

## 9. Analysis of Manpower Requirement

### 9-1 Forecast of Manpower Requirement

A forecast of manpower requirement by the year 2020 is very hard to make at present due to lack of necessary data, especially after 2008/09. Also the forecast of production, productivity and manpower requirement of the mines after the 2nd generation of CCOW is more difficult even by means of Questionnaire and Hearing because these new companies may be not willing to release the data for their project security. Eventually, most of the new companies did not submit sufficient data for the Questionnaire. So a trial of manpower requirement forecast for coal mines in Indonesia by 2020 is carried out based on the productivity estimated from the production scale and mining method of the existing coal mines in addition to the fundamental data obtained from the Questionnaire and Hearing.

#### 9-1-1 Existing Coal Mines

As mentioned in Chapter 8, the manpower of the existing coal mines is about 29,000 in total consisting of 23,000 from the open pit mines (80%) and 6,000 from the underground mines (20%).

Regarding the manpower forecast of the existing mines by 2020, the measures being adopted are

- a) to collect information on manpower from each company through the Questionnaire and Hearing as much as possible, and
- b) to compensate the lacking data in a most appropriate way after referring and analyzing existing data and in considering future projections.

The results obtained through these ways are summarized in Figure 9-1 and Tables 9-1, 9-2 and 9-3.

As the result, the required manpower of the existing mines in 2020 is forecasted at about 38,000 which are 1.3 times of the present one while the production is estimated at 2.4 times of the present one. Therefore, the productivity will become about 2 times of the present's.

Table 9-1 Manpower Constituents of PTBA and CCOW Mines (1995 - 2020)

Company	Registration	Productivity U/man · day	Manpower																	Remarks
			1995	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018	2020				
PTBA	U/G Company's		1,442	1,360	1,280	1,240	1,160	1,120	1,040	960	880	840	790	720	640	560				
	U/G Contractor's		366	340	320	310	290	280	360	440	470	1,010	1,060	1,130	900	840				
	U/G Total	2.17	1,809	1,700	1,600	1,550	1,450	1,400	1,400	1,400	1,400	1,850	1,850	1,850	1,540	1,400				
	O/P Company's		3,970	4,176	5,974	7,250	7,250	7,250	6,931	6,925	6,455	5,023	5,046	5,075	5,104	5,133				
	O/P Contractor's		2,941	3,024	4,326	5,250	5,250	5,250	5,019	5,015	4,675	3,641	3,654	3,675	3,696	3,717				
	O/P Total	2.93	6,911	7,200	10,300	12,500	12,500	12,500	11,950	11,940	11,130	8,670	8,700	8,750	8,800	8,850				
Company's			5,412	5,536	7,254	8,490	8,410	8,370	7,971	7,885	7,335	5,869	5,836	5,795	5,744	5,693				
	Contractor's		3,307	3,364	4,645	5,560	5,540	5,530	5,379	5,455	5,645	4,411	4,474	4,535	4,456	4,457				
	Total		8,719	8,900	11,900	14,050	13,950	13,900	13,350	13,340	12,980	10,280	10,310	10,330	10,200	10,150				
PT Arutmin	Company's		1,170	1,211	1,645	2,079	3,134	3,134	3,134	3,134	2,853	2,853	1,684	1,684	1,684	1,684				
	Contractor's		1,067	1,317	780	251	378	378	378	378	344	344	203	203	203	203				
	Total (O/P)	6.65	2,237	2,528	2,425	2,330	3,512	3,512	3,512	3,197	3,197	1,887	1,887	1,887	1,887					
PT Kandilo	Company's		75	75	75	75	75	75	75	75	75	75	75	75	75	75				
	Contractor's		178	156	156	156	156	156	156	156	156	156	156	156	156	156				
	Total (O/P)	11.20	253	231	231	231	231	231	231	231	231	231	231	231	231	231				
PT Berau Coal	Company's		223	230	190	400	450	450	450	450	450	450	450	450	450	450	450			
	Contractor's		275	280	360	700	750	900	900	900	900	900	900	900	900	900	900			
	Total (O/P)	3.71	498	510	550	1,100	1,200	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350				
PT Multi Harapan Utama	Company's		212	195	200	250	250	250	250	250	250	250	250	250	250	250	250			
	Contractor's		754	800	800	800	800	800	800	800	800	800	800	800	800	800	800			
	Total (O/P)	6.70	966	995	1,000	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050				
PT Kidaco Jaya Agung	Company's		850	846	870	900	925	950	970	990	1,000	1,035	1,070	1,200	1,225	1,250				
	Contractor's		594	460	810	1,150	1,295	1,440	1,510	1,585	1,600	1,715	1,800	1,975	2,100	2,100				
	Total (O/P)	4.81	1,444	1,306	1,680	2,050	2,220	2,390	2,480	2,575	2,600	2,750	2,900	3,100	3,200	3,350				
PT Kaltim Prima Coal	Company's		2,211	2,500	3,200	3,700	3,800	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900	3,900			
	Contractor's		2,717	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500			
	Total (O/P)	5.75	4,928	5,000	5,700	6,200	6,300	6,400	6,400	6,400	6,400	6,400	6,400	6,400	6,400	6,400	6,400			
PT Allied Indo Coal	Company's		225	200	200	200	200	200	200	200	200	200	200	200	200	200	200			
	Contractor's		589	600	600	600	600	600	600	600	600	600	600	600	600	600	600			
	Total (O/P)	4.08	814	800	800	800	800	800	800	800	800	800	800	800	800	800	800			
PT Taniho Harum	Company's		406	473	500	530	530	530	530	530	530	530	530	530	530	530	530			
	Contractor's (O/P)		472	520	500	-	-	-	-	-	-	-	-	-	-	-	-			
	Contractor's (U/G)		-	-	300	830	830	830	830	830	830	830	830	830	830	830	830			
	Total (O/P)	3.91	878	993	1,300	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360			
PT Adaro Indonesia	Company's		370	187	188	188	188	188	188	188	188	188	188	188	188	188	188			
	Contractor's		829	1,228	1,832	1,912	1,912	1,912	1,912	1,912	1,912	1,912	1,912	1,912	1,912	1,912	1,912			
	Total (O/P)	12.88	1,199	1,415	2,020	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100			
PT Chung Hua Overseas	Company's		-	60	150	300	300	300	300	300	300	300	300	300	300	300	300			
	Contractor's		-	130	325	650	650	650	650	650	650	650	650	650	650	650	650			
	Total (O/P)		-	190	475	950	950	950	950	950	950	950	950	950	950	950	950			
PT Indomineo Mandiri	Company's		60	60	75	290	290	290	290	290	290	290	290	290	290	290	290			
	Contractor's		189	140	156	935	935	935	935	935	935	935	935	935	935	935	935			
	Total		249	200	231	1,225	1,225	1,225	1,225	1,225	1,225	1,225	1,225	1,225	1,225	1,225	1,225			
CCOW	Company's		5,802	6,037	7,293	8,912	10,142	10,287	10,287	10,307	10,036	10,071	8,937	9,067	9,092	9,117				
	Contractor's		7,683	8,129	9,119	10,484	10,806	11,101	11,171	11,248	11,227	11,342	11,316	11,386	11,461	11,586				
	Total		13,485	14,166	16,412	19,396	20,948	21,368	21,458	21,553	21,263	21,413	20,253	20,453	20,553	20,703				
PTBA+CCOW	U/G		1,808	1,700	1,900	2,390	2,280	2,230	2,230	2,230	2,680	2,680	2,680	2,680	2,370	2,230				
	O/P		20,378	21,366	26,412	31,066	32,618	33,038	32,578	32,663	31,563	29,253	28,123	28,373	28,523	28,723				
	Total		22,186	23,066	28,312	33,448	34,898	35,268	34,808	34,893	34,243	31,933	30,803	31,053	30,893	30,953				

Table 9-2 Manpower Constituents of KP Mines (1995 - 2020)

Company	Registration	Productivity U/man·day	Manpower													Remarks		
			1995	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018		2020	
PT BukR Baiduri	Company's		415	300	300	300	300	300	300	300	300	300	300	300	300	300	200	
	Contractor's		399	900	900	900	900	900	900	900	900	900	900	900	900	900	900	570
	Total (O/P)	3.07	814	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	770
PT Fajar Buni Sekti	Company's		780	780	780	650	950	950	950	950	950	950	950	950	950	950	950	950
	Contractor's		798	820	820	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010	1,010
	Total (U/G)	1.35	1,558	1,600	1,600	1,660	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960	1,960
PT Kitadin	Company's (U/G)		2,381	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835
	Contractor's (O/P)		270	185	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Contractor's (U/G)		-	-	185	185	185	185	185	185	185	185	185	185	185	185	185	185
Total	0.98	2,661	1,820	1,820	1,820	1,820	1,820	1,820	1,820	1,820	1,820	1,820	1,820	1,820	1,820	1,820	1,820	
PT BukR Sunur	Company's (O/P)		159	159	144	-	-	-	-	-	-	-	-	-	-	-	-	-
	Company's (U/G)		-	-	15	152	152	152	152	152	152	182	182	182	182	212	212	212
	Contractor's (O/P)		337	337	303	-	-	-	-	-	-	-	-	-	-	-	-	-
Contractor's (U/G)		-	-	34	324	324	324	327	327	327	388	388	388	388	453	453	453	
Total	5.35	496	496	498	478	478	478	479	479	479	570	570	570	570	665	665	665	
PT Danau Mas Hilam	Company's		115	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
	Contractor's		125	120	120	120	120	120	120	120	120	120	120	120	120	125	125	125
	Total (O/P)	9.30	240	230	230	230	230	230	230	230	230	230	230	230	235	235	235	235
PT BukR Bara Utama	Company's		68	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
	Contractor's		69	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
	Total (O/P)	1.95	137	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
PT Karbindo Abesyspradhi	Company's		165	165	165	165	165	165	165	165	165	165	165	165	165	165	165	165
	Contractor's		172	172	172	172	172	172	172	172	172	172	172	172	172	172	172	172
	Total (O/P)	3.56	337	337	337	337	337	337	337	337	337	337	337	337	337	337	337	337
KP Mines	T. Company's		4,073	3,219	3,219	3,382	3,382	3,382	3,382	3,382	3,412	3,412	3,412	3,412	3,442	3,342	3,342	3,342
	T. Contractor's		2,170	2,814	2,814	2,781	2,781	2,791	2,791	2,794	2,794	2,855	2,855	2,855	2,855	2,925	2,995	2,995
	Total		6,243	5,833	5,833	6,173	6,173	6,173	6,176	6,176	6,261	6,267	6,267	6,267	6,367	5,937	5,937	5,937

Table 9-3 Manpower Constituents of KUD Mines (1995 - 2020)

Company	Mining	Productivity U/man·day	Manpower													Remarks	
			1995	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018		2020
KUD Usaha Karya Cempaka	0.7 mill. ton (Res.) O/P	1.94	180	200	200	200	200	200	200	200	200	200	200	200	200	200	200
KUD Bersama	O/P	4.98	30	190	190	190	190	190	190	190	190	190	190	190	190	190	190
KUD Madurelne	U/G		20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
	O/P (70%)		48	230	230	230	230	230	230	230	230	230	230	230	230	230	230
Total		4.01	68	250	250	250	250	250	250	250	250	250	250	250	250	250	250
KUD Bina Bersama	U/G?	2.36	30	65	65	65	65	65	65	65	65	65	65	65	65	65	65
KUD Makmur	O/P?	(2.37)	30	65	65	65	65	65	65	65	65	65	65	65	65	65	65
KUD Karya Muni	O/P?	(1.10)	15	30	30	30	30	30	30	30	30	30	30	30	30	30	30
KUD Total	U/G		50	85	85	85	85	85	85	85	85	85	85	85	85	85	85
	O/P		312	1,15	1,15	1,15	1,15	1,15	1,15	1,15	1,15	1,15	1,15	1,15	1,15	1,15	1,15
Total			362	800	800	800	800	800	800	800	800	800	800	800	800	800	800

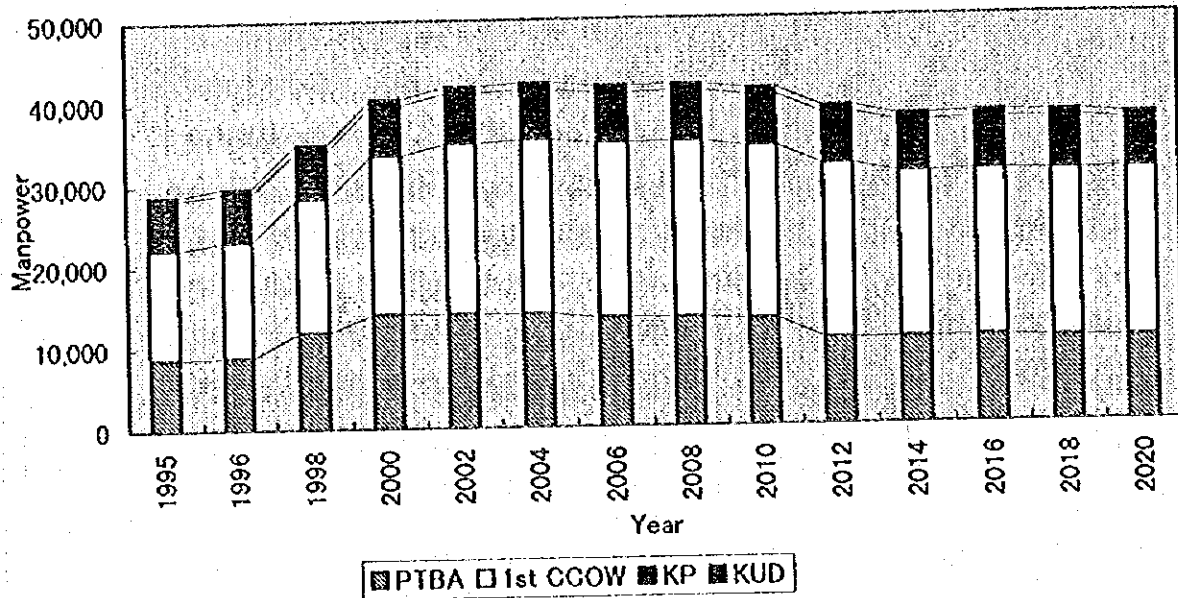


Figure 9-1 Manpower Forecasts of the Existing Coal Mines by 2020

#### 9-1-2 New Coal Mines

Forecasts of the manpower for new coal mines are made under the following measures:

- Grouping of the existing coal mines by production scale and mining method,
- Calculation of average productivity for each group at present and in 2020 referring the data of the existing coal mines,
- Estimation of productivity for coal mines of 2nd and 3rd generation CCOW, and
- Calculation of manpower by production and productivity under the following formula:

$$* \text{Manpower (day)} = \frac{\text{Production (ty)} \div \text{Productivity (t/man-day)}}{\div \text{Working days (day)}}$$

1) Grouping of the Existing Coal Mines by Production Scale and Mining Method

As shown in Table 9-4, the existing 14 coal mines are grouped into 5:

- a) Large scale open pit coal mines; > 5 million tons per annum
- b) Medium scale open pit coal mines; 1 to 5 million tons per annum
- c) Small scale open pit coal mines; <1 million tons per annum
- d) Small scale underground coal mines
- e) Cooperatives coal mines (KUD)

**Table 9-4 Average Productivity of Five Groups in 1995**

Mining Method & Scale	Contractor	Production (Tons)	Manpower	Productivity (t/man/day)	Working Days
Large Scale O/P	Arutmin	5,355,252	2,237	6.65	360
	KPC	10,208,219	4,928	5.75	360
	Adaro	5,553,146	1,198	12.88	360
	Average	21,116,617	8,363	7.01	360
Medium Scale O/P	Allied Indo	1,189,850	814	4.06	360
	MHU	1,974,210	966	6.70	305
	Tanito Harum	1,107,474	878	3.94	320
	Kideco Jaya	2,500,425	1,444	4.81	360
	Kendilo	1,021,850	1,444	4.81	360
Average	7,793,809	4,355	5.26	340	
Small Scale O/P	Berau	665,889	498	3.71	360
	Bukit Baiduri	749,813	814	3.07	300
	Bukit Sunur	796,060	496	5.35	275
Average	2,211,762	1,808	3.96	309	
Small Scale U/G	FBS	585,447	1,558	1.25	300
	Kitadin	718,238	2,661	0.98	275
Average	1,303,685	4,219	1.08	286	
KUD Mines	Total	229,091	317	2.18	292
Grand Total	Average	32,654,964	19,062	4.92	348.4

Remarks: Productivity of PIBA is computed at 2.17 of Ombilin mine and 2.93 of Tanjung Enim mine (O/P)

2) Projection of Average Productivity by Group

Average productivity in 1995 of each group is shown in Table 9-4, and that in 2020, which is estimated by the data obtained from Questionnaire and Hearing, is summarized in Table 9-5.

Table 9-5 Projected Average Productivity of Five Groups in 2020/21

Mining Method & Scale	Contractor	Production (Mill. tons)	Manpower	Productivity (t/man/day)	Working Days (Days/y)
Large Scale O/P	Arutmin	7.2	1,887	10.60	360
	KPC	22.0	6,400	9.55	360
	Adaro	20.0	2,100	26.46	360
	Kideco Jaya	15.0	3,350	12.44	360
	Berau Coal	10.0	1,350	20.58	360
	Average	74.2	15,087	13.66	360
Medium Scale O/P	MHU	3.0	1,050	9.37	305
	Tanito Harum	2.0	1,360	4.60	320
	Indominco	3.5	1,225	7.94	360
	Average	8.5(5.0)	3,635(2,410)	7.06(6.67)	331(311)
Small Scale O/P	Allied Indo	1.0	800	3.47	360
	Kendilo	1.0	231	12.03	360
	Bukit Baiduri	0.7	770	3.03	300
	Average	2.7(1.7)	1,801(1,570)	4.36(3.23)	344(335)
Small Scale U/G	FBS	0.8	1,960	1.36	300
	Kitadin	0.7	1,820	1.40	275
	Bukit Sunur	1.2	665	6.56	300
	Average	2.7(1.5)	4,445(3,780)	2.07(1.38)	293(288)
KUD Mines	Total KUD	0.3	800	1.28	292
Total	Average	88.4(82.7)	25,768(23,647)	9.68(9.88)	354(354)

Remarks: 1) Productivity projection of PTBA is made at 3.57 for Ombilin mine (U/G) and 3.58 for Tanjung Enim mine (O/P);

2) Average productivity in parenthesis of Medium Scale O/P, Small Scale O/P & U/G are figures except extraordinary ones for manpower forecasting.

The average productivity in 2020 is nearly two times of the present, in which the intent to improve productivity is revealed by coal companies through the Questionnaire and Hearing.

### 3) Selection of Average Productivity for 2nd and 3rd Generation CCOW

As the production scale of 2nd and 3rd generation contractors in 2020 is projected at 2 and 1.5 million tons per annum, respectively, 2nd generation mines will correspond to the medium scale open pit coal mines and 3rd generation mines will be correlated to the small scale underground coal mines. Therefore, the average productivity of them is estimated at 6.67 and 1.38 t/man/day, respectively.

The average productivity projections for existing mines in 1995 and for new mines in 2020 are compared in Table 9-6.

**Table 9-6 Present and Projected Average Productivity by Various Groups**

Grouping by Mining Method & Scale	Average Productivity(t/man/d)		Remark
	1995/96 (Actual)	2020/21 (Projected)	
(Government Mines) PTBA Ombilin (U/G) PTBA Tanjung Enim (O/P) Average	2.17 2.93 2.76	3.57 3.58 3.83	
(Current Contractors) a) Large Scale O/P Mines b) Medium Scale O/P Mines c) Small Scale O/P Mines d) Small Scale U/G Mines e) KUD Mines Average	7.01 5.26 3.96 1.08 2.18 4.92	13.66 7.06(6.67) 4.36(3.23) 2.07(1.38) 1.28 9.68	
(2nd Generation Contractors) a) O/P Mines (80%) b) U/G Mines(20%) Average	- - -	6.67 1.38 5.61	MSOPM SSUGM
(After 3rd Gen.) a) O/P Mines (80%) b) U/G Mines (20%) Average	- - -	6.67 1.38 5.61	MSOPM SSUGM

Among the production projections of current contractors, the average figures eliminated abnormal values in those of the medium scale open pit mines, small scale open pit mines and small scale underground mines are shown in parenthesis to be used for future manpower projections.

4) Computation of Necessary Manpower

Required manpower of the new coal mines in 2020 is estimated at 75,000 in total as shown in Figure 9-2, of which those of the 2nd and 3rd generation CCOW are assumed at 16,000 and 59,000, respectively.

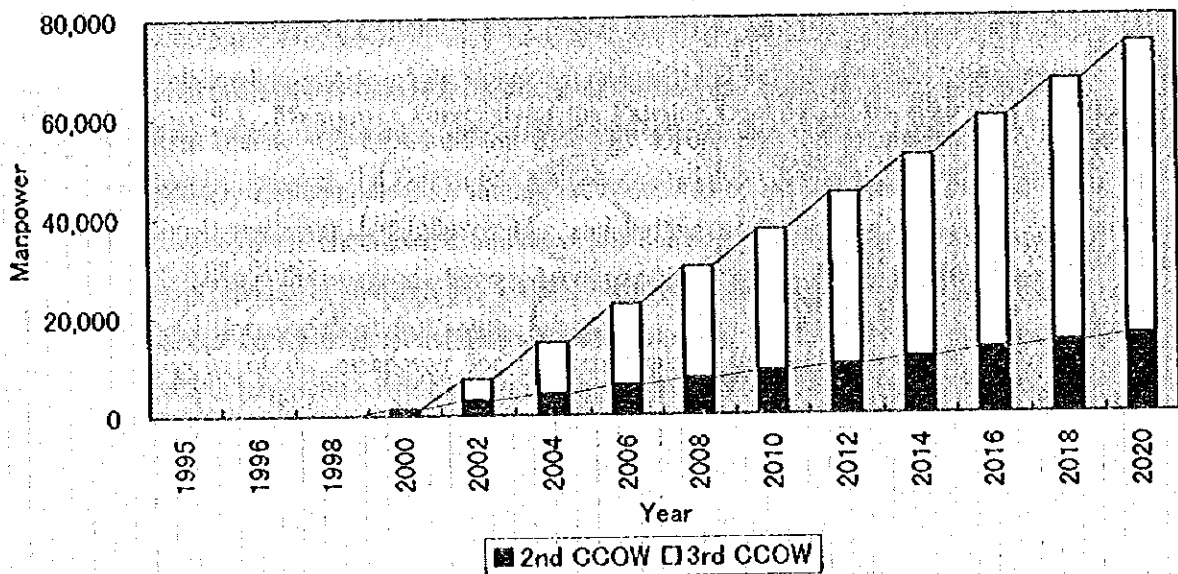


Figure 9-2 Required Manpower Projection of 2nd & 3rd Generation CCOW

As a reference, the progress of productivity in Japan is shown in Figure 9-3, in which a marked increase on production is recognized after 1987 due to the following reasons:

- a) Successive close down of the low productivity coal mines due to deepening of mines, such as Mitsubishi Takashima colliery (630,000 tpa, 1987), Mitsui Sunagawa colliery (760,000 tpa, 1988), Hokutan Mayachi colliery (570,000 tpa, 1988), Hokutan Horonai colliery (1.1 million tpa, 1989), and Mitsubishi



**Minamiohyubari (630,000 tpa, 1990), etc.**

- b) The results of full mechanization of the underground mining system, and various improvement on roadway driving and underground transportation, etc.**

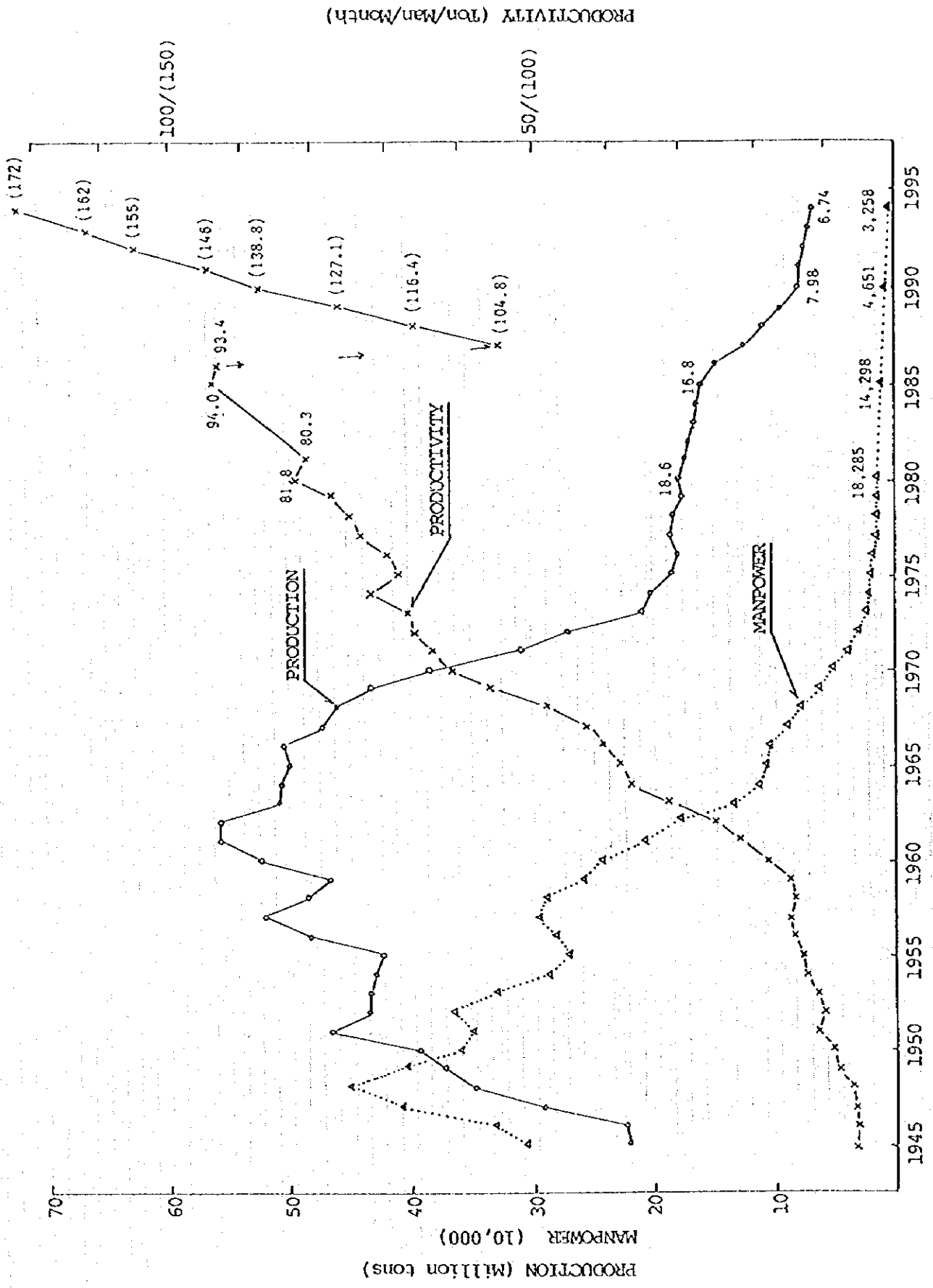


Figure 9-3 Production/Manpower/Productivity Transition in Japan

## 9-2 Analysis and Evaluation on Necessary Manpower Projections

A summary table of the necessary manpower projection for existing and the new coal mines is shown in Table 9-7. The necessary manpower in 2020 on Base Scenario is estimated at about 110,000. In the table, the manpower of direct and contractor is described only for existing coal mines because it is very difficult to estimate proportion of the direct to the contract with the rest of the new mines to be developed due to too poor information of them.

### 9-2-1 Analysis of Manpower Projection by Contract Type

According to the manpower projections by contract type, those of the existing coal mines belonging to PTBA, 1st generation CCOW and KP mines have completed their increment by 2000 and maintain stable after 2000. After 2000, the necessary manpower of the coal mines belonging to the 2nd and 3rd generation CCOW contractors starts to increase quite rapidly.

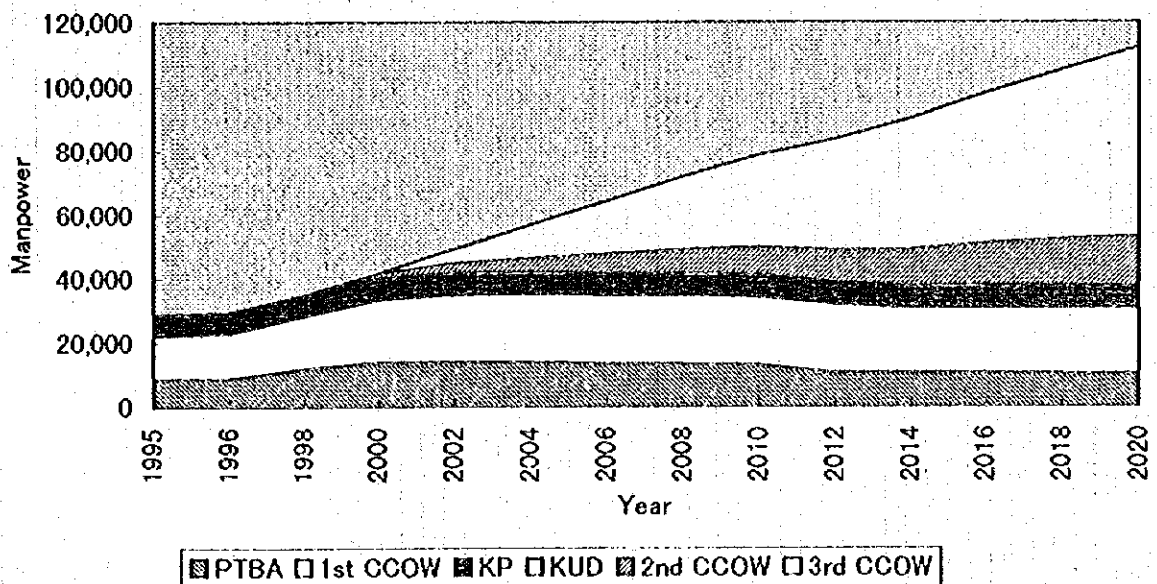


Figure 9-4 Manpower Projections by Contract Type

Table 9-7 Manpower Forecast in Coal Industry (1995 - 2020)

Company	Registration	Production t/ann - day	Manpower																		Remarks
			1995	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018	2020					
PTBA	U/G Company's		1,442	1,360	1,280	1,240	1,190	1,120	1,040	960	880	840	790	720	640	560					
	U/G Contractor's		380	340	320	310	290	280	260	240	230	210	190	180	160	140					
	U/G Total	2.36	1,820	1,700	1,600	1,550	1,480	1,420	1,300	1,280	1,110	1,090	1,000	900	800	720					
	O/P Company's		3,830	4,178	5,934	7,250	7,250	7,250	8,931	8,926	8,455	5,029	5,049	5,075	5,104	5,133					
	O/P Total	2.98	3,911	3,700	10,330	12,500	12,500	12,500	14,850	13,840	11,130	8,700	8,700	8,750	8,830	8,850					
PT Arutmin	Company's		1,170	1,211	1,645	2,073	3,134	3,134	3,134	3,134	3,134	3,134	3,134	3,134	3,134	3,134					
	Contractor's		1,087	1,247	780	261	378	378	378	378	378	378	378	378	378	378					
	Total (O/P)	0.65	2,257	2,520	2,425	2,830	3,512	3,512	3,512	3,512	3,512	3,512	3,512	3,512	3,512	3,512					
	Company's		75	75	75	75	75	75	75	75	75	75	75	75	75	75					
	Total (O/P)	11.20	253	231	231	231	231	231	231	231	231	231	231	231	231	231					
PT Berau Coal	Company's		273	230	190	400	450	450	450	450	450	450	450	450	450	450					
	Contractor's		275	280	290	200	750	900	900	900	900	900	900	900	900	900					
	Total (O/P)	0.71	408	510	550	1,100	1,200	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350					
	Company's		225	193	200	250	250	250	250	250	250	250	250	250	250	250					
	Total (O/P)	0.70	595	595	1,000	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050					
PT Cikoko Jaya Agung	Company's		850	848	870	900	925	950	970	990	1,000	1,035	1,070	1,100	1,125	1,150					
	Contractor's		554	460	410	1,130	1,295	1,440	1,610	1,665	1,800	1,715	1,830	1,900	1,975	2,100					
	Total (O/P)	4.81	1,404	1,268	1,680	2,050	2,220	2,220	2,480	2,575	2,800	2,750	2,900	3,100	3,200	3,250					
	Company's		2,211	2,500	2,200	3,700	3,800	3,800	3,800	3,800	3,800	3,800	3,800	3,800	3,800	3,800					
	Total (O/P)	6.75	4,828	5,000	6,700	8,200	8,500	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400	8,400					
PT Andal Indo Coal	Company's		225	290	200	200	200	200	200	200	200	200	200	200	200	200					
	Contractor's		689	650	650	630	630	630	630	630	630	630	630	630	630	630					
	Total (O/P)	4.08	914	940	850	830	830	830	830	830	830	830	830	830	830	830					
	Company's		406	473	500	630	630	630	630	630	630	630	630	630	630	630					
	Total (O/P)	3.91	876	893	1,300	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260	1,260					
PT Adaro Indonesia	Company's		370	187	144	144	144	144	144	144	144	144	144	144	144	144					
	Contractor's		826	1,228	1,832	2,912	3,512	3,512	3,512	3,512	3,512	3,512	3,512	3,512	3,512	3,512					
	Total (O/P)	12.88	1,196	1,415	2,020	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100					
	Company's		130	130	130	130	130	130	130	130	130	130	130	130	130	130					
	Total (O/P)	0.68	130	130	130	130	130	130	130	130	130	130	130	130	130	130					
PT Indonesia Mandiri	Company's		80	50	75	290	230	230	230	230	230	230	230	230	230	230					
	Contractor's		189	140	158	935	935	935	935	935	935	935	935	935	935	935					
	Total	249	200	231	1,225	1,225	1,225	1,225	1,225	1,225	1,225	1,225	1,225	1,225	1,225	1,225					
	Company's		5,107	6,637	7,293	8,912	10,142	10,142	10,142	10,142	10,142	10,142	10,142	10,142	10,142	10,142					
	Total	13,485	14,166	18,412	18,395	20,284	21,258	21,258	21,258	21,258	21,258	21,258	21,258	21,258	21,258	21,258					
SOOW (1st Generation)	U/G		0	0	0	0	0	0	0	0	0	0	0	0	0						
	O/P		13,465	14,166	18,412	18,395	20,284	21,258	21,258	21,258	21,258	21,258	21,258	21,258	21,258						
	U/G		1,836	1,700	1,900	2,240	2,240	2,240	2,240	2,240	2,240	2,240	2,240	2,240	2,240						
	O/P		20,378	21,368	24,412	31,005	32,818	33,018	33,878	32,863	31,563	29,253	28,123	28,523	28,223						
	Total	22,184	23,068	26,312	33,245	34,958	35,258	34,958	34,853	34,443	31,913	30,403	31,053	30,853	30,853						
PT BAA Baduri	Company's		415	300	350	300	300	300	300	300	300	300	300	300	300						
	Contractor's		399	900	900	900	900	900	900	900	900	900	900	900	900						
	Total (O/P)	1.07	814	1,200	1,250	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200						
	Company's		790	740	780	850	850	850	850	850	850	850	850	850	850						
	Total (O/P)	1.13	1,558	1,660	1,850	1,850	1,850	1,850	1,850	1,850	1,850	1,850	1,850	1,850	1,850						
PT Krasih	Company's (U/G)		2,391	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835						
	Contractor's (O/P)		790	185	0	0	0	0	0	0	0	0	0	0	0						
	Total	0.98	3,181	2,020	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835						
	Company's (O/P)		139	158	144	0	0	0	0	0	0	0	0	0	0						
	Total (O/P)	0.37	337	337	337	337	337	337	337	337	337	337	337	337	337						
PT Oasir Mahan	Company's		496	496	496	478	478	478	478	478	478	478	478	478	478						
	Contractor's		115	110	110	110	110	110	110	110	110	110	110	110	110						
	Total (O/P)	0.30	242	230	230	230	230	230	230	230	230	230	230	230	230						
	Company's		68	70	70	70	70	70	70	70	70	70	70	70	70						
	Total (O/P)	1.05	137	150	150	150	150	150	150	150	150	150	150	150	150						
PT Kerdindo Abangpraha	Company's		145	145	165	165	165	165	165	165	165	165	165	165	165						
	Contractor's		172	172	172	172	172	172	172	172	172	172	172	172	172						
	Total (O/P)	0.58	317	317	317	317	317	317	317	317	317	317	317	317	317						
	Company's (U/G)		0	0	15	152	152	152	152	152	152	152	152	152	152						
	Total (O/P)	0.35	317	317	317	317	317	317	317	317	317	317	317	317	317						
GP Misa	Company's		6,075	3,216	3,178	3,342	3,506	3,670	3,834	3,998	4,162	4,326	4,490	4,654	4,818						
	Contractor's		6,170	2,914	2,814	2,781	2,791	2,791	2,791	2,791	2,791	2,791	2,791	2,791	2,791						
	Total	0.243	5,833	5,833	6,123	6,170	6,170	6,170	6,170	6,170	6,170	6,170	6,170	6,170	6,170						
	U/G		196	200	200	200	200	200	200	200	200	200	200	200	200						
	O/P		458	190	190	190	190	190	190	190	190	190	190	190	190						
KUD Madjane	U/G		20	20	20	20	20	20	20	20	20	20	20	20	20						
	O/P (20%)		48	230	230	230	230	230	230	230	230	230	230	230	230						
	Total	4.91	68	250	250	250	250	250	250	250	250	250	250	250	250						
	U/G		338	30	85	85	85	85	85	85	85	85	85	85	85						
	O/P		237	30	85	85	85	85	85	85	85	85	85	85	85						
KUD Kaye Munt	O/P		15	30	30	30	30	30	30	30	30	30	30	30	30						
	Total	0.10	15	30	30	30	30	30	30	30	30	30	30	30	30						
	U/G		50	85	85	85	85	85	85	85	85	85	85	85	85						
	O/P		212	212	212	212	212	212	212	212	212	212	212	212	212						
	Total	3.62	302	302	302	302	302	302	302	302	302	302	302	302	302						
Current Oper U/G		5,807	6,020	6,454	6,724	6,821	6,871	6,874	6,874	6,874	6,874	6,874	6,874	6,874							
O/P		22,982	24,879	29,491	34,514	36,330	36,870	36,870	36,870	36,870	36,870	36,870	36,870	36,870							
Total	28,789	30,899	34,945	40,419	41,721	43,241	43,744	43,744	43,744												

### 9-2-2 Analysis of Manpower Projection by Mining Method

The present manpower of underground coal mines is about 6,000 which is about 20% of the total manpower. It might be increased into about 50,000, 8 times of the present one and 45% of the total, by 2020.

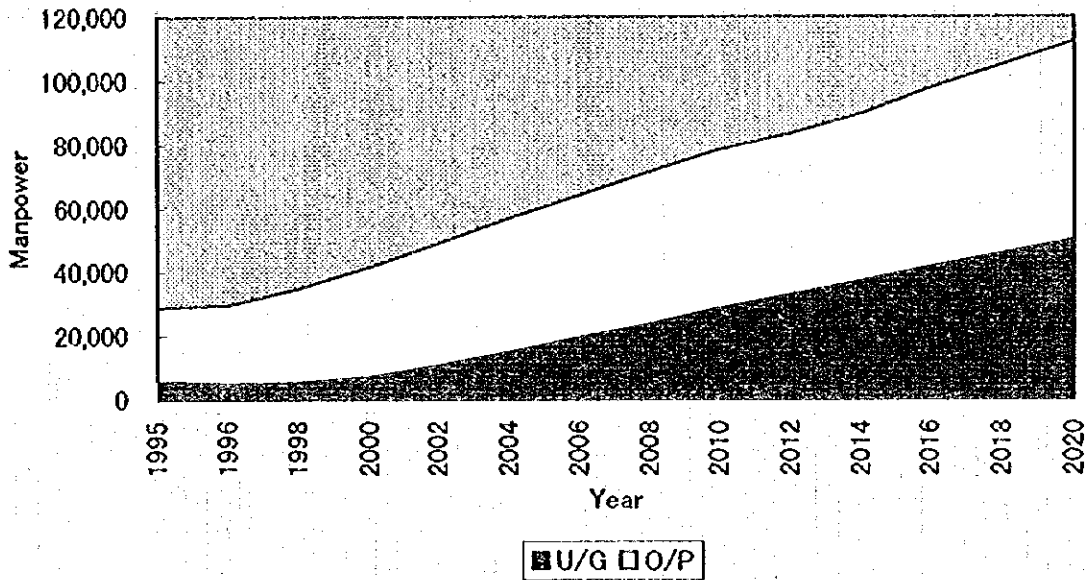


Figure 9-5 Manpower Projections by Mining Method

### 9-2-3 Three Scenarios on Manpower Projection

As same as the case of the coal production projection, three scenarios, i.e. High, Base and Low scenario, are made and shown in Table 9-8. Manpower of the High and Low scenarios in 2020 are estimated at about 130,000 and 100,000, respectively.

Table 9-8 Manpower Projection for Three Scenarios

Year	Scenario	PTBA			CCOW(1st Generation)			KP & KUD Mines			CCOW(2nd Generation)			CCOW(After 3rd Generation)			Grand Total		
		U/G	O/P	Total	U/G	O/P	Total	U/G	O/P	Total	U/G	O/P	Total	U/G	O/P	Total	U/G	O/P	Total
1996	High	2,040	8,640	10,680	-	16,999	16,999	3,994	3,976	7,970	-	-	-	-	-	-	6,074	29,615	35,639
	Base	1,700	7,200	8,900	-	14,166	14,166	3,320	3,313	6,633	-	-	-	-	-	-	5,020	24,679	29,699
	Low	1,530	6,480	8,010	-	12,749	12,749	2,988	2,988	5,976	-	-	-	-	-	-	4,518	22,211	26,729
1998	High	1,920	12,360	14,280	366	19,934	19,934	4,075	3,975	8,000	-	-	-	-	-	-	6,545	35,389	41,934
	Base	1,600	10,300	11,900	300	16,412	16,712	3,334	3,313	6,667	-	-	-	-	-	-	5,454	29,491	34,945
	Low	1,440	9,270	10,710	270	14,771	15,041	3,018	2,982	6,000	-	-	-	-	-	-	4,909	26,542	31,451
2000	High	1,860	15,000	16,860	996	22,279	23,275	5,027	3,341	8,368	604	979	1,583	-	-	-	8,669	41,417	50,086
	Base	1,550	12,500	14,050	830	18,566	19,396	4,189	2,784	6,973	503	816	1,319	-	-	-	7,224	34,514	41,738
	Low	1,395	11,250	12,645	747	16,709	17,456	3,770	2,506	6,276	453	704	1,187	-	-	-	6,502	30,002	36,504
2002	High	1,740	15,000	16,740	996	24,142	25,138	5,027	3,341	8,368	2,114	1,522	3,636	3,019	2,174	5,194	13,078	45,996	59,074
	Base	1,450	12,500	13,950	830	20,118	20,948	4,189	2,784	6,973	1,762	1,268	3,030	2,516	1,812	4,328	10,898	38,330	49,228
	Low	1,305	11,250	12,555	747	18,106	18,853	3,770	2,506	6,276	1,586	1,141	2,727	2,264	1,631	3,893	9,808	34,497	44,305
2004	High	1,680	15,000	16,680	996	24,646	25,642	5,027	3,341	8,368	3,019	2,174	5,194	7,247	5,218	12,464	18,151	50,196	68,347
	Base	1,400	12,500	13,900	830	20,538	21,368	4,189	2,784	6,973	2,516	1,812	4,328	6,039	4,348	10,387	15,126	41,830	56,956
	Low	1,260	11,250	12,510	747	18,494	19,231	3,770	2,506	6,276	2,294	1,631	3,895	5,435	3,913	9,348	13,613	37,647	51,260
2006	High	1,680	14,340	16,020	996	24,794	25,790	5,030	3,341	8,371	4,276	2,935	7,162	11,473	8,262	19,735	23,588	53,449	77,038
	Base	1,400	11,950	13,350	830	20,628	21,458	4,192	2,784	6,976	3,522	2,446	5,968	9,561	6,885	16,446	19,657	44,541	64,198
	Low	1,260	10,755	12,015	747	18,555	19,312	3,773	2,506	6,279	3,170	2,201	5,371	8,605	6,197	14,801	17,691	40,087	57,778
2008	High	1,680	14,328	16,008	996	24,868	25,864	5,030	3,341	8,371	5,132	3,696	8,828	15,701	11,305	27,006	28,722	57,355	86,077
	Base	1,400	11,940	13,340	830	20,723	21,553	4,192	2,784	6,976	4,277	3,080	7,357	13,084	9,421	22,505	23,935	47,796	71,731
	Low	1,260	10,746	12,006	747	18,651	19,398	3,773	2,506	6,279	3,849	2,712	6,621	11,776	8,479	20,255	21,542	43,016	64,558
2010	High	2,270	13,356	15,626	996	24,570	25,516	5,103	3,377	8,480	6,038	4,349	10,387	19,927	14,350	34,277	34,505	59,731	94,236
	Base	1,850	11,300	12,980	830	20,433	21,263	4,253	2,814	7,067	5,032	3,624	8,656	16,606	11,958	28,564	28,754	49,776	78,530
	Low	1,665	10,017	11,682	747	18,390	19,137	3,828	2,532	6,260	4,529	3,262	7,790	14,945	10,762	25,708	25,879	44,798	70,677
2012	High	2,220	10,404	12,624	996	22,480	23,476	5,103	3,377	8,480	6,944	5,000	11,945	20,129	14,494	34,623	33,031	50,546	100,292
	Base	1,850	8,670	10,520	830	18,793	19,563	4,253	2,814	7,067	5,787	4,167	9,954	18,116	13,045	31,161	29,728	45,491	75,219
	Low	1,665	7,803	9,468	747	16,860	17,607	3,828	2,532	6,260	5,208	3,750	8,959	16,116	11,945	28,067	28,170	43,104	67,274
2014	High	2,220	10,440	12,660	996	23,549	24,304	5,103	3,377	8,480	7,850	5,761	13,612	23,381	20,437	48,818	44,770	63,104	107,874
	Base	1,850	8,700	10,550	830	19,423	20,253	4,253	2,814	7,067	6,542	4,801	11,343	23,651	17,031	40,682	37,908	52,587	89,895
	Low	1,665	7,800	9,465	747	17,661	18,228	3,828	2,532	6,260	5,888	4,321	10,209	21,286	15,328	36,614	33,577	47,328	80,906
2016	High	2,220	10,500	12,720	996	23,548	24,544	5,103	3,377	8,480	9,058	6,523	15,581	32,609	23,480	56,089	50,204	67,210	117,414
	Base	1,850	8,750	10,600	830	19,623	20,453	4,253	2,814	7,067	7,548	5,436	12,984	27,174	19,567	46,741	41,837	56,008	97,845
	Low	1,665	7,875	9,540	747	17,661	18,408	3,828	2,532	6,260	6,793	4,892	11,686	24,457	17,610	42,067	37,653	50,407	88,061
2018	High	1,848	10,560	12,408	996	23,668	24,664	5,181	3,419	8,600	9,964	7,175	17,138	36,835	26,525	63,360	55,080	71,090	126,170
	Base	1,540	8,800	10,340	830	19,723	20,553	4,318	2,903	7,167	8,303	5,979	14,282	30,596	22,104	52,800	45,900	59,242	105,142
	Low	1,366	7,920	9,306	747	17,751	18,498	3,886	2,584	6,450	7,473	5,381	12,854	27,626	19,894	47,520	41,310	53,318	94,628
2020	High	1,680	10,620	12,300	996	23,848	24,844	5,181	2,903	7,167	10,870	7,826	18,696	41,214	29,677	70,891	60,196	74,620	134,815
	Base	1,400	8,850	10,250	830	19,873	20,703	4,318	2,419	6,737	9,058	6,522	15,580	34,345	24,781	59,076	50,163	62,183	112,346
	Low	1,260	7,965	9,225	747	17,886	18,633	3,886	2,177	6,063	8,152	5,870	14,022	30,911	22,258	53,168	45,147	55,965	101,111

Remarks: High and Low Scenarios are set at 20% up and 10% down of the Base Scenario

9-2-4 Evaluation of the Future Manpower Projections

The required manpower for coal production projections will be examined according to the validity of productivity employed. As shown in Table 9-9, the projected average productivity of the existing coal mines becomes about 2 times of that in 2020. While those of the new coal mines to be developed are set at lower figures in considering inferiority on technical skills and less experience in operation.

**Table 9-9 Projections on Future Productivity**

		Present (1995)	Future (2020)
Existing Coal Mines	O/P	5.08 t/man/day	10.30 t/man/day
	U/G	0.66 t/man/day	1.82 t/man/day
New Coal Mines	O/P	-	6.67 t/man/day
	U/G	-	1.38 t/man/day

The following measures would be required in order to achieve the projected productivity in the future:

a) Open pit mines:

An adoption of heavier heavy equipment and increment of new pits

b) Underground mines:

Mechanization of underground mining operations

c) Manpower development for underground mines:

Not marked change on coal production of existing underground coal mines in the past 5 years. This means that no progress on productivity in the future as far as retaining present mining methods except the Embalut mine of PT Kitadin which has increased its production into 1.7 times by Japanese technical assistance.

d) Manpower development for new U/G mines:

A fresh start training for every technology would be required because the new mines may not have any technology about the coal mining and its related operations.

It might be realistic and reasonable to obtain 2 times of productivity in the future.

### 9-3 Manpower Projections by Kind of Occupation

The kinds of occupation are classified into 6 technical and one administration based on the classification by the DOC. The manpower distribution by kind of occupation is summarized in Table 9-10 according the information collected through the Questionnaire.

**Table 9-10 Proportion Constitution of Manpower by Kind of Occupation**

(%)

Kind of Occupation	DOC	Questionnaire	
	1995/96	Average (1995)	Average (2020)
Management	6.04	0.68	0.72
Professional	6.54	4.10	4.34
Technician/Supervisor	16.42	4.25	4.53
Operator Skilled	31.77	9.16	10.24
Operator Middle Skilled	11.84	8.31	8.88
Operator Unskilled	0.83	14.00	16.62
Administration	26.56	4.70	4.97
Sub-total	100.00	45.20	50.28
Sub-contractor	0.00	54.80	49.72
Total	100.00	100.00	100.00

The proportion of each kind is quite different between that of the DOC and each average obtained from the Questionnaire. So average of the figures in the Table 9-10 is used in the report.

The manpower constituents and its annual increment by work with 3 scenarios in every 2 years during 1996 and 2020 are shown in Table 9-11.

The coal production in 2020 is estimated at about 4.5 times of the present one. The manpower in 2020 is, however, projected about 4 times, 112,346, of the present on a Base case, and the numbers above the supervisor are estimated at 10,803 (Supervisor: 5,106), which are about 3.4 times of the present numbers.



Table 9-11 Manpower Constituents and Its Increment (1996 - 2020)

	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018	2020
PTBA													
Direct	5,338	7,254	8,490	8,410	8,370	7,871	7,885	7,335	5,609	5,636	5,785	3,744	5,083
Sub-Con.	3,364	4,646	5,560	5,540	5,530	5,540	5,540	5,530	4,611	4,655	4,714	4,566	4,557
Sub-Total	8,900	11,900	14,050	13,950	13,900	13,410	13,425	12,865	10,220	10,291	10,500	8,310	9,640
CCOW													
Direct	6,037	7,293	8,912	10,142	10,287	10,287	10,307	10,038	10,071	9,937	9,087	9,092	9,117
Sub-Con.	8,129	10,484	11,171	11,171	11,171	11,171	11,246	11,227	11,342	11,342	11,386	11,461	11,586
Sub-Total	14,166	17,777	20,083	21,313	21,458	21,458	21,553	21,265	21,413	21,279	20,473	20,553	20,703
RP													
Direct	3,219	3,219	3,382	3,382	3,382	3,382	3,382	3,412	3,412	3,412	3,412	3,442	3,542
Sub-Con.	2,614	2,614	2,791	2,791	2,791	2,791	2,791	2,791	2,791	2,791	2,791	2,855	2,855
Sub-Total	5,833	5,833	6,173	6,173	6,173	6,173	6,173	6,203	6,203	6,203	6,203	6,297	6,397
MUD													
Direct	600	600	600	600	600	600	600	600	600	600	600	600	600
Sub-Con.													
Sub-Total	600	600	600	600	600	600	600	600	600	600	600	600	600
CCOW													
Direct	0	0	704	1,645	2,338	3,205	3,932	4,522	5,143	5,687	6,497	7,159	7,854
Sub-Con.	0	0	615	1,385	1,990	2,763	3,428	4,133	4,811	5,657	6,497	7,123	7,748
Sub-Total	0	0	1,319	3,030	4,328	5,968	7,360	8,655	9,954	11,343	12,994	14,282	15,602
CCOW													
Direct	0	0	0	2,350	3,811	5,832	12,028	14,824	17,890	20,395	23,308	26,487	29,706
Sub-Con.	0	0	0	1,978	4,778	7,614	10,478	13,640	16,733	20,287	23,303	26,334	29,370
Sub-Total	0	0	0	4,328	10,378	16,446	22,506	28,464	34,623	40,682	46,741	52,821	59,076
Total													
Direct	15,892	18,666	22,288	26,729	30,768	34,477	38,332	41,029	43,188	45,066	46,956	48,703	50,482
Sub-Con.	14,107	18,378	19,450	22,000	26,188	29,721	33,400	37,501	40,391	44,828	48,887	52,439	55,854
Sub-Total	29,999	37,044	41,738	48,729	56,956	64,198	71,731	78,530	83,579	89,895	95,843	101,142	106,336
Manager													
High	293	350	419	488	567	626	687	726	758	785	848	911	973
Base	244	24	348	33	415	25	573	16	652	11	707	26	739
Low	220	292	314	373	425	470	516	544	568	589	636	683	729
Professional													
High	1,751	2,097	2,514	2,984	3,389	3,759	4,127	4,359	4,553	4,715	5,097	5,471	5,845
Base	1,458	144	1,748	196	2,093	190	2,439	87	3,784	68	4,247	196	4,539
Low	1,313	1,673	1,885	2,238	2,549	2,819	3,086	3,270	3,414	3,536	3,823	4,103	4,384
Supervisor													
High	1,801	2,155	2,584	3,074	3,508	3,889	4,280	4,533	4,742	4,918	5,322	5,718	6,110
Base	1,501	1,786	2,153	2,561	2,923	3,241	3,587	3,778	3,951	4,088	4,435	4,793	5,164
Low	1,351	1,616	1,938	2,305	2,631	2,917	3,210	3,400	3,556	3,689	3,981	4,287	4,593
Skilled Operator													
High	3,271	4,487	5,357	6,400	7,456	8,389	9,319	9,991	10,528	10,984	11,950	12,849	13,789
Base	3,142	298	4,400	451	5,391	411	7,068	280	8,771	195	9,102	383	10,724
Low	2,828	3,365	4,041	4,652	5,592	6,277	6,889	7,493	7,684	8,245	8,683	9,651	10,349
Middle Skilled Operator													
High	3,521	4,211	5,049	6,007	6,858	7,608	8,373	9,071	9,628	10,420	11,182	11,966	12,800
Base	2,934	288	3,509	398	4,207	398	6,338	320	7,393	146	8,023	322	9,372
Low	2,640	3,159	3,766	4,506	5,143	5,704	6,280	6,854	6,991	7,231	7,815	8,394	8,974
Unskilled Operator													
High	5,572	6,582	7,920	9,630	11,247	12,823	14,480	15,784	16,782	17,641	19,277	20,820	22,404
Base	4,643	421	6,000	713	8,025	674	10,688	895	12,075	531	13,980	370	16,064
Low	4,178	4,937	5,840	7,223	8,438	9,607	10,887	11,823	12,584	13,231	14,458	15,915	17,603
Administration													
High	2,002	2,395	2,974	3,613	4,307	5,064	5,722	6,380	6,947	7,524	8,111	8,708	9,316
Base	1,868	165	2,385	225	2,844	196	3,584	176	4,343	78	4,869	179	5,578
Low	1,502	1,788	2,155	2,560	2,999	3,423	3,842	4,262	4,682	5,102	5,521	5,941	6,361
Subcontractor													
High	16,929	19,655	23,340	27,000	31,425	35,685	40,079	45,001	48,470	53,795	58,084	62,923	67,023
Base	14,108	1,136	18,450	1,825	26,188	1,768	29,721	1,839	40,391	2,219	44,829	2,029	49,387
Low	12,897	14,741	17,505	20,748	23,969	27,248	30,908	35,173	39,352	40,340	43,998	47,184	50,289
Grand-Total													
High	35,639	41,634	50,066	59,075	66,347	77,037	86,078	94,236	100,263	107,874	117,415	126,170	134,815
Base	28,898	2,823	34,945	3,745	49,229	3,603	64,188	3,787	71,731	3,389	85,577	3,159	97,845
Low	26,729	37,364	44,508	57,778	64,508	77,778	84,358	90,671	95,370	101,142	106,081	112,346	118,346

## 10. Proposed Conceptual Action Plan

### 10-1 Long-term Production Plan and Manpower Plan

According to the long-term production plan in Indonesia, the coal production that was 40 million tons in 1996 reaches 190 million tons in 2020, which accounts for 6 million tons increase on average every year. However, to achieve the goal, it is indispensable both to improve the mining technology and increase productivity so that the forthcoming change for the worse, increase in stripping ratio for the open pit mining and increase in the number of underground mines, should first be coped with.

As regards the increase in the underground mines, the percentage of production that was only 2.5% in 1995 as compared to the open pit mining is expected to reach as much as 11% in 2020 as shown in Table 10-1.

The number of manpower that was 30,000 in 1995 reaches 110,000 in 2020, of which underground manpower accounts for 50,000 and open pit mining for 60,000.

Table 10-1 Base Scenario Production up to 2020

	1996	2000	2005	2010	2015	2020
<b>Production</b> (Millio tons)						
U/G	1	2	7	12	17	21
O/P	48	95	122	137	149	168
Total	49	97	129	149	166	189
<b>Manpower</b> (1,000)						
U/G	5	7	18	29	40	50
O/P	25	35	43	50	54	62
Total	30	42	61	79	94	112
<b>U/G Production</b> <b>Rate (%)</b>	2.4	2.2	5.4	8.4	10.2	11.0

## 10-2 Necessity of Manpower Development

In Indonesia, the productivity in the coal industry is rather low as compared with other foreign countries and moreover as to the technical level, it is low as a whole except at some open pit mines. In addition, there is plenty of room for improvement in basic skills as well as in practical skills. To raise the technical level, it is necessary to develop relevant manpower soon.

As regards the manpower development, it is also necessary to provide training and education courses (inside and outside the enterprises) as shown in Figure 10-1 in order to develop and enhance employees' capability to carrying out the works. And as the capability is increased, incentive treatment such as promotion, pay increase, higher position, etc. should be given to them.

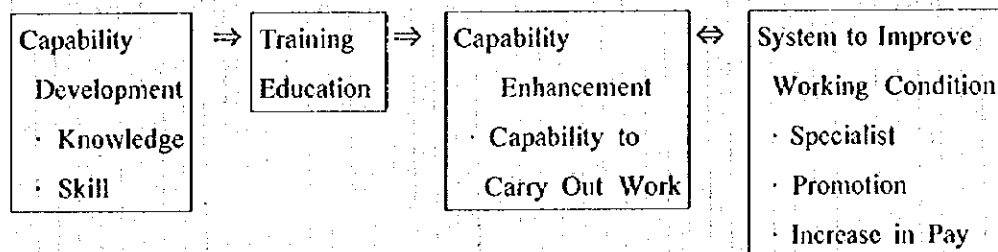


Figure 10-1 Outcome of Manpower Development

## 10-3 Establishment of Hierarchical Classification in Manpower Development

The hierarchical enterprise organization in coal industry can be divided into six classes from manager to unskilled operator as shown in Figure 10-2. In this report, however, the hierarchy is roughly divided into the following three classes taking into account the current duties taken in the enterprises and in consideration of the hierarchical manpower development method.

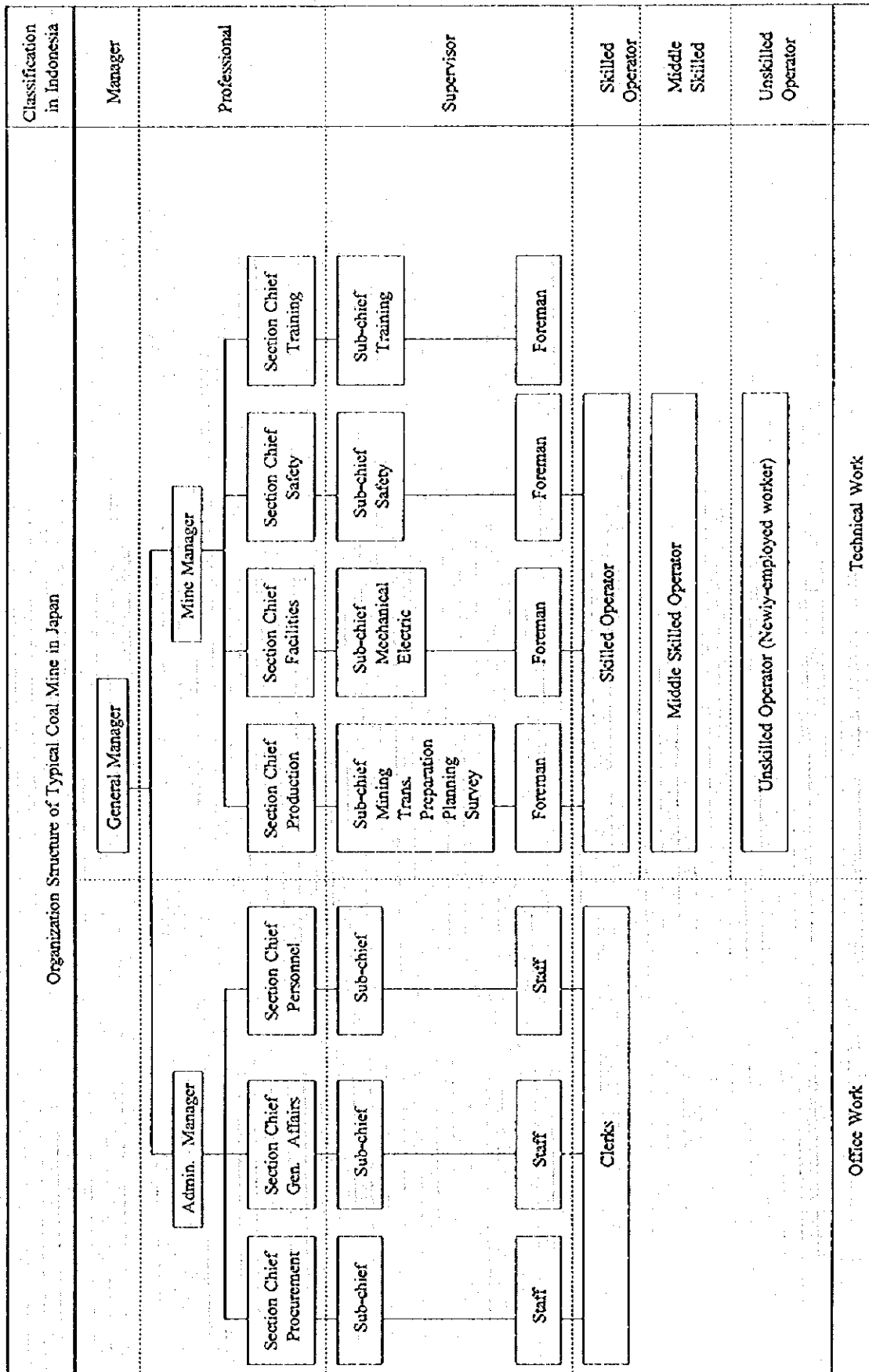


Figure 10-2 Organization Structure of A Coal Mine

**Table 10-2 Hierarchical Classification in Manpower Development**

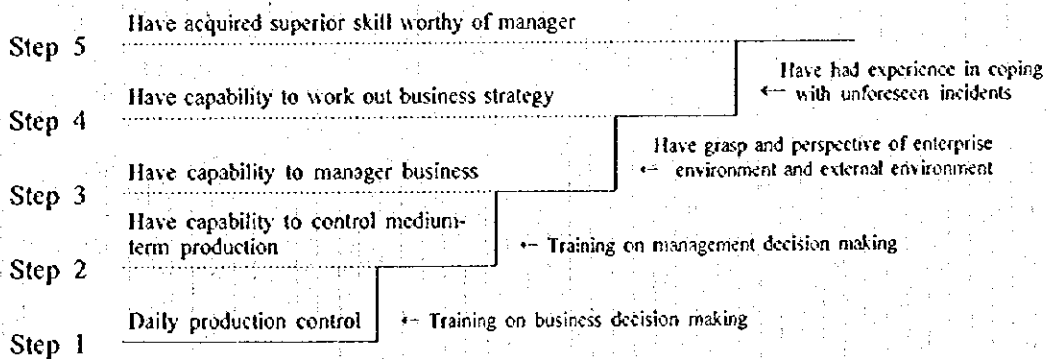
Organization Hierarchy	Manpower Development Hierarchy
Manager, Professional	Manager Class
Supervisor, Skilled operator	Supervisor Class
Middle skilled / Unskilled operator	Operator Class

**10-3-1 Hierarchical Technology Level**

The open pit mines presently operated in Indonesia by the 1st generation contractors to whom the foreign investment has been given has already accomplished the standard technical level thanks to the instruction and training conducted by the resident expatriate engineers.

On the other hand, at many other Indonesian coal mines, employees are still in the stage of gaining skills as shown in Figure 10-3 to 10-5.

**1) Manager class**



**Figure 10-3 Steps to Acquire Skill ( Manager Class )**

Duties of manager class shall be such that the manager of each department undertakes the daily production control and medium-term production control in accordance with the business strategy determined by their top management, and in addition, control expenses as budgeted and make alterations in plans if necessary. However, in Indonesia, since the capability to work out medium-term plans and control the business is presently still incomplete in some points, it is safe to say that the present level of manager class may be in Step 2 or 3 in Figure 10-3. It is therefore necessary to raise the level to Step 3 or 4 soon.

2) Supervisor class

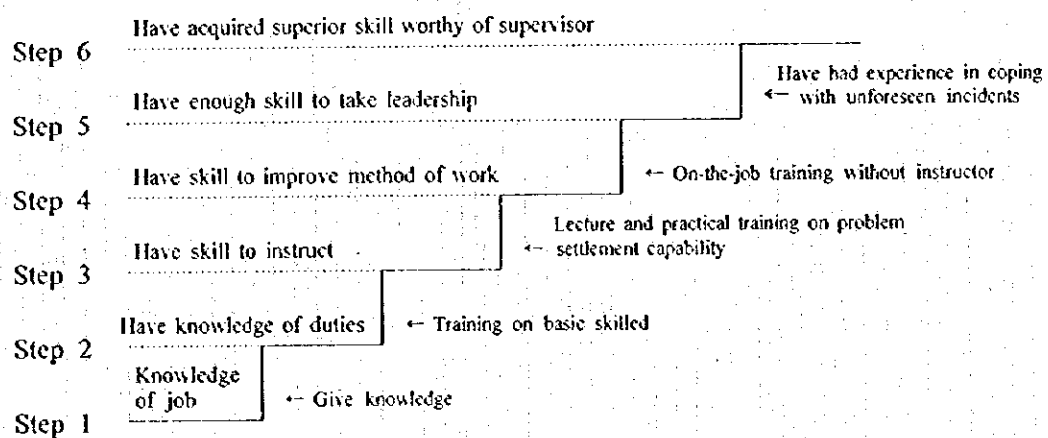
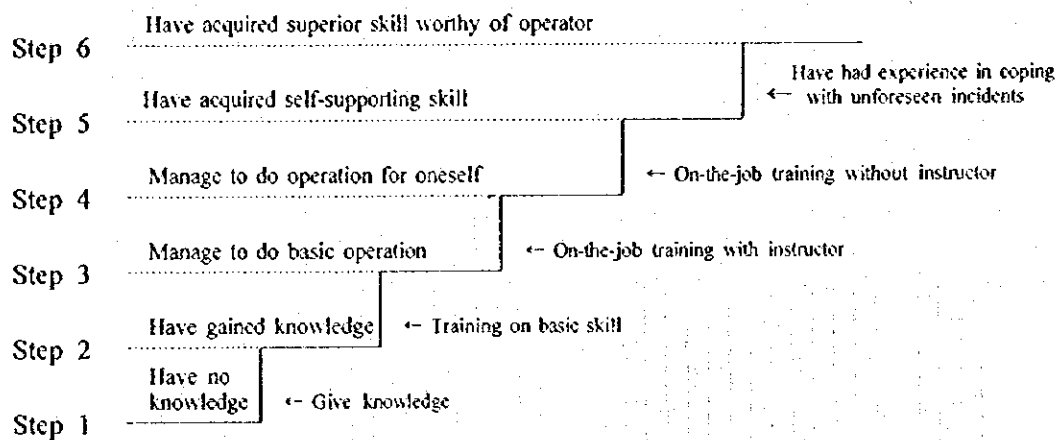


Figure 10-4 Steps to Acquire Skill ( Supervisor Class )

Present knowledge and skill of supervisor class to control and improve the works are not enough yet thereby much impeding the productivity. It is also safe to say that the present level of supervisor class may be around in Step 3 in Figure 10-4. It is necessary to improve the level to Step 4 or 5.

3) Operator class

Most operators are in Step 3 or 4 in Figure 10-5 and coupled with the old-fashioned production method, only achieving the low productivity.



**Figure 10-5 Steps to Acquire Skill ( Operator Class)**

As such, in consideration of the hierarchical skills to be acquired and incomplete skills shown in Figure 10-6, it is necessary to execute manpower development in an efficient manner to the extent that it reaches the Step 5 or 6 level.

In particular, the underground mining method that is presently adopted at three PTBA and KP mines is still in the rudimentary stage as to the mining equipment and production control capability. Accordingly, it is necessary to start the training on skills and instruction in know-how from the beginning. In addition, it is also necessary to develop the 2nd and 3rd generation underground coal mines.

### 10-3-2 Hierarchical Manpower Development to be Achieved

Taking into account the following factors, the number of manpower to be developed from now on in manager class, supervisor class and operator class is calculated as follows.

- Annual increase
- Age-limit retiring and turnover rate
- Refresher training is included or not

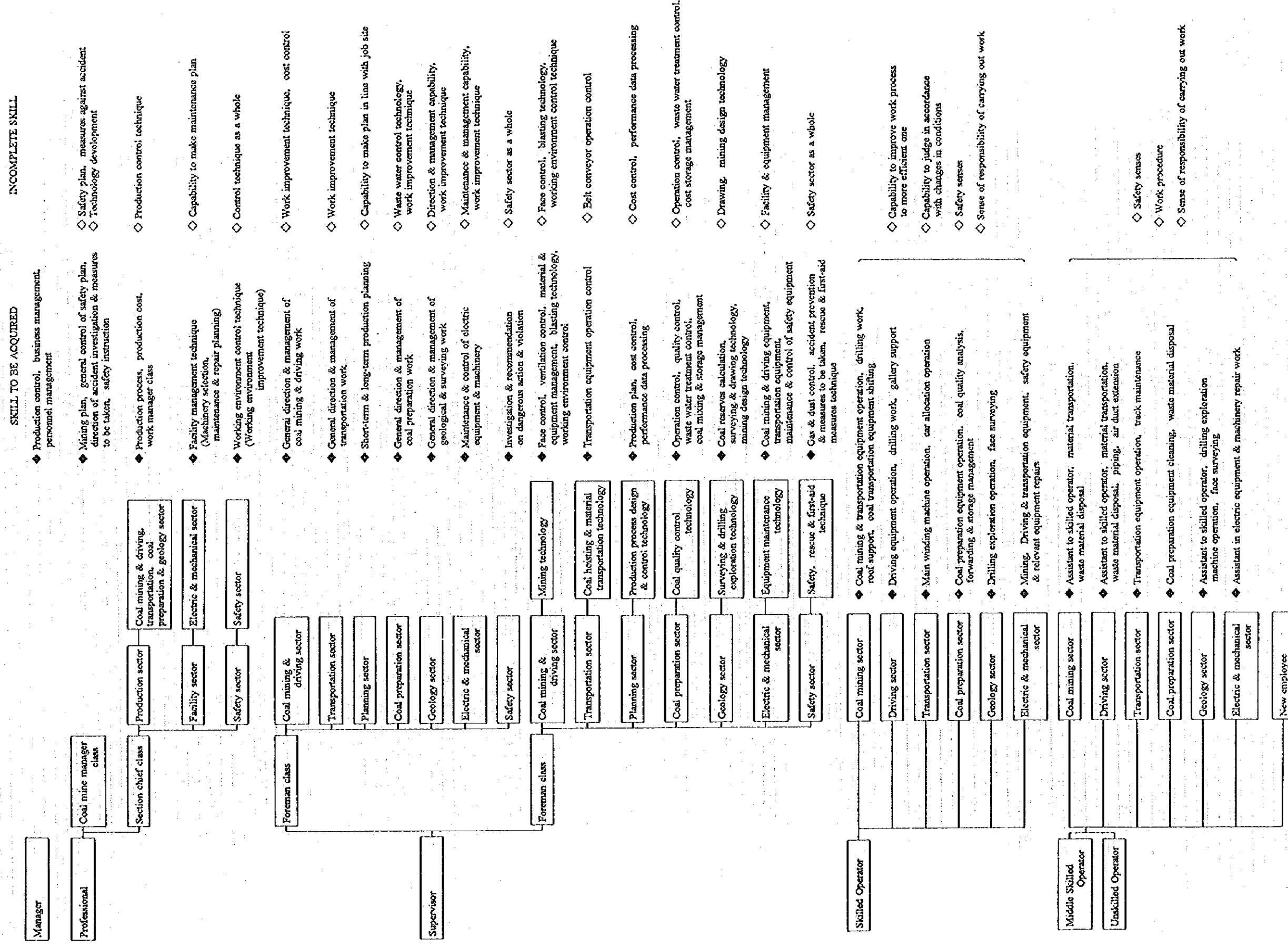
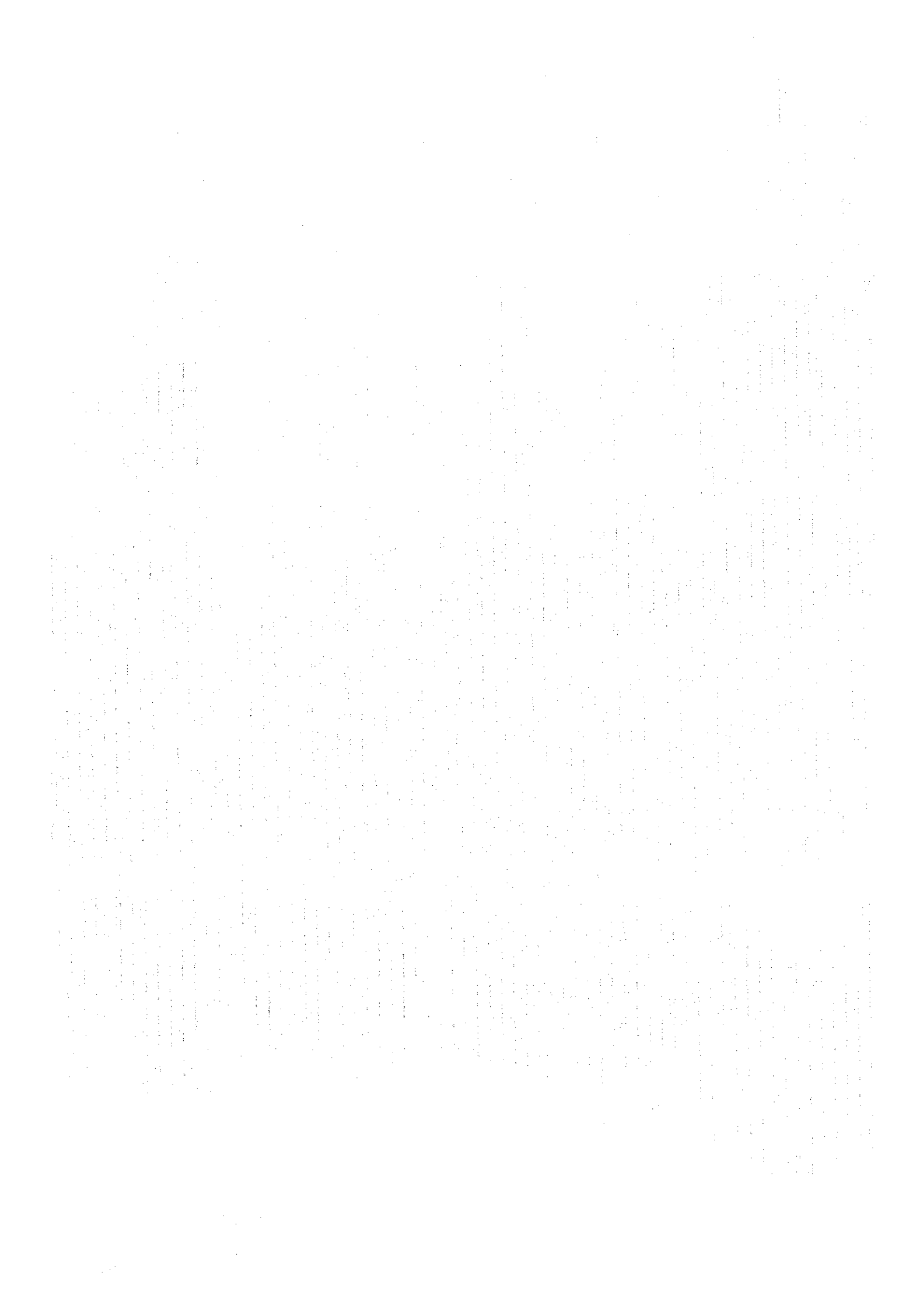


Figure 10-6 Skills to be Acquired by Hierarchy





1) Manager class

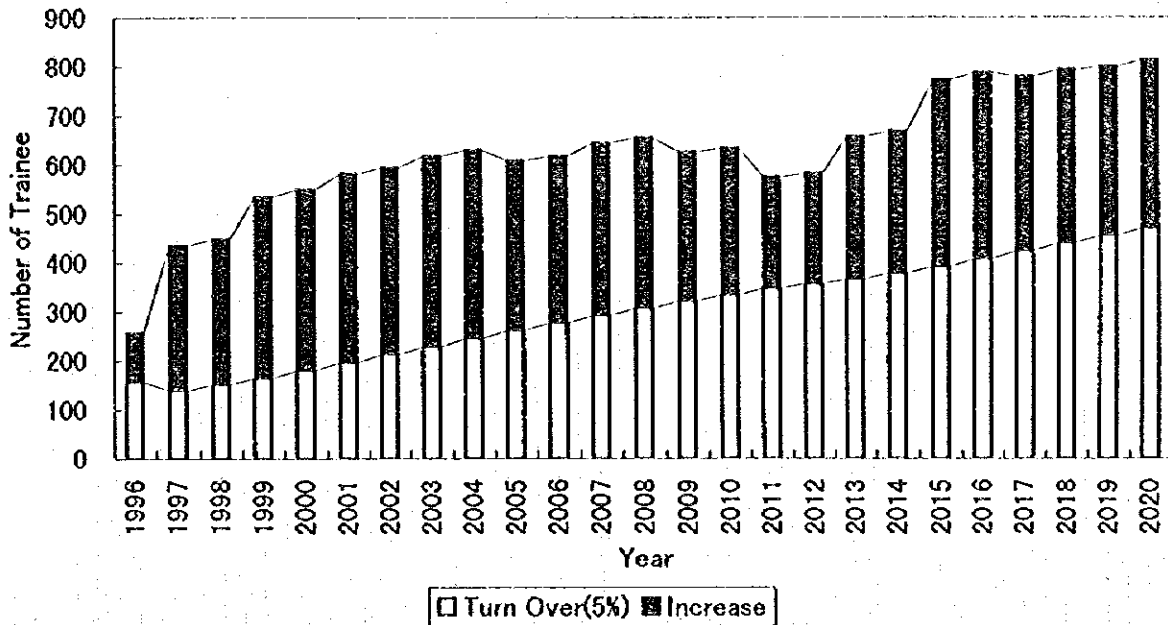


Figure 10-7 Number of Manager Class Manpower to be Developed

Figure 10-7 shows the number of manager class manpower to be developed by 2020, which is calculated taking into account the annual increase and age-limit retiring and turnover rate (5%).

It is known from the Figure 10-7 that in 2020, approx. 800 manager class manpower should be trained.

2) Supervisor class

To calculate the number of supervisor class manpower to be developed by 2020, the periodic refresher training that is necessary for this class once every five years is taken into account in addition to the annual increase and age-limit retiring and turnover rate (10%).

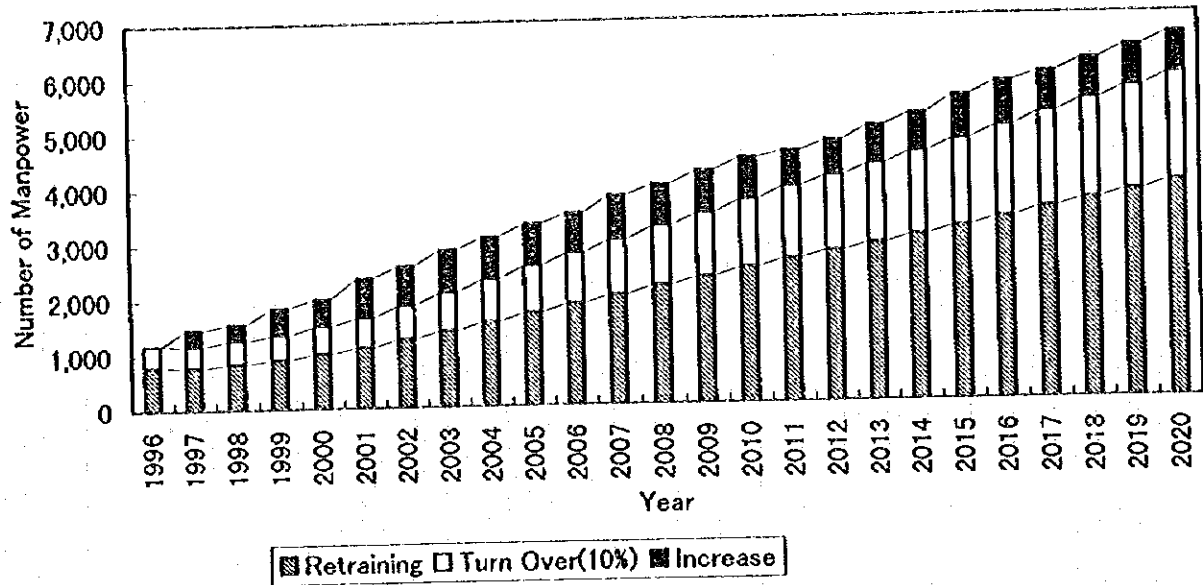


Figure 10-8 Number of Supervisor Class Manpower to be Developed

It is known from the Figure 10-8 that the number of supervisor class manpower to be trained gradually increases from 1,000 in 1996 to 6,600 in 2020.

3) Operator class

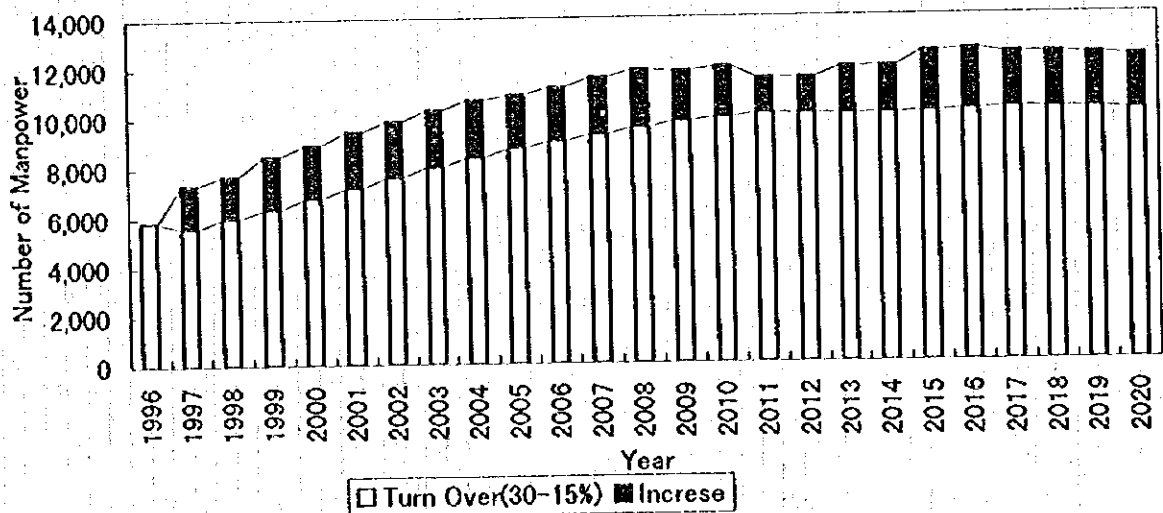


Figure 10-9 Number of Operator Class Manpower to be Developed

The number of operator class manpower to be developed by 2020 is calculated taking into account the annual increase and age-limit retiring and turnover rate (30% to 15%). The age-limit retiring and turnover rate that is as high as 30% at present is set to 15% in 2020 in consideration of the expected improvement in working environment and increase in health and welfare facilities in future.

It is known from the Figure 10-9 that the number of operator class manpower to be trained is on the increases up to 2008 but after that remains stable and is kept in the narrow range of around 12,000 or so as the age-limit retiring and turnover rate decreases.

### 10-3-3 Manpower Development Organization and Hierarchical Manpower Development

There are three manpower development organizations, namely, school, training center and in-company training. Table 10-3 shows the advantageous points of these organizations respectively.

**Table 10-4 Hierarchical Manpower Development Organization**

	Acceptability			Economy			Practical Training			Evaluation		
	A	B	C	A	B	C	A	B	C	A	B	C
University / College	○			○						⊙		
MDCM	○	○		○						⊙	○	
LPPT	○	○		○	○		○	○	○	○	⊙	○
In-company training	○	○	○			○	○	○	○			⊙

A : Manager Class, B : Supervisor Class, C : Operator Class

**Table 10-3 Features of Present Manpower Development Method**

	School Education	Training Center	In-Company Training
<b>Purpose</b>	To supply prospective manager class manpower to enterprise	Enhancement of production & safety technology	Development of capability to perform duties
<b>Method of Training</b>	Lecture & instruction in know-how take a leading part	Hierarchical & occupational training - Training on skill - Instruction in know-how	On-the-job training & group safety instruction - Skill training takes a lead part
<b>Prospective trainee</b>	Supervisor class or over 1,150 graduates/year	Supervisor class or over LPPT 50 graduates/year MDCM 1,500 graduates/year	Operator & new employee
<b>Instructor</b>	Full-time instructor Academic career & knowledge level is high. With less actual experience.	Full-time instructor Expertise level is high. With moderate actual experience.	Part-time instructor Knowledge level is generally low. With rich actual experience
<b>Advantages</b>	- Acquisition of basic knowledge up to high-grade expertise	- Acquisition of expertise & job-site know-how. - To deepen mutual understanding by exchanging information with other coal mines.	- Acquisition of skill to carry out work in line with job site. - On-the-job training - Inexpensive training cost
<b>Dis-advantages</b>	- Difficult to acquire job-site know-how - School fee is expensive - Hardly available except in Java	- Capacity is insufficient - Training cost is expensive - Trainees have to quit performing their duties	- Mostly dependent upon instructor's capability - Often causing waste of time unless carried out systematically

Table 10-4 shows the results of the survey of each manpower development organization as to such factors as acceptability (instructor and trainee) by hierarchy, economy and practical training.

1) Manager class

It is indispensable to train the manager class on production control and business management. On the other hand, the practical training is not necessary to them. In light of it, universities, colleges and MDCM's that have the manager class training course at present are suitable for training them.

2) Supervisor class

As for supervisor class, such expert instructors who are specialized in respective technical sectors are required. Hence it should be effective and economical to develop the supervisor class manpower in dedicated training organizations (such as LPPT at present). This is also recommendable in that the participants may obtain a variety of knowledge as a result of contact with other enterprise employees sent to the organizations.

As mentioned above, it is the most suitable way to train the prospective supervisors in dedicated training organizations. And it is also the most effective way that these supervisors undertake in-company training of operators in each enterprise thereby much increasing the productivity and improving the safety. Nonetheless, the present LPPT is hardly able to meet such requirements because of its inadequate manpower development capacity and unsuitable location and moreover difference in method of mining adopted in the curriculum and that actually used at mines where the practical training is available. In view of it, it is definitely necessary to establish a new training organization in East Kalimantan or South Kalimantan soon.

3) Operator class

It may be difficult to expect much from the operator class training. This is because the operator class is so many in number that accounts for over 50% of the total employees and moreover because it may be almost impossible to give them a

higher level of training in the light of the education level; the operator class mostly consists of secondary school graduates presently.

Under the circumstances, it should be concluded that it is suitable that the supervisors who underwent the training at the training center undertake the on-the-job training of the operator class in each enterprise.

#### 10-3-4 Evaluation of Instructors

There are four types of instructors, namely, education consultant instructor, school instructor, training center instructor and in-company instructor. To dispose these instructors for hierarchical training, such factors as availability, economy and practical training facilities have been checked in this report as shown in Table 10-5.

**Table 10-5 Procurement of Instructor**

	Availability			Economy			Practical Training			Evaluation		
	A	B	C	A	B	C	A	B	C	A	B	C
Educational Consultant	○						○	○	○	○		
School	○			○						○		
Training Center	○	○		○	○		○	○	○	○	○	
In-company training			○			○	○	○	○			○

#### 1) Education consultant instructor

- Training is given in each enterprise.
- Expert education consultants specialized in coal mining are less.
- Most expert consultants in business management and production control stay in Java.

2) School instructor

- Education is given in school.
- Expert instructors specialized in business management and production control are available.
- Instructors specialized in practical skill of coal mining are less.

3) Training center instructor

- Training is given in training center.
- Instructors have capability to give instruction in practical skills in respect of production and safety at coal mines.
- Expert instructors specialized in business management and production control are available at MDCM.

4) In-company instructor

- Instructors have capability to carry out training in line with the job-site requirements of each enterprise.

**10-4 Future Problems Involved in Manpower Development Organization**

**10-4-1 School Education**

The Indonesian school system is the same as in Japan. It consists of primary school-six years, secondary school-three years and high school-three years, of which only the primary school is compulsory. In addition, there are academy (a junior college)-two years and university-four years. The present ratio of pupils or students who go on to the next stage of education is 100% for primary school, 50% for secondary school, 33% for high school and 10% for junior college and university.



1) University and College

In Indonesia, there are fourteen universities and one college that have coal-related departments and courses. The education in geology is available at seven universities and one college, mine engineering at eight universities, metallurgy at three universities and industry at three universities. Mechanical and electrical courses are commonly found at many universities and colleges. The number of graduates from those universities is about 1,150 annually as shown in Table 10-6.

Table 10-6 Outline of Present Manpower Development in Coal Industry

University Course	Graduates	Training Centre MDCM		LPPT
Geology	467/8	Survey & Drawing	73(4)	50x2Y
Mining	509/8	Geology & Exploration	234(8)	
Metallurgy	75/2	Mineral Exploration	51(3)	
Industry	100/2	Drilling	36(3)	
Total	1,151/15	Seismic Survey	20(1)	
Mechanical	Non Limit	Remote Sensing	20(1)	
Electrical	Non Limit	Mining	161(4)	
Civil	Non Limit	Mine Safety	110(9)	
		Environmental	174(4)	
		Disasters	20(1)	
		Mine Management	120(4)	
		Administration	160(3)	
		Blast Class I	31(2)	
		Blast Class II	33(1)	
		Finance	260(3)	
		Coal Utilization	20(1)	
		General Education	91(3)	
		Others	73(4)	
Total	1,150+	Total	1,687(53)	50/Y

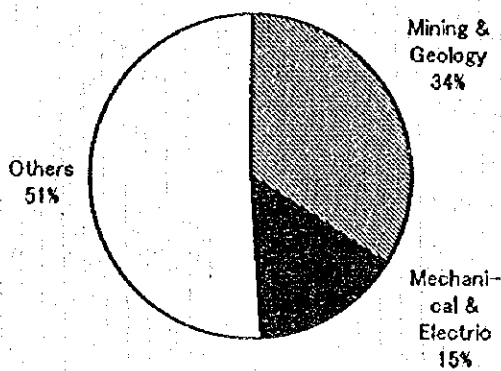
As is the case in other industries, manager class in the coal industry is mostly comprised of university graduates who possess basic knowledge and expertise as well. Table 10-7 shows the hierarchical education level in the coal industry. It is known from the Table that the university graduates account for the most part of the manager class and moreover it is safe to say that the percentage of the university graduates in the manager class may possibly be more and more increased as the engineering level advances from now on and coal is produced more and more.

**Table 10-7 Hierarchical Education Level**

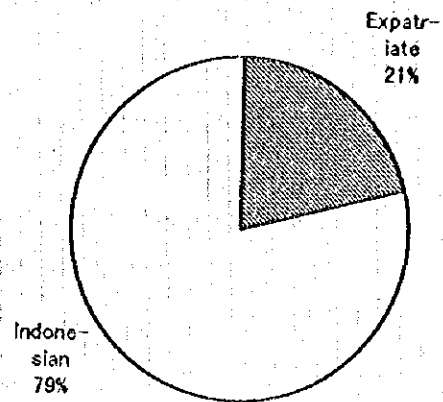
	Graduates (%)	
	University	High School
Manager	85	15
Professional	62	38
Supervisor	42	53
Skilled operator	-	71

**-Supply capacity of university graduates to coal industry**

As shown in Figure 10-10, the courses of study taken by the present university graduate manager class are mostly mining and geology that accounts for 34%, mechanical and electrical for 15% and others for 51%. The percentage of expatriates in the university graduate manager class accounts for 21% as shown in Figure 10-11.



**Figure 10-10 Courses of Study Taken by University Graduate Manager Class**



**Figure 10-11 Percentage of Expatriates in University Graduate Manager Class**

There are many universities in Indonesia that have mechanical and electrical courses. These universities therefore seldom pose any problem as to supply of mechanical and electrical course graduates. On the other hand, since the universities that supply graduates completed the mining and geology courses are very limited, they are taken up in this report.

If the composition remains the same as shown in Figure 10-10 and 10-11 until 2020, the manager class manpower to be developed in the mining and geology sectors becomes 215 in the light of the total number of the manager class manpower to be developed in 2020 which is 800 as mentioned previously,

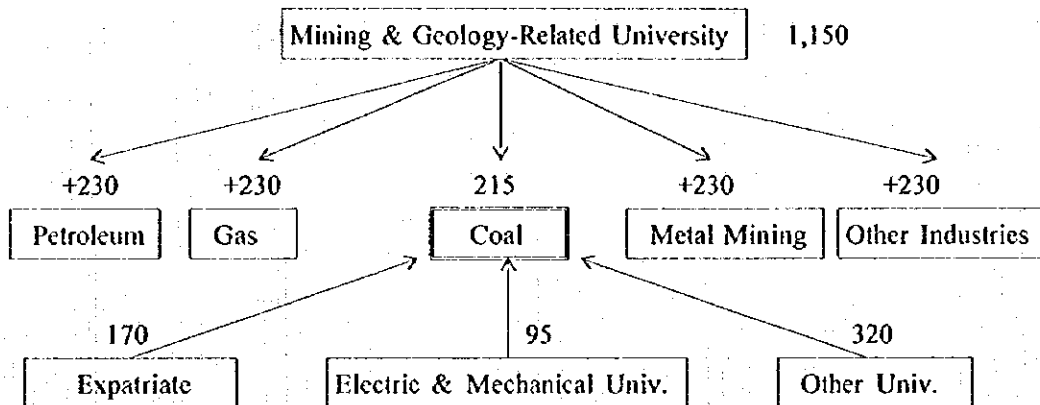


Figure 10-12 Supply Flow of University Graduates to Coal Industry

The present supply capacity of the graduates of the mining and geology-related universities is 1,150 annually who find employment in petroleum, gas, metal mining and other industries in addition to the coal industry as shown in Figure 10-12. And if the employment rate is supposed to remain the same until 2020, the subject manpower supply becomes 230.

As the result of the above discussion, it may safely be said that the supply of the university graduates to the coal industry just meet the increase in the manpower demand form now.

## 2) High School

The education level of the supervisors who have to take a leading part in the jog-site work should be at least on such a level that they possess the basic knowledge of physics, mathematics, etc. In this regard, the high school graduates are now taking the most part of the supervisor class.

On the other hand, coal-related instruction is seldom given to this class because of economical and time-wise restriction and moreover inadequate capability of instructors, though it is often routinely given to the new employees just after joining the enterprise or otherwise given to the trainees in the on-the-job training.

To cope with the above situations, it is necessary to develop the manpower of this class by sending them to the outside training centers or otherwise improving the in-company training method itself in each of the enterprises.

### 3) Future Problems

#### a) Training of instructor

To cope with an expected sharp increase in coal production from now on, it is necessary to develop superior manpower specialized in coal-related expertise at universities, and to this effect, it is definitely necessary to raise the level of university instructors.

Presently, the method of mining widely adopted in Indonesia is the open pit type and thus the open pit mining-related curricula and instructors are almost complete by now. On the other hand, the underground mining technology courses are seldom available in Indonesia. This is because the underground mining and such production are still rare cases in Indonesia.

Nonetheless, since it is expected that the underground mining may be developed more from the year 2000 onward, it is also necessary to train the instructors specialized in the underground mining technology.

As regards the refresher training of university and college instructors, which is already under way with the Institute of Technology Bandung taking a leading part supporting and training the instructors of the other universities, additional action should also be taken such as inviting superior home and overseas instructors in order to raise the technical level.

b) Joint research among coal mines and universities

To smoothly implement the coal production plan, it is also necessary to promote development of technologies suitable to respective coal mines and to make good use of competent human resources. To achieve the goal, the technical challenges that may occur in future or present coal mine operation must first be solved or improved through the joint research among universities and mines.

The above joint researches, if realized, may not only raise the technical level of the engineers in the coal industry but also increase the knowledge of the university students as to the coal industry thus contributing to some extent toward securing the manpower for the industry.

10-4-2 Training Center

The purpose of a training center is to develop manpower in such a way that enterprise employees are given training on skills and instruction in know-how so that after they have returned to the enterprise, they are able to contribute in many ways to their enterprises and moreover able to transfer their skill and know-how to the enterprise employees. In this regard, the trainees to be sent to the training centers should be at least the supervisor class or over.

Table 10-8 Outline of Training Center

	LPPT	MDCM
Location	Sumatra ( West Sumatra )	Java ( Bandung )
Capacity	50 graduates/year	1,500 graduates/year
Prospective Trainee	Supervisor ( mostly from PTBA )	Mostly manager & professional ( from all over the country )
Course	Coal Mining Mechanical Electric	Manager Training Blasting Qualification Government Inspector Training
Remark	Scheduled to be operated by Australian enterprise in future	

Presently, the coal-related training centers in Indonesia are two in number, namely, the LPPT and MDCM. The outline of these facilities is as shown previous page.

As a result of the site survey, it is found that there are strong requirements from coal mines for immediate training of supervisors and skilled operators on the grounds that:

-To cope with an expected sharp increase in coal production in future, it is indispensable and moreover effective to develop supervisor class manpower soon who are responsible for a work unit (mining face, driving face, respective transportation zones, maintenance, safety, etc.) in the coal mines and have direct powers to give directions there. After finishing the training course, they are also able to undertake the role of on-the-job training instructors in their respective enterprises.

-It is the responsibility of the skilled operator who is also the group leader of operators to smoothly and efficiently carry out the job-site work. To this effect, the skilled operators are required to obtain suitable basic knowledge of the job-site work so that they are able to increase the productivity more.

#### 1) Future problems

##### a) Manpower development capacity of training center

###### (1) LPPT

At present, the PTBA supervisor training is under way for the most part at LPPT. The LPPT has an advantage over other training centers in that it is provided with complete training facilities and has plenty of experienced instructors belonging to the center and available from the Ombilin coal mine as well. However, since the annual manpower development capacity of this center is small, only 50, it is still necessary to increase the manpower development capacity.

###### (2) MDCM

At MDCM, training of manager class trainees sent from coal mines and of government superintendent officers is under way. The MDCM is provided with

complete training facilities and courses with the annual manpower development capacity of 1,500.

In the future, however, the number of manpower to be developed in respect of the above-mentioned class is estimated to be about 800 in 2020. It is necessary therefore to improve the present facilities soon so that the center is able to cope with the above-mentioned increase in 2020. In addition, since it is likely that the safety challenges to be solved like underground accidents or disaster may come to the surface as the number of underground mining increases in future and exert influence on the coal production, it is recommended that the disaster prevention technology course should be included in the training curricula.

In Indonesia, the production and more utilization of coal lying a lot under the ground has been officially posted aiming at more use of the home energy to meet the higher level of domestic economic growth. However, in achieving the goal, the development of coal-related manpower, especially the supervisor class manpower directly in charge of the production job-site work plays a central role. In this regard, it is necessary to establish a training center in the vicinity of a coal mine where the practical training is available and moreover procure expert instructors who possess expertise and professional skills as well.

The supervisor class manpower to be developed is approx. 6,600 in 2020 as previously estimated. And if the present manpower development capacity continues to remain as it is, shortage of manpower development capacity may surely take place. It is therefore indispensable to newly establish several training centers soon in addition to improving the two existing training centers.

-Because of a sharp increase in the coal production, it is indispensable to train prospective skilled engineers specialized in production, planning, management, etc.

-Owing to the natural conditions, method of coal production surely shifts from the present open pit mining to underground mining. It is thus presumed that the underground mining engineers may be in short supply in future. It is necessary to develop such manpower soon.

-In view of the present technical level, it is necessary to develop the manpower in such a way as to raise the level of the job-site basic knowledge, control technique, safety, environment control, etc.

-It is clear that the present engineer training capacity of the LPPT and MDCM may hardly cope with the above situations. It is thus necessary to establish a number of training centers after due consideration given to location, occupational category of trainees, operation, organization, etc.

#### b) Method of training and education

As regards the manager class training, practical training on skills or the like is not necessary at all and thus it may safely be said that the training curricula presently adopted at MDCM for the manager class training is quite suitable. However, as regards the supervisor class, practical skills to install or operate various equipment are still needed. As such, it is necessary to establish in future new training centers in the vicinity of coal mines where the practical training is available.

#### c) Training of underground mining technology

It is presumed that as the underground mines are developed more and more, the number of manpower needed for the underground mining may become 50,000 in 2020, which amounts to as much as about 45% of the total coal industry employees. Under the circumstances, it is necessary to train instructors soon who are specialized in the underground mining and complete the training curricula.

#### 10-4-3 In-company Training

Presently, in-company on-the-job training is under way at almost all coal mines in Indonesia. This is because:

-Turnover rate of the operator class is high thus offering occasions for employment of many new workers.



-Method of mining differs from mine to mine thereby calling for an independent training method original with each mine.

As for the training curricula, lecture on safety instruction and on-the-job training on practical skills conducted on job-site take a leading part presently. Hence it is safe to say that the present method of training in respect of the operators who undertake the works on job-site is quite satisfactory.

Furthermore, in Indonesia, it is stipulated in the Mine Safety Regulations that more than 90 days of basic training and more than 30 days of follow-up training shall be given to the newly-hired employees.

On the other hand, though the in-company training of supervisor class or over is also under way in each enterprise, it is now found to be quite ineffective. This is because the dedicated education sections are still less in the enterprises and full-time instructors are difficult to secure causing a strong sense of problem in each coal mine.

#### 1) Future Problems

##### a) Deficiency of dedicated training sections

To enhance the productivity so that the rise in the labor costs in future is coped with, it is necessary to set up a proper training goal, grasp the present needs, review the training items, as well as execute periodic training. To implement these plans and periodic training, it is also necessary to establish more dedicated training sections and improve existing ones.

##### b) Short of full-time instructors

It is again necessary to select prospective full-time instructors out of the supervisors and skilled operators and train them to the extent that they can undertake the training of newly-employed operators as well as periodic education and training of unskilled operators.

**e) Imperfect curriculum**

At present, the curriculum adopted at each coal mine differs with each other. As such, it is necessary to prepare a common and basic curriculum soon. And based on this common curriculum, other curricula should be added in due course as necessary so that they fully meet the unique requirements of each coal mine.

**d) Method of training of supervisor class and over**

Manpower development of supervisor class or over should be undertaken at training centers.

10-4-4 Problems Involved in Each Manpower Development Organization and Action to Be Taken

Table 10-9 Problems Involved in Manpower Development Organizations & Action to be Taken

	Problems	Action to be Taken
School Education	<ul style="list-style-type: none"> <li>- Instructor training</li> <li>- Execution of joint research</li> </ul>	<ul style="list-style-type: none"> <li>- Disposition of expert instructors specialized in underground mining, instruction by domestic &amp; overseas instructors</li> <li>- Selection of research subject</li> </ul>
Training Center	<ul style="list-style-type: none"> <li>- Manpower development capacity : 800+7000 in 2020</li> <li>- Method of manpower : Practical training</li> <li>- Underground technology : Shortage of instructors</li> </ul>	<ul style="list-style-type: none"> <li>- Capacity increase : 2000 x 2</li> <li>- Coal mines to accept trainees</li> <li>- Technology transfer by expert instructors, improvement of curriculum</li> </ul>
In-company training	<ul style="list-style-type: none"> <li>- Inadequate training sections in enterprises</li> <li>- Shortage of instructors</li> <li>- Imperfect curriculum</li> </ul>	<ul style="list-style-type: none"> <li>- Increase &amp; Improve training sections</li> <li>- Train instructors at training center</li> <li>- Rearrange &amp; complete</li> </ul>

## 11. Proposed Action Plan

This execution plan shows how to develop the manpower required to achieve the increased production in future based on the results of survey of the natural conditions, technical level, market, etc. in Indonesian coal industry.

Concerning the hierarchical manpower development method, it is the most important thing to use the following procedure in such a manner as shown in Figure 11-1.

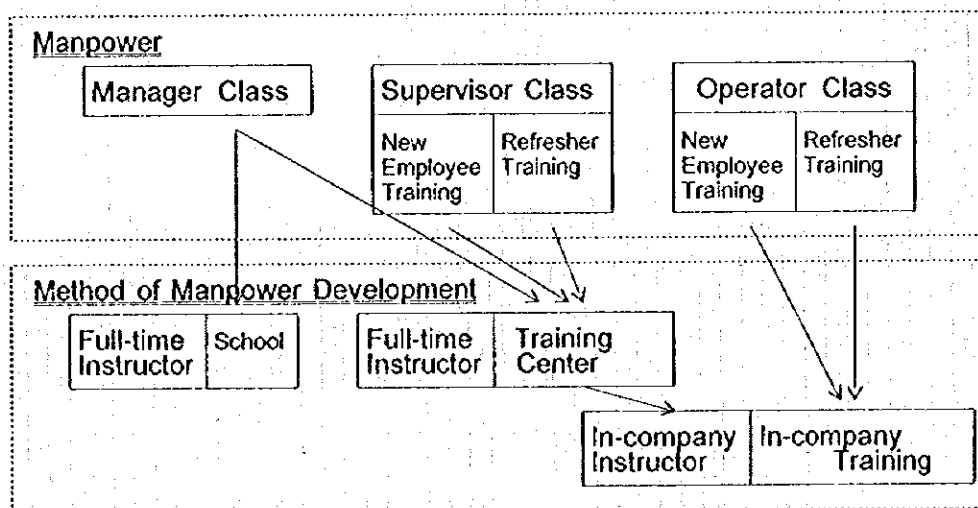


Figure 11-1 Method of Hierarchical Manpower Development

- 1) Training of manager class manpower should be undertaken by expert instructors in schools (university and college) or professional skill training organizations (MDCM).
- 2) Training of newly-employed supervisor class manpower and refresher training should be undertaken by expert instructors in professional skill training organizations (LPPT or other training centers) together with the practical training to be given at relevant coal mines.

- 3) Training of operator class manpower should be undertaken in each enterprise by supervisor class instructors who completed the training course in professional skill training organizations mentioned in 2) above with the job-site practical training taking a leading part of the curriculum.

To work out an action plan that enables reasonable and feasible manpower development in the way as mentioned above and moreover satisfies the local conditions, the manpower development method adopted in the Japanese coal industry is basically used on the grounds that:

-Geological conditions in Indonesia are similar to those in Japan

Since the state of coal reserves and geological age in Indonesia are similar to those in Japan, the manpower development methods adopted in Japan in respect of the production and safety are commonly used in Indonesia as well.

-Increase in productivity and decrease in accident frequency rate

The productivity has been improved during 35 years from 1965 to 1990 as shown below.

Productivity: 18 -> 140 (tons/man/month), approx. 8 times

Accident frequency rate: 676 -> 17 persons (per million), approx. 1/140

-Actual results found successful in Japan and technology transfer of them

## 11-1 School education (university and college)

### 11-1-1 Instructor Training

It is necessary to train underground mining engineers. In this regard, such instructors who have relevant knowledge should first be trained at universities and colleges. To achieve the goal, the following method should be adopted.

- 1) Invite the expatriate instructors specialized in the underground mining technology from Australia, America, Japan, etc.
- 2) Invite capable personnel who possess skills and experience in the underground mining from the coal enterprises and coal-related organizations to give a lecture at universities and colleges.
- 3) The Institute of Technology Bandung takes a leading part in training the instructors of other universities.
- 4) Make full use of study-abroad system such as an exchange professor or the like so that the training is undertaken at overseas universities.

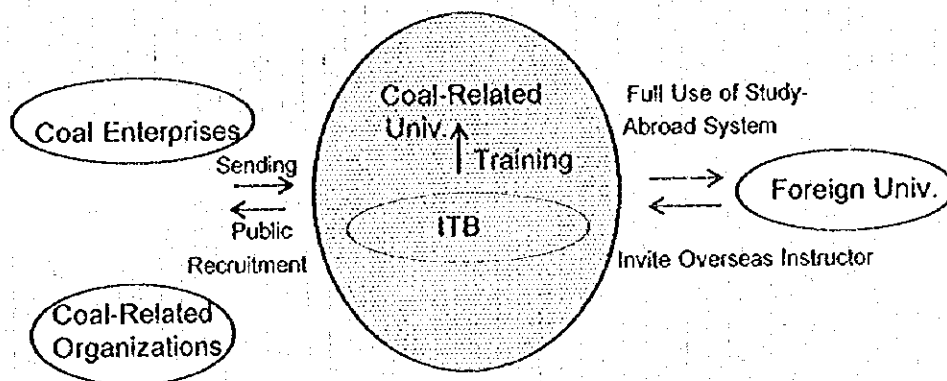


Figure 11-2 Instructor Training at Coal-Related Universities.

To implement the above plans, it is necessary that the Ministry of Energy and Mines requests the Ministry of Education and Culture to recognize the importance of training the instructors to undertake the training at coal-related universities and that both Ministries should jointly draw up an instructor training program and review it in detail.

It is also necessary that the Department of General Affairs of Mines or other competent organizations should ask for cooperation prior to inviting capable personnel to give a lecture at universities.

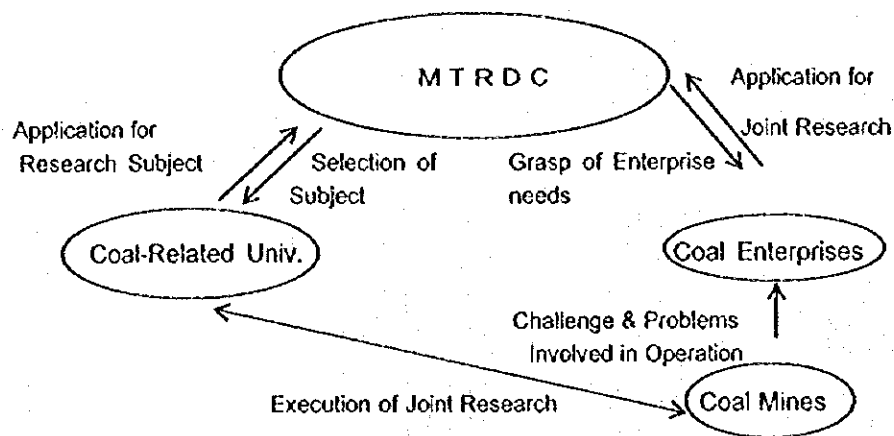
#### 11-1-2 Execution of Joint Research

Technique which will be needed at present and in future and technical challenges to be solved are as shown below.

- High-speed driving
- Soft soil zone driving
- Thick layer mining system
- Quality and selection and management of mining areas.
- Central monitor system
- Underground gas vent and utilization of gas
- Rock pressure control in deep underground mining
- Investigation of property of mine waste water and measures to be taken

In future, the above matters should be tackled by universities in terms of a graduation thesis or joint research with coal mines so that the problems presently involved in operation of the coal mines may be solved or at least improved thereby increasing the productivity and safety.

Execution of the joint research should be done as shown in Figure 11-3 as well as in the flow as shown below:



**Figure 11-3 Execution Chart of Joint Research**

- 1) Coal mines inform coal enterprises of the present problems and technical challenges to be solved.
- 2) MTRDC grasps the needs of coal enterprises.
- 3) Coal enterprises make a request to MTRDC for a joint research and MTRDC is furnished with research subjects from universities.
- 4) Selection of proper research subjects by MTRDC.
- 5) Execution of joint research

To implement the above plans, it is again necessary that the Ministry of Energy and Mines requests the Ministry of Education and Culture to plan out the joint research system and that the Department of General Affairs of Mines should secure funds to cater for the coal-related joint research expenses.



## 11-2 Training Center

### 11-2-1 Reinforcement of Existing Training Center

#### 1) LPPT

Presently, LPPT is proceeding with the joint operation plan with JBT Co. Although the details are not clear yet, outline of the LPPT that is presumed from the present state of the LPPT is as follows.

##### a) Manpower development capacity

On condition that the existing sleeping accommodations for 120 persons is effectively used and two courses, a long-term and short-term course, are opened, the number of manpower which can be developed becomes about 1,000 annually.

Three month course: 60 trainees, 3 terms/year, 180 graduates/year

Three week course: 60 trainees, 15 terms/year, 900 graduates/year

##### b) Curriculum

Since the practical training takes place at Ombilin mine, training on open pit mining will be the primary concern with the subject on underground mining, mainly the full-mechanized, also included in the curricula.

##### c) Training facilities, equipment and teaching materials

Since the LPPT is fully provided with the necessary training facilities, equipment and teaching materials, it is probably not necessary to purchase any large-size training equipment additionally.

##### d) Technical capability of instructors

The technical capability of the instructors will be much increased thanks to the Australian specialists who transfer technology to the LPPT instructors thereby developing the instructor class manpower.

**Table 11-1 Action Plan at LPPT**

	Present States	Future
Capacity	50 (actual result in 1995)	Approx. 1,000 Capacity increases by changing training period
Curriculum	-Mining -Mine mechanical -Mine electrical (50 graduates/year)  Two years course	-Mine mechanical -Mine electrical -Mine geology -Heavy equipment maintenance -Transportation & communications  Long-term course : for about 3 months Short-term course : for about 3 weeks
Facilities & Equipment	Sufficient	Large-size training equipment are not necessarily required.
Technical Capability of Instructors	Adequate	Training of instructors and trainees by Australian

2) MDCM

a) Manpower development capacity

Manpower development capacity of the MDCM is presently 1,500 graduates/year and moreover the MDCM is already equipped with enough facilities that enable training in 2020 of increased manager class trainees thus posing no problem at all.

b) Curriculum

At present, one each of lower, middle and top management training courses is under way for a period of one month or so. In view of the expected increase in the number of trainees from now on, it is necessary to increase the respective

courses to four terms or so per each per year.

In addition, it is well anticipated that as the cases of underground mining increases, such major and serious accidents as gas outburst, gas explosion, underground fire, spontaneous fire, etc. may probably occur increasingly in future. Under the circumstances, it is necessary that the following subjects on the accident prevention technique should also be included in the curriculum for the professional class manpower training.

- Generation of methane and mechanism of occurrence of accidents
- A sign of spontaneous fire and measures to be taken
- Underground fire, gas and coal dust explosion prevention technique

c) Training facilities and equipment

To conduct training on the accident prevention technique, it is necessary to provide the following equipment and materials.

- Gas and coal dust explosion simulation equipment
- Associated teaching materials

d) Technical capability of instructors

Since the MDCM has a good staff of instructors, it is probably not necessary to develop instructor class manpower furthermore. However, it is still desirable that the present instructors should periodically attend the seminars or the like held at universities or colleges.

**Table 11-2 Action Plan at MDCM**

	Present States	Future
Capacity	1,500 (actual results in 1995)	Present capacity is enough
Curriculum	Top, middle and lower management courses (180/term/year)	Increase top, middle and lower management courses (800/four terms/year) -Trainee : manager class  Newly establish an underground accident prevention course (150/two terms/year) -Trainee : professionals specialized in safety in particular
Facilities & Equipment	Sufficient	Gas & coal dust explosion simulation facilities, and its related teaching materials
Technical Capability of Instructors	Adequate	Participation in seminar or the like at universities

**11-2-2 Establishment of A New Training Center**

**1) Purpose**

The purpose of establishing the new training center is to increase the productivity and safety of the underground mining thereby striving hard to achieve the goal of the coal production program of Indonesia.

- Improve productivity by raising the level of underground mining technique
- Reduce accident frequency rate by raising the level of safety technique
- Increase estimated coal reserves by raising the level of exploration technique
- Enlarge marketplace by raising the level of coal preparation technique
- Reduce mine pollution and improve working environment into a complete one by raising the level of environment conservation technique

## 2) Selection of location

To decide the location of the new training center, the following factors are taken into consideration.

- Number of coal mines and underground coal mines
- Coal production

### a) Number of coal mines

Figure 11-4 shows the number of existing and newly-established coal mines located in the regions of Sumatra, East Kalimantan, South Kalimantan and others arranged in order of generation.

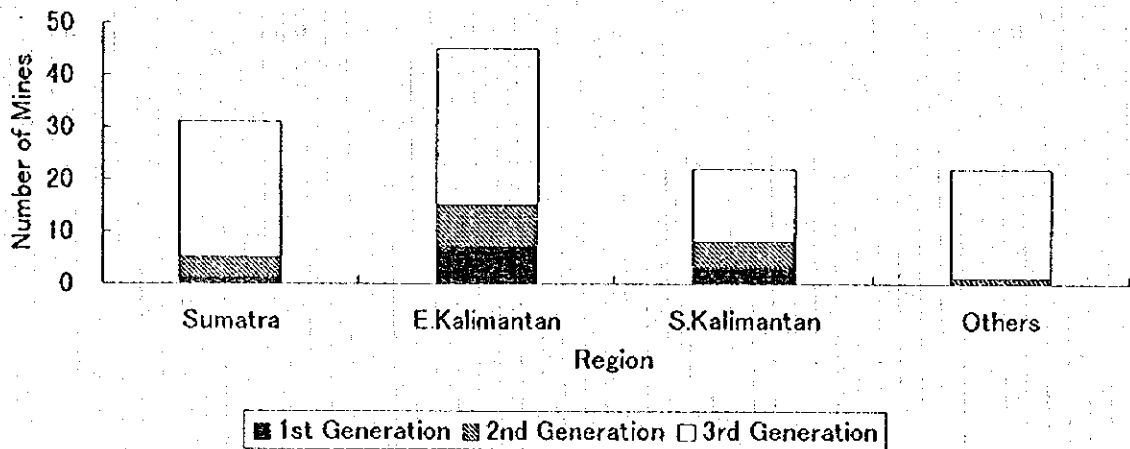


Figure 11-4 Number of CCOW Mines per Region

It is known from Figure 11-4 that the number of contractors per each region, Sumatra, East Kalimantan, South Kalimantan, are 31, 45 and 22 respectively, showing a good concentration on the East Kalimantan region. In addition, it should be noted that an underground mine, where the practical training is available, is presently in operation in this region.

The reason why such a concentration as mentioned above has taken place is that

the coal reserves in the Sumatra region were mostly made up in the later era and thus the coal mined from them generally offer only a low calorific value. Accordingly, the use of those coal is very limited to such purposes as the mine mouth power generation and the like, which reduce the transportation cost thus rendering the cost of coal rather economical.

#### b) Coal production

As stated in Chapter 6, it is estimated that the coal production in the Kalimantan region may also amount to about 70% of the total production in Indonesia.

As such, the location of the new training center should be determined in the Kalimantan regions and most preferably in the East Kalimantan region.

### 3) Trainees

Trainees should be mainly composed of underground mining supervisors. However, open pit mining supervisors should also be included as necessary. This is because the safety of open pit mining and surface restoration to the original state are expected to become an important technical challenge to be solved from now on.

- Underground mining supervisors
- Underground mining skilled operators
- Open pit mining supervisors

The hierarchical composition of manpower at a typical coal mine is that the unskilled and middle skilled operators occupy the most part, which amount to approx. 50% of the total. The education level of those operators is rather low, mostly the secondary school graduates. Those operators account for approx. 75% of the total number presently and thus it may surely be difficult to give them such a higher level of training at once.

In addition, it may also be almost impossible in the physical and economical aspects for a private enterprise to send a large number of employees to outside training centers all at once. In this regard, the training of those operators should

be conducted in the daily operation on respective job-sites, i.e., in terms of on-the-job training. And in order to most effectively carry out the on-the-job training of those operators, the technical level of supervisors and skilled operators who undertake the role of instructors should have been raised beforehand.

The number of manpower to be trained should be 1,000 in total per year and the aggregated terms 72 weeks per year with all the trainees becoming a boarder. Table 11-3 shows training courses, term, annual frequency and max. capacity per class.

#### 4) Procurement of trainees

As regards the procurement of the trainees, there seems to be no cause for anxiety. This is because the curricula are properly adjusted in such a way that the number of trainees to be sent from each coal mine is limited to that which never impedes the daily operation of them but on the contrary may satisfy the needs of respective coal mines. Nonetheless, the following action should further be taken so as to more facilitate dispatch of trainees from each mine.

- a) Prior to establishing the training center, the DGM (Department of General Affairs of Mines) or DOC (Department of Coal) should take a leading part in discussions with each private coal mine and make a request to them for cooperation and moreover to understand that the training center is essentially very effective and in a sense indispensable to each coal mine.
- b) Prepare an introductory brochure for the training center after having due discussions with relevant organizations.
- c) Establish Operation Management Committee (to be mentioned later) in order to plan out the annual manpower development program including the number of trainees to be sent, curricula, etc.
- d) Mine-related staff and operators should be bound to take a state examination for the underground and surface technician's license or obtain such licenses as are compulsory for the coal mine operators. And then relevant training courses

should be held at the training center in preparation for the qualifying examinations for those licenses, and a certificate of completion should be given to the graduates of the course.

5) Curriculum

**Table 11-3 Training Program**

Class	Course	Term	Annual Frequency	Max.Capa
Super- visor	Geology & drilling exploration	3 weeks	2 terms/year	40
	Coal mining & driving	5	2	50
	Mine mechanical & electrical	4	2	40
	Coal quality control	3	2	40
	Safety, rescue & first-aid	4	2	50
	Sub-total	38		440
Skilled Operator	Mining	3weeks	2 terms/year	50
	Driving	4	2	50
	U/G equipment maintenance	3	2	50
	Surface "	2	2	50
	Safety, rescue & first-aid	2	4	40
	Sub-total	34		560
	Total	72		1,000

The curriculum should be prepared mainly aiming at the training and education of supervisors and skilled operators and putting emphasis on the training on the technique that are most suitably applied to the underground mines of this region.

These technique should include at least such technique as open pit mining



technique and coal mine surveying, coal geology, coal exploration, coal mine planning, mine safety, equipment maintenance, management and design, coal quality control, coal preparation, etc.

It is necessary, however, to modify the curricula from time to time as necessary so as to meet the actual situation of that time. This is because the mining method is expected to be changed from the semi-mechanized to full-mechanized from now on as the advanced technology is introduced and labor cost rises.

As shown in Table 11-3, the training program is divided into two courses, supervisor course and skilled operator course. Table 11-4 to 11-7 show the expected effects from the training and details of the curricula.

Table 11-4 Outline of Supervisor Course

Training Course	Subject of Lecture	Main Item of Lecture	Purpose of Training & Expected Effects
Supervisor Course	Geology & drilling exploration technology	<ul style="list-style-type: none"> <li>◆ Analysis of geological structure</li> <li>◆ Mine surveying &amp; drawing</li> <li>◆ Mining plan design</li> <li>◆ Drilling exploration machine operation &amp; maintenance</li> <li>◆ Geophysical logging</li> <li>◆ Coal reserves calculation</li> </ul>	<p>Increase accuracy of analysis of geological structure of surveyed sections in newly developed mining areas &amp; improvement of mining plan.</p> <p>Coal mining face design taking into account the production &amp; safety. Enhancement of engineering capability to design auxiliary pits and roadway's for transportation, ventilation, etc.</p>
	Coal mining & driving technology	<ul style="list-style-type: none"> <li>◆ Face control</li> <li>◆ Blasting theory</li> <li>◆ Roof pressure &amp; control</li> <li>◆ Underground ventilation control</li> <li>◆ Material &amp; equipment management</li> <li>◆ Work control</li> </ul>	<p>Gain full knowledge of mining &amp; control technique in line with the capacity of coal mining &amp; driving equipment.</p> <p>Improve mining conditions, working environment &amp; the technique to set up the standard performance, etc. so that the productivity is increased and stable coal production is achieved.</p>
	Coal mine mechanical & electrical technology	<ul style="list-style-type: none"> <li>◆ Safety equipment control</li> <li>◆ Mining equipment maintenance &amp; control</li> <li>◆ Transportation equipment maintenance &amp; control</li> <li>◆ Explosion-proof equipment maintenance &amp; control</li> <li>◆ Work control</li> </ul>	<p>Equipment maintenance technique in terms of PM (productive maintenance/preventive maintenance).</p> <p>Reduction in frequency of breakdowns &amp; extension of equipment service life by standardizing the equipment maintenance &amp; repair procedures thereby achieving state production.</p>
	Coal quality control technique	<ul style="list-style-type: none"> <li>◆ Coal preparation supervision</li> <li>◆ Coal quality analysis</li> <li>◆ Debris disposal</li> <li>◆ Coal preparation waste water disposal</li> <li>◆ Surface restoration technique</li> <li>◆ Work control</li> </ul>	<p>Improvement in coal quality control &amp; reduction in environmental impact by proper waste water &amp; debris disposal.</p> <p>Recovery of coal &amp; improvement in environmental conservation technology by proper waste disposal.</p>
	Safety, rescue & first-aid technique	<ul style="list-style-type: none"> <li>◆ Relevant laws &amp; regulations</li> <li>◆ Gas &amp; coal dust suppression</li> <li>◆ Safety monitor control</li> <li>◆ Ventilation surveys and control</li> <li>◆ Rescue &amp; first-aid measures</li> </ul>	<p>Uplift safety senses and upgrade risk prediction measures Reduction in accident frequency rate by developing capability to improve the situations in working environment (coal dust, gas, temperature, roof-fall, etc.)</p>

**Table 11-5 Outline of Skilled Operator Course**

Training Course	Subject of Lecture	Main Item of Lecture	Purpose of Training & Expected Effects
Skilled Operator Course	Coal mining	<ul style="list-style-type: none"> <li>◆ Introduction to coal mining</li> <li>◆ Coal mining machinery operation</li> <li>◆ Introduction to blasting</li> <li>◆ Support</li> <li>◆ Work control</li> <li>◆ Accident prevention</li> </ul>	<p>Give guidance &amp; improve coal mining work process into an effective &amp; safe one</p> <p>Improve work efficiency &amp; acquire accident preventive technique.</p>
	Driving	<ul style="list-style-type: none"> <li>◆ Introduction to driving</li> <li>◆ Driving machinery operation</li> <li>◆ Introduction to blasting</li> <li>◆ Support</li> <li>◆ Work control</li> <li>◆ Accident prevention</li> </ul>	<p>Give guidance &amp; improve driving work process into an effective &amp; safe one.</p> <p>Improve work efficiency &amp; acquire accident preventive technique.</p>
	Underground equipment maintenance & repairs	<ul style="list-style-type: none"> <li>◆ Safety equipment repairs</li> <li>◆ Coal mining equipment repairs</li> <li>◆ Transportation equipment repairs</li> <li>◆ Work control</li> </ul>	<p>Grasp types, construction &amp; performance of various equipment.</p> <p>Increase working ratio by improving repair &amp; installation skills.</p>
	Surface facility maintenance & repairs	<ul style="list-style-type: none"> <li>◆ Power generation facility maintenance</li> <li>◆ Compressor maintenance</li> <li>◆ Large-scale facility maintenance</li> </ul>	<p>Improve, in particular, surface facility maintenance &amp; inspection into substantial ones.</p>
	Safety, rescue & first-aid	<ul style="list-style-type: none"> <li>◆ Relevant laws &amp; regulations</li> <li>◆ First-aid method</li> <li>◆ Rescue &amp; relief party practical training</li> <li>◆ Fire-fighting practical training</li> </ul>	<p>Take proper measures in an accident.</p> <p>Extraction of dangerous elements on job-site &amp; take action.</p> <p>Rescue activities in an accident.</p>

**Table 11-6 Supervisor Curriculum**

Course	Subject	Item
Geology & drilling exploration	Coal geology	Deposit & environment, coal measure, petrology
	Geological surveying & drilling	Mapping, drilling machine operation, core recording, sampling & adjustment
	Surveying & drawing	Survey equipment & usage, route survey, topography survey, underground survey, drawing practice, observed value calculation
Coal mining & driving	Coal mining face control	Blasting theory, roof pressure theory & control, ventilation control, material management, work control (TWI, etc.)
	Driving face control	Blasting theory, roof pressure theory & control, ventilation control, material management, work control (TWI, etc.)
Mine mechanical & electrical	Machinery control	Facility maintenance theory, machinery design, equipment installation, main fan control, large-size winding machine control, work control(TWI)
	Electrical Equipment control	Electric equipment & appliance installation, maintenance & safety, measures against accident, protective device, communications device control work control ( TWI, etc.)
Coal quality control	Coal preparation	Preparation, mixing, crushing, classification, storage technique, work control ( TWI, etc.)
	Quality control	Sampling & adjustment, proximate & ultimate analysis, particle size analysis, crushability
	Handling	Port & harbor, storage, transportation facility
	Environmental measure	Surface subsidence prevention, surface restoration
Safety, rescue & first-aid	Safety	Rescue & relief party teaming, rescue & first-aid work practical training, risk prediction training, fire & explosion, ventilation planning, emergency action & organization
	Rescue & first aid	

**Table 11-7 Skilled Operator Curriculum**

Course	Subject	Item
Coal mining	Introduction	Introduction to mining, introduction to blasting
	Equipment operation & handling	Mining machinery & transportation equipment operation, drilling method, installation & control of hydraulic prop & link bar
	Safety	Coal dust & gas accident prevention
	Work control	Safety work control
Driving	Introduction	Introduction to driving, introduction to blasting
	Equipment operation & handling	Driving machinery & transportation equipment operation, drilling method, gallery casing, gallery support
	Driving method	Shaft, rock, drift, blasting chamber driving
	Safety	Coal dust & gas accident prevention
	Work control	Safety work control
U/G equipment maintenance	Mining equipment	Mining & driving machinery
	Transportation machinery	Chain conveyor, belt conveyor, winding machine
	Safety equipment	Fan, drainage equipment, small-size compressor
	Work control	Safety work control
Surface equipment maintenance	Surface equipment	Power generation equipment & coal preparation facility maintenance & control, compressor
Environment, Safety, rescue & first-aid	First-aid method	Hemostatic method, emergency resuscitation
	Fire fighting method	Fire main cause analysis & measures to be taken, direct fire fighting, indirect fire fighting
	Rescue & relief party	Rescue & relief party teaming & training, action to be taken against respective accidents
	Environment conservation	Debris disposal & control, gob restoration, drainage

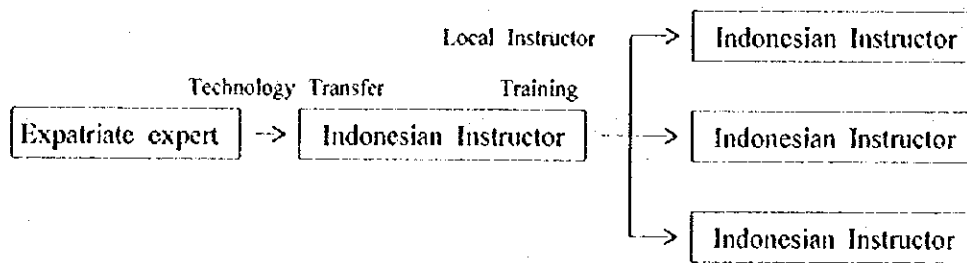
6) Procurement of instructors

Procurement of the instructors is a very important thing among others and is one of the two key factors in the operation of the training center. The other key factor is the procurement of the working funds. In this regard, the Department of General Affairs of Mines should basically be responsible for procuring such instructors from the coal industry, official world and academic circles.

However, since the level of the underground mining technique is still low in Indonesia now, the training center should proceed with the instruction of the Expatriate-Indonesian combined instructors for the first five years. And, during this five-year period, the necessary technology should fully be transferred from the Expatriate specialists to the Indonesian instructors.

In this event, however, the technology to be transferred from the overseas specialists should at least include the following technique as geology, surveying, drilling for exploration, mining and safety, design, maintenance and control of mechanical equipment, maintenance and control of electrical equipment, coal preparation, general affairs, financial affairs, etc.

Expatriate experts :		Indonesia instructors :	
* Geology sector	1	* Geology sector	1
* Mining sector	1	* Mining sector	2
* Safety sector	1	* Safety sector	2
* Mechanical & electrical sector	1	* Mechanical sector	1
* Coal preparation & environment sector	1	* Electrical sector	1
		* Coal preparation & environment sector	1
	5		8



**Figure 11-5 Instructor Training**

After completing the technical transfer, the Indonesian instructors should then fully undertake the training of prospective Indonesian instructors.

Figure 11-6 shows the annual curricula and instructor schedule at the coal mining training center.

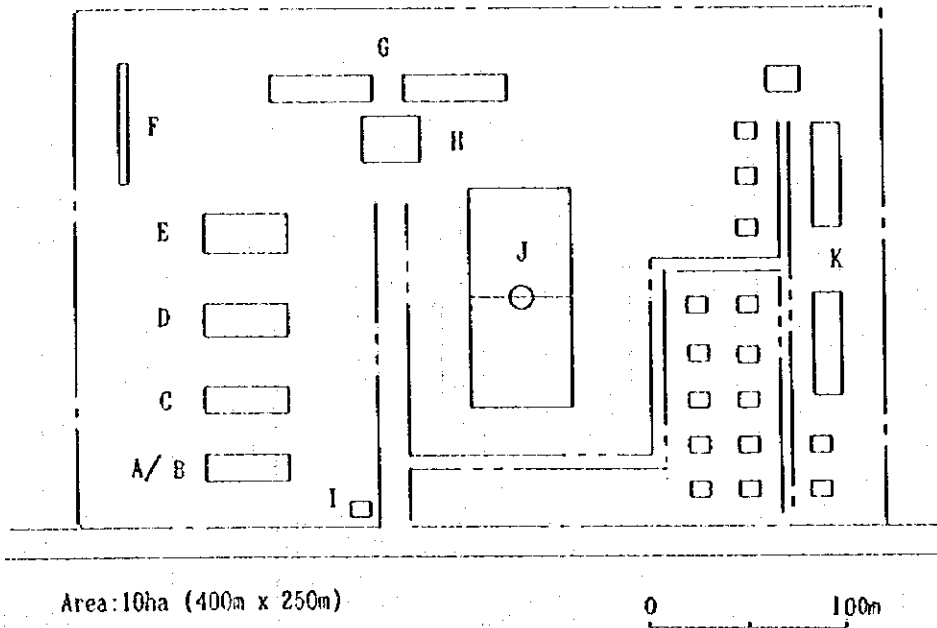
**7) Training facilities and investment**

Figure 11-7,11-8 shows the layout of the training center. The center should be provided with an office, training room (50+50), drawing room, workshop, multi-purpose hall, computer room, laboratory and library, dormitory (100), waiting room for instructors, dining hall, recreation room, training gallery, play ground, etc.

In addition to the above, the center should also be fully equipped with such training facilities and equipment as those for mining, safety, geology, mechanical and electrical, and in addition, workshop and vehicles for transportation and general training facilities as shown in Table 11-8 .







- A: Office
- B: Drawing room/Computer room
- C: Training rooms (2 floors)
- D: Laboratories
- E: Workshop
- F: Training Gallery
- G: Dormitories (2 floors)
- H: Multi purpose Hall
- I: Security
- J: Play ground
- K: Residence for Staff and Expatriate

Figure 11-7 Training Center Layout

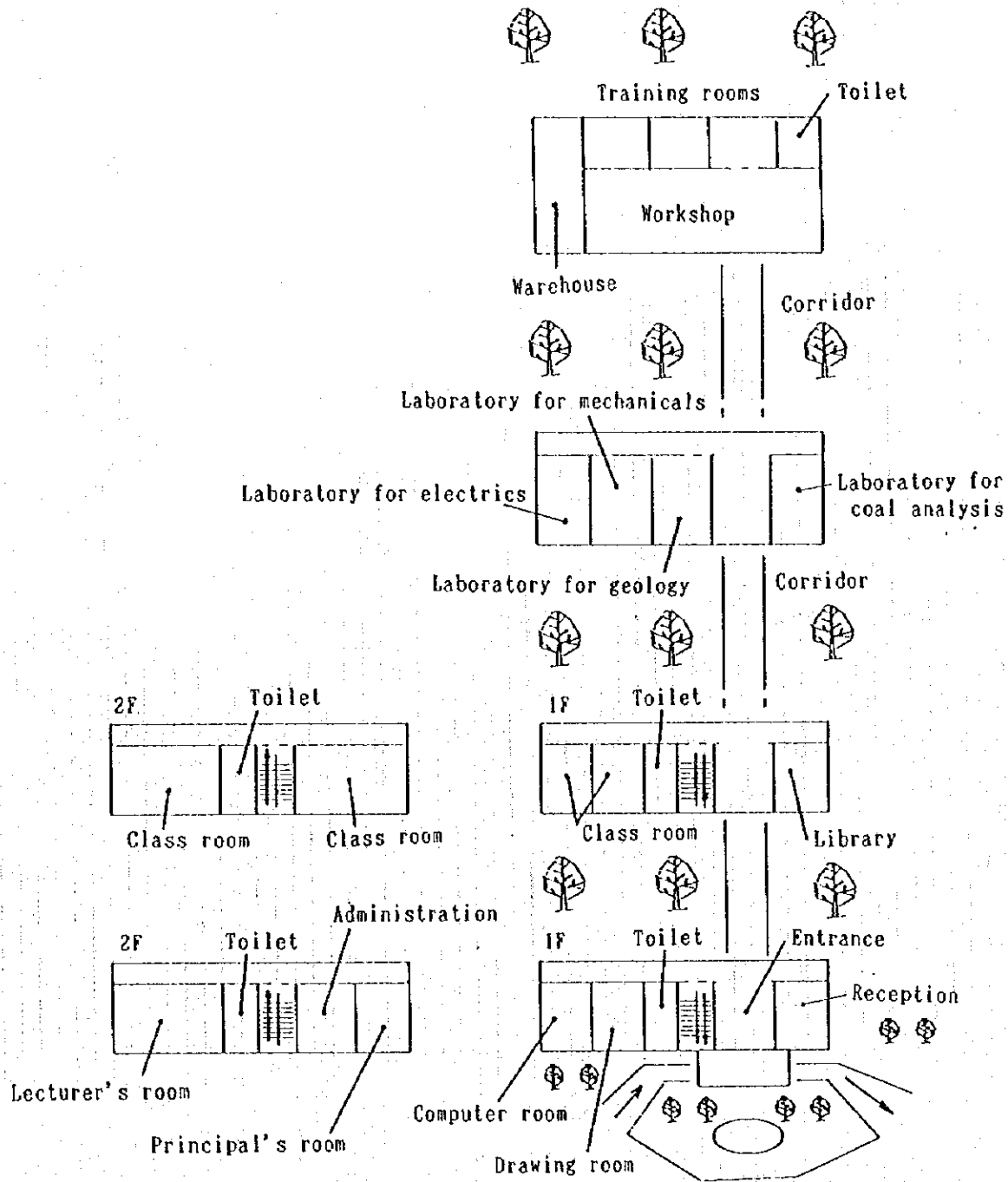


Figure 11-8 Conceptual Layout of Training Facilities

Table 11-8 Training Equipment & Materials

(Exchange Rate: Rp2,300/US\$)

Items	Unit	Unit Price	Total	Items	Unit	Unit Price	Total
<b>Eq't for Mining Tech.</b>				<b>Electrical Technology</b>			
Single prop & Iron bar	1 set	100,000	100,000	Oscillo scope	2 sets	15,000	30,000
Coal pick	5 sets	400	2,000	Tester	10 sets	300	3,000
Air auger	2 sets	600	1,200	Test rig	1 set	5,000	5,000
Leg hammer	2 sets	1,000	2,000	Transformer	2 sets	30,000	60,000
Chain conveyor	1 set	30,000	30,000	Magnetic switch	2 sets	5,000	10,000
Pump & pipes	1 set	30,000	30,000	Cable	1 set	10,000	10,000
Compressor	1 set	30,000	30,000	Interlock system	1 set	5,000	5,000
Ohm meter	5 sets	300	1,500	Communication system	1 set	3,000	3,000
Blasting machine	5 sets	2,000	10,000	Logic analyser	1 set	30,000	30,000
Extensometer	2 sets	10,000	20,000	Motor	1 set	3,000	3,000
Power pack	1 set	30,000	30,000	Motor controller bench	1 set	5,000	5,000
Others			30,000	Generator	1 set	20,000	20,000
				Mine lamp & charger	1 set	6,000	6,000
				Others			30,000
Sub-total			286,700	Sub-total			224,000
In Million Rp			659	In Million Rp			515
<b>Eq't for Ventilat' &amp; Safety</b>				<b>Workshop</b>			
Manometer	5 sets	100	500	Overhead crane	2 sets	10,000	20,000
Anerometer	5 sets	100	500	Lathe	2 sets	100,000	200,000
Thermometer	5 sets	100	500	Frise	2 sets	70,000	140,000
Hydrometer	5 sets	100	500	Boring	3 sets	10,000	30,000
Barometer	5 sets	200	1,000	Welding	5 sets	10,000	50,000
Noise meter	1 set	300	300	Shearing machine	2 sets	50,000	100,000
Methane gas detector	10 sets	2,000	20,000	Furnace	2 sets	30,000	60,000
CO Detector	5 sets	2,000	10,000	Bending machine	2 sets	50,000	100,000
Dust sampler	2 sets	2,000	4,000	Tools	1 set	60,000	60,000
Local fan & Vent. Tube	1 set	5,000	5,000	Others			40,000
Coal dust explosion	1 set	2,000	2,000				
deco set				Sub-total			800,000
Ventilation	2 sets	5,000	10,000	In Million Rp			1,840
Breathing apparatus	12 sets	10,000	120,000	<b>Processing Technology</b>			
Training gallery	1 set	30,000	30,000	Mini washing plant	1 set	80,000	80,000
Self rescue	15 sets	800	12,000	Analysis apparatuses	1 set	120,000	120,000
Others			30,000	Others			20,000
Sub-total			246,300	Sub-total			220,000
In Million Rp			566	In Million Rp			506
<b>Geological Technology</b>				<b>General</b>			
Maps	1 set	10,000	10,000	Overhead projector	2 sets	2,000	4,000
Boring machine	1 set	200,000	200,000	Slide projector	1 set	2,000	2,000
Transit	3 sets	20,000	60,000	Television & video set	5 sets	2,000	10,000
GPS	2 sets	5,000	10,000	Copy machine	2 sets	5,000	10,000
Climo-compass	10 sets	300	3,000	Telephone set	1 set	3,000	3,000
Level	10 sets	300	3,000	CAD system	2 sets	10,000	20,000
Measuring tape	10 sets	100	1,000	Computers	10 sets	5,000	50,000
Others			30,000	Drawing set	15 sets	2,000	30,000
Sub-total			317,000	Library, books	1 set	3,000	3,000
In Million Rp			729	Vehicles	3 units	30,000	90,000
<b>Mechanical Technology</b>				Others			30,000
Hydraulic benches	1 set	20,000	20,000	Sub-total			252,000
Pneumatic test bench	1 set	20,000	20,000	In Million Rp			580
Belt conveyor	1 set	60,000	60,000	<b>Grand Total</b>			
Hoisting machine	1 set	60,000	60,000	In Million Rp			2,616,000
Endless winch	1 set	40,000	40,000				6,085
Mine car	5 sets	10,000	50,000				
Rope tester	1 set	20,000	20,000				
Others			30,000				
Sub-total			300,000				
In Million Rp			690				

**Table 11-9 Estimated Investment in Coal Mining Training Center**

(Million Rp)

Item	Quantity	Unit Price	Total
<b>Land &amp; Building</b>			
Land	10 ha	200	2,000
Office	400 m <sup>2</sup>	0.5	200
Training Room	720 m <sup>2</sup>	0.5	360
Drawing Room	200 m <sup>2</sup>	0.5	100
Computer Room	200 m <sup>2</sup>	0.5	100
Workshop	800 m <sup>2</sup>	0.5	400
Laboratory	600 m <sup>2</sup>	0.5	300
Dormitory	2,000 m <sup>2</sup>	0.5	1,000
Multi-purpose Hall	600 m <sup>2</sup>	0.5	300
Staff Residence	1,500 m <sup>2</sup>	0.6	900
Play Ground	1	200	200
Training Gallery	1	200	200
<b>Sub-total</b>			<b>6,060</b>
<b>Facilities &amp; Others</b>			
Mining Technology	1	659	659
Ventilation & Safety	1	566	566
Geological Technology	1	729	729
Mechanical Technology	1	690	690
Electrical Technology	1	515	515
Repair Shop	1	1,840	1,840
Preparation	1	506	506
General	1	580	580
<b>Sub-total</b>			<b>6,085</b>
<b>Total Investment</b>			<b>12,145</b>

Table 11-9 shows the estimated required investment in the coal mining training center which is 12.145 billion Rp in total, of which the building construction cost amounts to 6.06 billion Rp and the facility and equipment procurement costs 6.085 billion Rp.

8) Administration and operation

At present, any officially established competent scheme relevant to the coal-related manpower development is not available in Indonesia. Under the situation, it is probable that the coal mining training center may have to grope its way, in connection with the establishment, toward how to raise funds, operate and manage the center. In the light of it, the government should have to take a leading part for some time after the commencement of the center in operation and management and after the center has fully been set on its way, it is recommendable that the center should be put under the private management of such organizations as the Coal Association or the like.

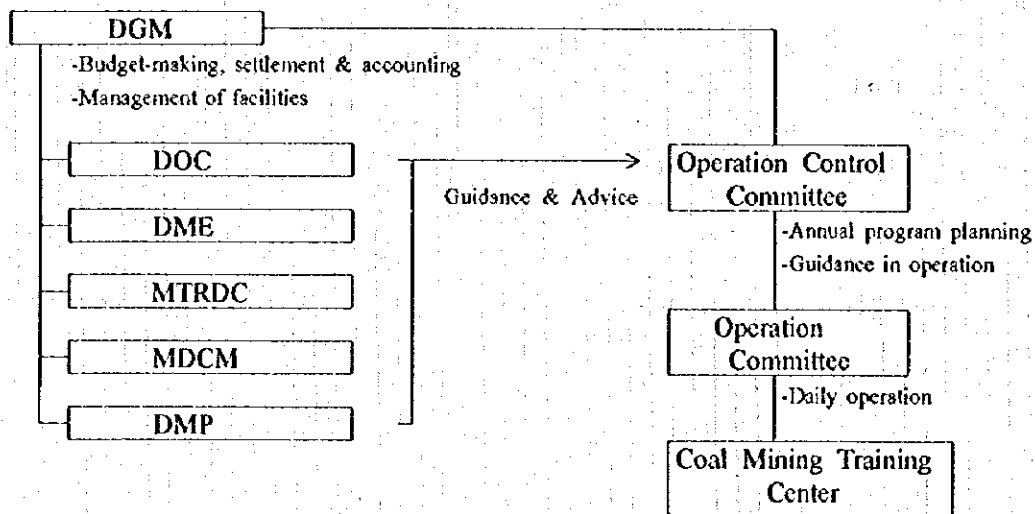


Figure 11-9 Center Operation-Related Organization ( Original )

As regards the operation and management of the training center just after the commencement, the Operation and Administration Committee should be set up in the Department of General Affairs of Mines (DGM) with the director of DGM appointed to the chairman of the committee. The Committee should be responsible for planning out the trainee procurement program and giving direction to the center as to its operation.

In addition to the above, Operation Subcommittee should also be set up with the head of the center appointed to the chairman of the subcommittee. The subcommittee should be responsible for the daily operation of the center.

**a) Operation and Administration Committee**

With the director of DGM assuming the chairman of the committee and the following members on the Committee, the Operation and Administration Committee should undertake to plan out the basic policy of operation and management of the center.

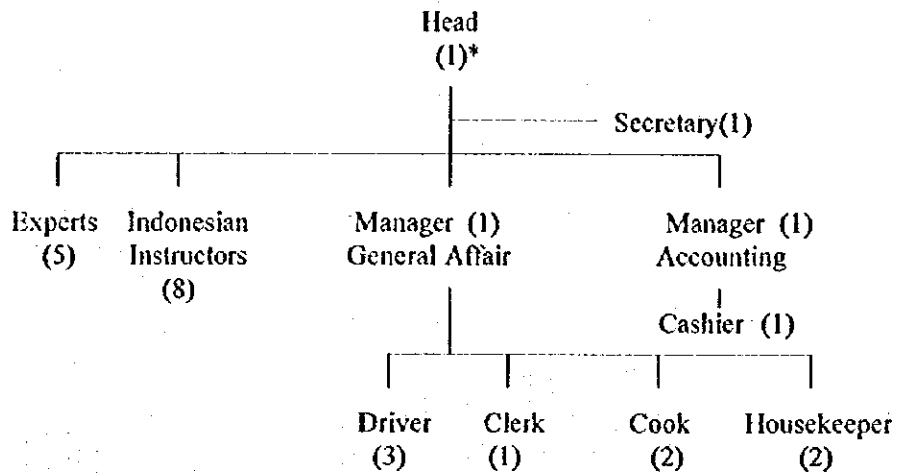
- Director of DGM: Chairman
- Director of DOC or DME: Member
- Director of MDCM: Member
- Delegates from the coal industry: Member
- Head of the center: Member
- Representatives of overseas specialists: Member

**b) Operation Subcommittee**

The Operation Subcommittee should undertake the practical side of the center operation and thus it has to plan out the execution program for the center in accordance with the basic policy of the Operation and Administration Committee and advice. The composition should be as follows:

- Head of the center: Chairman
- Representatives of overseas specialists: Member
- Representatives of Indonesian instructors: Member
- General affairs manager: Member
- Accounting manager: Member

Figure 11-10 shows the organization of the coal mining training center, which is comprised of twenty six full-time staff including the head of the center, plus fifteen part-time personnel as necessary.



Remark : Members marked with \* shows Class A and others Class B. In addition to the above member, 15 part-timers are needed.

Figure 11-10 Organization of Training Center

Table 11-10 Presumed Operating Cost of Coal Mining Training Center

( Million Rp )

Item	Quantity	Unit Price	Total
Monthly Salaries	( Expatriate ) : 5	450	2,330
	( Staff )		2,250
	Class A 11	5	80
	Class B 10	2.5	55
Maintenance			243
Consumables & materials			200
Others			50
Depreciation	( Land & building )		912
	( Facilities )		303
Overhead			609
Contingency			148
Total			148
			4,031

9) Fund raising and cash flow

Since the LPPT is a government-owned training facility, it is a matter of course that the government takes a leading part in the operation. However, in the case of a training center which deals with the trainees from the private coal mines, it is necessary to consult with the coal enterprises in advance on dispatch of trainees to the center and method of raising funds.

The funds needed for the center are divided into the construction costs (initial investment) for procuring the land, buildings, facilities, etc. and working funds of the center.

The construction costs amount to as much as 0.6 billion Japanese yen in total. It may therefore be difficult for the private enterprises to furnish all of such funds alone. However, since the cost needed for procuring the land and buildings and the cost for facilities, equipment and materials are almost equal with each other, it is desirable that the government provides the government-owned land and buildings. As for the facilities, equipment and materials, however, it may be possible to purchase by using the private funds.

The working funds can be catered for by school fee or otherwise by a subsidy which is inclusive of the amount equivalent to the school fee thereby exempting the trainees from paying the school fee and which should be collected from the coal enterprises. In this case, however, it is necessary to raise private funds anyway in such a style as a subsidy per production ton.

In addition to the above, such cases where overseas assistance is given in a form of investment for facilities and expatriate services are taken into account and then the cash flow of these six cases in total is fully examined with the NPV coefficient set to 15%.



**Table 11-11 Training Center Fund-Raising Plan**

Case	Overseas Technical Assistance			School Fee	Subsidy/ Production ton
	Land & Building	Facilities & Equipment	Operating Cost (Experts)		
1	×	×	×	○	×
2	×	×	×	×	Rp 48
3	×	×	×	○	Rp 39
4	×	○	○	×	Rp 31
5	×	○	○	○	Rp 21
6	×	○	○	×	Rp 19

**Case 1** : All the expenses will be paid by school fee without overseas assistance. This plan can hardly be implemented because of the school fee which amounts to as much as 1.79 million Rp per person for two week course.

**Case 2** : All the expenses will be paid by funds collected from the private enterprises in a form of a subsidy per production ton, which comes to 48 Rp, without overseas assistance and with the trainees entirely exempted from the school fee.

**Case 3** : All the expenses will be paid both by funds in a form of a subsidy and school fee (0.5 million Rp per person for two week course) without overseas assistance. In this case, it is necessary to collect a subsidy of 39 Rp per production ton from the private enterprises.

**Case 4** : All the expenses will be paid by funds in a form of a subsidy per production ton with overseas assistance given in a form of investment for facilities and expatriate services and with the trainees entirely exempted from the school fee. In this case, it is necessary to collect a subsidy of 31 Rp per production ton from the private enterprises.

**Case 5** : All the expenses will be paid both by funds in a form of a subsidy and school fee (same as mentioned above) with overseas assistance given in a form of investment for facilities and expatriate services. In this case, it is necessary to collect a subsidy of 21 Rp per production ton from the private enterprises.

**Case 6** : All the expenses will be paid by funds in a form of a subsidy per production ton with overseas assistance given in a form of investment for facilities and expatriate services and with the land and buildings furnished by the Indonesian government for the center. In this case, it is necessary to collect a subsidy of 19 Rp per production ton from the private enterprises.

In view of the purpose of establishing the training center and smooth operation of it from now on, it is safe to say that Case 6, where a subsidy of 19 Rp per production ton is collected from the private enterprises, is the most suitable plan. Table 11-12 shows the typical case study of the cash flow.

It is further recommended, however, that the subsidy per production ton should be addressed in two stages as shown below.

(1) For some time after the commencement of the center Indonesian government should pay the amount equivalent to the subsidy out of the royalty amount of 13.5% collected based on the P/S contract.

(2) When the center has fully been set on its way Subsidy per production ton should be collected from the private enterprises.

#### 10) Effects of training center

The direct and indirect effects of the coal mining training center are as shown below:

a) Rise in the level of the production technique improves by itself the productivity of each coal mine thereby increasing the production.





CASE 4

Table 11-12 Case Study of Cash Flow at Training Center

CASH FLOW WITH OVERSEAS ASSISTANCE  
INVESTMENT FOR FACILITIES AND EXPATRIATE  
SERVICES ARE THE ASSISTANT PORTION

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
-1	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
6,060	869	869	869	869	16,067	1,442	1,442	1,442	1,442	7,528	1,442	1,442	1,442	1,442	7,528	1,442	1,442	13,587	2,311	8,397	2,311	
CASH OUTFLOW																						
REVENUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCHOOL FEE	2,940	3,183	3,400	3,593	3,786	3,948	4,107	4,238	4,367	4,465	4,563	4,667	4,774	4,856	4,939	5,092	5,238	5,373	5,514	5,642	5,774	
SUBSIDY	2,081	2,314	2,531	2,724	2,921	3,065	3,196	3,295	3,372	3,428	3,474	3,512	3,542	3,564	3,579	3,589	3,595	3,598	3,600	3,600	3,600	3,600
CASH FLOW	-3,969	-1,654	877	3,601	-8,670	-6,164	-3,499	-703	2,222	-681	2,279	5,504	8,835	12,249	9,660	13,310	17,106	8,892	12,094	9,339	12,802	
ACCUMULATION																						
15 %																						
DCF FACTOR	0.870	0.756	0.658	0.572	0.497	0.432	0.376	0.327	0.284	0.247	0.215	0.187	0.163	0.141	0.123	0.107	0.093	0.081	0.070	0.061	0.053	0.046
2 NPV(1=15%)	1,150	1,818	1,750	1,564	1,558	-6,101	1,083	1,002	914	831	-757	603	541	483	-318	390	353	-664	225	-188	184	

CASE 5

CASH FLOW WITH OVERSEAS ASSISTANCE  
INVESTMENT FOR FACILITIES AND EXPATRIATE  
SERVICES ARE THE ASSISTANT PORTION

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
-1	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
6,060	869	869	869	869	16,067	1,442	1,442	1,442	1,442	7,528	1,442	1,442	1,442	1,442	7,528	1,442	1,442	13,587	2,311	8,397	2,311	
CASH OUTFLOW																						
REVENUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCHOOL FEE	2,022	2,185	2,334	2,465	2,589	2,710	2,819	2,909	2,987	3,055	3,132	3,203	3,277	3,333	3,390	3,495	3,596	3,688	3,784	3,873	3,963	
SUBSIDY	1,978	2,131	2,280	2,412	2,543	2,668	2,788	2,897	2,995	3,083	3,120	3,201	3,265	3,321	3,378	3,435	3,492	3,549	3,606	3,663	3,720	3,777
CASH FLOW	-4,082	-1,951	329	2,741	-9,302	-7,004	-3,997	-900	2,283	-548	2,771	6,163	9,027	13,140	10,640	14,323	18,107	9,338	13,756	11,677	15,774	
ACCUMULATION																						
15 %																						
DCF FACTOR	0.870	0.756	0.658	0.572	0.497	0.432	0.376	0.327	0.284	0.247	0.215	0.187	0.163	0.141	0.123	0.107	0.093	0.081	0.070	0.061	0.053	0.046
7 NPV(1=15%)	1,150	1,720	1,611	1,499	1,379	-6,286	1,253	1,130	1,012	905	-760	714	634	498	-308	394	352	-668	275	-127	218	

CASE 6

CASH FLOW WITH OVERSEAS ASSISTANCE  
INVESTMENT FOR FACILITIES AND EXPATRIATE  
SERVICES ARE THE ASSISTANT PORTION

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
-1	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
6,060	869	869	869	869	16,067	1,442	1,442	1,442	1,442	7,528	1,442	1,442	1,442	1,442	7,528	1,442	1,442	13,587	2,311	8,397	2,311	
CASH OUTFLOW																						
REVENUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCHOOL FEE	1,808	1,945	2,077	2,195	2,313	2,412	2,509	2,589	2,668	2,727	2,787	2,851	2,915	2,966	3,017	3,110	3,200	3,282	3,368	3,446	3,527	
SUBSIDY	939	1,076	1,208	1,325	1,434	1,534	1,627	1,714	1,795	1,871	1,945	2,017	2,087	2,154	2,219	2,282	2,344	2,405	2,465	2,524	2,582	2,640
CASH FLOW	939	2,013	3,223	4,349	-5,135	-2,168	-1,099	48	1,273	-3,527	-2,182	-774	700	2,225	-2,287	-618	1,140	-3,105	-2,046	-6,969	-5,783	
ACCUMULATION																						
15 %																						
DCF FACTOR	0.870	0.756	0.658	0.572	0.497	0.432	0.376	0.327	0.284	0.247	0.215	0.187	0.163	0.141	0.123	0.107	0.093	0.081	0.070	0.061	0.053	0.046
7 NPV(1=15%)	0	817	813	794	758	-3,821	419	401	375	348	-1,187	289	240	215	-354	178	183	-543	74	-302	85	

b) Rise in the level of the safety, rescue and first-aid technique reduces by itself the frequency rate of large accidents that may lead to suspension of the production.

c) Rise in the level of the exploration technique increases the minable coal reserves thereby enlarging the minable areas and extending the mine service life.

d) Rise in the level of the coal preparation and quality control technique may contribute to development of the export coal market and moreover to increase in the foreign-currency holdings and to economical and environment-friendly utilization of the coal in the domestic industries.

e) Stable operation of coal mines may contribute to hiring more workers by the government.

### 11-2-3 Ranking of Coal Mining Training Center and LPPT

The coal mining training center and the LPPT are ranked as shown below. Table 11-13 shows the comparison between the coal mining training center and the LPPT.

-As mentioned previously, in consideration of the geographical features, the LPPT may have the Sumatra region in its charge for the training and the new training center the Kalimantan region under its charge.

-However, the special curricula to be adopted by these two training centers should be different with each other. This is because these regions differ at present in the method of mining used at the relevant mines where the practical training is available : one is the full-mechanized and the other semi-mechanized.

-Nonetheless, the basic curriculum should be unified and standardized in the light of the future introduction of the qualifying examination and qualification systems.

Table 11-13 Comparison between Coal Mining Training Center & LPPT

Item	LPPT	Coal Mining Training Center
Upper Organization	Department of General Affairs of Mines/John Batman Research Institute Joint Venture	(Foundation) Coal Association of Indonesia (not established yet)
Purpose	Enhance the level of special knowledge and skills of employees and new employees of the mining industry of Indonesia. (It is most likely that the LPPT may substantially address only trainees from Sumatra in future.)	Raise the technical level of supervisors and skilled operators of the Kalimantan region for the most part and train instructors to undertake the in-company training in preparation for qualifying examinations and qualifications necessary for executing mine works.
Trainees	Supervisor class & newly-employed technicians (Trainees are mostly from the Ombilin mine.)	Supervisors of underground & open pit mines and skilled operators of underground mines
Instructor	Basically dependent on Australia. Australian-Indonesian combined instructors (Senior instructor: 2, Instructor: 11-subject undecided)	Expatriate specialists (in geology & drilling exploration, mining & safety, coal preparation & quality control, mechanical design, electrical design) take a leading part for 5 years from the outset, and during this period, the technology transfer to the Indonesian instructors should be accomplished so that in future the local instructors alone fully undertake the training (on geology & drilling exploration, mining & safety, coal preparation & quality control, coal treatment & utilization, mechanical design, electrical design, environment conservation).
Curriculum	Basically supervisor training curriculum but added with special skills and requirements from coal mines as necessary (in particular, full-mechanized technique).	Supervisor & skilled operator curricula (in particular, semi-mechanized underground mining-related technique: driving with blasting & supporting)
Location, Buildings & Facilities	In Ombilin, Sumatra, presently used by LPPT (for dormitory, capacity: 120)	Proposed site: Kalimantan, in the vicinity of Samalinda, preferably government-owned land & buildings, facilities to be newly established
Fund-Raising & Method of Operation	All the expenses are paid by a fund established in the executive committee of the Ombilin Mining Technology Manpower Training Foundation for the first year and from the second year onward by school fee. Profits are equally shared between the Department of General Affairs of Mines and John Batman Research Institute.	Funds are raised by the Department of General Affairs of Mines (in terms of subsidy per production ton) and operation is undertaken by the Coal Association of Indonesia.



#### 11-2-4 Establishment of Training Center and Points to Be Noticed from Now On

##### 1) Training center establishment plan

It is estimated that the number of supervisor and skilled operator class manpower to be developed at the training center amounts to 6,600 in 2020. To cope with the situation, it is necessary to gradually increase the number of training centers and reinforce the manpower development capacity as shown in Figure 11-11.

##### a) Sumatra

The present manpower development capacity of the LPPT should be increased to 1,000/year, then 1,500/year in 2007 and 2,000/year from 2015 onward.

##### b) Kalimantan

A new training center with the manpower development capacity of 1,000/year should be established in Samalinda, East Kalimantan, and then 2,000/year in 2005, and in 2018, its capacity should be increased to 3,000/year.

In addition, another new training center should be established in Banjarmasin, South Kalimantan in 2001, and then in 2012, its capacity should be increased to 2,000/year.

##### 2) Fund raising and cash flow

As a result of study of fund raising method and cash flow, it is known that the Case 6 of Table 11-14, in which the land and buildings are furnished from the Indonesian government, a subsidy of 29 Rp per production ton is collected from the enterprises and the trainees are fully exempted from paying the school fee, is the most suitable case.

##### 3) Points to be noticed from now on

a) Training system should always be such that as the technology advances, the curricula are reviewed from time to time as necessary and the training facilities are improved in such a way that the executed practical training fully satisfies the actual job-site requirements.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
<b>LPPT</b> (Sumatra)																										
Capacity of Centre																										
<b>CMTC</b> (East Kalimantan)																										
Capacity of Centre																										
Number of Trainers																										
<b>Other</b> (South Kalimantan)																										
Capacity of Centre																										
Number of Trainers																										
<b>Total Capacity of Training Centre</b>																										
Total Number of Trainers																										
<b>Sumatra</b>	355	439	467	554	600	708	772	855	924	994	1,046	1,140	1,196	1,269	1,337	1,370	1,427	1,503	1,566	1,661	1,733	1,784	1,850	1,920	1,987	
<b>Kalimantan</b>	828	1,025	1,089	1,294	1,399	1,653	1,802	1,996	2,157	2,320	2,442	2,660	2,790	2,960	3,121	3,196	3,331	3,506	3,653	3,875	4,043	4,163	4,317	4,481	4,637	
<b>Total</b>	1,183	1,464	1,556	1,848	1,999	2,361	2,574	2,851	3,081	3,314	3,488	3,800	3,985	4,229	4,458	4,565	4,758	5,009	5,219	5,536	5,776	5,947	6,167	6,401	6,624	

Figure 11-11 Manpower Development Capacity & Training Center Establishment Plan



Table 11-14 Case Study of Cash Flow at Two Coal Mining Training Centers

CASE 3

(REPLATIVE 1987-1)  
COAL MINING TRAINING CENTER  
CASHFLOW ANALYSIS

YEAR	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	TOTAL
PRODUCTION																							
OPEN CUT		94.7	101.2	107.6	113.0	118.4	122.5	126.6	129.7	132.8	134.7	136.7	138.2	141.8	143.8	145.5	148.5	153.5	157.2	161.0	164.5	168.0	
UNDERGROUND		2.1	2.9	3.6	4.5	5.4	6.6	7.7	8.9	10.0	11.3	12.5	13.4	14.3	15.2	16.0	17.0	17.8	18.5	19.3	20.0	20.8	
TOTAL		96.8	104.1	111.2	117.5	123.8	129.1	134.3	138.6	142.8	146.0	149.2	152.6	156.1	158.8	161.5	166.5	171.3	175.7	180.3	184.3	188.8	3,090
INITIAL & REPLACE INVESTMENT																							
LAND		2,000			2,000								2,000										10,000
BUILDINGS		4,060			4,060							4,060											20,300
FACILITIES		6,085			6,085							6,085											30,435
TOTAL		12,145			12,145							12,145											60,735
OPERATING COST																							
MAINTENANCE		243	486	486	486	486	486	486	486	486	486	486	486	486	486	486	486	486	486	486	486	486	486
CONSUMABLES		200	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
OTHERS		50	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
STAFF SALARIES		80	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
LECTURES FEE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EXPATRIATE		2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250
OVERHEAD		148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
CONTINGENCY		148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148	148
TOTAL		3,113	3,692	3,692	3,692	3,692	3,692	3,692	3,692	3,692	3,692	3,692	3,692	3,692	3,692	3,692	3,692	3,692	3,692	3,692	3,692	3,692	3,692
TOTAL CASH OUTFLOW																							
TRAINING																							
1 DAY COURSE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 WEEK COURSE		260	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520	520
3 WEEK COURSE		300	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
4 WEEK COURSE		360	720	720	720	720	720	720	720	720	720	720	720	720	720	720	720	720	720	720	720	720	720
5 WEEK COURSE		80	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
TOTAL		1,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
REVENUE																							
1 DAY COURSE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.5 WPK.		130	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260
0.8 WPK.		225	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450
1.0 WPK.		360	720	720	720	720	720	720	720	720	720	720	720	720	720	720	720	720	720	720	720	720	720
1.3 WPK.		100	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
57.16 \$/hr/ton		5,533	5,950	6,536	6,716	7,078	7,379	7,922	8,162	8,345	8,723	8,923	9,077	9,231	9,517	9,732	10,043	10,395	10,546	10,792	11,043	11,292	11,541
TOTAL		6,348	7,965	8,946	9,369	9,824	10,122	10,367	10,607	10,790	10,973	11,158	11,343	11,528	11,713	11,898	12,083	12,268	12,453	12,638	12,823	13,008	13,193
CASH FLOW																							
ACCUMULATION																							
15 %																							
1		0.870	0.756	0.658	0.572	0.497	0.432	0.375	0.327	0.284	0.247	0.215	0.187	0.163	0.141	0.123	0.107	0.093	0.081	0.070	0.061	0.053	0.045
6 NPV(1=15%)		-12,145	-7,763	2,824	2,661	-5,938	1,738	2,767	2,467	3,358	3,92	1,208	-0.15	1,511	1,306	433	722	662	-139	747	292	292	429

CASE 4

CASH FLOW WITH OVERSEAS ASSISTANCE  
INVESTMENT FOR FACILITIES AND EXPANSE  
SERVICES ARE THE ASSISTANT PORTION

Table 11-14 Case Study of Cash Flow at Two Coal Mining Training Centers

YEAR	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
CASH OUTFLOW	6,000	13,014	1,442	1,442	1,442	16,630	5,354	2,311	2,311	2,311	5,354	14,456	2,884	2,884	8,970	5,927	5,927	5,927	15,029	3,753	9,839	6,796
REVENUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SCHOOL FEE	55.53	70/ton	5,786	6,180	6,531	6,881	7,175	7,464	7,703	7,927	8,115	8,293	8,462	8,676	8,976	9,254	9,521	9,765	10,021	10,255	10,484	10,694
SUBSIDY	-6,060	-7,624	4,244	4,738	5,280	-9,749	1,281	5,153	5,392	5,625	-282	2,939	-5,974	5,792	5,942	6,127	3,584	-5,264	5,264	5,268	4,416	3,938
CASH FLOW	-13,064	-9,350	-1,611	477	-9,272	-7,461	-2,297	3,095	8,721	8,439	11,377	5,403	11,136	17,137	17,143	20,470	24,064	18,800	25,063	25,484	25,161	25,161
ACCUMULATION																						
DCF FACTOR	1.150	0.870	0.756	0.658	0.572	0.497	0.432	0.376	0.327	0.284	0.247	0.215	0.187	0.163	0.141	0.122	0.107	0.092	0.081	0.070	0.061	0.053
NPV(15%)	-6,060	-6,638	3,225	3,116	2,509	-4,847	707	1,937	1,763	1,589	-70	632	-1,117	941	840	1	356	354	-425	440	25	196

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CASE 5

CASH FLOW WITH OVERSEAS ASSISTANCE  
INVESTMENT FOR FACILITIES AND EXPANSE  
SERVICES ARE THE ASSISTANT PORTION

YEAR	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
CASH OUTFLOW	6,060	13,014	1,442	1,442	1,442	16,630	5,354	2,311	2,311	2,311	5,354	14,456	2,884	2,884	8,970	5,927	5,927	5,927	15,029	3,753	9,839	6,796
REVENUE	0	815	1,630	1,630	1,630	1,630	2,445	2,445	2,445	2,445	2,445	2,445	2,445	2,445	2,445	2,445	2,445	2,445	2,445	2,445	2,445	2,445
SCHOOL FEE	39.53	30/ton	3,828	4,117	4,398	4,647	4,896	5,108	5,312	5,482	5,648	5,774	5,901	6,035	6,174	6,281	6,387	6,495	6,605	6,719	6,837	6,957
SUBSIDY	-6,060	-6,371	4,305	4,586	4,825	-10,104	2,187	5,446	5,616	5,782	-292	-5,976	6,350	6,537	6,718	6,897	7,071	7,241	7,408	7,571	7,731	7,888
CASH FLOW	-14,431	-10,125	-5,539	-704	-10,908	-8,611	-3,166	2,430	8,232	8,064	11,046	5,070	11,620	18,277	18,364	22,672	26,990	22,100	29,613	31,146	30,892	
ACCUMULATION																						
DCF FACTOR	1.150	0.870	0.756	0.658	0.572	0.497	0.432	0.376	0.327	0.284	0.247	0.215	0.187	0.163	0.141	0.122	0.107	0.092	0.081	0.070	0.061	0.053
NPV(15%)	-6,060	-7,279	3,253	3,015	2,764	-5,023	950	2,047	1,836	1,644	-44	643	-1,117	1,065	941	83	419	382	-389	524	94	232

CASE 6

CASH FLOW WITH OVERSEAS ASSISTANCE  
INVESTMENT FOR FACILITIES AND EXPANSE  
SERVICES ARE THE ASSISTANT PORTION

YEAR	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
CASH OUTFLOW	6,060	13,014	1,442	1,442	1,442	10,870	5,354	2,311	2,311	2,311	5,354	8,397	2,884	2,884	8,970	5,927	5,927	5,927	8,970	3,753	9,839	6,796
REVENUE	0	859	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442	1,442
SCHOOL FEE	29.11	30/ton	2,818	3,030	3,237	3,420	3,604	3,758	3,909	4,055	4,197	4,343	4,442	4,544	4,623	4,701	4,847	4,987	5,115	5,249	5,371	5,486
SUBSIDY	0	1,949	1,583	1,795	1,978	-6,966	-1,896	1,508	1,724	1,846	-1,147	-1,011	-3,955	1,663	1,759	-4,289	-1,080	-940	-3,855	1,436	-4,468	-1,300
CASH FLOW	-6,060	-10,125	-5,539	-704	-10,908	-8,611	-3,166	2,430	8,232	8,064	11,046	5,070	11,620	18,277	18,364	22,672	26,990	22,100	29,613	31,146	30,892	
ACCUMULATION																						
DCF FACTOR	1.150	0.870	0.756	0.658	0.572	0.497	0.432	0.376	0.327	0.284	0.247	0.215	0.187	0.163	0.141	0.122	0.107	0.092	0.081	0.070	0.061	0.053
NPV(15%)	-6,060	-7,279	3,253	3,015	2,764	-5,023	950	2,047	1,836	1,644	-44	643	-1,117	1,065	941	83	419	382	-389	524	94	232

b) Effects of the method of training should always be followed up and checked by conducting questionnaire surveys of the activities of the training center graduates in each enterprise or holding interviews with them on job-sites.

c) Opportunities to present the good business results should be given to the training center graduates by holding seminars from time to time or otherwise by issuing periodical publications, thereby giving them an incentive to fully perform their duties on the job-sites.