrument and the exchange was on what is known as decadic pulsing. There is however a growing trend towards Dual Tone Multi Frequency (DTMF) signalling. Keeping the transistional phase in view it is desirable to standardise Dial Pulse/DTMF switchable instruments, eventually to be replaced by purely DTMF type. The latter type will involve significant savings in component costs.

The basic manufacture of telephone instruments involves procurement of various components, plastic housing and cords, assembly of components on a printed circuit board an d their soldering. assembly of various items in the housing, termination of cords and final testing. The whole process is fairly simple. To this however at a later stage can be added the production of moulded parts like housing etc.

In this preliminary project profile an attempt has been made to explore the economics of production facilities for annual output levels of 10,000 to 200,000 pieces of telephone instruments a year.

2.2 Project data and Calculations

The data, the assumptions and calculations for the project study are presented in the tables annexed as follows:

Table 1 : Financial performance projections at different levels of annual production.

Table 2: The per telephone set requirements of components and raw materials etc. and their cost.

Tables 3A to 3C: The plant, machinery, testing equipment and infrastructural requirements for different levels of annual production and the investment required.

Table 4: The manpower requirements and costs at the average annual remuneration in developing countries. for different levels of annual production.

2.3 Conclusions

The financial results of the preliminary project study can be summarised as below:

	Annual production level (000) lines	Capital Reqd. Fixed + Working thousand US$	Projected Selling price per set US$	Rate of return on fixed plant After interest & amortization %
a)	10	127	22.6	10
b)	50	223	18.7	33
c)	200	640	17.9	60

Above figures indicate that manufacturing units, down to annual production levels of 50,000 telephone instruments a year, set up in different countries on the basis of regional cooperation with organizational networking and sharing of knowhow and certain basic facilities, could produce telephones sets of high quality and reliability, at selling prices comparable to the prevailing international prices and earn a reasonable return on fixed capital after providing for the interest on borrowed capital and amortization of the fixed assets. The economical level could perhaps be stretched down to even 20,000 pieces a year.

Annexe 2 Table 1

Project for regional cooperation
for manufacture of
Telephone Instruments
at different levels of annual production
Projection of Financial performance

No.	Particulars	Costs etc in US $		
A:	**Production level in thousands of sets per annum**	**10**	**50**	**200**
B:	**Capital requirements**			
1.	Fixed assets	105,350	123,100	246,800
2.	Working Capital Required @ 15% of annual consumption of components & 10% of manpower expense	20,893	99,350	393,100
C:	**Production costs**			
3.	Cost of components	127,500	637,500	2,550,000
4.	Cost of manpower	17,675	37,250	106,000
5.	Capital amortization @ 12% ROR, 8 year average life (0.20)	21,070	24,620	49,360
6.	Interest @ 10% on working Capital	2,089	9,935	39,310
7.	Factory overheads @ 100% of manpower cost	17,675	37,250	106,000
8.	Cost of regional support including royalty, @ 5% for 200K; 10% for 50 K and 15% for 10 K of cost of components	19,125	63,750	127,500
9.	Total cost of production	205,134	810,305	2,978,170
10.	Cost of production per set	20.51	16.21	14.89
C:	**Value added tax, selling expenses & profit margin**			
11.	Value Added Tax @ 10% for 200K, 5% for 50K & nil for 10K	0.00	0.81	1.49
12.	Selling Expense @ 0.05% of cost of production	1.03	0.81	0.74
13.	Profit margin @ 5 cost of production	1.03	0.81	0.74
14.	**Total selling price/set**	**22.56**	**18.64**	**17.87**

Annexe 2 Table 1 (continued)
Project for regional cooperation
for manufacture of
Telephone Instruments
at different levels of annual production
Projection of Financial performance

No.	Particulars	Costs etc in US $		
	These selling prices are comparable for international prices for good quality, reliable sets. The project may therefore be considered viable.			
A:	**Annual production level in thousands of sets per annum**	**10**	**50**	**200**
D:	**Profitability**			
15.	Total Gross profit	10,257	40,515	148,909
16.	**Gross profit as % of fixed assets**	**10%**	**33%**	**60%**

Annexe 2 Table 2
Project for regional cooperation
for manufacture of
Telephone Instruments

Estimate of cost of components for a set

No.	Particulars	No. of types	Qty/ set no.	Price Rate US$ per	Price Total/set US$	%
1.	Capacitors, Metalized Plastic Film	10	12	50 /000	0.60	4.72
2.	Capacitors, Electrolytic Aluminium	4	6	80 /000	0.48	3.78
3.	Cords, Hand set, coiled	1	1	500 /000	0.50	3.94
4.	Cords, Instrument, Straight	1	1	300 /000	0.30	2.36
5.	Diodes	5	9	25 /000	0.23	1.77
6	FET	1	1	200 /000	0.20	1.57
7.	Hook Switches	1	1	60 /00	0.60	4.72
8.	Housing Parts Set of 13	1	1	2.5 /set	2.50	19.68
9.	IC's Dialler	1	1	400 /000	0.40	3.15
10.	IC's Speech	1	1	1000 /000	1.00	7.87
11.	IC's Ringer	1	1	400 /000	0.40	3.15
12.	Keybooard Push button	1	1	100 /00	1.00	7.87
13.	PCB's Single layer	1	1	600 /000	0.60	4.72
14.	Quartz Crystal Oscillator	1	1	300 /000	0.30	2.36
15.	R. Button	1	1	200 /000	0.20	1.57
16.	Resistors, Metal film (0.25w)	28	28	6 /000	0.17	1.32
17.	Resistors, Metal film (0.50w)	2	2	6 /000	0.01	0.09
18.	Transducers, Transmitter	1	1	600 /000	0.60	4.72
19.	Transducers, Receiver	1	1	600 /000	0.60	4.72
20.	Transducers, Ringer	1	1	200 /000	0.20	1.57
21.	Transistors	4	5	120 /000	0.60	4.72
22.	Varistors	1	1	120 /000	0.12	0.94
23.	Miscellaneous set of screws, washers terminals, rubber shoes etc	1	1	0.6 /set	0.60	4.72
24.	Packing materials				0.50	3.94
	Total/set	70	79		12.71	100.00
	Say				12.75	

Notes:

1. Above prices are based on a high quality, highly reliable DTMF/ Dial pulse switchable electronic telephone set.

2. Higher volumes & long term arrangements with suppliers could result in significant savings. This can be a very significant advantage of regional cooperation.

Annexe 2 Table 3A
Project for regional cooperation
for manufacture of
Telephone Instruments
ASSEMBLY LINE ONLY, ALL COMPONENTS BOUGHT OUT
Production level 200,000 sets a year
Infrastructure, Plant and Machinery

No.	Particulars	No.	Typical prices unit US$	total US$
A:	**Hand preparation of electronic components**			
1.	Cutting & bending jig & tools for axial components belted	1	200	200
2.	Cutting & bending jig & tools for components, singles	1	100	100
3.	Cutting device for transistors	1	200	200
4.	Straightening device for IC's	1	200	200
5.	Counting device for components belted	1	200	200
6.	Wire link cutter	1	50	50
7.	Component testing & preparation tables	2	500	1,000
B:	**Component insertion in PCB**			
1.	Conveyorised stuffing stations with stuffing jigs	12	800	9,600
C:	**Wave Soldering**			
1.	Wave soldering machine 12" size with cleaning & cutting facility	1	15,000	15,000
2.	Soldering frames for above	10	50	500
3.	Inspection & Repair table	1	200	200
4.	Soldering iron (temp. controlled)	1	50	50
D:	**Instrument Assembly**			
1.	Conveyorised Telephone set Assembly stations	30	800	24,000
2.	Pneumatic Screwdrivers	10	100	1,000
3.	Soldering irons	10	50	500
	Total carried forward			52,800

Annex 2 Table 3A

Project for regional cooperation
for manufacture of
Telephone Instruments
ASSEMBLY LINE TYPE, ALL COMPONENTS BOUGHT OUT
Production level 200,000 sets a year
Infrastructure, Plant and Machinery

No.	Particulars	No.	Typical prices unit US$	Typical prices total US$
	Brought forward			**52,800**
	E: Testing, labelling & packing			
1.	Digital LCR meter	1	1,000	1,000
2.	Digital capacitance meter	1	1,000	1,000
3.	Digital precision ammeter for low resistance measurement	1	1,500	1,500
4.	Insulation resistance tester	1	1,000	1,000
5.	High voltage test equipment	1	1,500	1,500
6.	IC,Transistors & Diodes tester	1	25,000	25,000
7.	In-circuit board tester taking upto 2048 points	1	15,000	15,000
8.	Key board tester	1	10,000	10,000
9.	Hook Switch life tester	1	1,000	1,000
10.	Cord life tester	1	1,000	1,000
11.	Ringer life tester	1	1,000	1,000
12.	Tone Pulse Telephone analyser	1	5,000	5,000
13.	Telephone tester with accessories including testing of transducers	1	35,000	35,000
14.	General purpose multi-meters	2	500	1,000
15.	Testing & labelling table	1	500	500
	Total machines, jigs, testers etc			**153,300**
	F. Infrastructure			
1.	Building, electric power dust filtering, water supply (sq m of built up area)	500	175	87,500
2.	office equipment & furniture	set	6,000	6,000
	Total infrastrusture			**93,500**
	Total fixed plant investment			**246,800**

Annex 2 Table 3B

Project for regional cooperation
for manufacture of
Telephone Instruments
ASSEMBLY LINE ONLY, ALL COMPONENTS BOUGHT OUT
Production Level 50,000 sets a year
Infrastrusture, machines, jigs & testers

No.	Particulars	No.	Typical prices unit US$	total US$
A:	**Hand preparation of electronic components**			
1.	Cutting & bending jig & tools for axial components belted	1	200	200
2.	Cutting & bending jig & tools for components, singles	1	100	100
3.	Cutting device for transistors	1	200	200
4.	Straightening device for IC's	1	200	200
5.	Counting device for components belted	1	200	200
6.	Wire link cutter	1	50	50
7.	Component testing & preparation tables	1	500	500
B:	Component insertion in PCB			
1.	Conveyorised stuffing stations with stuffing jigs	3	800	2,400
C:	Wave Soldering			
1.	Wave soldering machine 12" size with cleaning & cutting facility	1	10,000	10,000
2.	Soldering frames for above	10	50	500
3.	Inspection & Repair table	1	200	200
4.	Soldering iron (temp. controlled)	1	50	50
D:	Instrument Assembly			
1.	Conveyorised Telephone set Assembly stations	8	800	6,400
2.	Pneumatic Screwdrivers	4	100	400
3.	Soldering irons	4	50	200
	Total carried forward			**21,600**

Annexe 2 Table 3B

Project for regional cooperation
for manufacture of
Telephone Instruments
ASSEMBLY LINE ONLY, ALL COMPONENTS BOUGHT OUT
Production level 50,000 sets a year
Infrastrusture, machines, jigs & testers

No.	Particulars	No.	Typical prices unit US$	total US$
	Brought forward			21,600
	E: Testing, labelling & packing			
1.	Digital LCR meter	1	1,000	1,000
2.	Insulation resistance tester	1	1,000	1,000
3.	High voltage test equipment	1	1,500	1,500
4.	Telephone tester with accessories including testing of transducers	1	35,000	35,000
5.	Additional accessories for above to enable in cicuit board testing	1	5000	5,000
6.	General purpose multi-meters	2	500	1,000
7.	Testing & labelling table	1	500	500
	Total machines, jigs, testers etc			66,600
	F. Infrastructure			
1.	Building, electric power dust filtering, water supply (sq m of built up area)	300	175	52,500
2.	office equipment & furniture	set	4,000	4,000
	Total infrastructure			**56,500**
	Total fixed plant investment			**123,100**

Annexe 2 Table 3C

Project for regional cooperation
for manufacture of
Telephone Instruments
ASSEMBLY LINE ONLY, ALL COMPONENTS BOUGHT OUT
Production level 10,000 sets a year
Infrastrusture, machines, jigs & testers

No.	Particulars	No.	Typical prices unit US$	total US$
A:	**Hand preparation of electronic components**			
1.	Cutting & bending jig & tools for axial components belted	1	200	200
2.	Cutting & bending jig & tools for components, singles	1	100	100
3.	Cutting device for transistors	1	200	200
4.	Straightening device for IC's	1	200	200
5.	Counting device for components belted	1	200	200
6.	Wire link cutter	1	50	50
7.	Component testing & preparation tables	1	500	500
B:	**Component insertion in PCB**			
1.	Component stuffing stations with stuffing jigs	1	800	800
C:	**Wave Soldering**			
1.	Wave soldering machine 12" size with cleaning & cutting facility	1	8,000	8,000
2.	Soldering frames for above	4	50	200
3.	Inspection & Repair table	1	200	200
4.	Soldering iron (temp. controlled)	1	50	50
D:	**Instrument Assembly**			
1.	Conveyorised Telephone set Assembly stations	2	800	1,600
2.	Pneumatic [illegible]	2	100	200
3.	Soldering irons	2	50	100
	Total carried forward			**12,600**

Annexe 2 Table 3C (continued)

Project for regional cooperation

for manufacture of

Telephone Instruments

ASSEMBLY LINE UNIT, ALL COMPONENTS BOUGHT OUT

Production level 10,000 sets a year

Infrastrusture, machines, jigs & testers

No.	Particulars	No.	Typical prices unit US$	Typical prices total US$
	Brought forward			**12,600**
	E: Testing, labelling & packing			
1.	Digital LCR meter	1	1,000	1,000
2.	Insulation resistance tester	1	1,000	1,000
3.	High voltage test equipment	1	1,500	1,500
4.	Telephone tester with accessories including testing of transducers	1	35,000	35,000
5.	Additional accessories for above to enable in circuit board testing	1	5000	5,000
6.	General purpose multi-meters	2	500	1,000
7.	Testing & labelling table	1	500	500
	Total machines, jigs, testers etc			**57,600**
	F. Infrastructure			
1.	Building, electric power dust filtering, water supply (sq m of built up area)	250	175	43,750
2.	office equipment & furniture	set	4,000	4,000
	Total infrastructure			**47,750**
	Total fixed plant investment			**105,350**

Annexe 2 Table 4

Project for regional cooperation
for manufacture of
Telephone Instruments
ASSEMBLY LINE ONLY, ALL COMPONENTS BOUGHT OUT
Production Level 10,000 sets a year
Estimate of manpower costs for
Different Levels of Annual Production
(At average of prevailing manpower costs in developing countries)

No.	Activity		Manpower requirements & Costs		
A:	**Annual & daily production**				
1.	Annual production (pieces)		200K	50K	10K
2.	Daily production (250 working days a year)		800	200	40
B.	**Manpower requirement & costs**				
1:	**Skilled operatives**				
	Preparation of components		4	1	0.25
	Stuffing of components		12	3	1
	Wave soldering & cleaning		1	0.5	0.2
	Assembly		30	8	2
	Testing & packing		8	2	1
	General help		5	3	2
	Total		60	17.5	6.45
	Cost @ $1500 p.a.	US$	90,000	26,250	9,675
2:	**Supervisory**		3	2	1
	Cost @ $ 2000 p.a.	US$	6,000	4,000	2,000
3:	**Sales & Accounts**		2	1	1
	Cost @ $ 2000 p.a.	US$	4,000	2,000	2,000
C:	**Manager**		1	1	1
	Cost	US$	6,000	5,000	4,000
	Total manpower cost	US$	106,000	37,250	17,675

Annexe 3
Project for possible regional cooperation for manufacture of VERY SMALL PABX's (2+4, 3+8, 6+16, & 8+30) -10 K lines (1750 units) p.a.

1.1 Introduction

Small electronic private branch exchanges are used in large numbers at subscriber premises for integrating internal and public communication needs of small establishments. They combine the advantages of small initial investment, reliability, and elimination of the need for a dedicated PABX operator. There is going to be be substantial demand for such PABX's in developing countries with the growth of small business and industrial establishments. Suitable designs are available to handle from 2 to 8 or even 16 trunks from the public network to upto 30 internal extensions.

In this preliminary project profile an attempt has been made to explore the economics of production facilities for a very modest annual output 10,000 lines (measured in terms of trunks +extensions).

1.2 Project data and calculations

The data, the assumptions and calculations for the project study are presented in the tables annexed as follows:

Tables 1 : Financial performance projections at different levels of annual production.

Table 2: The per line requirements of components and raw materials etc. and their cost.

Tables 3: The plant, machinery, testing equipment, infrastructure and the investment required for the 10,000 lines of annual production .

Table 4: The manpower requirements and costs at the average annual remuneration in developing countries.

1.3 Conclusions

The projected basic financial performance of the project could be summarised as below:

	Annual Production level in (000) lines	Capital Reqd. Fixed + Working thousand US$	Projected Selling price per line US$	Rate of return on fixed plant After interest & amortization %
a)	10	156	27	104

The figures indicate that manufacturing units, down to an annual production level of 10,000 lines a year, set up in different countries on the basis of regional cooperation with organizational networking and sharing of knowhow and certain basic facilities, could produce and offer small private branch exchanges at selling prices comparable to the prevailing international prices and earn a highly attractive return on fixed capital after providing for the interest on borrowed capital and amortization of the fixed assets.

Annexe3 Table 1

Project for possible regional cooperation
for manufacture of
VERY SMALL PABX's (2+4, 3+8, 6+16, & 8+30)
10 K lines (1750 units) p.a.
Projection of financial performance

No.	Particulars	Amount (US$)
A:	**Capital requirements**	
1.	Fixed assets	120,000
2.	Working Capital Required @ 25% of annual consumption of components & 15% of manpower expense	33,656
B:	**Production costs**	
3.	Cost of components	116,125
4.	Cost of manpower	27,500
5.	Capital amortization @ 12% ROR, 6 year average life (0.20)	24,000
6.	Interest @ 10 on working Capital	3,366
7.	Factory overheads @ 100 of manpower cost	27,500
8.	Cost of regional support including royalty, @ 15% of cost of components	17,719
9.	Total cost of production	218,209
10.	**Cost of production per set**	**124.69**
C:	**Value added tax, selling expenses & profit margin**	
11.	Value Added Tax @ 10	12.47
12.	Selling Expense @ 10 of cost of production	12.47
13.	Profit margin @ 10 of cost of production	12.47
14.	**Total selling price/set (2+4) /per line**	**162.10 27**

This is comparable to international price. As seen below the financial return is quite attractive.

Annexe3 Table 1 (continued)
Project for possible regional cooperation
for manufacture of
VERY SMALL PABX's (2+4, 3+8, 6+16, & 8+30)
10 K lines (1750 units) p.a.
Projection of financial performance

No.	Particulars	Amount (US$)
D:	**Profitability**	
15.	Total Gross profit	124,691
16.	Gross profit as % of fixed assets	**104%**

Annexe 3 Table 2
Project for regional cooperation
for manufacture of
VERY SMALL PABX's

cost of components for a set 2+4 system

No.	Components:	Qty	Price		
		no.	Rate US$ per	US$	Total/set %
1	Capacitors, Metalized Plastic Film	6	50 /000	0.30	0.45
2	Capacitors, Ceramic	42	10 /000	0.42	0.62
3	Capacitors, Electrolytic Aluminium	16	80 /000	1.44	2.14
4	Connectors, Others	8	160 /000	1.28	1.90
5	Connectors, D type	2	500 /000	1.00	1.49
6	Diodes & transistors	18	10 /00	1.80	2.68
7	Flat cable set	1	500 /000	0.50	0.74
8	Housing Parts Metal cabinet	1	500 /00	5.00	7.43
9	IC's, ZIT microprocessor	1	150 /00	1.50	2.23
10	IC's, others	42	25 /00	10.50	15.61
11	LED's	2	30 /000	0.06	0.09
12	Miscellaneous: set of screws, washers terminals, rubber shoes etc	1	500 /000	0.50	0.74
13	Nicad battery, 3.6 volts 100 mAHr	1	120 /00	1.20	1.78
14	PCB's, 2, 14X10 & 12X9 inches	250	100 /000	25.00	37.16
15	Quartz Crystal oscillators	2	300 /000	0.60	0.89
16	Relays	12	100 /00	12.00	17.83
17	Resistors, Metal film	84	6 /000	0.50	0.75
18	Varistors	24	120 /000	2.88	4.28
19	Packing materials	1	800 /000	0.80	1.19
	Total/set			67.28	100.00
	Say			67.50	

Notes:

1. Above prices are based on 2+4 PABX i.e. 6 lines set. Taken proportionately this will mean slight over provision for larger sizes

2. Higher volumes & long term arrangements with suppliers could result in significant savings.

Annexe 3 Table 3
Project for regional cooperation
manufacture of
VERY SMALL PABX's
Production level: 10,000 lines (Extensions + trunks)

Infrastructure, Plant & Machinery

No.	Particulars	Qty. no.	prices unit US$	prices total US$
A:	**Hand preparation of electronic components**			
1.	Cutting & bending jig & tools for axial components belted	1	200	200
2.	Cutting & bending jig & tools for radial components belted	1	200	200
3.	Cutting & bending jig & tools for components, singles	1	100	100
4.	Cutting device for transistors	1	200	200
5.	Straightening device for IC's	1	200	200
	Counting device for components belted	1	200	200
6.	Wire link cutter	1	50	50
7.	Component testing & preparation tables	1	500	500
B:	**Component insertion in PCB**			
1.	Conveyorised stuffing stations with stuffing jigs	5	800	4,000
C:	**Wave Soldering**			
1.	Wave soldering machine 12" size with cleaning & cutting facility	1	6,000	6,000
2.	Soldering frames for above	100	50	5,000
3.	DI water plant	1	1000	1,000
4.	Inspection & Repair table	1	200	200
5.	Soldering iron (temp. controlled)	1	50	50
D:	**PABX Assembly**			
1.	Conveyorised PABX Assembly stations	3	800	2,400
2.	Pneumatic Screwdrivers	3	100	300
3.	Soldering irons	3	50	150
	Total carried forward			**20,750**

Annexe 3 Table 3 (continued)
Project for regional cooperation
manufacture of
VERY SMALL PABX's
Production level: 10,000 lines (Extensions + trunks)

Infrastructure, Plant & Machinery

No.	Particulars	qty.	-----prices----- unit US$	total US$
		no.		
	Brought forward			**20,750**
	E: Testing, labelling & packing			
1.	Digital LCR meter	1	1,000	1,000
2.	Digital capacitance meter	1	1,000	1,000
3.	Digital precision ohmmeter for low resistance measurement	1	1,500	1,500
4.	Insulation resistance tester	1	1,000	1,000
5.	High voltage test equipment	1	1,500	1,500
7.	In-circuit board tester taking upto 2048 points	1	15,000	15,000
8.	EPROM Programmer	1	2000	2,000
9.	Return Loss analyser	1	3000	3,000
10.	DTMF analyser	1	5,000	5,000
11.	Oscilloscope 20MHz	1	2000	2,000
12.	DC Power supply	1	500	500
13.	General purpose multi-meters	2	500	1,000
14.	Testing & labelling table	1	500	500
	Total machines, jigs, testers etc			**55,750**
	F. Infrastructure			
1.	Building, electric power dust filtering, water supply (sq m of built up area)	300	175	52,500
2.	office equipment & furniture	set	6,000	6,000
	Total infrastructure			**114,250**
	Add Contingencies			5,000
	Total fixed plant investment			**119,250**
			Say	**120,000**

Annexe 3 Table 4
Project for regional cooperation
manufacture of
VERY SMALL PABX's
10K lines(equivalent to 1750 2+4 units)
Annual Manpower costs
(At average of prevailing manpower costs in developing countries)

No.	Activity		Manpower requirements and costs
1.	Annual production (pieces)		10K (1670 units)
2.	Daily production (250 working days a year)		40 lines 6-7 units
3.	Manpower requirement		
A:	**Skilled operatives**		
	Preparation of components		1
	Stuffing of components		4
	Wave soldering & cleaning		1
	Assembly		2
	Testing & packing		3
	General help		2
	Total		13
	Cost @ $1500 p.a.	**US$**	**19,500**
B:	**Supervisory**		**1**
	Cost @ $ 2000 p.a.	**US$**	**2,000**
C:	**Sales & Accounts**		**1**
	Cost @ $ 2000 p.a.	**US$**	**2,000**
C:	**Manager**		**1**
	Cost	**US$**	**4,000**
	Total manpower cost	**US$**	**27,500**

Annexe 4
Project for possible regional cooperation for manufacture of Jelly filled telephone cables 4500 Sheath Km, 500,000 CKm (Steel tape armoured)

4.1 Introduction

Every subscriber's terminal equipment has to be connected to the public telecommunication network by a dedicated 2wire/4 wire circuit. Till now, except for serving very large private branch exchanges with a large number of main lines, insulated copper wire pairs formed into suitable cables laid underground in ducts have been found to be the most reliable and cost effective means for this connection. Various types of cable constructions have been developed and used. At present jelly filled cables with individual conductors insulated with either solid polyethelene or foam are the most widely accepted. In many developing countries where ducts have not been laid yet, steel tape armoured cables are in use.

In this preliminary project, economics of setting up a jelly filled telephone cable plant with a modest annual capacity of 500,000 conductor kilometers in 4500 sheat kilometers with steel tape armouring has been studied.

4.2 Project data and calculations

The data, the assumptions and calculations for the project study are presented in the tables annexed as follows:

Tables 1 : Financial performance projections

Table 2: The raw material requirements

Tables 3: The plant, machinery, testing equipment, infrastructure and the investment required.

Table 4: The manpower requirements and costs at the average annual remuneration in developing countries.

1.3 Conclusions

The projected basic financial performance of the project can be summarised as below:

	Annual Production level in CKM	Capital Reqd. Fixed - Working million US$	Projected Selling price per Ckm US$	rate of return on fixed plant After interest & amortization %
a)	500,000	8.00	23.50	12.78

The figures indicate that manufacturing units, for stell tape armoured jelly filled cables at a modest annual capacity of 500,000 CKm can be quiet economical. The economics will imporve further with use of unarmoured cables once cables once cables ducts have been constructed.

Annexe 4 Table 1

A possible project for regional cooperation

Production of Jelly filled telephone cables
(Steel tape armoured)
Projection of financial performance

No	Particulars	Cost etc US$
A:	**Investment required**	
1.	Fixed Plant	7,073,920
2.	Working capital at 25% of annual raw material and 15% of manpower costs	1,698,400
B:	**Production costs**	
1.	Raw materials	6,691,000
2.	Manpower	171,000
3.	Amortization of plant at 12% ROR for average life of 6 years (CRF 20%)	1,414,784
4.	Interest on working capital at 10% per annum	169,840
5.	Plant overhead @ 150% of manpower cost	256,840
6.	Regional support including royalty @ 5% of raw material costs	334,550
	Total production costs	**9,037,674**
C:	**VAT, selling expense, & margin**	
1.	Value added tax @ 10% of production cost	903,767
2.	Selling expense @ 10% of production value	903,767
3.	Margin @ 10% of production value	903,767
4.	**Total selling price**	**11,748,976**
	per CKm	**23.50**

Annexe 4 Table 1 (Continued)
A possible project for regional cooperation
Production of Jelly filled telephone cables
(Steel tape armoured)
Projection of financial performance

No	Particulars	Cost etc US$
D:	**Return on fixed plant**	
1.	Gross profit	903,767
2.	Rate of return on fixed plant after amortization & interest	12.78%

Likely Sales realization at international prices of steel tape armoured jelly filled cables

No	Paticulars	Qty Sheath Km	Rate US$ per Km	Sales Value US$
1.	0.5 mm 20 pair	250	1,400	350,000
2.	0.5 mm 50 pair	4,200	2,600	10,920,000
3.	0.5 mm 400 pair	30	17,500	525,000
4.	0.5 mm 600 pair	40	20,000	800,000
	Total			12,959,000

Annexe 4 Table 2
A possible project for regional cooperation
Production of Jelly filled telephone cables
(Steel tape armoured)
Raw materials required for production of
About 500,000 conductor Km in 4500 sheath Km

Sl. No.	Particulars	Qty Reqd M.T.	Unit Price US$/MT	Total Cost US$
1.	Annealed Bright Copper Rods	900	2,500	2,250,000
2.	High Density Polyethylene	350	1,515	530,250
3.	Colour Master Binder	15	10,000	150,000
4.	Colour Binder	5	3350	16,750
5.	Filling Compound	400	1,020	408,000
6.	Polyester Film(core wrap)	20	3800	76,000
7.	Aluminium Laminate(Poly-Al)	120	3,000	360,000
8.	Low Density Polyethelene(LDPE)	675	1,600	1,080,000
10.	LDPE Tape	90	1380	124,200
11.	Galvanized steel tape	1,400	700	980,000
12.	Flooding compound	40	1020	40,800
13.	Wooden cable drums (no.'s)	4,500	150	675,000
	Total			6,691,000

Annexe 4 Table 3
A possible project for regional cooperation
Production of Jelly filled telephone cables

Machinery,Tools,Testers & infrastructure required for production of about 500,000 conductor Km in 4500 sheath Km of jelly filled cables

Sl. No.	Particulars	Qty Reqd no.'s	Unit Price US$/Pc.	Total Cost US$
A:Machines				
1.	Rod Breakdown Machine	1	150,000	150,000
2.	High Speed Wire Drawing	2	60,000	120,000
3.	Tandem Insulating Machines	2	550,000	1,100,000
4.	Twinning Machine with Pay Offs	6	100,000	600,000
5.	High Speed repair & rewinding Machine	1	100,000	0 100,000
6.	Stranding (Drum twist)M/c	1	900,000	900,000
7.	Sheathing, filling & Jacketing	1	675,000	675,000
8.	Jelly Filling equipment	1	480,000	480,000
7.	Cable repair line	1	50,000	50,000
8	Armouring Machine	1	85,000	85,000
	Total A: Machines			**4,260,000**
B:Testing equipment				
1.	Automatic Cable test centre	1	280,000	280,000
2.	Resistance Unbalance Meter	1	3,000	3,000
3.	DC Resistance Bridge Meter	1	12,000	12,000
4.	Insulation Tester	1	500	500
5.	Multimeters	2	200	400
6.	Thermal Analyser	1	27,000	27,000
7.	Optical Micrometer	1	7,000	7,000
8.	Extrusion Plastometer	1	6,200	6,200
9.	Density Gradient Meter	1	3,500	3,500
10.	ECSR Notching Jig with Accessories	1	4,000	4,000
	Total B: Testing Equipment			**343,600**

Annexe 4 Table 3 continued
A possible project for regional cooperation
Production of Jelly filled telephone cables

Machinery, Tools, Testers & infrastructure required for production of
about 500,000 conductor Km in 4500 sheath Km
of jelly filled cables

Sl. No.	Particulars	Qty Reqd no.'s	Unit Price US$/Pc.	Total Cost US$
C:Miscellaneous equipment				
1.	Fork Lift Trucks	2	10,000	20,000
2.	Mobile Cranes	2	10,000	20,000
3.	Process drums(Assorted sizes)	1000	Various	50,000
4.	Mobile welder	1	5,000	5,000
5.	Air Compressor	1	10,000	10,000
6.	Weigh Bridge	1	3,000	3,000
7.	Misc(bins,trolleys,reels etc)	lot	100,000	100,000
	Total C: Miscellaneous Equipment			**208,000**

	D: INFRASTRUCTURE	Area Sq. M.	Unit cost US$/Sq M	Total Cost US$
1.	Land	100,000	1	100,000
2.	Building	5,000	150	750,000
3.	Electric Power	Lot	25	50,000
4.	Environmental control	Lot	40	100,000
5.	Water Supply	Lot	10	50,000
6.	Misc(transport,Furniture etc)	Lot		250,000
	Total D: Infrastructure			**1,300,000**

SUMMARY OF LIKELY INVESTMENT

A: Machines	4,260,000
B: Testers etc	343,600
C: Misc. Equipment	208,000
D: Infrastructure	1,300,000
E: Handling, Installation & Erection and trial runs @ 20% of A to C	962,320
Total estimated investment	7,073,920
	7,073,920

Notes:

1. All prices are estimates of International Prices FOB country of origin; no frieght, insurance, local taxes etc have been included.
2. Frieght, insurance, installation & trial runs under supervision of suppliers have been included under E.

Annexe 4 Table 4
A possible project for regional cooperation
Production of Jelly filled telephone cables
Annual Manpower requirements & costs
(At the average emoluments in developing countries)

No.	Activity	Manpower required & Cost	
		no	cost US$
A:	**Annual production (CKM)**	**500,000**	
	Daily production (average 250 working days) (CKM)	2,000	
B:	**Manpower required**		
1.	Skilled manpower		
	Inward goods	10	
	Wire drawing	4	
	Insulating	2	
	Twinning	3	
	Repair & rewinding	2	
	Stranding	2	
	Sheathing, filling, jacketing	2	
	Cable repair	2	
	Armouring	2	
	Testing	4	
	Total	33	
	Annual cost @ US$ 2000		66,000
2.	General help	10	
	Annual cost @ US$ 1500		15000
3.	Supervision & testing	10	
	Annual cost @ US$ 2500		25,000

Annexe 4 Table 4 (continued)
A possible project for regional cooperation
Production of Jelly filled telephone cables
Annual Manpower requirements & costs
(At the average emoluments in developing countries)

No.	Activity	Manpower required & Cost	
		no	cost US$
4.	Accounts, Sales, buyers	15	
	Annual cost @ US $ 3000		45,000
5.	Managers	2	
	Annual Cost @ US$ 6000		12,000
6.	General Manager	1	
	Annual Cost @ US$ 6000		6,000
Total annual manpower cost			**171,000**

Annexe 5
Project for possible regional cooperation for manufacture of Optical fibre cables from bought out fibre

5.1 Introduction

Digital transmission systems are another essential requirement of modern public telecommunications networks. A wide variety of transmission systems based on coaxial cables, optical fibre cables, terrestrial radio links and satellite based radio links, are available and offer optimal solutions for different netowork topologies. For countries with substantial land mass and fairly well distributed habitations, transmission systems based on optical fibre cables provide a higly reliable and cost effective transmission medium. One can expect very substantial demand for such cables.

There is already very large capacity for production of optical fibres internationally and a very keen competition in the same. Initial investment in optical fibre plants is substantial. The process of manufacture is rather critical. Fibre production by itself therefore is not a very attractive proposition for smaller countries.

There is however a significant possibility of setting up units to form cables from bought out fibre. These could be economical at even modest levels of production.

In this preliminary project profile an attempt has been made to explore the economics of production facilities for a very modest annual output of 2500 sheath kilometers of optical fibre cables with an averrage of 10 fibres each.

5.2 Project data and calculations

The data, the assumptions and calculations for the project study are presented in the tables annexed as follows:

Tables 1 : Financial performance projections for a unit producing 2500 sheath kilometers of Optical fibre cables annually.

Table 2: The components and raw materials etc. and their cost.

Tables 3: The plant, machinery, testing equipment, infrastructure and the investment required for the plant.

Table 4: The manpower requirements and costs at the average annual remuneration in developing countries.

1.3 Conclusions

The projected basic financial performance of the project could be summarised as below:

	Annual Production level in Sheath Km	Capital Reqd. Fixed + Working thousand US$	Projected Selling price per Km US$	Rate of return on fixed plant after interest & amortization %
a)	2500 Km	4,585	162	7.93

The figures indicate that manufacturing units, down to an annual production level of 2500 sheath Km of optical fibre cables are ecomically viable, with selling price comparable to international prices though the rate return is modest.

It would appear that a project with a somewhat larger capacity willprove even more attractive.

Reference: Tables 1 to 4 attatched.

Annexe 5 Table 1

Project for regional cooperation
manufacture of
2500 sheath kilometers of optical fibre cables
from bought out fibre

Summary of financial performance projections

No.	Particulars	Amount (US$)	% of selling price
	A: Capital requirements		
1.	Fixed assets (as per table 3)	4,042,500	100.94
2.	Working Capital Required @ 25% of annual consumption of raw materials 15% of the the annual manpower expense	542,575	13.55
	B: Production costs		
3.	Cost of raw materials (as per table 2)	2,143,000	53.51
4.	Cost of manpower (as per table 4)	45,500	1.14
5.	Capital amortization @ 12% ROR, and an overall average life of 8 years (20% of 1 above)	808,500	20.19
6.	Interest @ 10% on working Capital (2 above)	54,258	1.35
7.	Factory overheads @ 100% of manpower cost	45,500	1.14
8.	Cost of regional support including royalty, @ 5% of cost of raw materials	107,150	2.68
9.	Total cost of production	3,203,908	80.00
	C: Value added tax, selling expenses & profit margin		
11.	Value Added Tax @ 10% of cost of production (9 above)	320,391	8.00
12.	Selling Expense @ 5% of cost of production	160,195	4.00
13.	Profit margin @ 10% of cost of production	320,391	8.00
14.	Total selling price to ensure above profit Margin	4,004,884	100.00

Annexe 5 Table 1 (continued)
Project for regional cooperation
manufacture of
2500 sheath kilometers of optical fibre cables
from bought out fibre

Summary of financial performance projections

No.	Particulars	Amount (US$)	% of selling price
15.	**Selling price per Km**		1,602
	This is generally comparable to the current international prices and therefore the project may be considered viable.		
16.	Return on fixed assets		7.93

Annex 5 Table 2

Project for regional cooperation
manufacture of
2500 sheath kilometers of optical fibre cables
from bought out fibre

Annual requirement of Raw Materials
Average size of cables: 10 fibres

No.	Particulars	Unit	Qty. Reqd. Qty	Unit Cost US$	Total Cost US$ (000)
1.	Optical fibre	Km	30,000	0.10	3
2.	Strength Member(FRP)	Kg	31,250	24.00	750
3.	Polypropylene	Kg	37,500	3.33	125
4.	Filling Jelly	Kg	25,000	4.00	100
5.	Polyester Tape	Kg	2,500	16.00	40
6.	High Density Polyethelene	Kg	75,000	1.67	125
7.	Nylon	Kg	43,750	22.86	1,000
	Total				**2,143**

Thus the raw material costs work out to about 2,143/2.5 = 856 US$ per Km or 86 US cents per meter of fibre cable with an average of 10 fibres.

Annexe 5 Table 3

Project for regional cooperation
manufacture of
2500 sheath kilometers of optical fibre cables
from bought out fibre

Infrastructure, Machinery, Tools & Testers

No.	Particulars	Qty Reqd no.'s	Unit Price US$/Pc.		Total Cost US$
A:	**Inward Goods Inspection (other than fibres)**				
1.	Melt flow index	1			
2.	Visio Meter	1			
3.	Colour Analyser	1			
4.	Differential Scanning Calorimeter	1			
5.	Others (lot)	1			
	Total				**100,000**
B:	**Instruments for fibre Testing**				
1.	Optical Time Domain Reflectometer	1			
2.	Geometry Test set	1			
3.	Mode field dia test set	1			
4.	Chromatic dispersion test set	1			
5.	Attenuation test set	1			
6.	Others (lot)	1			
	Total				**400,000**
C:	**Production Machinery**				
1.	Fibre rewinder	1	100,000	100,000	
2.	Cable Rewinder	1	200,000	200,000	
3.	Extrusion Line no 1	1	680,000	680,000	
4.	Extrusion Line no 2	1	640,000	640,000	
5.	Stranding & Filling line	1	680,000	680,000	
	Total				**2,300,000**
D:	**Reels, drums, carriages etc**		**Lot**		**200,000**
E:	**Finished goods inspection**				
1.	Walk in environmental chamber	1			
2.	Torsion Tester	1			
3.	Impact Tester	1			
4.	Crash Tester	1			
5.	Flexibility Tester	1			
	Total				**400,000**
F:	**Total Plant & Machinery (A to E)**				**3,400,000**

Table 3 (continued)
Project for regional cooperation
manufacture of
2500 sheath kilometers of optical fibre cables
from bought out fibre

Infrastructure, Machinery, Tools & Testers

No.	Particulars	Qty Reqd no.'s	Unit Price US$/Pc.	Total Cost US$
G:	**Infrastructure**			
1.	Land (sq m)	10000	1	10000
2.	Building (sq m)	2000	160	320,000
3.	Power supply & standby plant	Lot		64,000
4.	Compressed air supply	Lot		16,000
5.	Chilled water	Lot		20,000
6.	Ventilation	Lot		20,000
	Total			**450,000**
H:	**Total investment required (F+G)**			**3,850,000**
	Add contingencies @ 5%			192,500
	Grand Total			**4,042,500**

Table 4

Project for regional cooperation
manufacture of
2500 sheath kilometers of optical fibre cables
from bought out fibre

annual manpower costs

(At average of prevailing manpower costs in developing countries)

No.	Activity		Manpower required & cost in dollars
1.	**Annual production in Km of cables**		2500
2.	Daily production (250 working days a year in Km of cables		10
3.	**Manpower requirement**		
A:	**Skilled operatives**		
	Inwards goods inspection		2
	Extruder		2
	Stranding Machine		1
	Jelly filling station		1
	Paper Wrapping machine		1
	Cable rewinding		2
	Testing Lab		2
	Total		11
	Cost @ $1500 p.a.	**US$**	**16,500**
B:	**Supervisory**		2
	Cost @ $ 2000 p.a.	**US$**	**4,000**
C:	**Sales & Accounts**		2
	Cost @ $ 2000 p.a.	**US$**	**4,000**
D:	**Engineers**		6
	Cost @ $ 2500 p.a.		**15000**
E:	**Manager**		1
	Cost	**US$**	**6,000**
	Total manpower cost	**US$**	**45,500**

Annexe 6
A possible project for regional/subregional cooperation
Test & Calibration Facility

6.1 Introduction

A test and calibration facility is an important requirement for a successful modern telecommunication industry. Most large enterprises generally have an in house facility. For the modest scales of production in many of the developing countries it is desirable to cooperate on a regional/ subregional basis and pool the resources for such a facility and share its services. The major objectives of such a cooperative facility could be:

- **Testing, evaluating and screening of components and systems for the client enterprises.** These could include:

  Passive, active, discrete, integrated or hybrid electronic and electromechanical components.

  Systems, assemblies ans subassemblies.

- **Reliability evaluation of components, systems and subsystems**

  Under different environmental conditions

  Under mechanical shocks etc

- **Calibration of equipment and standards**

- **Quality Advisary service**

  Quality manual preparation

  Product reliability assessment

  Assessment of critical components

  Quality audit

  Reliability prediction

6.2 Test set ups

All these activities call for establishment of sophisticated test set ups, tuned to the parameters, specifications and tolerances. To help appreciate the nature of test set ups the 3 tables following, give the details of typical parameters etc., the specifications and ranges and typical equipment requirements:

Table 1: Typical Test Set ups for Testing, qualifying and screening of electronic & telecommunications components and systems.
Table 2: Typical Test Set ups for Reliability evaluation of electronic & telecommunications components and systems.

Table 3: Typical Test Set ups for Calibration of Test instruments, and standards for use in telecommunications industry.

6.3 Investment required

No attempt has been made to cost the individual set ups and instruments. However on a rough guess an investment of about half a million dollars is estimated for the type of facilities envisaged in tables 1 to 3. A number of such facilities exist in some of the countries in the region and there is also an ITU/UNDP project under implementation for networking of the national facilities in the region, with headquarters at Seoul in Korea.

References

Tables 1 to 3

Annexe 6 Table 1

A possible project for regional/subregional cooperation

Test & Calibration Facility

Typical Test Set ups for

Testing, qualifying and screening of electronic & telecommunications components and systems.

Product	Typical specification	Test set up (Typical Equipments)
1. Components (passive) Resistors, Capacitors, Inductors, Transformers, Chokes, Potentiometers, Electromechanical devices, & Relays etc	R: 0.02 micro ohm to 100 M ohm and secondary parameters upto 1 GHz frequency L: 1 micro H to 100 KH C: 10E-5 pF to 1F	Video Bridge (ESI 2110) Impedance Analysers (HP4191A & HP4192A) LCR Meters (HP4274A & HP4275A) Q-Meter (Marconi 1245A) Resistance Bridge (GR 1666) Cap. Bridge (GR 1620A) Ind. Bridge (GR 1630AV) Res. Noise Tester (Quantech 315B)
2. Components (Active, Discrete) Transistors Diodes Others	Various DC Parameters Power upto 100W/200A in pulse mode Rise/fall time characteristics down to 6 nSec.	Programmabale Curve Tracer (Tecktronix 576) with high current option Programmable Pulse Generator (Wavetek 859) Waveform processing Oscilloscope (Tektronix 7854)

Annexe 6 Table 1(continued)

A possible project for regional subregional cooperation

Test & Calibration Facility

Typical Test Set ups for

Testing, qualifying and screening of electronic & telecommunications components and systems.

Product	Typical specification	Test set up (Typical equipments)
3. Components (Integrated Ccts)	Static parameters covering TTL, ECL, CMOS, Memories & Processors, Telecom Circuits, Codecs	Digital IC Test System (GR 1732) PC Based IC Tester (STM 4000, Triple crown 700) IC Handler (EMS 202-3,4,5,6) Universal EPROM Programmer (Recal-Dana 221)
4. Bare Boards	4096 points Programmable test 40 micro amp to 4mA Voltage Comparator ranges 0 v to 10 v with High Voltage option to 200V Continuity range 100 ohms to 100 K ohms Isolation 500 onms to 100 K ohms	Bare Board Tester (Kryterion 400)
5. Subsystems		
a) Filters & Amplifiers etc	Frequency 100Hz to 1.5 GHz 10 Hz resolution	Spectrum Analyser (HP8568A) Polyscop SWOB-5
b) TIC/SN Cards	Emulation of various microprocessors	Emulator (Microtek) Logic Pulser (HP546A Current Tracer (HP547A)

Annexe 6 Table 1 (continued)

A possible project for regional/subregional cooperation

Test & Calibration Facility

Typical Test Set ups for

Testing, qualifying and screening of electronic & telecommunications components and systems.

Product	Typical specification	Test set up (Typical Equipments)
5. Subsystems (continued)		
c) Transreceivers & RF systems	Input/output parameters Attenuation 120dB upto 1 GHz, (0.4 to 1040 MHz) AM, FM, PM functions (55KHz to 1360 MHz)	Shielded Enclosure (Ray Proof Model 14) Counter (HP 5345A) Power Meter (HP 438A) Distortion Analyser (HP339) Signal generator (Marconi 2017) Mod. Analyser (R&S FAM) Attenuator (R&S DPU) Distortion Analyser (HP 334A)
d) Telephones	Speech & Signal parameters	Telephone tester (Microtek) with accessories for tranducer tests
e) Other devices	As may be specified	Dedicated/ custom built testers

Annexe 6 Table 2

A possible project for regional/subregional cooperation

Test & Calibration Facility

Typical Test Set ups for

Reliability evaluation of electronic & telecommunications components and systems.

Type of test	Typical specification	Test set up (Typical Equipments)
A:Climatic		
1. Thermal shock	-60 deg to 200 deg centigrade	Thermal shock Chamber (Heraeus Votsch)
2. Combined RH & Temperature	Relative humidity 10% to 95%, Temp -70 to 130 deg C 1 m bar absolute to normal pressure	Combined Environmental Chamber (Heraeus Votsch)
3. Thermostream on bench	-60 to 160 deg C	(Temptronics TD042A)
4. Humidity on bench	upto 98 , -20 to 80 deg C	Humidity Test System
5. Dry Heat upto	200 deg C	Dry Heat Test System
6. Dust	as per JSS	Dust Test System
7.Corrosion	at 40 deg C, 95% RH with corrosive solution	Corrosion test system
B:Mechanical Endurance		
1. Vibration	1200 lbf. 25mm (p-p) 68 gm, 5 Hz to 3500 Hz	Vibration Test System (Ling Dynamics LDS 724 COMBO 721)
2. Impact (Shock)	200 lbs max, 18 inches Variable Waveform	Impact (Shock) Test System (AVCC SM110)
3. Impact (Bump)	113.6 Kg Max 25 mm drop 40 g peak	Impact (Bump) Test System (VBT-250)
4. Solderability	upto +230 deg C	Solderability Test System (Solorace Rotodip RD3

Annexe 6 Table 3

A possible project for regional/subregional cooperation

Test & Calibration Facility

Typical Test Set ups for

Calibration of Test instruments, & various parameters for use in telecommunications industry

Parameter	Accuracy	Typical set up
1. D.C. Voltage & Current	+/- 0.3 PPM 2.1111110 V	D.C.C. Potentiometer (Guideline 9930)
	1 micro V to 1100 V	D.C.Calibration Syst (Fluke 7105A)
	200 micro A to 20 A, 0.03%	Meter Calbrator (Fluke 5100B & 5220A)
	+/- 2 ppm/year for 1.00018V at 20 deg. C	Electronic Standard Cell (Cropico ESC-1)
	Power supply D.C. upto 1000A	D.C. Power Supply (HP6464C)
2. A.C. Voltage & Current	100 micro V to 1100V +/- 0.01% to +/-1%	A.C. Calibration System (Fluke 5200A, 5215A)
	10 micro A to 20 A +/- 0.07%	
3. Time/Frequency	1X10E-11/month stability Freq. 0.1,1, 5, & 10 MHz	Rubidium Frequency Standard (R&S XSRM)
	Frequency count 50 micro Hz to 1 GHz upto 11 digit display	Frequency Counter (HP5345A)
	Signal Generation 1 to 2600 MHz (-136 to + 10 dBm)	Synthesized Signal Generator (HP 8660C)
	10 KHz to 2 GHz 1 uV, -50dBm to 73 dBm	RF Millivoltmeter (R&S URVA)
4. R.F.Power	+/-0.5 upto 44 dBm 100 KHz to 4.2 GHz	Power meter (HP 436A)

Annexe 6 Table 3(continued)

A possible project for regional/subregional cooperation

Test & Calibration Facility

Typical Test Set ups for

Calibration of Test instruments, & various parameters for use in telecommunications industry

Parameter	Accuracy	Typical set up
5. Modulation	+/- 1 % FSD for AM & FM	Modulation Meter Marconi 2305
6. Attenuation	-/- 0.02% to +/- 0.3% 0 to 140 dB, upto 1 GHz	Programmable Attenuator (R&S DPVP)
7. Inductance	+/- 0.1%, 100 micro H to 10 H	Inductance Standards
8. Capacitance	+/- 5 ppm, 10 pF to 1000 pF +/-0.05%, 0.001 micr F to 1 micro F	Capacitance standard
9. Resistance	-/-0.001% to +/-0.02%, 0.001 ohm to 1 M ohm	Resistance standards (Standard Valhalla 273A)
	-/-1% upto 1 T ohm	
	1 ppm to 0.1% upto 11 G ohm	
10. Temperature	+/- 0.75 deg C, -80 to +250 deg C	Quartz Thermometer (HP 2804)
11. Oscilloscope	+/- 0.25%, 200 micr V to 100 V p-p, 250 KHz to 250 MHz	Oscilloscope Calibrator (Tektronix TM503)
12. Computer aid for calibration		Instrument Controller Fluke 1722A 16 bit processor & calibration software.