

10.3 Effects of Electrification

10.3.1 Saving of Energy with Electrification

(1) Preface

Structurally, the supply and demand in the world have undergone a drastic change with the first oil crisis in 1973 as a turning point, and there are signs of an instability in the global energy supply and rises in its prices. This is a phenomenon common to all nations of the world, be they oil producing countries or otherwise.

And the years in which increasing draining oil resources are exploitable gradually decrease and some people go as far as to predict that it will become no longer possible to increase oil production in the near future.

Given this situation, each nation is energetically striving to carry out energy-saving measures in various sectors. The transport sector is not an exception.

Presumably, the measures to reduce fuel consumption in the railway sector include, among others, the use of vehicles of the energy-saving type with the development and adoption of energy-saving equipment, operation of trains and revision of train timetables with a view to uplifting the load factor, and promotion of electrification for purposes of the use of energy substitutes. In the transport sector, which is characterized by the fact that the means of transport are not immovable, it is difficult to shift to the use of energy substitutes.

On this score, it might be said that electrification is a significantly useful measure as it will provide a basic solution in tiding over the difficulty or maintaining a motive power source which is required in light of the feature of mobility which lies in the aforementioned means of transport.

(2) Ways of Computing Volume of Saving

In regard to the degree to which energy may be saved with railway electrification in comparison with the past, two methods are conceivable for the computation. One may be worked out in conjunction with a change in the type of fuel as a source of motive power, whereas the other is designed to provide a comprehensive picture of all favorable effects which may be produced on other sectors by a rise in the transport efficiency brought about by electrification -- e.g., the efficient

operation of rapid vehicles is expected to reduce the required number of vehicles and save energy for the production of vehicles.

As regards the latter, a uniform methodology has yet to be established, and there is a danger that the volume of saving may be overlooked and duplication computation committed. With this in mind, an attempt is made here to compute the energy saving volume according to the former way of thinking.

(3) Trial Computation of Energy Saving

In computing the amount of energy to be saved due to electrification, the following hypothesis is established. The transport volume in 2020, as will be discernible from Table 2.3.33, Chapter 2, would be 42,585,650,000 passenger-kilometers in the passenger sector and 2,683,730,000 ton-kilometers in the freight sector for the case of "with." For the case of "without," the transport volume would be 16,067,700,000 passenger-kilometers and 940,600,000 ton-kilometers respectively. Energy is compared between the following two cases.

- ① Energy which will be required when the transport volume for the case of "with" is all carried by electric railway.
- ② Addition of energy which will be required when the transport volume for the case of "without" is all carried by diesel locomotive with energy which will be required when the balance from the case of "with" is transported -- i.e., passengers by bus and freight by truck.

In a nutshell, an attempt is made to discern how much energy may be saved with electric traction in regard to the transport volume for the case of "with."

The volumes of electricity and light oil which will be used in 2002 are made clear on the basis of train-kilometers which correspond to the respective transport volumes. The volumes of energy to be consumed by buses and trucks are also computed from the cost comparison contained in this chapter. When 1 kWh, = 2,450 Kcal and one litre of light oil = 9,200 Kcal are used, the following computation may be made in terms of light oil.

205 × 10⁶ liters in the case of 1

517 × 10⁶ liters in the case of 2

In other words, 312 × 10⁶ liters or a daily average of 0.86 × 10⁶ liters = 230,000 gallons may be saved in 2002, contributing greatly to the national energy policy.

10.3.2 Comparison of Transport Cost

The shift of motive power for the operation of trains to electricity signifies a drastic change in the transport system such as the transport system and setting of trains. Consequently, there are many items related to operating railway services. Fig. 10.3.1 shows the interaction and cause and effect between the major features of electric traction and their effects on the railway management with particular reference to their external effects as well as their relationship with national targets.

As indicated in this figure, electric traction is of advantage in many aspects. Here, special attention is focused on the management sector and electric traction is compared with diesel traction and automobile transport. For the sake of this comparison, there is a need to come out with preconditions. With the transport volume for the case of "with" in 1990 is taken up, the transport costs for electric and diesel traction in the year as well as the transport costs for passengers and freight when the volume of transport converted to railways is hypothesized as that of automobile transport.

(1) Motive Power Cost

For the computation of fares which correspond to the volume of electric power to be consumed by electric locomotives, the PLN Supply Regulation I₄ is used. It is assumed that light oil for use by diesel locomotives, buses and trucks will be used, and the prices used here are those at which light oil would have been exported if it had not been used by electric locomotives. This is by no means an unreasonable hypothesis, because it may be realized after the electrification is completed. The prices thus computed are 0.541 and 0.710 Rupiahs per passenger-kilometer for electric locomotive and diesel locomotive, respectively, in the transport of passengers. They are 1.431 and 1.529

Rupiahs per ton-kilometer in the transport of freight.

In automobile transport, the prices are 1.131 Rupiahs per passenger-kilometer and 4.898 Rupiahs per ton-kilometer, indicating that those prices are considerably higher than in the railway transport.

(2) Vehicle Repair Cost

Electric locomotives feature an extremely simple motive power generating mechanism, making it generally free from a breakdown. Consequently, it is readily surmisable that the repair cost of electric locomotives is exceedingly lower than that of diesel locomotives. Moreover, the speed acceleration and deceleration of electric locomotives are greater than those of diesel locomotives. This feature makes it possible for electric locomotives to reduce their running hours, lessening the number of kilometers after which they must return to the depot for a regular check. All these factors make it possible to raise the operation efficiency. These features also make it possible to reduce the required number of electric locomotives.

Consequently, the repair cost of electric locomotives per transport volume unit is by far smaller than that of diesel locomotives. Incidentally, this repair cost includes not only that which is required at the workshops but the cost of materials required at the depot.

Needless to say, ground facilities, such as substations and overhead contact wire, must be built for the operation of electric trains. Here, common investments are not taken up on the assumption that they will be offset irrespective of the traction system.

In the same vein, the costs for the construction and maintenance of roads are not taken into account for automobile transport.

(3) Saving of Personnel Cost

Due to improvements in the operation of vehicles as has been elucidated earlier, the number of electric locomotives required is small. Consequently, it is possible to reduce the number of personnel engaged in inspecting electric locomotives at the depot and, moreover, that of engine men, assistant engine men and conductors in a proportional manner.

Incidentally, it is assumed in this computation that the crew including conductors are five for a passenger train, three for a freight

train, three for a bus and two for a truck. The number of maintenance men at a depot is looked upon as two for a locomotive, be it electric or diesel.

Here again, massive transport, a merit of railway transport, is fully put to effective use. The personnel cost per transport volume unit is by far lower than in automobile transport.

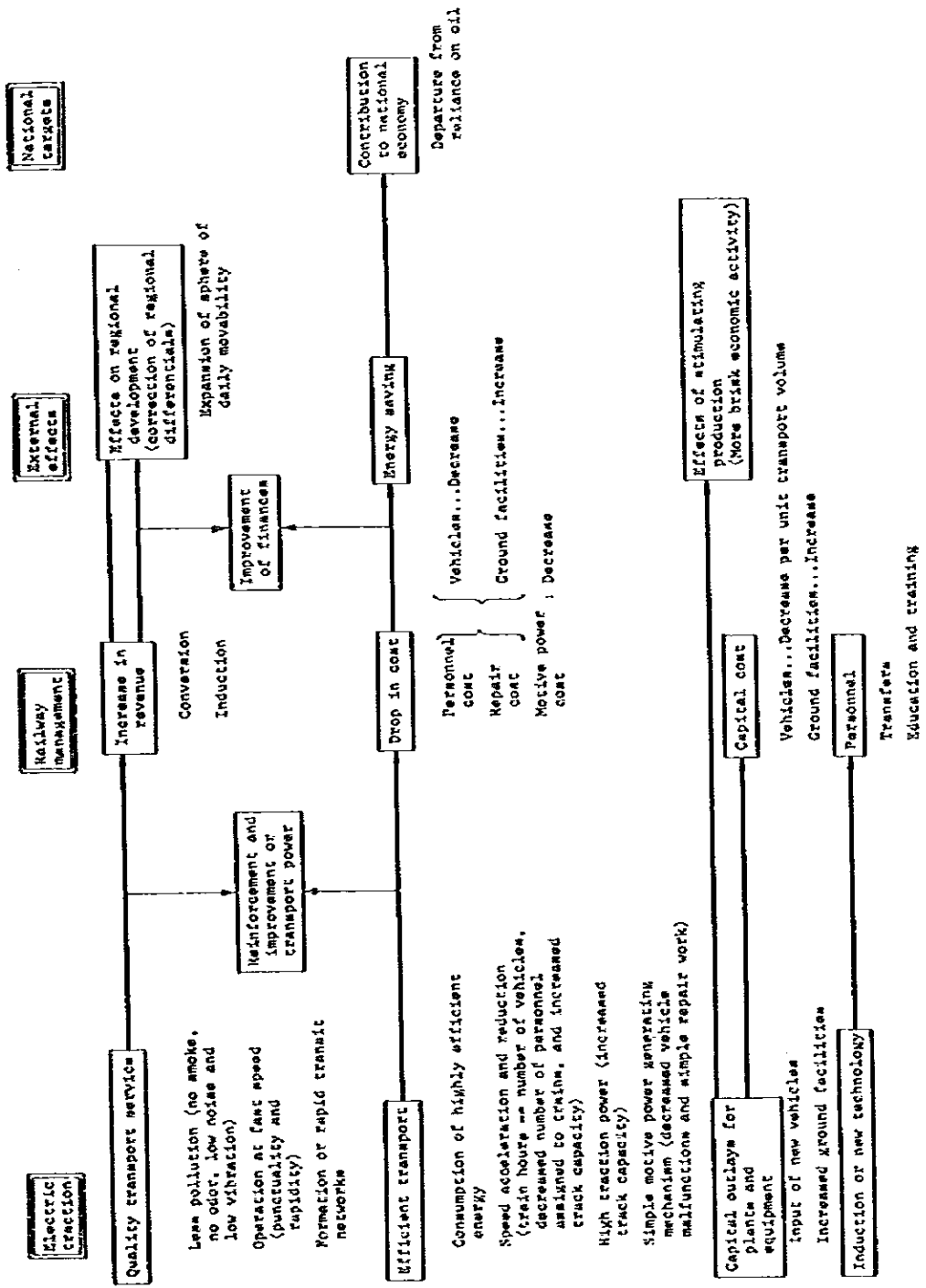


Fig. 10.3.1 Relationship between Electrification and Railway Management

Table 10.3.1 Comparison of Transport Cost

	Passenger (Rupiah/passenger-kilometer)			Freight (Rupiah/ton-kilometer)		
	Electric locomotive traction	Diesel locomotive traction	Bus	Electric locomotive traction	Diesel locomotive traction	Truck
Motive power cost	0.541	0.710	1.131	1.431	1.529	4.898
Maintenance cost of rolling stock or vehicle	0.034	0.177	1.627	0.071	0.207	4.881
Personnel cost of driver, assistant driver and inspector	0.071	0.171	0.991	0.104	0.158	5.244
Total	0.646	1.058	3.749	1.606	1.894	15.023

10.3.3 Effects of Electrification on Industries

Railway electrification makes it possible to offer users comfortable transport and a frequent service to it. On the other hand, the revenue will increase and the operation cost will decrease, contributing greatly to the railway management. As is discernible from this chapter, it requires an enormous amount of investment, undeniably constituting one of the factors lying heavy on the management. From what is to be elucidated, however, it can be affirmed that such a huge amount of investment will become one of the major factors stimulating the economic development of the Republic of Indonesia. Here, an attempt will be made to analyze the way in which investment in the electrification may encourage a rise in the output of industry.

Various contemporary industries cannot exist by themselves. They carry out production while they are linked to one another in trade. The relations are extremely complicated and their activity is influenced by the demands of the national economy.

When a new demand has arisen in a certain industrial sector, the effects from the production activity not only are confined to this particular industrial sector but extend to its indirectly associated industrial sectors. For example, let us think about the case in which there has arisen a new demand for power transmission facilities. It is only natural that this demand makes its appearance in the form of an encouragement of production in the associated steel, general machinery and electric appliance industries.

However, there will presumably be cases in which there arise calls for an increase in the production of trucks for the transport of those facilities and equipment, suggesting that the effects are so far-reaching to encompass sectors which seem to be unrelated at first sight. Moreover, the increase in the production of trucks will encourage an increase in the production of the machinery industry in a cycle of repercussions. This is because the relations, in which industrial activities rely on one another, are complicatedly intertwined.

When an analysis is to be made of the way, in which investment in electrification goes as far as to produce an impact on the activity of various industries, an attempt will be made here to show briefly

upon an analysis of the relations with industries which will be incorporated.

(1) Input-Output Table

The Input-Output Table expresses dealings among industries in terms of amounts of money which are a unit of evaluation common to each industrial sector. Table 10.3.2 is a simplified version. In this table, for example, a check of "manufacturing industry" in the "Demand" column indicates that the total output stands at 200. When the goods and services inputted for this total output are evaluated in terms of producer prices, 30 is inputted from the agricultural sector, 100 from the manufacturing industrial sector and 20 from the commercial and transport sector. The value added stands at 50.

A rowwise check of the "Supply" column by the manufacturing industrial sector indicates that 10 is supplied to the agricultural sector and 10 to the commercial and transport sector with 80 consumed as final demand including domestic consumption and exports. We will also come to realize that total supply is equal to the total output of 200. Similar reading may also be made of other sectors.

(2) Table of Input Coefficients

This table provides values which express the amounts of necessary materials which must be inputted from various sectors at producing the unit product. They are divided by the total output of the sector concerned. This makes it possible to know mutual relations among industries through the input of necessary materials, casting light on links among industries.

Table 10.3.3 shows such links. For example, the figure 0.083 represents the necessary production unit from the commercial and transport sector for the output of one unit in the agricultural sector.

(3) Table of Inverse Matrix

If it is assumed here that plans are worked out for a 30% increase in the output of, say, the manufacturing industrial sector, it will become necessary to raise output by 0.150×0.3 in the agricultural sector and 0.100×0.3 in the commercial and transport sector for their realization. Moreover, for a rise of above-mentioned $0.150 \times 0.3 = 0.045$ in the agricultural sector, it will be necessary to increase

output by 0.167×0.045 in its sector, 0.167×0.045 in the manufacturing industrial sector and 0.083×0.045 in the commercial and transport sector, indicating that the initial plan for a rise of 0.150×0.3 in the manufacturing industrial sector is not enough. The same idea is also applicable to others and in fact infinitely repeated. The table of Inverse Matrix is an attempt to compute this ultimate result and it might be described as the coefficients of far-reaching effects. In other words, the Inverse Matrix expresses the ultimate output of directly and indirectly necessary various industrial sectors for the output of one unit in a given sector.

Inverse Matrix are computed in Table 10.3.4 according to the input-output table. If the output is raised by 30% in the manufacturing industrial sector, the output will also increase by $2.237 \times 0.3 = 0.6711$ in the sector and by $2.907 \times 0.3 = 0.872$ in all industry.

(4) More Practical Table of Inverse Matrix

For the sake of simplification, no reference has earlier been made to imports but the fact is that most countries depend on imports for some (most, depending on the industry) of the domestic demand. With this in mind, an attempt will be made here to compute values in close proximity with the realities. A Table of Inverse Matrix prepared on the basis of this notion has been made public, and the computation of repercussions to industry which will be shown later is also based on Input-Output Table of Indonesia 1975 published by Biro Pusat Statistik. We can define the following equation.

$$\text{Total demand} = \text{intermediate demand} + \text{final demand}$$

Therefore, an equation for only domestic products may be obtained if the amount of imports is subtracted from both sides of the equation. That is,

$$\begin{array}{r} \text{Total demand} \\ \text{(domestic)} \\ \text{products} \end{array} = \begin{array}{r} \text{Intermediate demand} \\ \text{(domestic} \\ \text{product} \end{array} + \text{imports} + \begin{array}{r} \text{Final demand} \\ \text{(domestic} \\ \text{products} \end{array} + \text{imports} - \begin{array}{r} \text{Amount} \\ \text{of} \\ \text{imports} \end{array}$$

The intermediate demand represents the amount consumed by the industrial sectors in its production process and the final demand

represents the amount consumed by the pure consumption sector as a matter of course. The above equation may be symbolized as:

$$X = AX + F - M$$

This equation may be transformed to:

$$X = [I - A]^{-1} [F - M]$$

where X, A, F and M are matrices or vectors, I is a unit matrix and A is an input coefficient matrix.

In case [F - M] is already known in the above equation, the left side may be computed. Set aside F (final demand), M (imports) is determined by the conditions of production activity at home, so that it is not of such a character that it should be determined a priori. In other words, it is something that should be endogeneously determined. Here, let us think of the premise that the final demand is already known and imports are in proportion to the total domestic demand.

Next, the import coefficient of product i is defined as follows.

$$m_i = M_i / (\sum_j AX + Y_i)$$

where m_i : import coefficient of product i,

M_i : Amount of imports of product i,

$\sum_j AX$: Intermediate demand of product i,

Y_i : Final domestic demand of product i.

On the other hand, when a balance of demand is taken into consideration, the following equation is produced.

$$\begin{aligned} \text{Total demand} &= \text{Intermediate demand} + \text{Final domestic demand} + \\ &(\text{domestic products}) \\ &\text{Exports} - \text{Imports} \end{aligned}$$

This equation may be symbolized as follows:

$$X = AX + Y + E - M$$

The matrix \bar{M} , which the above import coefficient m_i is diagonalized, is made and substituted in the above equation.

$$X = \frac{I}{I - (I - \bar{M})A} [(I - \bar{M})Y + E]$$

$(I - \bar{M})A$ in the above equation indicates as follows: Now that \bar{M} is the import coefficient matrix, $(I - \bar{M})$ is, so to speak, the domestic production matrix. As A is the matrix of input coefficient, $(I - \bar{M})A$ indicates the rate at which the domestic products are used for the intermediate demand. In the same vein, $(I - \bar{M})Y$ indicates the final domestic demand of the domestic products. The above equation may be rewritten as follows:

$$X = [I - (I - \bar{M})A]^{-1} [(I - \bar{M})Y + E]$$

The existence of such an inverse matrix is mathematically corroborated and universal.

Table 10.3.5 indicates inverse matrix coefficients for Indonesia as the industrial sector is divided into 66.

(5) Trial Computation of Repercussions to Production

In order that the procurement of goods may be of effect in raising domestic production, it is necessary that the goods should be domestically produced. This is because imports are not directly related to the domestic production of goods.

Of the amount to be invested in the electrification work, the portion which will be procured with local currency is classified in Table 10.3.6 according to Input-Output Table. It would be exceedingly troublesome to classify and express by industry and in terms of amounts of money the machinery, equipment and material which are required for the construction work related to the electrification (portion with local currency), but here an attempt is made to make as accurate presentations as much as possible. Nevertheless, not included are the labor and other costs incidental to the electrification which we define, in this case, have no effect in raising domestic production.

As the aforementioned concept is incorporated in regard to the amounts of investment in the table, the volume which produces a far-reaching effect on production -- i.e., the volume of an increase in

production which must be attained by each industry, including the given industry, with an investment of 230.6 billion Rupiahs in Table 10.3.6 may be computed as indicated Table 10.3.7.

**Table 10.3.2 Input-Output Table
(Simplified Version)**

Demand / Supply	Agri- culture	Manu- facturing industry	Commerce and transport	Final demand	Total output
Agriculture	10	30	0	20	60
Manufacturing industry	10	100	10	80	200
Commerce and transport	5	20	2	25	52
Value added	35	50	40		
Total output	60	200	52		

Table 10.3.3 Table of Input Coefficients

Demand / Supply	Agriculture	Manufacturing industry	Commerce and transport
Agriculture	0.167	0.150	0.000
Manufacturing industry	0.167	0.500	0.192
Commerce and transport	0.083	0.100	0.038

Table 10.3.4 Table of Inverse Matrix

Demand Supply	Agriculture	Manufacturing industry	Commerce and transport
Agriculture	1.289	0.403	0.080
Manufacturing industry	0.493	2.237	0.446
Commerce and transport	0.162	0.267	1.093
Total	1.944	2.907	1.619

Table 10.3.5 Table of Inverse Matrix in 66 Subdivisions $[I - (I - \bar{M})A]^{-1}$

	Rice plants	Rice	Maize	Cassava	Vegetables and fruits	Other edible crops	Rubber
Demand	01	02	03	04	05	06	07
Supply	01	02	03	04	05	06	07
01	101 249 912	79 228 358	10 339	42 975	9 234	8 057	41 719
02	1 672	109 001 617	1 702	1 741	1 731	1 424	0 594
03	1 397	1 268	101 664 890	2 055	1 730	1 398	9 339
04	2 534	2 824	2 859	122 509 972	3 441	3 299	15 441
05	3 235	3 635	3 281	4 783	101 571 278	2 866	24 396
06	2 137	2 112	2 232	2 697	2 113	106 928 295	14 390
07	1 523	1 775	2 866	4 652	4 692	2 911	186 796 493
08	1 476	1 359	1 965	1 594	2 349	1 576	8 057
09	11 834	10 531	5 935	5 795	42 860	13 303	81 961
10	13 213	11 269	6 176	4 892	18 660	15 051	68 335
11	16	14	19	19	10	11	55
12	162	168	112	166	71	107	1 293
13	125	129	85	128	52	80	995
14	54	51	36	42	46	47	370
15	98	93	54	66	93	91	715
16	126	120	74	1 891	105	108	938
17	4 007	9 294	8 855	23 233	6 503	15 493	14 147
18	63 168	51 655	291 464	120 123	223 021	103 654	10 154
19	2 818	6 219	4 304	12 663	2 708	9 544	11 741
20	2 839	2 837	2 122	2 824	1 247	1 706	19 398
21	44 073	53 420	148 952	74 049	63 035	34 945	267 266
22	15 852	16 206	92 119	44 596	22 319	57 525	115 720
23	2 810	2 919	1 959	2 937	1 681	1 721	22 811
24	4 841	4 642	8 940	7 811	3 981	5 314	20 939
25	74 608	65 291	102 569	63 163	54 039	51 584	1 114 973
26	62 406	56 238	71 162	17 728	33 315	37 707	112 295
27	1 130	1 154	822	1 150	477	701	8 561
28	16 340	14 041	6 960	5 849	22 054	18 352	111 329
29	4 752	4 690	6 772	7 536	5 974	4 895	31 969
30	5 206	5 452	3 793	5 577	2 634	3 225	43 443
31	3 610	3 395	2 031	2 443	3 283	3 208	26 662
32	2 163	2 220	1 511	2 151	1 161	1 577	16 212
33	1 148	1 158	767	1 058	564	757	8 868
34	60	54	74	71	39	43	209
35	13 756	44 970	31 878	103 496	19 826	80 592	35 325
36	79 937	306 659	264 621	733 144	131 252	569 105	79 729
37	67 182	92 787	592 926	245 765	199 972	21 921	147 626
38	37 143	34 164	20 497	25 940	14 967	18 159	247 126
39	1 355 944	1 069 069	1 752 065	424 663	745 835	455 943	1 037 858
40	350 699	298 761	144 507	117 571	483 316	397 114	2 356 664
41	63 827	61 525	93 374	86 858	57 112	65 594	550 395
42	4 467	4 975	7 776	12 881	4 595	8 106	89 761
43	23 122	25 575	19 563	6 426	14 042	25 719	98 282
44	8 383	9 593	7 330	1 990	3 957	9 318	30 616
45	4 436	4 463	10 366	8 788	3 733	5 484	18 668
46	5 392	5 339	11 596	10 287	4 265	6 490	22 855
47	135 607	116 859	456 413	441 227	141 398	177 221	441 993
48	11 939	11 245	13 126	8 240	8 391	8 457	49 440
49	78 720	77 738	123 257	218 728	79 751	134 461	1 945 756
50	2 734	2 984	3 192	8 118	1 797	2 652	26 518
51	107 538	96 021	141 459	83 307	67 656	64 953	329 229
52	482 747	554 452	423 218	97 856	216 028	536 915	1 738 859
53	338 284	426 593	819 280	2 028 038	415 570	764 402	5 239 448
54	44 881	47 304	31 269	48 258	16 614	27 914	387 699
55	6 378	5 929	5 750	17 553	3 571	6 129	34 900
56	145 516	184 358	269 260	621 991	197 193	289 355	2 573 630
57	162 045	166 304	194 649	154 034	131 753	118 662	475 876
58	14 049	12 915	12 168	13 941	6 457	9 669	51 957
59	203 648	166 855	191 941	86 230	131 934	103 556	511 275
60	23 977	21 266	9 553	13 441	4 968	8 130	237 260
61	1 523 773	1 226 016	227 251	356 156	85 866	221 547	2 045 140
62	62 974	60 981	47 267	62 524	57 309	35 670	216 721
63	-	-	-	-	-	-	-
64	26 613	23 403	10 218	14 898	8 618	8 552	71 858
65	16 176	13 983	12 733	14 432	6 670	7 083	104 945
66	-	-	-	-	-	-	-
TOTAL	107 043 293	185 141 326	108 186 193	129 067 366	105 370 719	111 529 538	240 310 244

	Cane sugar Fruit sugar	Coconuts	Palm oil	Tobacco	Coffee	Tea	Clove
Demand	08	09	10	11	12	13	14
Supply							
01	36 518	22 185	37 190	43 817	57 550	46 048	20 919
02	9 429	6 501	9 401	11 350	17 788	11 682	6 920
03	6 874	3 595	7 731	6 165	9 361	7 617	4 165
04	11 897	8 773	14 775	14 077	21 564	15 131	8 410
05	127 641	13 664	19 959	245 064	42 074	33 387	12 810
06	14 307	9 736	13 113	15 579	25 218	16 569	8 948
07	34 149	5 722	24 036	26 733	11 831	17 022	4 395
08	109 966 360	4 267	7 279	6 831	10 853	8 244	4 658
09	12 164 322	110 900 743	34 698 573	23 916	24 414	43 409	21 042
10	13 656	3 168	100 197 181	15 469	10 428	36 358	20 497
11	48	25	48	163 811 555	61	54	21
12	1 359	936	1 160	1 521	122 294 461	1 523	870
13	1 054	727	892	1 188	1 928	127 048 799	645
14	280	159	306	282	417	317	100 412 141
15	516	268	579	477	710	563	302
16	660	433	780	740	1 140	830	440
17	1 980 825	11 941	16 190	11 166	52 677	25 751	66 266
18	18 207	65 152	91 064	51 633	116 937	152 601	125 672
19	13 217	13 260	14 652	17 151	23 800	15 357	10 061
20	20 561	13 652	17 878	23 659	37 111	22 954	12 632
21	342 146	130 043	615 718	336 931	229 948	484 890	189 146
22	73 336	103 231	68 553	87 340	191 975	184 627	173 331
23	24 602	17 226	20 747	27 791	45 396	27 670	14 827
24	16 187	11 817	23 022	16 208	12 097	18 059	7 062
25	300 118	44 639	337 929	348 132	242 518	400 446	170 147
26	144 601	54 356	113 433	77 031	54 059	103 298	40 154
27	9 130	6 241	7 713	10 267	16 519	10 237	5 426
28	49 412	5 640	80 755	21 883	17 342	47 255	26 275
29	27 737	15 678	24 105	35 843	45 776	33 543	15 452
30	47 450	33 183	39 459	52 651	85 495	53 116	27 774
31	16 420	10 789	21 749	18 799	28 479	21 907	11 594
32	16 034	10 746	14 327	17 768	28 261	18 064	9 558
33	8 872	5 993	7 903	9 754	15 705	9 927	5 193
34	181	95	181	213	231	206	82
35	27 214	64 714	45 061	43 925	49 927	33 439	31 367
36	145 917	411 352	279 291	287 809	275 551	215 024	214 121
37	69 464	90 530	183 817	384 390	112 967	870 742	159 178
38	157 922	74 817	273 860	229 415	266 805	125 761	55 750
39	2 268 969	200 387	785 752	1 014 054	574 608	1 070 990	552 863
40	248 674	64 612	1 705 552	392 258	232 511	551 136	532 430
41	494 041	65 845	531 414	538 263	380 929	623 523	176 690
42	112 754	16 733	77 794	87 456	37 819	55 035	13 606
43	79 752	48 069	185 606	53 216	88 567	81 301	35 419
44	38 725	19 877	32 893	18 480	13 366	28 211	8 811
45	15 293	14 531	19 179	15 433	10 855	16 646	6 066
46	20 565	16 963	28 681	19 171	14 318	19 257	7 213
47	285 215	528 821	475 581	377 086	356 736	401 123	192 864
48	194 121	27 161	112 582	137 436	52 854	80 481	13 439
49	1 134 475	328 201	1 679 891	1 912 249	795 473	1 138 864	270 037
50	22 201	4 536	92 714	20 211	23 077	19 618	5 715
51	267 250	70 725	255 236	315 992	281 213	522 791	203 468
52	1 813 397	1 153 977	1 782 436	1 061 112	769 522	1 620 209	493 340
53	3 386 551	1 198 590	2 722 843	7 599 774	8 744 311	12 242 119	649 709
54	425 649	299 553	352 596	469 597	777 759	474 284	247 816
55	21 604	4 197	25 235	18 112	26 115	26 878	12 959
56	1 605 023	296 442	999 417	2 612 366	1 748 387	1 810 745	213 812
57	382 908	89 315	452 270	498 892	370 661	431 558	166 742
58	36 662	12 106	31 107	40 318	41 890	47 232	11 394
59	456 379	58 139	359 284	301 922	371 607	318 892	154 974
60	58 221	29 513	95 357	54 887	90 349	183 224	17 353
61	1 853 778	178 988	1 015 655	945 547	1 018 369	1 281 773	736 451
62	454 500	70 365	170 210	476 713	473 141	265 427	53 456
63	-	-	-	-	-	-	-
64	49 669	14 597	37 294	154 836	183 136	69 618	141 420
65	181 699	7 517	149 752	87 074	31 222	27 970	11 554
66	-	-	-	-	-	-	-
TOTAL	141 747 507	116 995 731	151 738 855	165 018 115	141 920 211	153 962 999	106 769 252

	Nutmeg	Other spices	Other plants	Livestock	Meat	Poultry farming	Lumbering
Demand	15	16	17	18	19	20	21
Supply	15	16	17	18	19	20	21
01	27 256	10 409	18 739	2 591 937	1 362 050	1 176 031	41 024
02	5 382	1 634	5 027	413 943	219 670	193 741	9 937
03	3 206	990	2 958	236 687	125 330	447 740	5 393
04	10 406	3 286	7 215	667 423	352 027	283 025	14 836
05	8 453	3 214	10 504	337 911	189 623	98 418	24 919
06	7 293	2 125	7 459	502 172	267 662	316 330	14 658
07	4 154	3 351	6 790	4 384	8 017	1 178	34 039
08	6 304	1 812	3 554	672 562	351 713	11 924	6 091
09	8 656	4 238	9 345	232 126	127 738	39 053	15 844
10	8 512	3 939	6 870	408 781	214 096	79 333	8 192
11	24	17	24	15	51	13	99
12	371	110	687	513	980	15 059	1 434
13	285	84	532	359	760	8 770	1 169
14	79	31	128	121	196	3 842	283
15	100 280 591	45	217	242	332	7 519	435
16	193	100 000 063	338	272	471	5 303	689
17	37 336	29 499	100 062 407	219 728	116 473	13 510	10 189
18	937 806	191 384	89 099	100 612 756	52 184 152	6 745	10 516
19	24 658	9 004	13 074	8 173	100 011 293	7 297	18 465
20	5 961	1 972	13 545	7 616	14 805	101 702 878	24 135
21	182 352	214 064	422 039	121 693	111 019	110 638	109 531 056
22	77 459	293 131	140 947	61 369	41 343	73 175	46 521
23	6 657	1 933	12 575	9 261	17 823	74 478	26 304
24	7 497	7 277	15 969	10342	9 004	3 160	25 643
25	130 521	66 365	157 955	69 709	150 034	43 341	594 439
26	83 121	33 666	101 113	86 656	56 176	12 219	105 989
27	2 536	785	4 652	3 353	6 677	4 522	10 104
28	8 076	4 234	9 566	34 501	21 872	16 792	13 418
29	19 229	8 159	13 258	1 587 732	845 144	1 140 703	30 478
30	12 715	3 776	24 145	17 632	34 090	27 973	49 830
31	4 916	1 671	8 579	6 592	11 650	14 982	17 288
32	4 635	1 464	8 116	6 075	11 624	465 017	17 372
33	2 401	726	4 498	3 261	6 457	3 714	9 460
34	50	63	93	57	195	50	378
35	203 187	74 822	73 319	38 599	32 376	12 285	48 511
36	1 423 552	522 207	495 059	271 221	218 174	84 005	319 010
37	121 640	625 659	276 909	67 856	52 867	304 686	180 215
38	27 035	19 036	45 117	36 597	70 428	51 162	536 560
39	2 412 669	873 938	1 944 955	66 679	35 297	28 217	1 632
40	150 049	84 700	166 344	190 213	144 195	185 201	198 252
41	109 222	72 068	177 610	113 938	250 029	71 427	996 812
42	10 288	8 972	21 173	13 487	25 901	3 457	111 854
43	10 745	8 797	43 580	61 582	45 212	24 139	150 376
44	3 562	2 806	17 365	18 701	14 153	3 939	42 429
45	7 146	8 729	8 282	8 373	6 808	2 819	20 986
46	8 553	9 637	23 245	13 865	11 335	3 675	29 336
47	338 498	414 402	187 204	205 485	132 802	90 885	329 904
48	16 887	9 069	20 160	21 679	53 956	8 706	198 782
49	128 662	131 909	426 116	265 370	545 149	52 289	2 468 224
50	5 704	3 879	7 809	3 828	18 046	9 030	63 254
51	215 246	100 986	167 387	162 546	141 370	64 444	690 849
52	203 463	159 445	1 008 654	1 067 394	859 265	210 627	2 409 741
53	1 008 875	940 139	773 956	733 950	5 134 477	707 527	4 520 489
54	112 459	31 197	215 867	158 217	304 931	181 183	439 702
55	8 036	4 356	8 538	5 455	40 088	4 007	97 595
56	486 674	691 057	294 179	191 460	2 573 971	145 645	1 336 239
57	265 392	148 681	260 070	93 119	270 674	73 751	1 149 227
58	13 028	11 201	11 508	9 575	93 789	7 206	98 973
59	284 563	138 450	279 738	56 154	59 068	45 306	1 738 562
60	10 530	9 547	23 057	18 841	32 881	18 339	93 655
61	151 341	249 814	437 128	451 703	517 736	284 849	2 478 585
62	54 459	42 725	62 956	63 274	373 704	103 985	801 782
63	-	-	-	-	-	-	-
64	11 733	10 230	15 275	38 846	45 031	32 767	74 612
65	17 667	9 817	81 600	11 311	238 459	7 271	130 762
66	-	-	-	-	-	-	-
TOTAL	109 530 015	106 322 813	108 704 156	113 394 975	169 193 739	109 227 704	132 479 941

	Other agricultural products	Fisheries	Iron ores	Well drilling and natural gas	Other well drilling	Fabrication of keepable food	Oil products
Demand	22	23	24	25	26	27	28
Supply							
01	6 855	133 241	45 916	7 051	21 733	257 371	98 463
02	1 127	43 829	16 447	2 536	6 459	41 526	17 104
03	622	22 294	9 203	1 210	3 682	77 090	4 665 565
04	2 723	57 065	18 943	2 732	7 951	141 502	34 595
05	3 870	119 127	33 793	4 863	15 043	783 449	54 650
06	1 643	235 314	22 338	3 422	8 821	1 227 182	1 477 893
07	4 584	31 824	16 326	1 602	9 343	19 339	26 249
08	707	22 791	9 743	1 379	3 811	2 366 726	21 222
09	2 939	42 606	39 042	2 442	17 244	562 147	43 069 467
10	1 727	19 683	33 214	963	13 070	138 655	10 774 294
11	23	54	204	28	45	189	396
12	156	23 865	2 215	348	660	116 075	17 321
13	120	11 021	1 731	273	672	67 324	10 384
14	39	6 072	459	68	173	30 157	101 020
15	53	11 866	744	99	288	59 354	301 194
16	79	8490	1 103	155	434	212 782	28 917
17	10 247	45 441	8 150	868	27 313	76 215	438 426
18	4 482	16 063	11 962	1 819	6 902	1 631 736	63 983
19	8 076	26 879	20 646	3 151	12 068	3 017 924	39 141
20	2 954	23 607	33 569	5 212	13 460	55 179	55 600
21	1 076 914	665 918	133 910	16 583	662 777	495 803	394 117
22	100 875 125	418 325	25 265	4 524	268 953	107 338	70 326
23	2 814	118 868 427	39 487	6 239	15 576	21 458 842	43 288
24	18 572	15 207	100 138 453	6 068	15 614	72 216	117 744
25	60 328	537 900	1 178 955	100 385 834	230 854	649 568	827 603
26	21 472	252 517	52 258	9 979	100 015 717	105 017	77 375
27	1 137	11 247	15 346	2 389	5 807	117 482 649	19 893
28	2 537	56 857	45 074	1 851	17 761	495 950	100 583 301
29	4 232	122 582	35 196	5 333	18 585	259 565	94 706
30	5 214	64 353	74 334	11 733	30 277	212 369	87 929
31	1 997	38 392	28 497	3 845	11 196	9 991 914	41 994
32	2 060	725 241	26 812	4 122	10 189	3 612 545	505 985
33	1 038	9 694	14 268	2 194	5 555	20 360	16 363
34	86	207	778	107	172	714	1 508
35	58 145	234 569	24 411	3 359	46 422	66 429	58 076
36	411 144	809 478	157 228	21 834	313 311	439 174	362 876
37	22 340	1 061 060	85 653	15 334	3 648 240	473 234	184 426
38	133 848	145 352	229 956	32 349	77 923	302 707	851 740
39	412	43 574	2 030	252	1 355	77 468	255 285
40	43 827	400 529	870 722	20 786	312 273	1 643 257	1 023 101
41	101 145	900 165	1 977 577	276 916	357 112	1 655 978	1 376 587
42	13 359	104 320	52 450	5 195	28 091	58 247	80 011
43	23 676	59 624	60 952	10 269	23 582	118 306	100 967
44	8 655	9 419	20 196	4 077	5 399	20 183	26 262
45	9 116	10 462	24 270	2 239	20 076	37 638	50 001
46	28 884	20 239	44 279	3 546	20 217	47 718	159 004
47	378 352	124 976	506 026	34 919	832 187	1 703 900	2 166 079
48	12 958	30 746	1 850 819	103 382	46 017	217 504	638 110
49	257 779	2 249 795	1 095 219	110 837	412 040	1 071 640	1 492 989
50	20 475	11 788	21 115	1 278	11 247	22 168	42 122
51	74 124	217 910	5 203 658	492 637	206 624	2 468 805	2 207 638
52	496 871	501 217	1 154 363	236 583	294 821	1 472 038	1 457 037
53	1 528 111	7 895 304	3 012 970	138 644	2 645 427	14 596 603	8 969 304
54	44 869	455 850	657 974	104 207	261 685	938 537	659 609
55	5 781	19 441	52 042	5 438	13 858	65 303	71 117
56	248 266	1 510 257	426 013	59 656	1 150 163	2 835 944	3 600 433
57	237 068	456 148	497 945	39 071	294 206	1 168 862	7 557 368
58	16 787	61 644	532 353	77 242	35 097	298 454	78 348
59	283 045	299 560	133 931	10 018	207 134	673 291	1 430 865
60	34 282	54 959	316 863	27 258	26 969	196 393	247 414
61	332 401	1 430 327	1 850 321	314 804	492 740	2 054 425	1 317 879
62	201 172	249 761	1 841 078	334 513	400 657	853 256	411 053
63	-	-	-	-	-	-	-
64	13 456	133 039	350 640	60 039	112 873	335 832	140 783
65	22 715	54 445	198 722	21 658	140 850	279 458	189 453
66	-	-	-	-	-	-	-
TOTAL	107 171 628	112 157 916	125 421 620	103 069 798	114 456 443	201 650 091	201 134 856

	Rice polishing	Wheat and other seeds	Sugar refining industry	Food manufacturing industry	Drinks manufacturing industry	Tobacco industry	Textile industry
Demand	29	30	31	32	33	34	35
Supply	29	30	31	32	33	34	35
01	78 079 871	2 218 435	48 699	2 677 282	216 955	57 613	45 042
02	2 107 650	79 169	14 650	154 762	19 594	14 111	11 648
03	3 463	5 210 700	9 034	828 963	12 787	85 543	7 041
04	7 278	1 796 609	20 692	2 187 596	20 217	35 422	27 668
05	14 511	182 939	1 048 941	655 449	158 744	73 378	30 400
06	8 245	11 590 838	21 335	31 163 944	24 458	19 910	19 716
07	3 543	15 243	15 199	9 677	13 458	9 763	17 994
08	3 829	2 233 333	22 598 879	2 059 990	1 865 541	9 117	7 627
09	15 253	613 138	2 531 072	1 196 261	306 681	30 987	35 639
10	12 053	112 502	28 165	275 499	107 402	18 925	28 245
11	28	147	71	79	110	26 267 816	88
12	789	10 863	2 072	3 171 334	2 159	1 959	1 902
13	610	6 721	1 609	1 822 455	1 595	1 529	1 403
14	152	3 278	492	818 147	606	12 518 156	420
15	262	6 899	701	1 665 575	1 136	610	731
16	399	42 567	1 204	1 698 128	40 525	2 474	925
17	4 653	110 269	441 498	234 623	56 622	82 874	15 367 109
18	52 091	89 392	24 866	263 402	11 449	32 130	73 953
19	7 950	117 966	36 154	344 790	18 587	17 554	110 840
20	12 058	2 217 454	31 004	85 007	27 334	23 457	24 354
21	67 423	624 858	413 428	261 354	472 224	119 272	193 492
22	15 359	39 171	40 960	52 987	51 918	47 312	45 256
23	14 268	570 853	37 668	113 176	30 959	35 859	27 523
24	8 894	50 481	265 265	30 854	56 412	11 830	55 783
25	156 477	625 853	744 744	429 115	521 600	492 003	553 345
26	54 271	46 510	80 611	205 501	192 455	39 007	61 845
27	5 280	2 845 545	13 884	162 695	12 492	13 200	10 450
28	16 169	671 143	44 954	1 576 985	141 214	27 121	39 473
29	100 962 411	2 825 154	37 658	3 338 927	216 583	36 586	35 692
30	27 106	122 255 192	71 591	1 756 759	72 233	68 335	52 109
31	10 283	5 393 856	100 082 490	1 700 968	8 249 634	26 325	20 811
32	9 238	296 713	24 450	100 329 186	34 707	22 710	30 493
33	5 479	15 924	13 752	14 170	102 944 145	22 491	10 096
34	108	558	271	302	419	100 000 248	337
35	17 879	202 127	186 453	56 202	38 367	26 453	106 846 656
36	99 483	1 409 760	1 301 025	374 441	224 193	123 367	6 452 502
37	62 237	392 378	260 523	134 369	1 225 773	124 189	282 842
38	76 049	592 196	295 132	362 537	268 764	2 406 857	280 802
39	1 053 659	226 278	463 341	330 706	43 857	235 843	300 343
40	310 680	1 178 873	711 811	1 706 045	2 850 699	451 572	731 504
41	245 157	1 039 546	1 228 334	704 659	872 872	311 414	914 589
42	11 158	45 185	47 268	30 363	42 681	31 784	47 546
43	25 987	55 057	73 187	293 330	1 359 730	72 101	60 164
44	9 055	13 998	27 911	29 020	46 291	11 535	20 790
45	5 562	17 187	16 171	10 678	15 602	6 652	13 274
46	7 940	25 380	26 255	15 965	22 531	11 856	22 853
47	110 242	629 815	320 192	321 065	372 987	151 829	314 839
48	139 145	272 894	720 542	136 555	426 254	83 466	357 198
49	202 621	782 566	576 017	536 561	669 397	635 033	568 493
50	6 270	41 720	22 817	14 581	26 594	15 013	35 663
51	356 073	2 862 283	6 307 335	1 834 637	2 807 987	468 699	5 412 926
52	520 107	765 609	1 523 890	841 205	1 255 994	560 739	1 187 465
53	3 373 310	23 610 171	5 418 131	7 659 586	4 460 675	12 440 603	8 165 092
54	242 326	737 768	645 764	456 064	512 339	612 918	459 611
55	9 685	65 829	55 199	69 214	47 070	36 090	58 892
56	799 727	2 538 035	1 484 007	2 025 606	1 780 678	1 600 806	2 177 969
57	251 360	1 771 870	455 653	804 657	695 158	348 136	770 812
58	23 049	131 283	86 995	83 375	198 655	97 270	123 870
59	179 990	749 116	245 830	464 783	365 816	268 332	678 434
60	67 865	342 630	169 069	212 773	222 810	209 259	258 744
61	1 589 960	2 120 743	1 391 733	2 329 456	2 470 168	2 255 169	1 000 794
62	166 596	514 544	313 935	266 395	510 072	343 731	334 952
63	-	-	-	-	-	-	-
64	63 728	138 447	111 664	120 534	255 922	150 968	167 735
65	170 274	99 434	491 856	205 190	821 204	38 370	452 079
66	-	-	-	-	-	-	-
TOTAL	191 884 851	206 257 029	153 576 066	183 607 641	140 842 502	164 037 858	155 490 045

	Sewing industry	Lumbering and its products	Printing industry	Fertilizer manufacture	Refining industry	Oil refining industry	Rubber goods
Demand	36	37	38	39	40	41	42
Supply							
01	81 338	70 629	641 563	30 518	207 008	34 061	66 674
02	20 250	17 710	20 913	9 327	108 767	11 040	22 459
03	17 856	14 272	18 993	10 738	259 436	6 166	29 035
04	281 813	25 913	679 306	16 285	253 438	15 795	91 057
05	38 935	50 910	46 144	19 174	152 177	22 272	44 661
06	35 018	27 774	26 049	11 989	116 583	15 385	29 839
07	175 344	69 879	26 733	17 429	49 107	6 500	30 021 146
08	20 185	12 977	18 024	8 267	160 726	6 600	22 062
09	148 596	126 213	185 470	118 207	3 713 028	22 079	333 544
10	150 648	93 008	204 393	135 755	4 444 325	17 330	383 898
11	93	187	121	73	153	79	106
12	2 775	2 319	2 306	979	4 590	1 527	2 308
13	1 936	1 782	1 787	744	2 974	1 193	1 727
14	799	604	746	412	8 187	297	1 052
15	1 564	1 032	1 460	825	19 350	456	2 270
16	1 728	1 456	1 847	987	19 911	745	2 570
17	3 176 919	555 666	86 578	44 455	450 456	3 747	473 421
18	1 109 539	18 656	17 677	7 577	22 689	7 741	136 610
19	2 069 984	31 954	28 939	13 058	28 669	13 294	244 649
20	29 998	41 975	36 872	15 349	28 814	23 112	31 441
21	233 321	26 174 126	431 768	143 254	765 456	72 242	263 527
22	43 825	1 630 915	206 982	38 306	462 118	20 484	77 359
23	33 729	41 971	39 979	16 224	31 359	27 237	36 268
24	59 643	46 321	142 681	58 578	201 763	30 438	50 324
25	668 900	582 264	930 545	4 023 914	1 263 357	60 514 265	644 971
26	59 984	95 482	148 831	3 063 225	474 912	43 143	97 270
27	12 678	17 190	15 198	6 467	16 650	10 308	13 953
28	194 772	119 950	256 057	168 894	5 472 295	24 306	477 096
29	56 639	52 415	49 927	21 896	103 875	24 230	47 231
30	63 769	107 221	74 621	30 403	59 241	52 425	69 868
31	41 901	40 598	53 379	29 721	658 800	19 054	77 935
32	50 114	29 510	29 745	13 675	112 800	17 897	33 924
33	13 185	15 832	15 639	7 287	54 042	9 828	16 545
34	355	711	462	278	622	301	404
35	18 467 322	118 971	422 478	204 262	134 615	9 358	2 621 659
36	132 105 051	523 537	422 703	286 136	816 384	46 943	15 055 684
37	219 165	106 780 311	693 159	200 312	1 451 284	49 457	376 840
38	588 011	449 658	118 367 711	403 330	1 449 344	650 132	472 773
39	67 387	14 218	15 870	100 093 239	61 315	1 369	181 752
40	3 920 205	2 494 687	5 534 731	3 685 493	121 110 453	447 987	10 413 725
41	1 117 820	975 586	1 643 875	2 260 973	2 116 072	101 506 451	873 991
42	350 899	229 797	86 044	56 591	140 913	19 142	100 169 338
43	85 259	273 755	193 055	76 611	1 268 950	46 365	183 263
44	18 773	33 846	58 670	16 496	55 532	17 113	25 012
45	10 226	116 628	15 863	10 432	27 091	18 897	22 330
46	35 754	35 583	176 435	16 593	44 573	26 093	35 652
47	222 988	690 891	348 459	156 717	1 051 335	756 918	818 197
48	264 942	190 454	231 528	405 619	239 907	216 155	365 909
49	455 234	1 274 379	936 254	1 698 141	713 416	375 892	707 340
50	296 172	122 767	272 832	16 704	37 978	33 025	91 312
51	4 262 662	2 207 476	3 107 205	5 843 095	1 742 580	1 710 071	1 738 569
52	1 006 686	1 613 465	1 427 864	891 108	1 161 667	978 496	1 245 393
53	6 445 583	15 102 071	9 782 668	2 152 376	8 925 891	1 297 962	6 821 413
54	563 771	684 163	650 993	265 429	502 102	459 453	611 271
55	77 600	74 709	95 724	44 356	80 448	23 025	63 968
56	1 842 266	1 718 458	2 567 012	952 367	2 093 761	342 641	1 933 739
57	712 590	2 869 624	1 079 164	759 300	1 410 558	264 041	859 625
58	138 168	117 779	163 562	90 182	166 594	139 707	122 189
59	507 599	3 988 565	944 157	593 029	898 462	70 850	604 953
60	141 978	181 138	260 528	71 614	185 094	154 706	162 268
61	1 630 769	4 710 373	2 776 132	913 593	2 714 497	3 032 626	2 892 598
62	553 490	762 730	726 371	430 511	1 047 365	659 065	452 695
63	-	-	-	-	-	-	-
64	132 551	167 561	416 429	114 188	170 845	169 619	137 458
65	280 968	214 564	203 182	455 147	274 439	70 835	348 661
66	-	-	-	-	-	-	-
TOTAL	185 359 970	178 706 934	158 321 856	130 598 202	171 802 044	174 709 710	184 326 059

	Nonmetallic goods	Cement manufacturing industry	Steel industry	Non-ferrous metals	Metals	Electric machinery and appliances	Conveyances and maintenance
Demand	43	44	45	46	47	48	49
Supply							
01	2 506 992	76 014	45 954	30 729	49 350	58 893	51 033
02	128 444	11 913	12 704	10 538	13 950	17 602	14 870
03	32 986	11 935	8 004	6 057	10 368	14 597	10 777
04	22 727	38 648	16 142	12 560	20 356	27 657	22 655
05	51 420	29 561	35 283	21 845	39 659	45 455	38 820
06	30 892	101 950	18 459	14 132	19 597	23 909	21 035
07	19 473	18 233	11 174	10 981	159 410	38 367	1 641 874
08	11 808	31 500	8 212	6 263	9 715	12 829	10 366
09	279 042	83 500	42 816	28 912	77 074	123 553	74 434
10	134 785	89 779	35 455	25 905	74 510	128 060	71 608
11	118	86	103	127	1 631	139	107
12	2 371	10 196	1 724	1 391	1 834	2 198	1 976
13	1 794	6 127	1 377	1 090	1 415	1 700	1 526
14	1 019	2 676	384	315	1 183	614	472
15	2 372	5 209	643	459	813	1 127	836
16	1 430	4 038	945	714	1 125	1 491	1 175
17	26 748	202 061	6 858	7 008	16 571	22 187	45 963
18	16 793	11 001	9 459	7 704	12 301	12 957	18 500
19	26 449	18 453	16 238	13 308	21 409	22 147	32 374
20	34 800	22 492	27 528	21 234	29 463	32 745	30 003
21	4 499 365	1 170 066	190 853	161 819	1 001 696	252 376	1 756 764
22	65 738	76 292	30 694	24 609	33 101	34 670	68 472
23	39 134	69 391	31 861	24 780	32 835	38 653	35 398
24	45 693	1 062 188	1 623 489	59 829 825	1 433 484	1 134 091	185 640
25	633 169	1 645 368	832 700	748 661	525 922	402 505	520 218
26	10 143 539	6 239 822	64 411	45 275	96 873	74 380	53 043
27	14 632	9 840	11 989	9 621	12 345	14 544	13 343
28	562 377	116 914	47 190	34 557	95 430	163 199	91 937
29	68 376	53 035	35 060	22 539	38 243	40 492	37 626
30	72 194	50 857	60 601	46 579	61 696	73 271	67 985
31	37 205	107 121	24 485	18 594	30 550	41 803	31 778
32	33 697	296 564	21 984	16 966	22 878	27 351	24 152
33	14 307	9 516	11 771	9 055	12 794	14 879	13 175
34	449	327	394	454	6 209	528	407
35	87 345	1 318 593	15 533	17 520	34 186	44 562	177 879
36	227 368	345 027	93 451	107 236	217 673	276 373	1 050 691
37	831 847	361 925	106 307	269 293	583 774	434 957	2 064 790
38	428 022	3 176 938	229 249	214 129	304 404	859 249	198 341
39	37 451	7 783	1 913	1 410	3 455	3 730	12 273
40	2 324 627	2 408 068	917 938	684 233	2 002 105	3 451 444	1 903 925
41	1 060 266	2 759 467	1 396 610	1 255 667	880 956	674 739	861 134
42	63 205	58 905	36 273	35 166	205 082	118 768	5 475 415
43	100 352 791	136 725	72 326	51 738	71 173	164 375	206 771
44	1 883 364	100 167 774	36 428	17 679	17 830	17 132	14 917
45	15 035	19 761	102 424 713	17 824	1 864 756	540 519	265 856
46	19 800	31 276	1 537 045	100 167 965	2 126 475	1 507 852	249 751
47	313 929	298 761	219 647	374 350	106 236 582	2 676 071	757 833
48	161 872	425 422	713 294	1 226 756	213 456	103 256 956	645 887
49	1 218 419	1 124 731	684 881	682 960	683 184	998 207	124 434 892
50	32 122	27 137	18 095	18 913	220 026	30 921	53 578
51	1 505 202	9 525 192	8 626 598	3 345 506	2 691 842	1 802 236	1 577 555
52	1 311 537	2 598 241	1 433 707	1 012 485	908 208	816 751	656 681
53	7 819 225	5 820 741	10 704 513	2 153 300	13 525 570	13 368 177	11 037 325
54	634 810	406 058	539 457	411 452	548 877	652 561	602 029
55	111 735	138 690	46 598	34 559	47 462	54 822	39 914
56	5 696 615	4 477 459	1 574 354	318 939	1 974 066	1 438 558	1 538 094
57	1 369 458	1 027 457	829 700	337 184	631 308	610 594	683 890
58	111 097	73 390	91 148	324 826	117 146	166 744	159 608
59	1 609 976	624 747	749 869	105 457	773 526	432 146	446 131
60	113 681	200 759	359 196	206 268	268 534	272 243	134 318
61	1 858 854	2 131 506	2 153 187	1 181 092	1 891 354	2 827 044	2 550 593
62	634 272	739 752	3 536 403	1 144 472	2 312 577	1 131 343	711 643
63	-	-	-	-	-	-	-
64	264 743	109 298	112 745	234 883	331 628	222 269	109 811
65	360 869	127 617	179 729	245 582	176 190	351 403	152 945
66	-	-	-	-	-	-	-
TOTAL	152 072 838	152 358 858	142 744 824	177 414 583	145 996 992	142 334 419	163 845 313

	Other manufacturing industries	Electricity, gas and water	Construction industry	Commerce	Restaurants	Rail transport	Road transport
Demand	50	51	52	53	54	55	56
Supply	50	51	52	53	54	55	56
01	85 013	65 566	423 744	122 763	4 929 666	253 452	350 500
02	27 548	15 707	34 728	35 434	2 022 008	87 879	20 652
03	12 855	9 545	19 152	18 289	1 169 523	38 043	6 008
04	652 856	21 266	38 460	41 383	2 365 061	69 719	14 472
05	44 942	38 579	73 474	164 008	4 038 538	164 404	25 326
06	23 741	23 465	45 893	50 176	3 113 942	104 413	15 535
07	121 694	17 976	25 145	16 331	16 342	190 844	187 575
08	13 397	10 268	19 661	20 659	1 259 986	42 642	6 598
09	69 029	40 021	85 333	82 187	1 650 875	87 841	20 196
10	48 851	32 751	62 292	11 549	217 114	41 304	13 910
11	136	192	227	149	3 415	244	70
12	1 805	2 249	4 455	5 087	309 942	10 831	1 541
13	1 371	1 733	3 429	3 974	241 116	8 657	1 207
14	436	496	919	853	48 827	1 770	289
15	733	768	1 553	1 427	84 967	3 030	477
16	994	1 178	2 240	2 310	140 445	4 784	745
17	137 464	8 645	31 265	10 101	115 883	43 977	10 679
18	782 813	14 007	23 668	25 709	1 345 749	68 340	10 903
19	1 493 878	24 478	40 258	43 628	2 277 188	119 477	18 725
20	607 596	40 069	65 797	74 848	4 447 901	174 399	25 464
21	8 317 719	251 286	5 220 274	79 692	475 206	3 050 031	225 939
22	269 720	78 591	1 779 077	19 628	116 756	237 800	14 500
23	185 780	41 176	79 417	93 439	5 745 727	197 695	28 251
24	4 183 101	779 519	375 695	10 186	38 461	1 295 835	29 070
25	536 945	7 129 935	475 006	426 451	810 670	3 351 733	2 461 041
26	170 421	176 599	4 155 440	38 340	149 873	531 525	19 548
27	11 664	16 315	29 143	31 065	2 067 693	71 684	10 591
28	65 292	45 334	100 500	24 007	863 829	72 171	20 140
29	57 764	46 589	87 586	78 637	4 345 018	174 471	475 567
30	57 651	77 762	150 935	178 595	11 106 645	361 454	52 945
31	24 957	30 355	57 614	57 396	3 481 081	118 439	18 858
32	24 805	27 938	55 427	58 184	3 495 122	122 642	18 160
33	11 099	15 015	28 025	32 459	1 990 421	65 129	10 005
34	516	732	866	532	13 092	928	267
35	614 216	25 964	76 615	43 607	148 468	204 330	45 162
36	3 953 431	158 953	345 823	295 406	984 371	1 372 412	292 819
37	2 798 592	141 337	2 352 366	99 368	251 819	628 124	256 525
38	462 415	526 507	484 613	436 428	555 054	1 364 065	391 867
39	8 277	2 366	8 806	4 622	177 351	9 675	7 145
40	1 189 611	854 670	1 576 857	233 232	935 357	950 838	354 149
41	899 490	11 959 469	796 212	715 029	1 351 745	5 637 262	4 126 579
42	150 962	58 012	65 103	53 515	50 939	630 443	624 656
43	332 959	189 230	4 013 091	60 743	362 118	553 883	38 970
44	20 038	22 037	1 726 582	13 776	33 369	218 011	6 908
45	55 615	31 937	457 681	7 285	18 331	93 410	34 191
46	6 961 098	45 606	568 593	10 727	26 934	128 269	36 393
47	1 810 170	496 805	5 503 695	120 739	529 539	1 075 925	235 518
48	162 811	992 611	569 610	54 938	178 939	376 644	169 592
49	837 808	1 216 270	1 047 081	958 561	912 518	14 016 252	14 160 290
50	100 154 681	22 106	38 301	28 153	45 585	278 425	47 697
51	1 655 281	103 936 454	707 966	392 425	1 643 741	3 500 528	472 513
52	693 430	4 179 895	100 851 269	763 450	1 692 032	12 653 215	369 724
53	14 410 546	4 744 035	14 032 440	100 934 304	10 585 313	8 211 276	3 047 493
54	501 116	678 673	1 315 004	1 668 765	100 695 891	3 212 923	458 732
55	52 659	174 832	168 299	51 432	65 925	100 223 611	49 472
56	2 349 776	945 331	4 575 133	1 285 742	2 554 353	1 572 063	101 680 036
57	1 241 777	2 754 404	1 388 150	322 704	1 045 339	1 745 451	862 741
58	135 723	155 582	135 053	233 416	111 499	153 790	46 534
59	1 204 395	474 553	1 138 810	65 357	491 695	1 178 058	582 932
60	137 471	245 337	257 765	311 345	390 196	190 081	139 502
61	1 880 678	1 884 075	1 874 258	4 763 182	2 333 776	5 103 135	1 261 516
62	642 720	776 203	1 357 223	1 479 819	1 262 095	1 168 259	333 625
63	-	-	-	-	-	-	-
64	153 023	121 030	203 607	335 345	225 612	3 268 391	211 701
65	170 899	121 755	162 985	65 057	360 336	245 893	153 050
66	-	-	-	-	-	-	-
TOTAL	164 126 403	147 067 173	161 430 585	117 524 531	191 445 464	181 068 380	134 504 651

	Waterway transport	Air transport	Forwarding	Communications	Financing	Construction industry	General government national defense
Demand	57	58	59	60	61	62	63
Supply							
01	431 467	310 306	42 647	139 019	127 333	83 637	-
02	32 744	118 841	19 968	42 066	48 653	15 666	-
03	17 216	71 833	5 976	14 701	21 863	8 726	-
04	38 260	145 002	16 655	48 849	54 846	20 170	-
05	242 809	239 886	23 311	70 368	89 966	31 956	-
06	79 476	272 446	15 235	39 648	61 599	32 307	-
07	128 516	71 747	16 910	78 772	10 010	8 623	-
08	33 835	105 035	6 410	16 429	24 850	10 049	-
09	41 693	125 491	22 280	50 853	40 148	22 992	-
10	24 214	43 086	16 673	36 694	12 732	12 722	-
11	4 740	28 850	82	602	228	725	-
12	5 867	26 036	1 512	4 311	6 349	3 226	-
13	3 958	18 558	1 175	3 525	5 038	2 303	-
14	3 531	18 675	299	568	1 069	966	-
15	2 470	9 241	458	1 282	1 745	1 175	-
16	4 538	11 336	732	1 840	2 760	1 393	-
17	32 315	23 614	10 434	65 646	6 626	6 291	-
18	145 385	86 640	10 244	44 750	31 752	11 061	-
19	273 566	147 918	17 970	79 794	54 755	18 862	-
20	406 020	260 601	23 618	72 403	96 921	32 555	-
21	252 923	237 215	295 900	619 149	146 666	655 456	-
22	41 934	53 695	61 211	192 931	43 918	720 167	-
23	121 863	360 621	27 064	74 614	115 438	40 572	-
24	36 820	28 682	35 721	75 221	21 571	50 657	-
25	2 367 502	4 552 783	809 857	674 061	212 180	143 646	-
26	84 936	109 158	122 172	433 794	94 401	512 018	-
27	94 625	321 531	9 907	30 328	42 305	14 868	-
28	47 669	91 147	23 729	53 499	27 400	22 162	-
29	519 989	267 998	26 943	74 558	96 295	37 978	-
30	184 417	762 950	50 654	128 456	214 530	78 112	-
31	112 662	321 966	18 285	45 279	68 295	27 269	-
32	133 011	459 018	18 456	51 712	72 378	57 777	-
33	55 185	205 216	9 728	24 405	41 629	20 636	-
34	18 043	109 944	312	2 291	868	2 761	-
35	161 940	80 067	34 771	349 139	22 505	18 222	-
36	1 121 113	532 225	218 841	2 396 915	102 136	85 752	-
37	243 050	199 104	540 394	392 311	89 413	309 498	-
38	386 417	514 534	644 460	2 824 047	1 553 501	369 614	-
39	10 915	13 356	1 617	5 609	4 308	2 347	-
40	549 228	872 459	429 428	931 614	247 923	303 361	-
41	3 969 900	7 635 757	1 358 266	1 129 892	355 650	240 783	-
42	423 616	237 041	54 438	256 196	32 490	26 345	-
43	108 862	134 450	124 311	434 713	99 700	501 196	-
44	33 491	42 263	49 973	178 761	38 340	212 309	-
45	31 803	27 125	21 340	59 442	13 234	61 201	-
46	43 043	33 313	39 224	81 266	23 343	74 230	-
47	315 064	497 774	358 432	688 907	164 044	693 013	-
48	241 138	133 593	252 363	473 209	115 040	86 961	-
49	8 925 380	5 032 824	1 143 857	2 581 244	650 569	436 355	-
50	127 172	44 590	188 426	103 510	82 622	46 837	-
51	944 290	631 929	1 307 645	2 637 866	659 264	260 612	-
52	1 910 732	2 413 365	2 895 840	10 359 754	2 260 947	12 386 570	-
53	3 609 485	2 834 922	2 731 949	4 101 496	1 619 709	2 058 387	-
54	761 563	5 591 198	451 477	1 094 938	1 916 013	697 770	-
55	57 815	32 155	47 113	178 076	118 777	29 183	-
56	646 270	728 452	995 068	1 357 951	858 358	1 131 584	-
57	111 009 436	1 524 452	350 120	525 052	144 757	216 753	-
58	78 720	108 430 430	77 158	1 991 583	530 194	125 413	-
59	3 409 825	309 156	100 129 547	275 939	85 272	161 538	-
60	322 998	929 844	539 856	100 418 067	1 301 743	141 069	-
61	4 598 502	3 846 478	3 552 058	4 686 991	101 116 455	1 639 107	-
62	1 250 073	3 492 442	4 076 772	1 147 120	2 323 782	109 773 257	-
63	-	-	-	-	-	-	100 000 000
64	838 355	761 334	184 732	2 754 561	1 448 772	96 763	-
65	200 658	337 776	158 650	265 106	506 242	348 826	-
66	-	-	-	-	-	-	-
TOTAL	152 357 490	157 822 844	124 711 853	147 955 162	120 272 738	125 764 359	100 000 000

	Social welfare service	Entertainment	Unclassifiable	
Demand	64	65	66	TOTAL
Supply				
01	1 082 562	69 139	-	282 488 502
02	685 805	25 162	-	107 118 415
03	22 181	11 787	-	115 325 891
04	49 416	28 647	-	133 465 485
05	761 865	161 471	-	112 766 916
06	102 336	37 797	-	158 511 412
07	13 496	18 346	-	220 379 855
08	28 859	12 455	-	144 236 191
09	127 852	91 379	-	215 069 260
10	89 296	97 474	-	119 500 170
11	61	350	-	190 124 702
12	26 888	3 078	-	126 126 609
13	28 929	2 117	-	129 353 475
14	2 201	938	-	113 999 433
15	4 298	1 549	-	102 437 144
16	3 637	1 653	-	101 674 623
17	36 669	155 184	-	125 154 194
18	334 268	43 260	-	161 854 005
19	624 276	87 377	-	111 874 257
20	811 532	25 573	-	112 137 796
21	256 452	143 512	-	176 991 530
22	57 549	30 648	-	110 076 865
23	419 657	30 811	-	149 720 722
24	38 350	27 859	-	174 034 590
25	347 360	315 059	-	210 237 666
26	105 210	70 165	-	130 446 133
27	145 027	11 405	-	123 802 026
28	111 119	124 491	-	113 789 833
29	679 664	33 279	-	119 516 433
30	208 092	59 041	-	139 931 368
31	49 958	38 985	-	131 530 202
32	240 516	63 700	-	111 930 627
33	15 660	84 527	-	106 026 984
34	233	1 332	-	100 173 035
35	142 305	932 746	-	135 570 478
36	944 548	2 815 959	-	186 958 546
37	595 283	139 545	-	136 324 074
38	1 966 221	817 214	-	149 463 807
39	27 199	14 098	-	122 408 678
40	2 222 906	2 620 024	-	197 362 232
41	581 350	527 725	-	177 581 204
42	41 282	55 181	-	111 136 744
43	205 402	244 072	-	114 375 891
44	37 891	21 653	-	105 673 068
45	14 632	10 101	-	106 800 353
46	45 196	21 334	-	114 893 977
47	278 768	185 274	-	141 944 024
48	89 539	369 494	-	118 778 931
49	479 956	545 026	-	213 026 199
50	378 370	56 907	-	104 096 875
51	944 750	1 355 827	-	206 236 359
52	2 027 906	1 015 921	-	203 909 038
53	3 878 484	2 736 318	-	459 732 207
54	414 514	522 625	-	139 428 619
55	36 357	27 890	-	103 145 649
56	924 198	1 119 590	-	192 626 863
57	307 351	263 494	-	158 769 739
58	95 673	69 109	-	116 791 595
59	177 312	135 472	-	134 265 645
60	189 821	120 137	-	111 792 087
61	505 019	1 605 765	-	212 395 529
62	569 236	2 012 710	-	148 349 881
63	-	-	-	100 000 000
64	100 198 722	162 995	-	116 597 684
65	457 853	106 822 755	-	118 058 394
66	-	-	100 000 000	100 000 000
TOTAL	126 620 397	129 291 515	100 000 000	9640 109 061

Table 10.3.6 Amounts of Investment by Industry

(In million Rupiahs)

Classification by industry	Amount
Wooden goods	7244
Oil refining industry	4960
Nonmetallic goods	15853
Cement manufacturing industry	11151
Basic steel products	34552
Nonferrous metals	3393
Metals	34980
Electric machinery and appliances	10369
Conveyances and maintenance	3162
Other manufacturing industries	31114
Construction industry	73817
Total	230595

Table 10.3.7 Amount of Repercussion to Production by Industry

(In million Rupiahs)

No.	Industry	Amount	No.	Industry	Amount
1	Rice plants	538	36	Sewing industry	1873
2	Rice	55	37	Lumber and its products	1602
3	Maize	26	38	Printing industry	1177
4	Cassava	243	39	Fertilizer manufacture	17
5	Vegetables and fruits	85	40	Refining industry	2810
6	Other edible crops	66	41	Oil refining industry	1888
7	Rubber	156	42	Rubber goods	331
8	Cane sugar and fruit sugar	26	43	Nonmetallic goods	517
9	Coconuts	157	44	Cement manufacturing industry	484
10	Palm oil	115	45	Steel industry	751
11	Tobacco	1	46	Nonferrous metals	3585
12	Coffee	6	47	Metals	1565
13	Tea	4	48	Electric machinery and appliances	542
14	Clove	2	49	Conveyances and maintenance	1579
15	Nutmeg	3	50	Other manufacturing industries	138
16	Other spices	3	51	Electricity, gas and water	6447
17	Other plants	123	52	Construction industry	10857
18	Livestock	49	53	Commerce	18690
19	Meat	500	54	Restaurants	1338
20	Poultry farming	247	55	Rail transport	116
21	Lumbering	6138	56	Road transport	4461
22	Other agricultural products	402	57	Waterway transport	1740
23	Fisheries	132	58	Air transport	274
24	Iron ores	4624	59	Forwarding	1654
25	Well drilling and natural gas	4084	60	Communications	379
26	Other well drilling	2797	61	Financing	3790
27	Fabrication of keepable food	31	62	Construction industry	2592
28	Oil products	215	63	General government and national defense	
29	Rice polishing	101	64	Social welfare service	306
30	Wheat and other seeds	154	65	Entertainment	562
31	Sugar refining industry	73			
32	Food manufacturing industry	110			
33	Drinks manufacturing industry	33			
34	Tobacco industry	4		Total	93775
35	Textile industry	407			

10.4 Education and Training of Personnel

10.4.1 Present Situation of PJK's Personnel Education

The Indonesian State Railways is concentrating its efforts on an improvement of its facilities in order to raise the transport efficiency and strenuously carrying out the education and training of personnel to secure personnel with necessary skills with the collaboration of Department Pendidikan dan Kebudayaan (Department of Education and Culture) and universities. An outline of these efforts is given below.

The education and training of personnel of the Indonesian State Railways are carried out by two educational facilities -- the Railway Engineering College and the Training Center. On-the-job training is also conducted at each workshop.

(1) Railway engineering college

The Railway Engineering College was established in Bandung in 1950. It has four educational courses. The four courses concern the operation of trains, maintenance of railway tracks and civil engineering work and the technical systems of signals, communication and machinery. They are designed to bring up cadre technicians. The term of each course is three years and it has 30 trainees.

In 1950 through 1960, the Railway Operational Academy with a four-year course was established to bring up cadre technicians for the Indonesian State Railways. The fact that this Academy made a fresh start as the Railway Engineering College attests to Indonesia's awareness of the importance of training personnel -- cadre technicians, in particular. For enrollment in the College, prospective applicants must be those who have served as railwaymen for 2~4 years after graduation from high school and have been recommended as diligent workers by the chiefs of the workshops to which they are assigned. The trainees are selected from among them in an entrance examination.

(2) Training center

There are two Training Centers in Bandung and a third in Yogyakarta. These centers aim at training the supervisors or blue-collar workers and cadre officials.

The training centers in Bandung have business, signals and communications, civil engineering work, and management and technical control courses. The training period is three or six months. Each course accepts about 30 trainees. It is opened two or four times a year. About 60 to 120 are trained.

The training center in Yogyakarta is located next to a railway workshop and engaged in the education and training of diesel locomotive engineers, checkup men and personnel of other workshops. The training period is 13 weeks for locomotive engineers, 19 days for vehicle checkup men and two months for other personnel of workshops. In each course, 25 men are trained each time.

The training consists of lectures and practical training. The former accounts for 70~80 percent of the training period.

In addition to the aforementioned training courses, the Indonesian State Railway authorities have four courses for basic training. These courses are designed to provide about one year of re-education, depending on the school career. They primarily consist of on-the-job training at the workshops.

In the Republic of Indonesia, two five-year development programs have been formulated and performed in the past. At present, the Third Five-Year Development Program (PELITA III) which was started in 1979 is under way. As part of this program, the state railways has plans to shift the educational emphasis to the technical aspects as follows in response to advances in technology. In other words, stress is put on technical education as is discernible from the following rates of trainees in the technical education:

PELITA IV	25:75
PELITA V	35:65
PELITA VI	50:50

The program for fiscal 1982 includes:

- Investment in and replenishment of the training centers
- Assignment of full-time instructors
- Collaboration with universities and related institutions
- Review of selective examination system

The program for fiscal 1983 includes:

- Replenishment of the curriculum
- Replenishment of staff officials to facilitate the activity of the training centers
- Replenishment of instructors
- Enlightenment and education to awaken PJKA personnel as railwaymen.

The Education and Training Program for fiscal 1982 is shown in Table 10.4.1.

The organization for the education and training of personnel is illustrated in Fig. 10.4.1.

10.4.2 Reinforcement and Improvement of Education and Training

In order that the Indonesian State Railways may accomplish its mission as a public means of land transport, its modernization is an urgent task, to say the least of the land facilities and vehicles referred to in this report. Naturally, it is staff officials of the state railways that give full play to the capacities of these superior facilities. For this reason, whether or not this education and training will come out to be a success is infallibly influences the future management of the state railways.

The education and training of personnel should be designed to awaken them to the mission the Indonesian State Railways ought to accomplish and their role as staff members. At the same time, they are designed to acquaint themselves with knowledge and skills of the kind which may drive them to have confidence in themselves as professionals. (This point is referred to in the fiscal 1983 program.) For this, there is a need to develop and establish a system of education and training, both qualitatively and quantitatively.

The education and training of personnel may be divided into two -- one at the workshops and the other at specified educational facilities.

Education and training at the workshops constitute the basis for the education and training of staff officials. In other words, it is necessary that managers or officials in a leading position should keep themselves well acquainted with the knowledge, aptitude and attitude of their subordinates and come to grips with the necessity of educating and training them so that their education and training may be carried out in an effective and reasonable manner. Naturally, it is desirable that close ties of collaboration be established with educational institutions in the state railways. Presumably, education and training at the workshops may include, among others, on-the-job training in the routine work process, lecture meetings in concentrated education, lectures to cadre officials on the management of workshops, competitions to boost knowledge and skills, and lecture meetings on over-the-counter service to personnel assigned to the business sector.

Education through educational institutions may include, among others, regular education for the newly employed and promotion, correct distribution of personnel, education for adaptation to newly introduced techniques, re-education for the qualitative enhancement of personnel and the selection of personnel in a managerial position, and instruction by correspondence which may be received during the off-duty hours. For these types of education, it is desirable to assign full-time instructors who have an extensive knowledge about all aspects of the railway business, to say the least of their specialized sector.

In addition, a system of commissioning education may be conceived whereby skillful personnel may be dispatched to educational institutions for a certain period in order that they may acquaint themselves with knowledge and skills necessary, for the execution of their duties. By encouraging suggestions a system may also be conceived to enhance the consciousness of participation on the part of personnel. Their interest in work may be fostered by encouraging personnel to come out with excellent ideas and designs, so that their work volition may be enhanced and such ideas and designs may reflect the management.

When the above methods for education and training are studied, it may be pointed out, first of all, that the facilities available at present are obsolete and wanting. This situation makes it inevitable to confine the rate of lectures to practical training to 7:3 or 8:2. For practical training, moreover, industrial facilities which are in operation inevitably have to be used. But it is a fact that the technical innovations at present are so remarkable that the use of teaching aids is indispensable for the understanding of what is taught in a lesson. With this in mind, it is desirable that obsolete facilities be replaced and the educational environment improved with the demand of education taken into account.

As is elucidated in this report, plans are afoot for an improvement of the railway tracks, construction work for the installation of automatic signals, development of workshops and rolling stock depots. These construction projects offer unparalleled opportunities for education and training. Plans are also afoot for the progressive introduction of electric locomotives. Given this situation, it is necessary to work out elaborate programs to prevent any deviation or gap in the acquisition of technology by programming the participation of many personnel in the introduction of ground facilities and vehicles.

10.4.3 Personnel Training Accompanying Electrification

In the preceding section the necessity for training to raise the pride and consciousness of the State Railways' workers was discussed and the subject of actual means to realize this was touched upon. In this section the specific items are generally enlarged upon and the completion of the training center which will be a definite step towards this goal is also dealt with. Moreover, plans for the individual departments are dealt with at length in the Appendix..

After electrification-modernization has been carried out, the training center will play an important role in the development of PJKA's overland transportation and as such, it is essential that it be brought to completion. Its location is expected to be at either Jakarta or Bandung in the center of the PJKA region.

An outline of the training center, fully equipped with the facilities required for training in each department, is as follows. Since practical training is indispensable to professional education, the training center must be equipped with special training apparatus.

This example practice room for each department operation, electricity, construction and engineering, is arranged to give fundamental general training. In actual practice, it may be necessary to train in the field.

Since education extends for a long period of time, dormitory space is provided to all students. Therefore, not directly concerned with actual practice, education in daily living is also paid attention.

In other words, education in daily living is based on the personality formation as a good member of society and a good railwayman. It aims at education of active staff, who will develop their abilities on their own, conscious of each individual's problems. For this purpose, the dormitory system will (1) give strict discipline, (2) foster independent spirit, (3) encourage a cooperative spirit and (4) keep good manners. Thoroughgoing education will be carried out in this manner. Also, communication between seniors and juniors is considered a means of education.

1) Outline of facilities (draft)

a) Area of the site	35,000m ²
b) Building area	11,500m ²
Main building (5-storied)	3,500m ²
Practice building (2-storied)	3,500m ²
Gymnasium	1,000m ²
c) Class room	
General class room	20 rooms 350 men
Special class room (audiovisual education, etc.)	3 rooms 150 men
d) Student dormitory	3,500m ²

2) Training center layout plan

Fig. 10.4.2 shows an outline draft.

Table 10.4.1 Training Program (1)

FY 1982

No.	Education course	Persons/year	Period	Place
1	1st phase, training of new personnel	762	2 weeks	on-the-job training at each branch
2	Training of new personnel graduated from university or bachelors	21/25	1 year	Bandung and study tour
3	Training of personnel associated with accounting and personnel affairs	30	2 months	Bandung Air Force School used
4	Training of personnel associated with material	30	2 months	"
5	Training of enginemen	37	9 months	PJKA Training School in Bandung
6	Training of checkup men for sleeping cars	30	1.5 months	Bogor
7	Training for personnel promotion to foremanship/railway track maintenance at the Western Branch Office	120	1 week	On-the-job training at the Western Branch Office
8	Training of personnel for promotion to foremanship/railway track maintenance at the Central Branch Office	120	1 week	On-the-job training at the Central Branch Office
9	Training of personnel for promotion to foremanship/railway track maintenance in South Sumatra	50	1 week	On-the-job training in South Sumatra
10	Training of personnel associated with railway tracks and buildings	30	2 months	The same as in 3
11	Training of personnel associated with bridges	60	1 month	The same as in 5

Table 10.4.1 Training Program (II)

No.	Training course	Persons/year	Period	Place
1	2nd phase, training of newly employed personnel	1,355	2-3 weeks	On-the-job training at each branch office
2	Training of managers	30	3-4 months	Bandung
3	Training of personnel graduated from university	2	2.5 years	"
4	Training for study in foreign countries	2	2.5 "	"
5	Training of railway police men	30	3 months	"
6	Training of personnel associated with accounting and personnel affairs	60	2.5 "	"
7	Training of personnel associated with railway tracks and buildings	30	2.5 "	"
8	Training of personnel associated with bridges	30	2.5 "	"
9	Training of checkup men for sleeping cars	25	1.5 "	"
10	Training of personnel for promotion to foremanship/Western Branch Office	161	1 "	Western Branch Office
11	Training of personnel for promotion to foremanship/Central Branch Office	161	1 "	Central Branch Office
12	Training of personnel for promotion to foremanship/Eastern Branch Office	162	1 "	Eastern Branch Office
13	Training of personnel for promotion to foremanship/South Sumatra	100	1 "	North Sumatra
14	Training of personnel associated with signals for promotion	30	3 months	Bandung
15	Training of personnel associated with communications for promotion	30	3 "	"
16	Training of engineers/Western Branch Office	30	5.5 "	Western Branch Office
17	Training of engineers/Central Branch Office	30	5.5 "	Central Branch Office
18	Training of engineers/Eastern Branch Office	30	5.5 "	Eastern Branch Office
19	Training of engineers/South Sumatra	30	5.5 "	South Sumatra
20	Training of engineers/South Sumatra/Western Sumatra	36	5.5 "	North Sumatra
21	Training of diesel locomotive instructors	25	2 "	Central Branch Office
22	Diesel locomotive maintenance training/West Sumatra	25	3 "	"
23	Training of personnel graduated from university	30	6 "	Bandung
24	Other various kinds of training/Western Branch Office	30	6 "	Western Branch Office
25	Other various kinds of training/Central Branch Office	30	6 "	Central Branch Office
26	Other various kinds of training/Eastern Branch Office	30	6 "	Eastern Branch Office
27	Other various kinds of training/South Sumatra	30	6 "	South Sumatra
28	Other various kinds of training/West Sumatra	30	6 "	West Sumatra
29	Other various kinds of training/North Sumatra	30	6 "	North Sumatra
30	Other various kinds of training/Western Branch Office	30	3 "	Western Branch Office
31	Other various kinds of training/Central Branch Office	30	3 "	Central Branch Office
32	Other various kinds of training/Eastern Branch Office	30	3 "	Eastern Branch Office
33	Other various kinds of training/South Sumatra	30	3 "	South Sumatra
34	Other various kinds of training/North Sumatra	30	3 "	North Sumatra

Table 10.4.1 Training Program (III)

FY 1982

No.	Training course	Personnel	Period	Place
1	Railway Engineering College (mechanical engineering)	28	3 years	Bandung Training School
2	Railway Engineering College (civil engineering)	29	3 "	"
3	Railway Engineering College (signal and communication engineering)	30	3 "	"
4	Railway Engineering College (operation engineering)	30	3 "	"
5	Training of DL enginemen	45	6 months	Bandung
6	Training of DL assistant enginemen (I)	40	4 "	"
7	" (II)	35	4 "	"
		237		
1	DL maintenance training (I)	25	2 months	Jakarta Training School
2	" (II)	25	2 "	"
3	DL instructors' training	25	2 "	"
4	Training of personnel associated with electric facilities of passenger cars	25	1.5 "	"
5	Training of personnel associated with freight cars	25	6 "	"
		125		

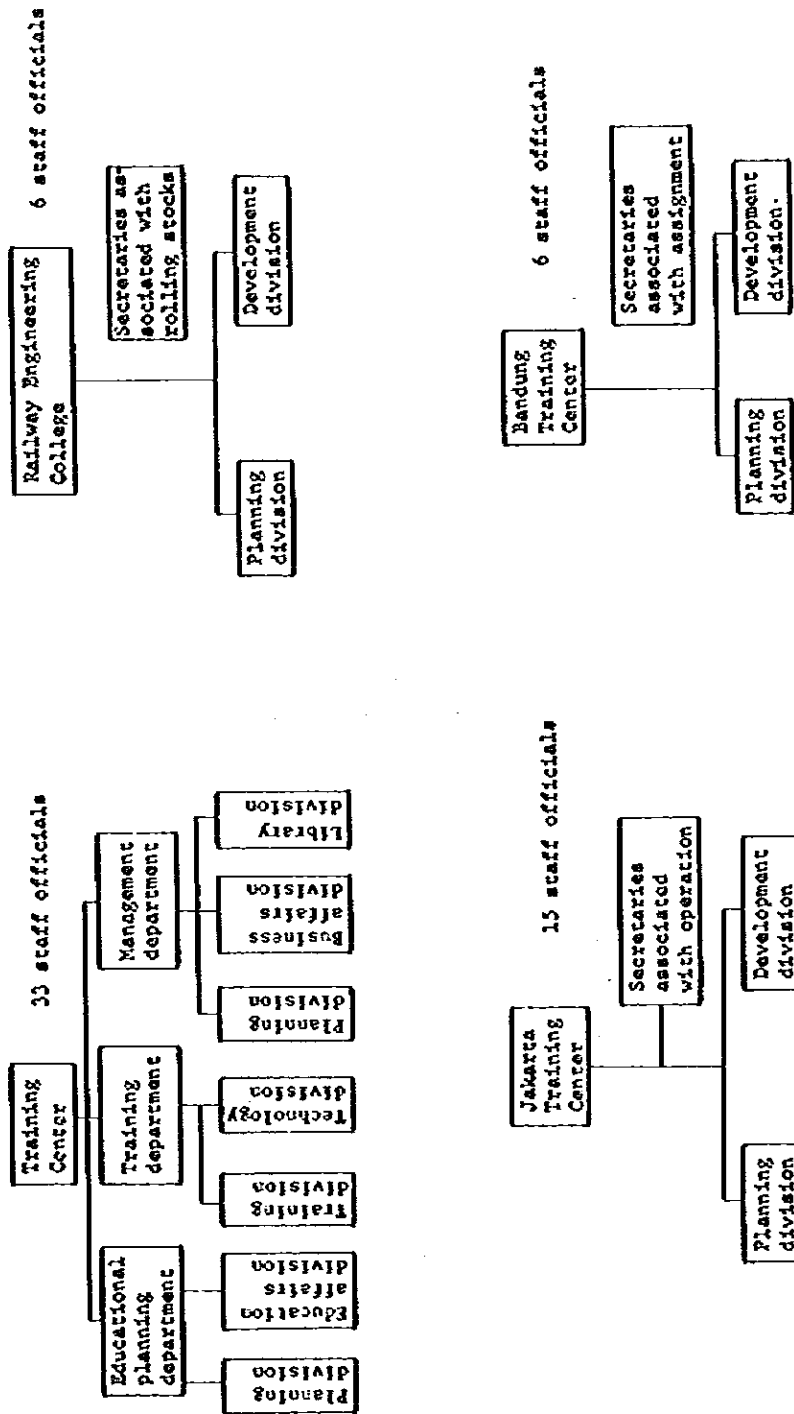


Fig. 10.4.1 Organization for Education and Training

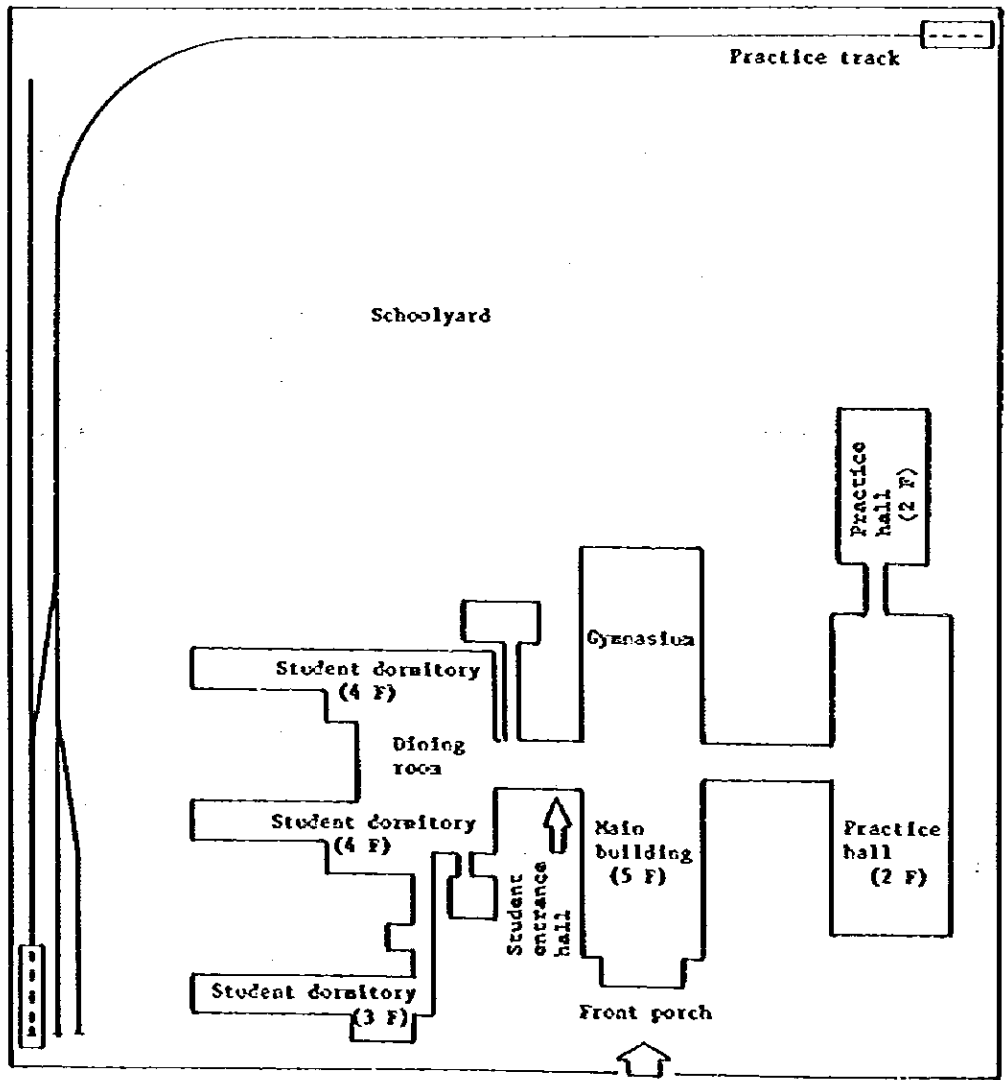


Fig. 10.4.2 Layout of Training Center (draft)

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