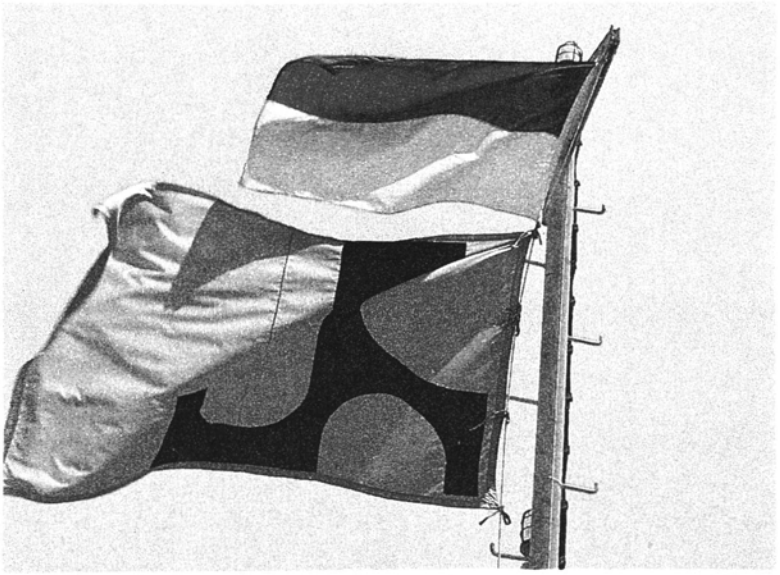
Appendix 1

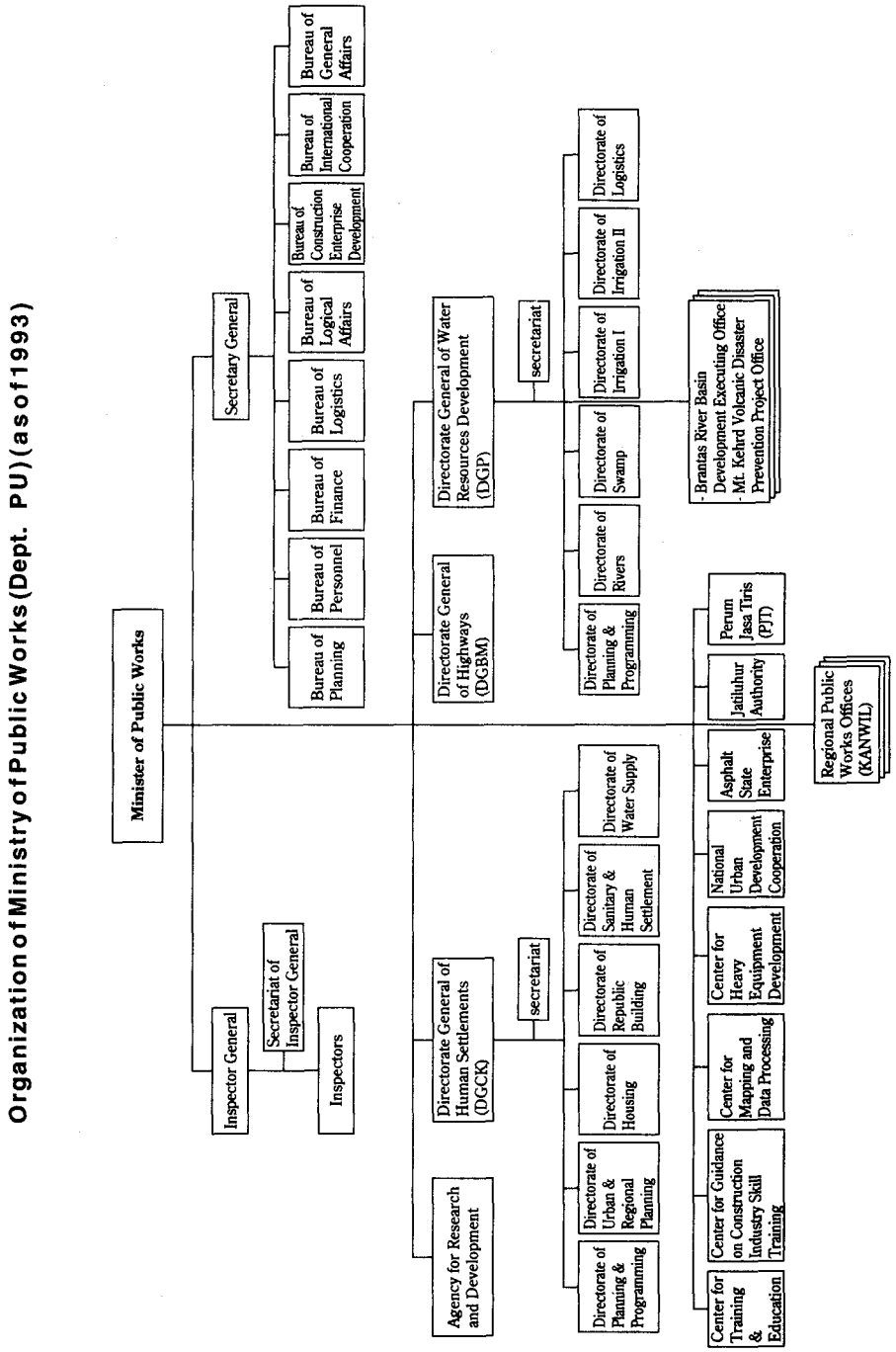
Reference Materials



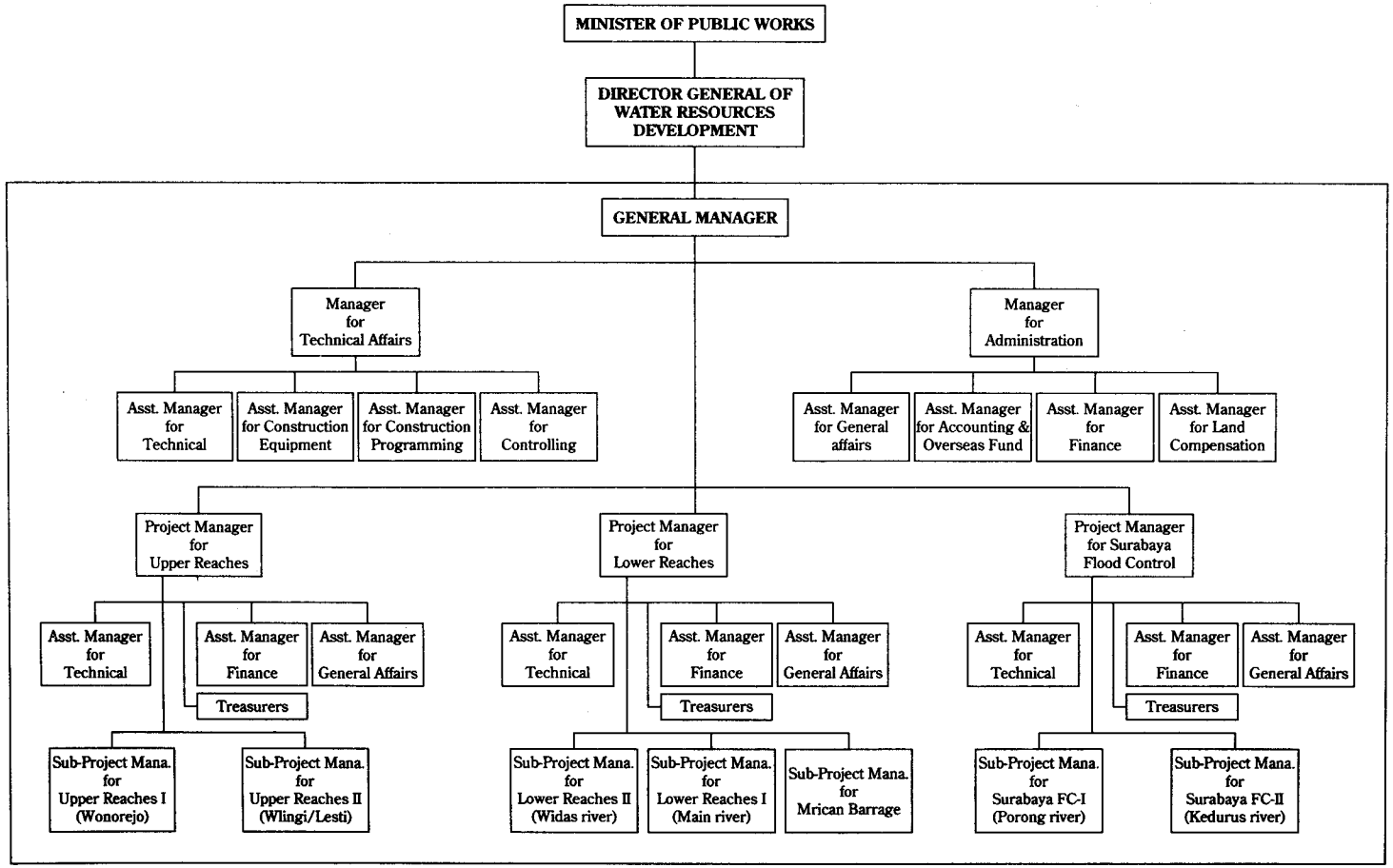
National flag of Indonesia (top) and flag of Ministry of Public Works (bottom) (photographed in 1974)

1. Organizations related to Brantas River Basin Development Project
2. Projects and A/D funds
3. Specifications of projects
4. Materials Related to Indonesia and Brantas Basin

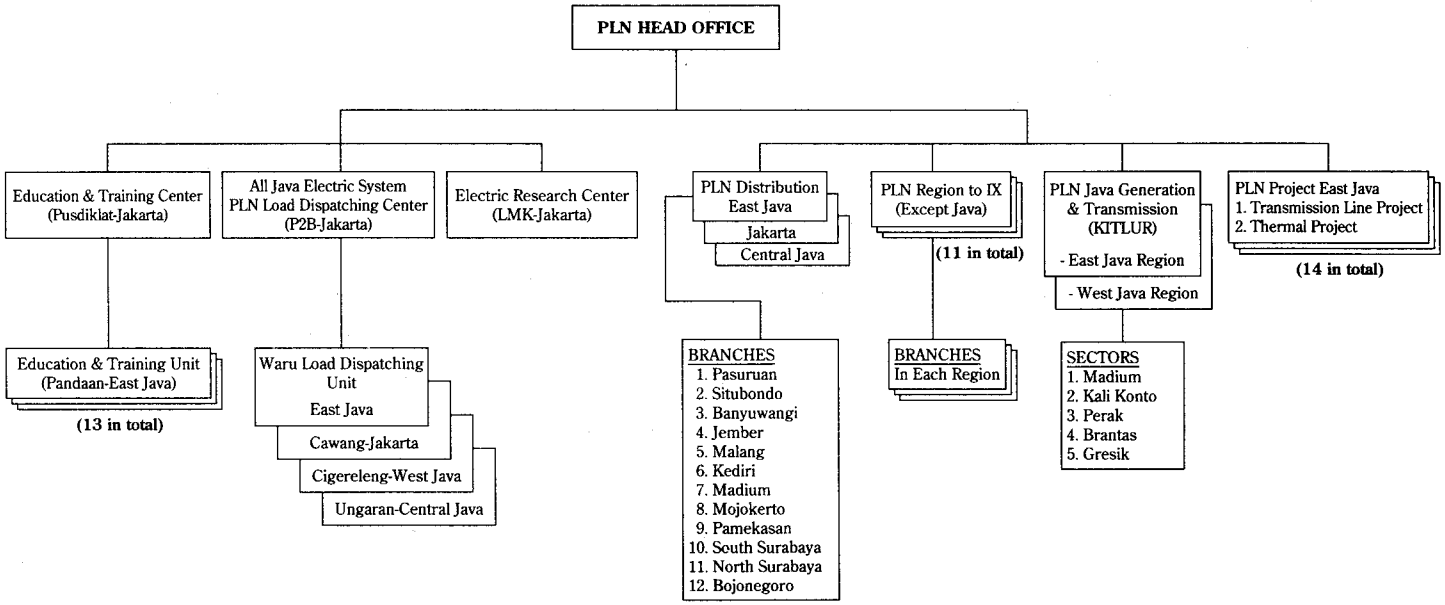
1. Organizations related to Brantas River Basin Development Project



Organization of Brantas River Basin Development Executing Office (as of 1993)



Organization of State Electric Company (PLN) (as of 1993)

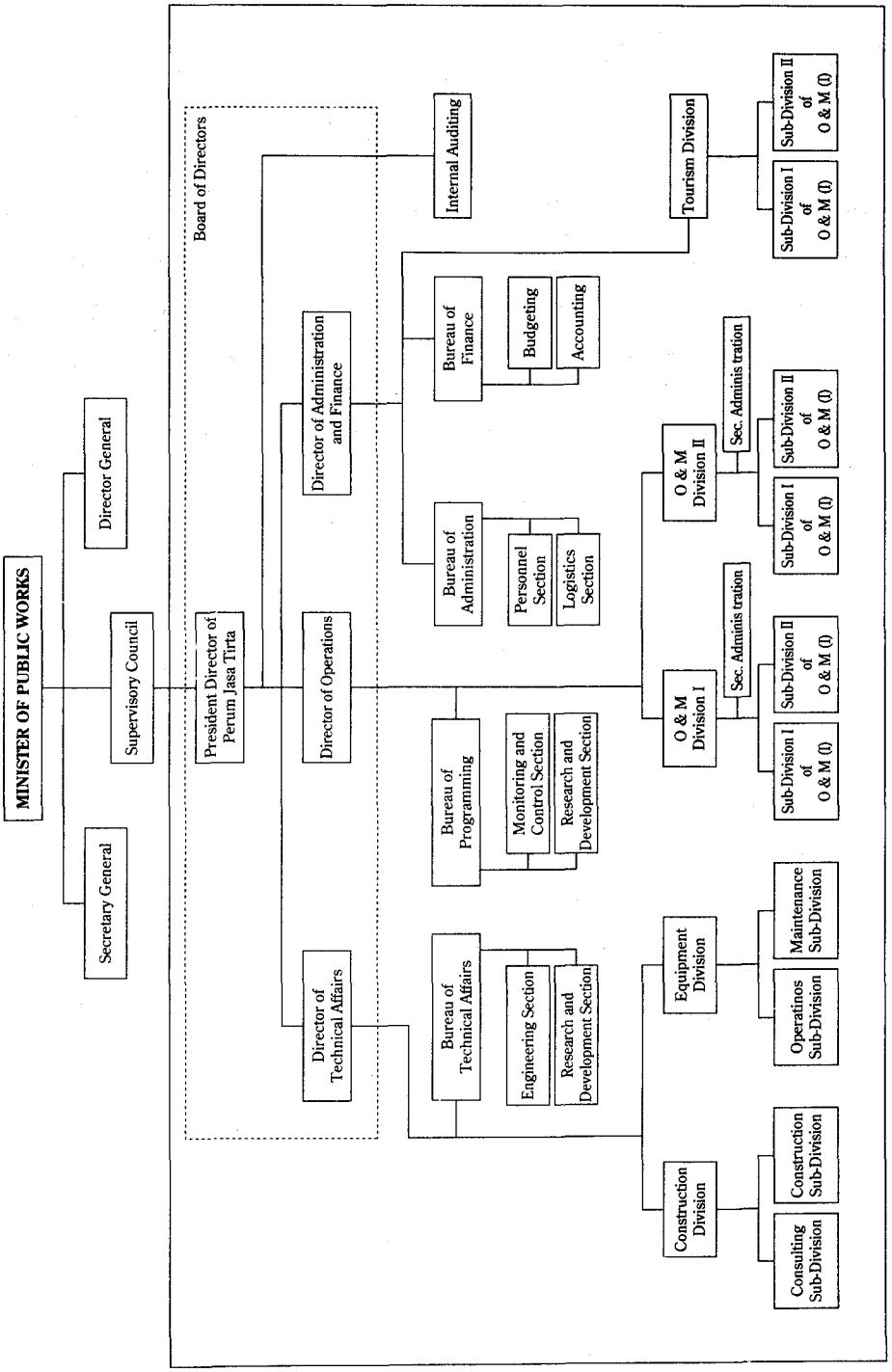


LEGEND
P2B : Pusat Prengatur Beban se-Jawa
KITLUR : Prembangkit dan Pernyalur
PIRING : Proyek Induk Jaringan
PIKITTERM : Proyek Induk Pembangkit Ternal
PUSDIKLAT : Pusat Penyelidikan dan Latihan

Note:
1) PLN Region XII was re-organized as "PLN DISTRIBUSHI JAWA TIMUR" as from January 22, 1983. PLN Region XI and XIII were also re-organized accordingly.
2) New PLN Region XI was organized for Bali Island as from January 22, 1983.
3) PLN Pembangkit dan Penyaluran Jawa was also re-organized as from February 12, 1983 Madura area is included in East Jawa region.

APPENDIX 1

Organization of Public Company (JASA TIRTA) (as of 1993)



APPENDIX 1

Trends in number of personnel in the Brantas River Basin Development Executing Office

Office	Job category	1967	1970	1975	1980	1985	1990	1995
Brantas Office	Clerical	–	35 (0)	174 (3)	160 (5)	104 (3)	96 (3)	71 (4)
	Technical	–	69 (6)	235 (27)	390 (35)	296 (22)	154 (27)	99 (21)
	Total	30	104 (6)	409 (30)	550 (40)	400 (25)	250 (30)	170 (25)
Mt. Kelud Volcanic	Clerical	–	39 (6)	193 (5)	186 (3)	145 (6)	131 (4)	64 (5)
Disaster Prevention	Technical	–	3,958 (27)	6,693 (14)	5,754 (22)	2,455 (24)	1,419 (31)	809 (43)
Project Office	Total	1,570	3,997 (33)	6,886 (19)	5,940 (25)	2,600 (30)	1,550 (35)	873 (48)
	Grand total	1,600	4,101 (39)	7,295 (49)	6,490 (65)	3,000 (55)	1,800 (65)	1,043 (73)

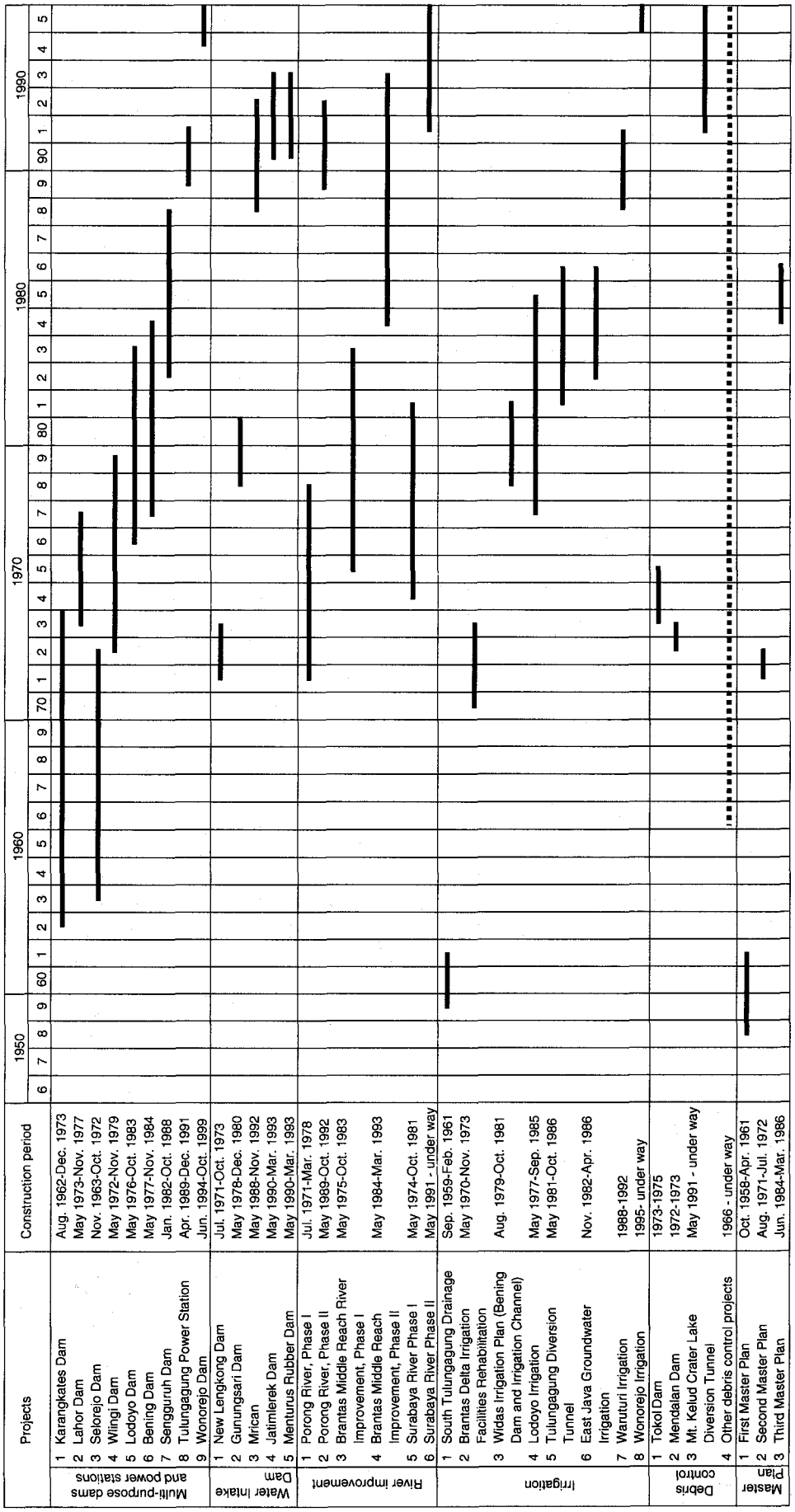
Remark: Parenthesized numbers represent college-graduate engineers.

Source: Brantas Office

APPENDIX 1

2. Projects and A/D funds

List of work schedules of projects



Master plans and projects

Development period	Master plan	Formulation, implementation, and consultancy	Projects (PJ)	Work period	Fund	Work form	Construction cost (x 10^6 yen)			Outline of project
							Foreign currency	Local currency	Total	
Phase I	1st Master Plan	Formulated in 1962 Consultancy by Nippon Koei	South Tulungagung Irrigation PJ	1959-1962	Reparations	Contracting	710	290*	1,000	Diversion channel (open channel and tunnel)
			Karangkates Dam PJ	1962-1973	Reparations, OECF, Indonesian gov.	Contracting, Brantas Office work	14,638	11,230	25,868	Fill dam, power station
			Selorejo Dam PJ	1963-1972	Reparations, OECF, Indonesian gov.	Contracting, Brantas Office work	2,843	2,554	5,397	Fill dam, power station
			Kali Porong River Improvement PJ	1971-1977	OECF, Indonesian gov.	Brantas Office work	1,459	7,221	8,680	River improvement
			Lengkong Dam PJ	1971-1973	OECF, Indonesian gov.	Brantas Office work	–	–	–	Diversion wier
			Brantas Delta Irrigation PJ	1970-1973	OECF, Indonesian gov.	Brantas Office work	468	1,102	1,570	Irrigation facilities rehabilitation and improvement
			Karangkates Expansion PJ (Lahor Dam)	1973-1977	OECF, Indonesian gov.	Brantas Office work	3,268	8,444	11,712	Fill dam, generator extension (Karangkates Power Station)
			First Master Plan				200	–	200	
Phase II	2nd Master Plan	Formulated in 1972 Implemented by OTCA Consultancy by Nippon Koei	Wlingi Dam PJ	1975-1978	OECF, Indonesian gov.	Brantas Office work	6,150	12,500	18,650	Fill dam
			Lodoyo Dam and Power Station PJ (incl. Wlingi P/S)	1977-1984	OECF, Indonesian gov.	Brantas Office work	7,008	3,141	10,149	Wlingi Power Station extension, Lodoyo Dam Power Station
			Kali Surabaya River Improvement PJ	1974-1981	OECF, Indonesian gov.	Brantas Office work	4,498	6,581	11,079	Gunungsari Dam, motorization of gates, water intake and outlet, coastal embankment
			Brantas Middle Reach River Improvement PJ (I)	1975-1983	OECF, Indonesian gov.	Brantas Office work	6,222	14,672	20,894	Bank raising, bed dredging, revetment
			Widas Dam Irrigation PJ (incl. Bening Dam)	1977-1984	OECF, Indonesian gov.	Brantas Office work	1,833	4,930	6,763	Bening Dam, channel improvement, fixed wier
			Sengguruh Dam and Power Station PJ	1982-1988	Austria, ADB, Indonesian gov.	Brantas Office work	12,404	9,300	21,704	Fill dam, power generation
			Tulungagun Diversion Improvement PJ	1989-1991	ADB, Indonesian gov. 1970	Brantas Office work, contracting	7,628	1,673	9,301	Channel, tunnel
			Waruturi Irrigation PJ (incl. Mrican Barrage)	1988-1992	ADB, Indonesian gov.	Brantas Office work, contracting	1,693	2,000*	3,693	Mrican Dam, channel
			Lodoyo Irrigation PJ	1977-1985	ADB, Indonesian gov.	Brantas Office work, contracting	1,881	5,213	7,094	Channel, irrigation facilities
			Kelud Debris Control PJ (Munguran, Tokooru Debris Barrier)	1972-1975	Indonesian gov.	Brantas Office work, contracting	0	440	440	Debris barrier
			2nd Master Plan				200	–	200	
Phase III	3rd Master Plan	Formulated in 1986 Implemented by JICA Consultancy by Nippon Koei	Brantas Middle Reach River Improvement PJ (II)	1984-1993	OECF, Indonesian gov.	Brantas Office work	6,000	14,500	20,500	Bank raising, bed dredging, rubber dam (at two locations)
			Tulungagung Power Generation PJ	1989-1991	Austria, Indonesian gov.	Brantas Office work, contracting	3,614	3,481	7,095	Power generation
			Kediri-Nganjuk Groundwater Irrigation PJ	1982-1986	IBRD, Indonesian gov.	Brantas Office work, contracting	790	1,000*	1,790	Groundwater survey, well excavation

			Wonorejo Dam and Power Generation PJ	1994-1999 (scheduled)	OECF, Indonesian gov.	Contracting	14,954	–	14,954	Fill dam, power geration
			3rd Master Plan				200	–	200	
Suste-nance and accelera-tion of project			Kali Porong River Restoration PJ	1989-1992	OECF, Indonesian gov.	Brantas Office work	1,767	2,000*	3,767	Revetment, bed dredging, bank enlargement
			Mt. Kelud Debris Control PJ	1991- under way	OECF, Indonesian gov.	Brantas Office work, contracting	3,246	1,000*	4,246	Diversion tunnel
Surabaya Urban Area Develop-ment Phase	Urban Develop-ment	Formulated in 1983 Implemented by JICA Consultancy by Pacific Consultants International	Surabaya Highway PJ	1976-1988	ADB, Indonesian gov.		10,000	–	–	Surabaya - Gunpooru
			Surabaya Beltway New Construction and Extension PJ	1994-1988 (scheduled)	OECF, Indonesian gov.	Contracting	11,256	–	–	Enlargement, new construction
			Juanda Airport Extension PJ		OECF, Indonesian gov.	Contracting	519	–	–	Airport E/S
			Communication Network Improvement PJ	1992-1994	OECF, Indonesian gov.	Contracting	11,032	–	–	In-city communication network
			Gresik Thermal Power Extension PJ	1990-1992	OECF, Indonesian gov.	Contracting	68,100	–	–	Thermal power extension
			City Sewerage Improvement and Extension PJ	1991 - under way	OECF, Indonesian gov.	Brantas Office work, contracting	4,683	–	–	Sewerage
			Others		ADB, IBRD Indonesian gov.	–	373	–	–	
					Total of construction cost	Brantas River	103,674	113,272	216,946	
						Surabaya City	105,399	–	–	
						Sum total	209,073	–	–	

Remark: For Surabaya Urban Area Development Project, listed above are all the OECF-related projects and major projects under foreign assistance other than OECF.

Foreign assistance to Brantas River Basin Projects by Year

Unit: 10^6 yen

Year	Brantas River Basin projects (excluding Surabaya City)				Surabaya City related projects (financed by OECF only)		
	Japan		Foreign countries other than Japan	Project	Surabaya City	Surabaya City related	Project
	OECF	Others (reparations and JICA			OECF		
1958		◎ 710		◎South Tulungagung Diversion			
		◎ 200		◎First Master Plan			
1968	● 1,096	◎6,925		● Selorejo Dam ◎ Karangkates Dam			
	● 4,009	◎1,239		● Karangkates Dam ◎ Selorejo Dam			
1969	● 3,704 ● 468			● Karangkates Dam ● Brantas Delta Irrigation			
	● 508 ● 979			● Selorejo Dam ● Kali Porong Improvement			
1970				● Kali Porong Improvement		◎ 2,912	◎ East Java Transmission Line
						◎ 456	◎ East Java Transmission Line
1971	● 3,356	◎ 200		● Kali Surabaya Improvement	● 373	◎ 490	● Surabaya Port Dock Improvement
				◎2nd Master Plan			◎ Madura Textile Plant Improvement
1972	● 724			● Kali Surabaya Improvement		◎ 4,337	◎ East Java Transmission Line
1973	● 3,268			● Lahor Dam			
1974	● 6,150			● Wlingi Dam		◎ 5,850	◎ East Java Transmission Line
						◎ 1,348	◎ Cotton cloth plant
1975	● 418			● Kali Surabaya Improvement		◎ 10,512	◎ East Java Transmission Line
1976	● 480			● Kali Porong Improvement	● 14,272	◎ 556	● Gresik Thermal Power
							◎ Cotton cloth plant
	● 7,008			● Wlingi P/S, Lodoyo			
1977	● 504		△ 1,881	● Brantas Middle Reach Improvement (I)			
				△ Lodoyo Irrigation			
1978	● 5,718			● Brantas Middle Reach Improvement (I)		◎ 3,447	◎ Railway improvement
	● 1,833			● Widas Dam Irrigation			
1979						◎ 3,300	◎ Railway improvement
1980					● 368	◎ 3,826	● Gresik Thermal Power
							◎ Road improvement
1981			△ 12,404	△ Sengguruh Dam	28,210		● Gresik Thermal Power

1982			△ 790	△East Java Province Groundwater Development			
1983					● 8,815 ● 11,990		● Gresik Thermal Power ● Gresik Thermal Power
1984	●6,000	◎ 200		●Brantas Middle Reach Rier Improvement (II) ◎3rd Master Plan		◎ 14,000	◎ East Java Transmission Line
1985					● 418		● City sewerage
1986						◎ 7,946	◎ Undersea cable
1987							
1988	●1,767		△ 1,693	●Porong River Restoration △ Waruturi Irrigation			
1989			△ 7,628 △ 3,614	△Tulungagung Diversion △Tulungagung Power Generation	● 4,445		● Gresik Thermal Power
1990					● 4,220		● City sewerage
1991	● 241			●Wonorejo Dam			
	●3,246			●Kelud Debris Control			
1992					● 2,941	◎ 820	● Telecommunication ◎ Telecommunication
1993	14,713			●Wonorejo Dam	● 8,091 ● 519 ● 11,256		● Telecommunication ● Airport ● Road improvement
Total	66,190	9,474	28,010		95,918	59,800	
Grand total of assistance: =103,674					Grand total of assistance = 155,718		

Remarks: 1) The cost for master plans are rough estimates.
2) Of Surabaya city-related projects, "Surabaya City" refers to assistance to Surabaya City and "Surabaya City related", that to Surabaya City and neighboring areas.
3) Funds marked by ●, ◎, and △ correspond to the projects with the same mark.

List of firms who participated in major Brantas River Basin Development projects

Project	Work	Japanese and other national JV				Indonesian side		
		Consultant	Construction contractor	Trading firm	Manufacturer	Local consultant	Local contractor	Local subcontractor
1 South Tulungagung Diversion	Civil	Nippon Koei Co., Ltd. (Kajima Corp.)	–	–	–	–	–	–
2 Selorejo Dam Power Generation	Civil	Nippon Koei Co., Ltd. (Kajima Corp.)	–	–	–	–	Brantas Office (force account)	–
	Electrical	–	Tomen Corp.	Tomen Corp.	Ebara Corp. Meidensha Corp.	–	–	Site Erection Force provided by BTS was used.
	Mechanical	–	Nichimen	Nichimen	Sakai Iron Works Co., Ltd.	–	–	Site Erection Force provided by BTS was used.
3 Karangkates Dam Power Generation	Civil	Nippon Koei Co., Ltd. (Kajima Corp.)	–	–	–	–	Brantas Office (force account)	–
	Electrical	–	Nichimen	Nichimen	Toshiba Corp.	–	–	Site Erection Force provided by BTS was used.
	Mechanical	–	Nichimen	Nichimen	Sakai Iron Works Co., Ltd.	–	–	Site Erection Force provided by BTS was used.
4 Lahor Dam	Civil	Nippon Koei Co., Ltd. (Kajima Corp.) (Kumagai Gumi Co., Ltd.)	–	–	–	–	Brantas Office (force account)	–

	Electrical	–	–	–	–	–	–	–
	Mechanical	–	Nichimen	Nichimen	Sakai Iron Works Co., Ltd.	–	–	Site Erection Force provided by BTS was used.
5 Wlingi Dam Power Gneration	Civil	Nippon Koei Co., Ltd. (Kajima Corp.)	–	–	–	–	Brantas Office (force account)	–
	Electircal	–	Sumitomo Corp.	Sumitomo Corp.	Toshiba Corp. Meidensha Corp.	–	–	Site Erection Force provided by BTS was used.
	Mechanical	–	Sumitomo Corp.	Sumitomo Corp.	Sakai Iron Works Co., Ltd. NKK Corp. Narushima Suimon	–	–	PT. Permiko
6. Lodoyo Dam Power Generation	Civil	Nippon Koei Co., Ltd. (Kajima Corp.)	–	–	–	–	Brantas Office (force account)	–
	Electrical	–	Sumitomo Corp.	Sumitomo Corp.	Toshiba Corp. Meidensha Corp.	–	–	Site Erection Force provided by BTS was used.
	Mechanical	–	Sumitomo Corp.	Sumitomo Corp.	Sakai Iron Works Co., Ltd. Kawasaki Heavy Industries, Ltd.	–	–	PT. BBI
7 Bening Dam Power Generation	Civil	Nippon Koei Co., Ltd.	–	–	–	–	Brantas Office (force account)	–
	Electrical	–	Sumitomo Corp.	Sumitomo Corp.	Meidensha Corp.	–	–	Site Erection Force provided by BTS was used.

	Mechanical	–	Mitsui & Co., Ltd.	Mitsui & Co., Ltd.	Marusei Heavy Industry Works, Ltd. Narushima Suimon	–	–	PT. Barata Indonesia
8 Tulungagung Diversion	Civil	Nippon Koei Co., Ltd. (Kajima Corp.)	–	–	–	Indra Karya	PT. BRANTAS SAC NUSANTARA	–
	Electrical	–	–	–	–	–		–
	Mechanical	–	Kurimoto Ltd.	–	Kurimoto Ltd.	–	PT. BBI	PT. BBI
9 New Lengkong Dam	Civil	Nippon Koei Co., Ltd. (Kajima Corp.)	–	–	–	–	–	–
	Electrical	–	–	–	–	–	–	–
	Mechanical	–	Tomen Corp.	Tomen Corp.	Takada Kiko Co., Ltd.	–	–	Site Erection Force provided by BTS was used.
10 Surabaya River Gunungsari Dam	Civil	Nikken Consultants, Inc. Nippon Koei Co., Ltd.	–	–	–	–	–	–
	Electrical	–	–	–	–	–	–	–
	Mechanical	–	Nomura Trading Co., Ltd.	Nomura Trading Co., Ltd.	Kurimoto Ltd. Nippon Sharyo, Ltd.	–	–	PT. BBI

11 Surabaya River Improvement	Civil	Nikken Consultants, Inc. Nippon Koei Co., Ltd.	–	–	–	Indra Karya and two other companies	Brantas Office (force account)	–
	Electrical	–	–	–	–	–	–	–
	Mechanical	–	J/O Kumagai Gumi-Ebara-Sumitomo-Kadin Int'l–Ebarindo-Dian Phalh-Ruheak Phala	Sumitomo Corp.	Ebara Corp. Ruteak Phala	–	–	–
12 Sengguruh Power Generation	Civil	Nippon Koei Co., Ltd.	–	–	–	Indra Karya	Brantas Office (force account)	–
	Electrical	–	Elin–Boring Consortium	–	Boring & Co., Ltd. Elin Union AG.	–	–	PT. Truba Jukong Engineering
	Mechanical	–	Ishikawajima-Harima Heavy Industries Co., Ltd.	Nomura Trading Co., Ltd.	Ishikawajima-Harima Heavy Industries Co., Ltd.	–	–	PT. Barata Indonesia PT. Cilegon Fabricator PT. Truba Jukong Engineering
13 Brantas Middle Reach River Improvement	Civil	Nippon Koei Co., Ltd.	–	–	–	PT. Indra Karya	PT. Idee Muruni Pratama PT. Panca Guna Utama Permian and Panca Guna J/V	–
	Electrical	–	–	–	Japan Radio Co., Ltd.	–		–

	Mechanical	–	Nichimen Sumitomo Corp.	Nichimen Sumitomo Corp.	Bridgestone Corp. Sumitomo Heavy Industries, Ltd.	–	–	PT. Djawa Baru PT. Amarta Karya PT. Barata Indonesia
14 Tulungagung Power Generation	Civil	Nippon Koei Co., Ltd. (Kajima Corp.)	–	–	–	PT. Indra Karya		–
	Electrical	–	Elin–Voest Alpine Consortium	–	Voest Alpine Elin Union AG.	–	–	PT. Multi Fabricator PT. Cita Contta
	Mechanical	–	Elin-Voest Alpine Consortium	–	Elin-Voest Alpine Consortium	–	–	PT. Multi Fabricator
15 Wonorejo Dam	Civil	Nippon Koei Co., Ltd.	Kajima-Taisei-PP. Tegrh J/O	–	–	PT. Indra Karya PT. Wiratman Yodia Karya	–	–
	Electrical	–	–	–	–	–	–	–
	Mechanical	–	–	–	–	–	–	–
16 Porong River Improvement	Civil	Nippon Koei Co., Ltd. (Kajima Corp.)	–	Tomen Corp.	Nichiyu Kooki	PT. Indra Karya PT. Wiratman & Associate	PT. Wijaya Karya PT. Solobhakti PT. Jatisono Multi Konstruksi PT. Kertas Baski Rachmat	–
	Electrical	–	–	–	–	–	–	–
	Mechanical	–	–	Sumitomo Corp. Tomen Corp.	Komatsu Ltd.	–	PT. Mandala B.T. PT. Djawa Barn	–

Remarks:

1) Companies enclosed in parentheses sent construction guidance engineers for these projects.

2) Brantas Office (force account) refers to a project directly executed by the Brantas Office (BTS).

Note: Civil work consultants also served as consultants on electrical and mechanical works.

3. Specifications of projects

(1) Dam

Karangkates Dam

1. Project	Karangkates Dam Project		
2. Location	Brantas main stream, vicinity of Karangkates Village, Malang Pref., East Java Province, Republic of Indonesia		
3. Purpose	Power generation, irrigation, city water, flood control		
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia		
5. Consultant	Nippon Koei Co., Ltd. (construction technology supervision), Kajima Corp.		
6. Contractor	1) Contracting (diversion channel work): Kajima Corp. 2) Brantas Office civil work 3) Machinery and electric equipment (fabrication, assembly, and installation of hydraulic turbines, generators, and accessories): Toshiba Corp. 4) Iron and steel work (fabrication, assembly, and installation of hydraulic gates, surge tanks, and hydraulic iron pipe conduits): Sakai Iron Works Co., Ltd. 5) Equipment and materials: provided by Nichimen		
7. Financing	War reparations, OECF, Indonesian government		
8. Project details (a) Major spec.			
Reservoir	Basin area	2,052 km^2	
	Average annual precipitation	2,195 mm	(1951-59, at Pohgajih Flow Gauging Station)
	Average monthly flow rate	55.5 m^3/s	(1951-59, at Karangkates Flow Gauging Station)
	Design flood discharge (inflow)	2,580 m^3/s	
	Total storage capacity	343,000,000 m^3	
	Active storage capacity	253,000,000 m^3	
	Design sediment	90,000,000 m^3	
	Reservoir area	7.9 km^2	
	FWL	EL 276.0 m	
	HWL	EL 272.5 m	
	LWL	EL 246.0 m	
Storage facilities	Dam	Type	Inclined core rockfill dam
		Height	100.0 m
		Crest length	750 m
		Top elevation	EL 278.0 m
		Volume	6,020,000 m^3
	Spillway	Type	Side-overflow weir and gate (sluice gate) spillway, Open channel
		Overflow	50.0 m

		weir length	
		Waterway	370.0 m
		Capacity	1,000 m^3/s
	Diversion channel, temporary cofferdam	Type	Circular pressure tunnel
		Size	L 600 m, Inner dia. 9.0 m
		Capacity	1,000 m^3/s
		Dam	Center core rockfill dam, Dam volume:1,800,000 m^3
Power facilities	Max. water use	180 m^3/s (incl. 60 m^3/s for Lahor)	
	Max. output	105,000 kW (incl. 35,000 kV for Lahor)	
	Headwater level	EL 272.5 m	
	Tailwater level	EL 181.0 m	
	Total head	91.5 m	
	Active head	78.0 m	
	Water intake	Type	Independent tower (one roller gate)
		Size	W 7.5 m x H 7.5 m
	Headrace	Type	Circular concrete tunnel
		Size	L 257.8 m, 7.5 m dia.
	Iron pipe conduit	Type	Exposed hydraulic iron pipe conduit, spherical branch
		Size	L 163.5 m, Inner dia. 3.75 m-3,000 x 3 lines
	Surge tank	Type	Restricted orifice, circular steel water tank
		Size	H 50.0 m, Inner dia. 7.0 m
	Power station	Type	Sited above ground
		Size	L 52.0 m x W 14.0 m x H 19.6 m (above ground)
	Generating equipment: hydraulic turbine	Type	Vertical shaft Francis turbine
		Capacity	35,000 kW x 3 units (incl. 1 unit for Lahor)
	Generating equipment: generator	Type	Single-phase AC, synchronous
		Capacity	39,000 kVA x 3 units (incl. 1 unit for Lahor)
	Substation	Type	Outdoor sited
		Capacity	39,000 kVA x 3 units (incl. 1 unit for Lahor)

(b) Project cost

Source	Price (x 10^6)	Exchange rate	Yen terms (x 10^6)
Reparations	¥6,925		6,925
OECF	¥7,713	¥360/$1	7,713
Indonesian gov.	Rp9,742	Rp415/$1	11,230
Total			¥25,868 x 10^6

(c) Economic benefit	Peak power	105,000 kW (incl. 35,000 kW for Lahor)
	Annual generated energy	289 x 10^6 kWh (incl. 75.8 x 10^6 kWh for Lahor)
	Supply volume (dry season)	20.0 m^3/s
	Flood control: Inflow	1,930 m^3/s
	Outflow	440 m^3/s

(d) Others Work period	Diversion channel: Aug. 1962-Nov. 1964 Dam and power station: May 1962-Dec. 1973 Start up: Generator No. 1 (P = 35,000 kW) Jan. 1973 Generator No. 2 (P = 35,000 kW) Sep. 1973 Generator No. 3 (P = 35,000 kW, for Lahor Dam) Sep. 1975

APPENDIX 1

Lahor Dam

1. Project	Lahor Dam Project		
2. Location	Lahor River, Brantas branch, vicinity of Karangkates Village, Malang Pref., East Java Province, Republic of Indonesia		
3. Purpose	Power generation, irrigation, city water		
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia		
5. Consultant	Nippon Koei Co., Ltd. (construction technology supervision), Kajima Corp., Kumagai-Gumi Co., Ltd.		
6. Contractor	1) Brantas Office civil work 2) Iron and steel: Sakai Iron Works Co., Ltd. 3) Equipment and materials: Nichimen		
7. Financing	OECF, Indonesian government		
8. Project details (a) Major spec.			
Reservoir	Basin area	170 km^2	
	Annual average precipitation	3,250 mm (1960-69, average of Lahor Dam basin)	
	Monthly average flow rate	12.0 m^3/s (1960-69, average at Lahor Dam point)	
	Design flood discharge (inflow)	415 m^3/s	
	Total storage capacity	36,110,000 m^3	
	Active storage capacity	29,430,000 m^3	
	Design sediment	6,680,000 m^3	
	Reservoir area	2.63 km^2	
	FWL	EL 274.5 m	
	HWL	EL 272.5 m	
	LWL	EL 253.0 m	
Storage facilities	Dam	Type	Center core rockfill dam
		Height	74.0 m
		Crest length	446 m
		Top elevation	EL 277.5 m
		Volume	1,286,000 m^3
	Spillway	Type	Side-overflow weir, flip bucket
		Overflow weir length	26.0 m
		Waterway	L 200 m
		Capacity	145 m^3/s
Power facilities (Karangkates	Max. water use	60 m^3/s	
	Headwater level	EL 272.5 m	

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Dam)	Tailwater level	EL 181.0 m	
	Active head	78.0 m	
	Water intake	Type	Karangkates intake tower and headrace are shared.
		Size	Gate: W 3.4 m x H 3.4 m
	Connected channel (Karangkates reservoir)	Type	Non-pressure circular tunnel
		Size	Inner dia. 2.5 m
	Iron pipe conduit	Type	Exposed hydraulic iron pipe conduit
		Size	L 193 m, Inner dia. 3.4 m
	Surge tank	Type	Restricted orifice, circular steel tank
		Size	H 50 m, Inner dia. 7.0 m
	Power station	Type	Karangkates Power Station is shared.
	Generating equipment: hydraulic turbine	Type	Vertical shaft Francis turbine
		Capacity	35,000 kW
	Generating equipment: generator	Type	Single-phase AC, synchronous
		Capacity	39,000 kVA
	Substation	Type	Outdoor sited (Karangkates Substation is shared.)
		Capacity	39,000 kVA

(b) Project cost

Source	Price (x 10^6)	Exchange rate	Yen terms (x 10^6)
OECF	¥3,268	Rp415 /¥	3,268
Indonesian gov.	Rp11,678	Rp300/$	8,444
Total			¥11,712 x 10^6

(c) Economic benefit	Peak power	35,000 kW
	Annual generated energy	75,800,000 kWh
	Supply volume (dry season)	1.9 m^3/s
	Annual profit	US$2,143.6 x 10^3
(d) Others		
Work period	May 1973-Nov. 1977	

APPENDIX 1

Selorejo Dam

1. Project	Selorejo Dam Project		
2. Location	Brantas main stream, vicinity of Ngantang Village, Malang Pref., East Java Province, Republic of Indonesia		
3. Purpose	Power generation, irrigation, flood control		
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia		
5. Consultant	Nippon Koei Co., Ltd. (construction technology supervision), Kajima Corp.		
6. Contractor	1) Brantas Office civil work 2) Machinery and electric equipment (fabrication, assembly, and installation of hydraulic turbines, generators, and accessories): Ebara Corp., Meidensha Corp. 3) Iron and steel work (fabrication, assembly, and installation of hydraulic gates and hydraulic iron pipe conduits): Sakai Iron Works Co., Ltd. 4) Equipment and materials: provided by Tomen Corp. and Nichimen		
7. Financing	War reparations, OECF, Indonesian government		
8. Project details (a) Major spec.			
Reservoir	Basin area	236.0 km^2	
	Annual average precipitation	2,764 mm (1951-81, at Semen point)	
	Monthly average flow rate	17.1 m^3/s (1951-59)	
	Design flood discharge (inflow)	720 m^3/s	
	Total storage capacity	62,300,000 m^3	
	Active storage capacity	54,600,000 m^3	
	Design sediment	7,700,000 m^3	
	Reservoir area	3.5 km^2	
	FWL	622.6 m	
	HWL	620.0 m	
	LWL	598.0 m	
Storage facilities	Dam	Type	Zone type rockfill dam
		Height	49.0 m
		Crest length	450.0 m
		Top elevation	EL 625.0 m
		Volume	1,990,000 m^3
	Spillway	Type	Side-overflow weir and spillway tunnel
		Overflow weir length	30.0 m
		Waterway	L 515 m (incl. floodway 114 m), Inner dia. 5.5 m
		Capacity	700 m^3/s
	Diversion channel,	Type	Circular pressure tunnel

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	temporary cofferdam	Size	Dia. 5.5 m
		Capacity	220 m^3/s
Power facilities	Max. water use	14.9 m^3/s	
	Max. output	4,500 kW	
	Headwater level	EL 622.6 m	
	Tailwater level	EL 576.6 m	
	Total head	46.0 m	
	Active head	41.5 m	
	Water intake	Type	Tower (two gates)
		Size	W 3.5 m x H 4.5 m
	Headrace	Type	Circular concrete tunnel
		Size	L 405.0 m, Dia. 2.5 m
	Iron pipe conduit	Type	Tunnel type hydraulic iron pipe conduit
		Size	L 67.0 m, Inner dia. 2.2 m-2.0 m
	Surge tank	Type	Single-operated circular concrete vertical shaft
		Size	H 41 m, Inner dia. 9 m
	Power station	Type	Sited above ground
		Size	L 28.5 m x W 23.5 m x 10.5 H (above ground)
	Generating equipment: hydraulic turbine	Type	Kaplan turbine
		Capacity	4,800 kW x 1 unit
	Generating equipment: generator	Type	Single-phase AC, synchronous
		Capacity	5,600 kVA
	Substation	Type	Outdoor sited
		Capacity	5,600 kVA transforming unit

(b) Project cost

Source	Price (x 10^6)	Exchange rate	Yen terms (x 10^6)
Reparations	¥1,239		1,239
OECF	¥1,604		1,604
Indonesian gov.	Rp2,944	Rp415/$1 (¥360/$1)	2,554
Total			¥5,397 x 10^6

(c) Economic benefit	Peak power	4,500 kW
	Annual generated energy	20,000,000 kWh
	Supply volume (dry season)	4.0 m^3/s
	Flood control: Inflow	720 m^3/s
	Outflow	260 m^3/s

(d) Others

Work period

Nov. 1963-Oct. 1972

Start up: (P = 4,500 kW) Sep. 1972

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Wlingi Dam

1. Project	Wlingi Dam Project		
2. Location	Brantas main stream, vicinity of Wlingi Village, Blitar Pref., East Java Province, Republic of Indonesia		
3. Purpose	Power generation, debris control, irrigation, flood control		
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia		
5. Consultant	Nippon Koei Co., Ltd. (construction technology supervision), Kajima Corp.		
6. Contractor	1) Brantas Office civil work 2) Machinery and electric equipment (fabrication, assembly, and installation of hydraulic turbines, generators, and accessories): Toshiba Corp., Meidensha Corp. 3) Iron and steel work (fabrication, assembly, and installation of hydraulic gates and hydraulic iron pipe conduits): Sakai Iron Works Co., Ltd., NKK Corp., Narushima Suimon 4) Equipment and materials: provided by Nichimen		
7. Financing	OECF, Indonesian government		
8. Project details (a) Major spec.			
Reservoir	Basin area	2,890 km^2	
	Annual average precipitation	2.227 mm (1951-62, at Wlingi Dam site)	
	Monthly average flow rate	109.1 m^3/s (1951-62, at Wlingi Dam site)	
	Design flood discharge (inflow)	2,840 m^3/s	
	Total storage capacity	24,000,000 m^3	
	Active storage capacity	5,200,000 m^3	
	Design sediment	19,800,000 m^3	
	Reservoir area	3.8 km^2	
	FWL	163.50 m	
	HWL	163.50 m	
	LWL	162.00 m	
Storage facilities	Dam	Type	Rockfill dam
		Height	47.0 m
		Crest length	475 m (bed section), 200 m (both banks section): Total 675.0 m
		Top elevation	166.5 m
		Volume	630,000 m^3 (main dam)
	Spillway	Type	Gate spillway
		Waterway	L 85.5 m
		Gate	Four tainter gates (W 10.7 m x H 10.0 m)
		Capacity	2,840 m^3/s

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	Diversion channel, temporary cofferdam	Type	Open channel, culvert
		Size	Open channel 363 m, Culvert 179 m: Total 542 m
		Capacity	1,610 m^3/s (Max. 1,820 m^3/s)
Power facilities	Max. water use	294 m^3/s	
	Max. output	27,000 kW x 2 units	
	Headwater level	EL 163.5 m	
	Tailwater level	EL 142.0 m (294 m^3/s) EL 141.0 m (147 m^3/s)	
	Total head	21.5 m	
	Active head	21.5 m	
	Water intake	Type	Dam parallel gate intake
		Size	Roller gate: W 8.0 m x H 7.5 m x 2 units
	Iron pipe conduit	Type	Steel sheet lined reinforced concrete
		Size	L 13.0 m x Inner dia. 6.5 m x 2 lines
	Power station	Type	Sited semi underground
		Size	L 54.0 m x W 22.0 m x H 16.5 m (above ground)
	Generating equipment: hydraulic turbine	Type	Vertical shaft Kaplan turbine
		Capacity	27,000 kW x 2 units
	Generating equipment: generator	Type	Single-phase AC, synchronous
		Capacity	28,000 kVA x 2 units
	Substation	Type	Outdoor sited
		Capacity	28,000 kVA x 2 units
	Transmission system	Type	Single line
		Capacity	154 kV
	Others		

(b) Project cost

Source	Price (x 10^6)	Exchange rate	Yen terms (x 10^6)
OECF	¥6,150	¥300/$1	6,150
Indonesian gov.	Rp17,292	Rp415/$1	12,500
Total			¥18,650 x 10^6

Note: The cost for Generator No. 2 is excluded.

(c) Economic benefit	Peak power	54,000 kW
	Annual generated energy	164,980,000,000 kWh
	Flood control: Inflow	2,840 m^3/s
	Outflow	2,370 m^3/s
	Annual profit	US$25,043,000
	Internal rate of return (EIRR)	14.1%

(d) Others
Work period

May 1972-Nov. 1979
Start up: Generator No. 1 (P = 27,000 kW) Jan. 1978
Generator No. 2 (P = 27,000 kW) Nov. 1979

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Bening Dam

1. Project	Bening Dam Project		
2. Location	Bening River, the tributary of Widas River, Brantas branch, Nganjuk Pref., East Java Province, Republic of Indonesia		
3. Purpose	Power generation, irrigation		
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia		
5. Consultant	Nippon Koei Co., Ltd.		
6. Contractor	1) Brantas Office civil work 2) Machinery and electric equipment (fabrication, assembly, and installation of hydraulic turbines, generators, and accessories): Meidensha Corp.. 3) Iron and steel work (fabrication, assembly, and installation of hydraulic gates and hydraulic iron pipe conduits): Marusei Heavy Industry Works, Ltd., Marushima Suimon 4) Equipment and materials: provided by Sumitomo Corp.		
7. Financing	OECF, Indonesian government		
8. Project details (a) Major spec.			
Reservoir	Basin area	89.5 km^2	
	Annual average precipitation	1,884 mm (1956-75, at Nganjuk)	
	Monthly average flow rate	2.6 m^3/s (1956-75, at Bening Dam point)	
	Design flood discharge (inflow)	600 m^3/s	
	Total storage capacity	28,900,000 m^3	
	Active storage capacity	24,800,000 m^3	
	Design sediment	2,100,000 m^3	
	Reservoir area	4,100 km^2	
	HWL	108.6 m	
	LWL	93.0 m	
Storage facilities	Dam	Type	Center core rockfill dam
		Height	35.0 m
		Crest length	660.0 m
		Top elevation	EL 111.0 m
		Volume	596,800,000 m^3
	Spillway	Type	Gate spillway (roller gate), open channel
		Waterway	L 230 m x W 26.0 m-14.0 m
		Capacity	600 m^3/s
	Diversion channel, temporary cofferdam	Type	Open channel, pressure tunnel
		Size	Open channel: L 110 m x W 5 m
			Tunnel: L 250 m x Inner dia. 5.0 m
		Capacity	320 m^3/s (20-year flood)

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Power facilities	Max. water use	4.5 m^3/s	
	Max. output	650 kW	
	Headwater level	EL 108.6 m	
	Tailwater level	EL 80.0 m	
	Total head	28.6 m	
	Active head	21.6 m	
	Water intake	Type	Funnel-shaped
		Size	Inner dia. 2.0 m x H. 10.6 m
	Headrace	Type	Circular concrete tunnel
		Size	Inner dia. 5.0 m
	Iron pipe conduit	Type	Tunnel-type hydraulic iron pipe conduit
		Size	Inner dia. 0.7 m
	Power station	Type	Sited above ground
	Generating equipment: hydraulic turbine	Type	Horizontal shaft cross flow turbine
	Generating	Capacity	650 kW
	equipment:	Type	Single-phase AC, synchronous
	generator	Capacity	710 kW
	Substation	Type	Outdoor sited
		Capacity	1,000 kVA
(b) Project cost	(Refer to the project cost for the Widas Irrigation Project.)		
(c) Economic benefit	Peak power	650 kW	
	Annual profit	US$16,986	
(d) Others			
Work period	1977-1984		
	Irrigation area: 4,400 ha		
	Start up: Nov. 1984		

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Sengguruh Dam

1. Project	Sengguruh Dam Project		
2. Location	Brantas main stream, vicinity of Sengguruh Village, Malang Pref., East Java Province, Republic of Indonesia		
3. Purpose	Power generation		
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia		
5. Consultant	Nippon Koei Co., Ltd.		
6. Contractor	1) Brantas Office civil work 2) Machinery and electric equipment: BoYing Co., Ltd., Elin Union AG. 3) Machinery: Ishikawajima-Harima Heavy Industries Co., Ltd., Boma Bisma Indra, and other three local contractors 4) Equipment and materials: provided by Nomura Trading Co., Ltd.		
7. Financing	ADB, Indonesian government		
8. Project details (a) Major spec.			
Reservoir	Basin area	1,659 km^2	
	Annual average precipitation	2,065 mm (at Karangkates point)	
	Monthly average flow rate	55.2 m^3/s (at Sengguruh point)	
	Design flood discharge (inflow)	2,950 m^3/s	
	Total storage capacity	21,500,000 m^3	
	Active storage capacity	2,500,000 m^3	
	Design sediment	19,000,000 m^3	
	Reservoir area	EL. 2,370 km^2	
	FWL	EL 293,100 m	
	HWL	EL 292,500 m	
	LWL	291,400 m	
Storage facilities	Dam	Type	Center core rockfill dam
		Height	33.0 m
		Crest length	378.0 m
		Top elevation	EL 296.0 m
		Volume	477,000,000 m^3
	Spillway	Type	Gate spillway (two roller gates), open channel (rectangular)
		Waterway	Bottom W 36.5 m x H 18.5 m x L 75.0 m
		Capacity	2,950 m^3/s
	Diversion channel, temporary	Type	Open channel (trapezoid)
		Size	Bottom W 20.0 m x H 9.0 m (gradient: 1:0.5)
		Capacity	1,060 m^3/s

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Power facilities	Max. water use	184.0 m^3/s	
	Max. output	29,000 kW	
	Headwater level	EL 292.5 m	
	Tailwater level	EL 272.5 m	
	Total head	20.0 m	
	Active head	18.5 m	
	Water intake	Type	Lateral gate intake (roller gate)
		Size	W 6.5 m x H 6.5 m x 2 units
	Iron pipe conduit	Type	Exposed
		Size	L 85.0 m (x 2 lines), Inner dia. 6.5 m-5.2 m
	Power station	Type	Sited above ground
		Size	W 35.0 m x L 49.0 m x H 17.0 m
	Generating equipment: hydraulic turbine	Type	Vertical shaft Kaplan turbine
		Capacity	15,000 kW x 2 units
	Generating equipment: generator	Type	Single-phase AC, synchronous
		Capacity	16,000 kVA x 2 units
	Substation	Type	Sited outside
		Capacity	16,200 kVA x 2 units, 6,000 kVA x 1 unit, 300 kVA x 2 units

(b) Project cost

Source	Price (x 10^3)	Exchange rate	Yen terms (x 10^6)
Australia	US$19,345	¥300/US$1	5,804
ADB	US$22,000		6,600
Indonesian gov.	US$31,000		9,300
Total	US$72,345 x 10^3		¥21,704 x 10^6

(c) Economic benefit	Peak power	29,000 kW
	Annual generated energy	98,560,000 kWh
	Annual profit	US$8,000,000

(d) Others

Work period

Jan. 1982-Oct. 1988

Start up: Oct. 1988

APPENDIX 1

Tulungagung Power Generation

1. Project	Tulungagung Power Generation Project		
2. Location	Vicinity of Sidemu Village, Tulungagung Pref., East Java Province, Republic of Indonesia		
3. Purpose	Power generation		
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia		
5. Consultant	Nippon Koei Co., Ltd., PT Indra Karya		
6. Contractor	1) Brantas Office civil work 2) Machinery and electric equipment (fabrication, assembly, and installation of hydraulic turbines, generators, and accessories): Voest Alpine Elin Union AG, PT Indra Karya, PT Multi Fabricator, PT Cita Contta 3) Iron and steel work (fabrication, assembly, and installation of hydraulic gates etc.): Voest Alpine Elin Union AG, PT Indra Karya, PT Multi Fabricator, PT Cita Contta		
7. Financing	Australia, Indonesian government		
8. Project details (a) Major spec.			
Reservoir	Basin area	1,296 km^2	
	Annual average precipitation	1,915 mm (average of Ngrowo River basin)	
	Monthly average flow rate	30.9 m^3/s (1981-82, 1986-92, at the point of water intake)	
	Rainy season average flow rate	49.3 m^3/s	
	Dry season average flow rate	16.6 m^3/s	
Power facilities	Max. water use	62 m^3/s	
	Max. output	36,000 kW	
	Headwater level	HWL 79.6 m, LWL 76.0 m	
	Tailwater level	EL 0.5 m	
	Total head	79.1 m	
	Active head	70.0 m	
	Water intake	Type	Lateral intake (without intake weir), roller gate
		Size	W 7.5 m x H 2 m x 1 unit, W 5 m x H 5 m x 1 unit
	Headrace	Type	Concrete/steel sheet lined pressure tunnel, pressure iron pipie conduit
		Size	L 1,450 m, Inner dia. 4.2 m-5.0 m
	Iron pipe conduit	Type	Tunnel-type, exposed hydraulic iron pipe conduit x 1 line (branched to 2 lines in the lower part)
		Size	L 102 m, Inner dia. 42 m
	Surge tank	Type	Restricted orifice, circular concrete tank
		Size	H 29.6 m, Inner dia. 4.2 m
	Power station	Type	Sited above ground
		Size	W 23.0 m x L 37.5 m x H 29.5 m

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	Generating equipment: hydraulic turbine	Type	Vertical shaft Francis turbine
		Capacity	18,000 kW x 2 units
	Generating equipment: generator	Type	Single-phase AC, synchronous
		Capacity	19,000 kVA x 2 units
	Substation	Type	Outdoor sited
		Capacity	19,000 kVA x 2 units
	Transmission system	Type	ACSR type
		Capacity	70 kV
	Others		

(b) Project cost

Source	Price (x 10^3)	Exchange rate	Yen terms (x 10^6)
Australian loan	US$28,200	¥128.15/$1	3,614
Indonesian gov.	Rp6,162	Rp1,770.1/$1	3,481
Total			¥7,095 x 10^6

(c) Economic benefit	Peak power	36,000 kW
	Annual generated energy	184,000,000 kWh
(d) Others		
Work period	Apr. 1989-Dec. 1991	
	Start up: Nov. 1991	

APPENDIX 1

Wonorejo Dam

1. Project	Wonorejo Dam Project		
2. Location	Gondan River, the tributary of Ngrowo River, Brantas branch, Wonorejo Village, Tulungagung Pref., East Java Province, Republic of Indonesia		
3. Purpose	Power generation, city and industrial water, flood control		
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia		
5. Consultant	Nippon Koei Co., Ltd.		
6. Contractor	1) Contracted civil work: Kajima-Taisei-PP J/O 2) Machinery and electric equipment (fabrication, assembly, and installation of hydraulic turbines, generators, and accessories): PT. BBI, Indra Karaya 3) Iron and steel work (fabrication, assembly, and installation of hydraulic gates and hydraulic iron pipe conduits):		
7. Financing	OECF, Indonesian government		
8. Project details (a) Major spec.			
Reservoir	Basin area	126.3 km^2 (incl. modified basin area of Son River 82,8 km^2)	
	Annual average precipitation	2,492 m (Wonorejo Dam)	
	Monthly average flow rate	1.72 m^3/s (at the Wonorejo Dam point on Gondan River) 6.37 m^3/s (at the Sugawi Intake Weir point on Son River)	
	Design flood discharge (inflow)	820.00 m^3/s	
	Total storage capacity	122,000,000 m^3	
	Active storage capacity	106,000,000 m^3	
	Design sediment	16,000,000 m^3	
	Reservoir area	3.85 km^2	
	FWL	EL 185.0 m	
	HWL	EL 183.0 m	
	LWL	EL 141.0 m	
Storage facilities	Dam	Type	Center core rockfill dam
		Height	100.0 m
		Crest length	545.0 m
		Top elevation	EL 188.0 m
		Volume	6,150,000 m^3
	Spillway	Type	Side-overflow weir and open channel
		Waterway	L 110.0 m
		Capacity	540 m^3/s
	Diversion channel, temporary cofferdam	Type	Tunnel
		Size	Inner dia. 5.0 m
		Capacity	150 m^3/s

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Power facilities	Max. water use	12.0 m^3/s	
	Max. output	6,500 kW	
	Headwater level	EL 183.0 m	
	Tailwater level	EL 109.1 m	
	Total head	73.9 m	
	Active head	63.9 m	
	Water intake	Type	One roller gate
		Size	W 3.0 m x H 3.586 m
	Headrace	Type	Inclined channel, horizontal channel (to serve also as diversion channel tunnel)
		Size	Inner dia. Inclined channel: 3.0 m Horizontal channel: 5.0 m
	Iron pipe conduit	Type	Tunnel type (with 1.6 m-wide river water discharging hollow jet valve)
		Size	L 195 m, Inner dia. 1.9 m
	Power station	Type	Sited above ground
		Size	W 12.0 m x H 24.6 m
	Generating equipment: hydraulic turbine	Type	Vertical shaft Francis turbine
		Capacity	6,500 kW
	Generating equipment: generator	Type	Single-phase AC, synchronous
		Capacity	7,000 kVA x 1 unit
	Substation	Type	Outdoor sited
		Capacity	7,000 kVA x 1 unit

(b) Project cost

Source	Price (x 10^6)	Exchange rate	Yen terms (x 10^6)
OECF	¥14,954		14,954
Indonesian gov.	–		–
Total			¥14,954 x 10^6

(c) Economic benefit	Peak power	6,500 kW
	Annual generated energy	31,700,000 kWh
	Supply volume (dry season)	12.0 m^3/s
	Flood control: Inflow	820 m^3/s
	Outflow	540 m^3/s
(d) Others		
Work period	Jun. 1994-Oct. 1999 (scheduled)	

Note: *Designs of generations may be subject to change.*

APPENDIX 1

New Lengkong Dam (Diversion Weir)

1. Project	Lengkong Dam (Diversion Weir) Dam Project		
2. Location	Brantas main stream, vicinity of Mojokerto, Mojokerto Pref., East Java Province, Republic of Indonesia		
3. Purpose	Flood discharge control for Porong River, Diversion to Surabaya River (city, industrial, and agricultural water), irrigation water supply to Brantas Delta		
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia		
5. Consultant	Nippon Koei Co., Ltd. (construction technology supervision), Kajima Corp.		
6. Contractor	1) Brantas Office civil work 2) Iron and steel work (fabrication, assembly, and installation of hydraulic gates): Takada Kiko Co., Ltd. 3) Equipment and materials: provided by Tomen Corp.		
7. Financing	OECF, Indonesian government		
8. Project details (a) Major spec.			
Reservoir	Basin area	9,700 km^2	
	Annual average precipitation	1,500-3,000 mm (1950-58, for whole basin)	
	Monthly average flow rate	287.0 m^3/s (1951-62, at Jabon)	
	FWL	EL 19.2 m (on upper reach side)	
	HWL	EL 17.75 m	
Storage facilities	Dam	Type	Floating foundation movable weir
		Height	11.3 m
		Crest length	151.9 m
		Top elevation	EL 20.8 m
		Dam body and floor slab concrete	12,000,000 m^3
		Foundation	Steel pipe pile, concrete pile
	Gate	Type	Roller gate
		Size	W 11.1 m x H 4.8 m x 8 units
(b) Project cost	(included in the Porong River Improvement Project.)		
(c) Others Work period	Jul. 1971-Oct. 1973		

APPENDIX 1

Gunungsari Dam

1. Project	Surabaya River Improvement Project, Gunungsari Dam Project		
2. Location	Surabaya main stream, vicinity of Gunungsari, Gresik Pref., East Java Province, Republic of Indonesia		
3. Purpose	Diversion weir for irrigation and city and industrial water supply		
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia		
5. Consultant	Nikken Consultants, Inc., Nippon Koei Co., Ltd., Tokyo Construction Consultants Co., Ltd.		
6. Contractor	1) Brantas Office civil work 2) Machinery: Kurimoto Ltd., Nippon Sharyo, Ltd. 3) Equipment and materials: provided by Nomura Trading Co., Ltd.		
7. Financing	OECF, Indonesian government		
8. Project details (a) Major spec.			
Reservoir	Basin area	533.2 km^2	
	Annual average precipitation	1,554 mm (1925-73, in Surabaya City)	
	Monthly average flow rate	70.2 m^3/s (at Gunungsari Dam point)	
	Design flood discharge (inflow)	400 m^3/s	
	HWL	EL 4.6 m	
	LWL	EL 0.15 m	
Storage facilities	Dam	Type	Floating foundation movable weir
		Height	7.5 m
		Crest length	77.2 m
		Top elevation	EL 7.65 m
		Foundation	Main body, steel pipe pile: ø 508 Epron concrete pile: ø 300
	Spillway	Type	Four roller gates, One scouring gate
		Size	Roller gate: W 14.3 m x H 4.75 m Scouring gate: W 8.0 m x H 5.75 m
	Water intake (for irrigation)	Type	Lateral intake, sluice gate
		Size	W 3.40 m x H 5.65 m x 1 unit
(b) Project cost	(included in the Surabaya River Improvement Project.)		
(c) Others Irrigation area Work period	 3,800 ha May 1978-Dec. 1980		

APPENDIX 1

Lodoyo Dam

1. Project	Lodoyo Dam Project		
2. Location	Brantas main stream, vicinity of Lodoyo Village, Blitar Pref., East Java Province, Republic of Indonesia		
3. Purpose	Flow regulation, power generation		
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia		
5. Consultant	Nippon Koei Co., Ltd. (construction technology supervision), Kajima Corp.		
6. Contractor	1) Brantas Office civil work 2) Machinery and electric equipment (fabrication, assembly, and installation of hydraulic turbines, generators, and accessories): PT. BBI, Indra Karya 3) Iron and steel work (fabrication, assembly, and installation of hydraulic gates and hydraulic iron pipe conduits):		
7. Financing	OECF, DANA, Indonesian government		
8. Project details (a) Major spec.			
Reservoir	Basin area	3,017 km^2	
	Annual average precipitation	2,227 mm (at Wlingi Dam point)	
	Monthly average flow rate	109.1 m^3/s (at Wlingi Dam point)	
	Design flood discharge (inflow)	3,970 m^3/s	
	Total storage capacity	5,200,000 m^3	
	Active storage capacity	5,000,000 m^3	
	Design sediment	200,000 m^3	
	Reservoir area	940 km^2	
	FWL	EL 135.5 m	
	HWL	EL 136.0 m	
	LWL	EL 125.5 m	
Storage facilities	Dam	Type	Floating foundation movable weir
		Height	12.0 m
	Spillway	Type	Roller gate
		Size	W 12.0 m x H 11.3 m x 8 units
Power facilities	Max. water use	57.5 m^3/s	
	Max. output	4,500 kW	
	Headwater level	EL 136.0 m	
	Tailwater level	EL 126.5 m	
	Total head	9.5 m	
	Active head	8.5 m	
	Water intake	Type	One roller gate

APPENDIX 1

	Generating equipment: hydraulic turbine	Type	Tubular turbine
		Capacity	4,500 kW
	Generating equipment: generator	Type	Single-phase AC, synchronous
		Capacity	4,000 kVA x 1 unit
	Substation	Type	Outdoor sited
		Capacity	4,000 kVA x 1 unit

(b) Project cost

Source	Price (x 10^6)	Exchange rate	Yen terms (x 10^6)
OECF Included in the Wlingi Dam Project			
DANA	US$24.2	¥300/$1	7,260
Indonesian gov.	Rp12,717	Rp415/$1	9,193
Total			¥16,453 x 10^6

(c) Economic benefit	Peak power	4,500 kW
	Annual generated energy	31,700,000 kWh
(d) Others	May 1978-Oct. 1983	
Work period	Start up: Oct. 1983	

(2) River improvement

Porong River Improvement

1. Project	Porong River Improvement Project, Phase I			
2. Location	Mojokerto and Sidoarjo Prefs., East Java Province, Republic of Indonesia			
3. Purpose	Flood protection			
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia			
5. Consultant	Nippon Koei Co., Ltd. (construction technology supervision), Kajima Corp.			
6. Contractor	1) Brantas Office civil work 2) Equipment and materials: provided by Tomen Corp.			
7. Financing	OECF, Indonesian government			
8. Project details (a) Major spec.				
Plan	Basin area	11,800 km^2 (at river mouth)		
	Design flood	50-year flood		
	Flood discharge	1,500 m^3/s		
	Covered section	Whole of Porong River (Lengkong Dam to river mouth), 50 km		
Work	Embankment	1,275,000 m^3		
	Wooden pile groyne	80,000 pieces		
	Revetment	50,000 m^2		
	Bed excavation	1,468,000 m^3		
	Short cut channel dredging	1,300,000 m^3		
(b) Project cost	(including the construction cost of the Lengkong Dam)			
	Source	Price (x 10^6)	Exchange rate	Yen terms (x 10^6)
	OECF (Phase 1)	¥1,459	¥360/$1	1,459
	Indonesian gov.	Rp8,234	Rp415/$1	7,221
	Total			¥8,680 x 10^6
(c) Economic benefit	Flood damages	US$1,498,000		
(d) Others	Work period for Phase I	Jul. 1971-Mar. 1978		

APPENDIX 1

Surabaya River Improvement

1. Project	Surabaya River Improvement Project			
2. Location	Surabaya River and tributaries, Surabaya City, Mojokerto Pref., East Java Province, Republic of Indonesia			
3. Purpose	Flood protection, improvement of irrigation facilities, salt injury protection			
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia			
5. Consultant	Nikken Consultants, Inc., Nippon Koei Co., Ltd.			
6. Contractor	1) Brantas Office civil work 2) Iron and steel work (fabrication, assembly, and installation of hydraulic gates): Kurimoto Ltd., Nippon Sharyo, Ltd. 3) Equipment and materials: provided by Nomura Trading Co., Ltd.			
7. Financing	OECF, Indonesian government			
8. Project details (a) Major spec.				
	Basin area	630.7 km^2		
	Annual average precipitation	1,554.6 mm (1927-73)		
	Average temperature	26.8 °C (Max. 31.2 °C, Min. 23.1 °C)		
	Design flood	100-year flood		
	Flood discharge	400 m^3/s (Surabaya main stream)		
	Covered section	Surabaya River (I = 1/3,500), Marmoyo River (I = 1/2,300), Mas River and mouth (I = 1/2,500)		
	Surabaya River	Channel improvement, Reconstruction of Gunungsari Dam, Motorization of Mlirip Gate and Jagir Gate		
	Marmoyo River	Channel improvement		
	Mas River and mouth	Reconstruction of dyke along coast (10,000 m^3), Reconstruction of discharge gate at mouth, dredging of regulation pond for revetment (V = 410,000 m^3)		
(b) Project cost	(including the construction cost of the Gunungsari Dam)			
	Source	Price (x 10^6)	Exchange rate	Yen terms (x 10^6)
	OECF (Phase 1)	¥4,080	¥210/$1	4,080
	Indonesian gov.	Rp16,512	Rp526.9/$1	6,581
	Total			¥10,661 x 10^6
(c) Others Work period	May 1974-Oct. 1981			

APPENDIX 1

Brantas Middle Reach River Improvement

1. Project	Brantas Middle Reach River Improvement Project, Phase I, Phase II			
2. Location	Tulungagung and Mojokerto Pref., East Java Province, Republic of Indonesia			
3. Purpose	Flood protection, establishment of flood prediction and warning system			
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia			
5. Consultant	Nippon Koei Co., Ltd., Indra Karya			
6. Contractor	1) Brantas Office civil work 2) Rubber weir (fabrication, assembly, and installation): Bridgestone Corp., Sumitomo Heavy Industries, Ltd. 3) Equipment and materials: provided by Nichimen , Sumitomo Corp.			
7. Financing	OECF, Indonesian government			
8. Project details (a) Major spec.				
Plan	Design flood	50-year flood		
	Flood discharge	890 m^3/s-1,500 m^3/s		
	Covered area	Kediri City to Lengkong Dam: approx. 110 km		
Work	Embankment	1,400,000 m^3		
	Bed dredging	150,000 m^3		
	Revetment	118,000 m^2		
	Pumping station	At one location		
	Rubber dam	At two locations (Jatimlerek, Menturus)		
	Others	Set		
(b) Project cost	(Phase I, Phase II)			
	Source	Price (x 10^6)	Exchange rate	Yen terms (x 10^6)
	OECF	¥12,222	¥226.74/$1	12,222
	Indonesian gov.	Rp80,668	Rp627/$1	29,172
	Total			¥41,394 x 10^6
(c) Economic benefit	Annual profit	US$3,811,000 (of the whole project profit)		
	Internal rate of return (EIRR)	10.4% (of the whole project EIRR)		
(d) Others Work period	May 1975-Mar. 1993			

(3) Irrigation

South Tulungagung Diversion Tunnel (Nejama)

1. Project	South Tulungagung Diversion Tunnel Project (Nejama)		
2. Location	Tulungagung Pref., East Java Province, Republic of Indonesia		
3. Purpose	Land reclamation		
4. Executing Agency	Bureau of Irrigation, Ministry of Public Works, Republic of Indonesia		
5. Consultant	Nippon Koei Co., Ltd.		
6. Contractor	Kajima Corp.		
7. Financing	War reparations		
8. Project details (a) Major spec.			
Plan	Reclaimed area	Approx. 28,000 ha	
Work	Tunnel	Type Specification	Circular concrete tunnel Inner dia. 7.2 m L 1,000 m

(b) Project cost

Source	Price (x 10^6)	Exchange rate	Yen terms (x 10^6)
Reparations	¥710		710
Indonesian gov.			290 (estimate)
Total			¥1,000

Note: The figure for the Indonesian government is estimated.

(c) Others
Work period: Sep. 1959 - Feb. 1961

APPENDIX 1

Lodoyo Irrigation

1. Project	Lodoyo Irrigation Project			
2. Location	Vicinity of Lodoyo, Blitar City, Blitar Pref., East Java Province, Republic of Indonesia			
3. Purpose	Improvement of irrigation facilities			
4. Executing Agency	EJIS, Ministry of Public Works, Republic of Indonesia			
5. Consultant	Brantas Office (force account)			
6. Contractor	Local contractors			
7. Financing	ADB, Indonesian government			
8. Project details (a) Major spec.				
Plan	Irrigation area	13,500 ha (incl. newly developed 7,400 ha)		
Work	Trunk (primary) channel	28 km		
	Secondary channel	86 km		
	Minor channel	One set		
(b) Project cost	Source	Price (x 10^6)	Exchange rate	Yen terms (x 10^6)
	ADB	¥1,881		1,881
	Indonesian gov.	Rp10,842	¥2.08/Rp	5,213
	Total			¥7,094 x 10^6
(c) Economic benefit	Annual profit	US$2,903,000		
	Internal rate of return (EIRR)	15.7%		
(d) Others Work period	May 1977 - Sep. 1985			

APPENDIX 1

Widas Irrigation

1. Project	Widas Irrigation Project			
2. Location	Widas River, Brantas branch, Jombang Pref., East Java Province, Republic of Indonesia			
3. Purpose	Improvement of irrigation facilities			
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia			
5. Consultant	Nippon Koei Co., Ltd.			
6. Contractor	Brantas Office civil work/local contractors			
7. Financing	OECF, Indonesian government			
8. Project details (a) Major spec.				
Plan	Irrigation area	Dry season: 5,200 ha, Rainy season: 8,600 ha		
	Annual average precipitation	1,884 mm (at Nganjuk Station)		
Work	Glatik Barrage	Type	Floating foundation concrete fixed weir	
		Intake rate	7.4 m^3/s	
		Size	W 54.2 m x H 11.5 m	
	Waterway	Length 17km; Excavation 181,000 m^3; Filling 129,000 m^3		
	Road	Set of farm roads		
	Bridge	16 road bridges		
	Gutter, siphon culvert, etc.	At 51 locations		
(b) Project cost	(including the construction cost of the Bening Dam)			
	Source	Price (x 10^6)	Exchange rate	Yen terms (x 10^6)
	OECF	¥1,833	¥300/$	1,833
	Indonesian gov.	Rp10,270	Rp625/$	4,930
	Total			¥6,763 x 10^6
(c) Economic benefit	Annual profit	US$16,301,000		
	Internal rate of return (EIRR)	15%		
(d) Others Work period	Aug. 1979-Oct. 1981			

APPENDIX 1

Tulungagung Diversion

1. Project	Tulungagung Diversion Project (Parit Agung Channel)				
2. Location	Ngrowo River, Brantas branch, Parit Agung District, Tulungagung Pref., East Java Province, Republic of Indonesia				
3. Purpose	Land reclamation				
4. Executing Agency	Brantas River Basin Development Executing Office, Ministry of Public Works, Republic of Indonesia				
5. Consultant	Brantas Office (force account)				
6. Contractor	PT Brantas Abipraya				
7. Financing	ADB, Indonesian government				
8. Project details (a) Major spec.					
Plan	Channel flow capacity	60 m^3/s (total channel capacity: 466 m^3/s)			
Work	Channel improvement	24.2 km (trapezoid, bottom width: 10 m-29 m)			
	Tunnel excavation	1,156 m(dia. 7.5 m)			
	Barrage	One set (incl. Tulungagung Gate etc.)			
	Bridge	10 bridges			
(b) Project cost					
	Source	Price	Exchange rate	Yen terms (x 10^6)	
	ADB	US$45,263 x 10^3	¥168.52/$	7,628	
	Local currency	Rp3,485 x 10^6	Rp2,083/$	1,673	
	Total			¥9,301 x 10^6	
(c) Others Work period	May 1981-Oct. 1986				

APPENDIX 1

East Java Groundwater Development Study

1. Project	East Java Groundwater Development Study Project (Phase I, Phase II)				
2. Location	Nganjuk and Kediri Prefs., East Java (Phase I), Whole East Java (Phase II), Republic of Indonesia				
3. Purpose	Study of groundwater for irrigation, planning and design of groundwater irrigation facilities				
4. Executing Agency	Directorate General of Water Resources Development, Ministry of Public Works, Republic of Indonesia				
5. Consultant	Phase I: British consultant Phase II: Nippon Koei Co., Ltd.-ELC (Italy)-Wiratman & Associates(Indonesia) JV				
6. Contractor	Local contractors				
7. Financing	IBRD, Indonesian government				
8. Project details (a) Major spec.					
Plan	Irrigation area	Phase I: Kediri-Nganjuk area: studied. Phase II: Blitar-Kediri-Nganjuk area: 3,600 ha Tuban-Mojokerto-Pasuruan-Puroboringo area: 2,650 ha Jumpuluh-Lumajan-Banyuwagi-Sitoubondo area: studied			
	Well depth	100 m-130 m			
	Pumping rate per well	30 lit./s-60 lit./s			
(b) Project cost	(Phase II)				
	Source	Price (x 10^3)	Exchange rate	Yen terms (x 10^6)	
	IBRD	US$4,000	¥197.5/$1	790	
(c) Others Work period	Phase I: 1972-1980 Phase II: Nov. 1982-Apr. 1986				

(4) Volcanic Disaster Prevention

Mt. Kelud Debris Control

1. Project	Mt. Kelud Debris Control Project	
2. Location	Area surrounding Mt. Kelud, East Java Province, Republic of Indonesia	
3. Purpose	Eruptive debris control	
4. Executing Agency	Mt. Kelud Volcanic Disaster Prevention Project Office, Ministry of Public Works, Republic of Indonesia	
5. Consultant	Nippon Koei Co., Ltd., Colombo Plan	
6. Contractor	Project Office (force account)	
7. Financing	Indonesian government	
8. Project details (a) Major spec.		
Plan	Quantity of ejecta	200,000,000 m^3 (per eruption, 15-year interval assumed)
	Sediment capacity	66,000,000 m^3 (per eruption, sediment volume produced for three years after eruption: 64,000,000 m^3)
	Debris control facilities	Debris barrier (21) Checkdam (40) Groundsel (140) Groundsel for rapid streams (19) *Earth reservoir* (12) Note: Figures in ( ) are the number of planned locations per eruption as of 1982.
(b) Project cost		

Source	Price (x 10^6)	Exchange rate	Yen terms (x 10^6)
Indonesian gov.	Rp6,000/year	Rp2,083/¥	2,880/year

Note: Tokol Debris Barrier (1973-75), Mendalan Debris Barrier (1972-73)
Construction cost: Rp609 x 10^6

(c) Others Work period	1960 - under way

APPENDIX 1

Mt. Kelud Emergency Debris Control

1. Project	Mt. Kelud Emergency Debris Control Project (Measures for 1990 Eruption)				
2. Location	Mt. Kelud crater lake, Malang Pref., East Java Province, Republic of Indonesia				
3. Purpose	Rehabilitation of crater lake diversion tunnel (countermeasures against lahar)				
4. Executing Agency	Mt. Kelud Volcanic Disaster Prevention Project Office, Ministry of Public Works, Republic of Indonesia				
5. Consultant	Yachiyo Engineering Co., Ltd., Nippon Koei Co., Ltd., three local consultants				
6. Contractor	Project Office (force account)				
7. Financing	OECF, Indonesian government				
8. Project details (a) Major spec.					
Plan	Rehabilitation of crater lake diversion tunnel	874 m, Inner dia. 1.6 m-1.8 m			
(b) Project cost	Source	Price (x 10^6)	Exchange rate	Yen terms (x 10^6)	
	OECF	¥3,246		3,246	
	Indonesian gov.			1,000	
	Total			¥4,246 x 10^6	
	Note: The figure for the Indonesian government is estimated.				
(c) Others Work period	1992 – under way				

APPENDIX 1

4. Materials Related to Indonesia and Brantas Basin

(1) Population

Unit: 10^3

	1950	1960	1965	1970	1975	1980	1985	1990	1993	1995	2000
1.1 Major Islands											
1.1.1 Whole Indonesia	77,495*	95,116*	105,077	119,470*	135,670*	147,490	164,629	179,322	192,935	194,440	209,518
1.1.2 Kalimantan	–	3,998*	4,245*	4,985*	5,694*	6,723*	7,749	8,911	9,616	10,521	11,999
1.1.3 Sumatra	–	15,258*	17,817*	20,017*	24,296*	28,016	32,719	37,939	41,154	40,970	45,337
1.1.4 Sulawesi	–	6,934*	7,690*	8,317*	9,420*	10,409	11,594	12,508	13,546	13,772	151,022
1.1.5 West Irian	–	742*	827*	896*	1,041*	1,174	1,376	1,600	1,778	1,956	2,285
1.1.6 Java	51,267*	61,884*	67,991*	75,033*	82,487*	91,220	100,207	-	114,147	114,988	121,761
1.1.7 Others	–	6,300*	6,627	7,177	8,081	9,948	10,984	10,790	12,694	12,235	13,115
1.2 Java Island											
1.2.1 West Java (incl. Jakarta City)	–	19,974*	23,234*	26,214	28,914	33,953	40,716	44,458	48,111	48,498	53,339
1.2.2 Central Java	–	20,483*	22,920*	23,123	25,831	28,098	28,224	30,628	32,656	32,614	33,450
1.2.3 East Java	17,838*	21,427*	23,483*	24,838	27,742	29,169	31,267	32,488	33,380	33,886	34,972
(1) Brantas Basin	7,059*	8,367	9,174	9,917	11,103	12,010	12,450	13,073	13,475	-	-
(2) Surabaya City	724*	1,008	1,106	1,403	1,691	2,028	2,097	2,192	2,286	2,701	2,902
1.3 Major city											
1.3.1 Jakarta	1,432	2,811	3,463	4,437	5,404	6,503	7,756	8,938	10,320	9,161	10,054
1.3.2 Surabaya	724*	1,008	1,106	1,403	1,691	2,028	2,097	2,192	2,286	2,701	2,902
1.3.3 Medan	–	683	749*	951*	1,146*	1,374	1,565*	1,736	1,842	1,910	2,065

Source: Statistical Yearbook of Indonesia 1994, issued by Central Bureau of Statistics Jakarta-Indnesia (1972-94)

Remarks: 1) Asterisked figures have been estimated from the previous and following years.
2) For 1995 and 2000, the figures are also estimated.

APPENDIX 1

(2) Education-1

Unit: school

	1970	1975	1980	1985	1990	1993
2.1 No. of schools						
(1) Whole Indonesia						
Primary school	65,950	73,589	110,050	139,511	147,066	148,257
Junior high school	7,231	7,843	12,016	16,860	20,605	18,601
Senior high school	2,815	2,979	4,207	8,102	11,064	10,410
University/college	231	381	403	630	963	1,173
(2) Java Island						
Primary school	–	40,114	57,888	72,851	74,936	75,875
Junior high school	–	4,032	5,889	8,377	9,758	8,923
Senior high school	–	1,623	2,466	4,409	5,975	5,475
University/college	–	–	–	302	499	655
(3) East Java						
Primary school	9,772	11,846	17,049	21,696	22,460	22,458
Junior high school	996	1,188	1,893	2,812	3,111	2,791
Senior high school	430	445	998	1,458	1,956	1,742
University/college	–	–	117	129	163	193
(4) Surabaya City						
Primary school	–	797	912	1,022	1,168	1,122
Junior high school	–	238	268	406	458	375
Senior high school	–	137	156	240	271	264
University/college	–	–	18	–	–	56
(5) Malang City						
Primary school	–	1,324	1,493	1,698	2,115	2,100
Junior high school	–	153	208	337	443	450
Senior high school	–	92	106	166	194	214
University/college	–	–	20	–	–	27

APPENDIX 1

(2) Education - 2

Unit: people

	1970	1975	1980	1985	1990	1993
2.2 No. of students						
(1) Whole Indonesia						
Primary school	12,821,618	14,280,157	22,487,053	26,550,015	26,348,376	26,339,995
Junior high school	1,292,230	1,900,154	3,412,116	5,669,966	5,686,718	5,577,040
Senior high school	598,110	795,423	2,023,560	3,131,269	3,869,964	3,766,650
University/college	206,800	250,125	543,075	1,217,560	1,485,894	1,995,999
(2) Java Island						
Primary school	7,819,730	8,438,204	12,440,193	13,629,465	14,250,418	14,279,215
Junior high school	–	1,119,501	1,693,596	2,721,280	3,111,050	3,133,057
Senior high school	–	483,207	1,471,915	1,756,805	1,815,313	2,133,436
University/college	–	–	–	519,345	930,208	1,348,639
(3) East Java						
Primary school	2,484,193	2,610,836	4,016,482	4,208,779	3,874,339	3,791,866
Junior high school	204,151	331,378	590,573	984,989	949,564	861,778
Senior high school	94,381	124,528	338,312	540,543	643,113	601,282
University/college	–	–	74,088	117,691	252,212	318,970
(4) Surabaya City						
Primary school	–	246,283	277,081	281,132	310,501	297,027
Junior high school	–	35,970	82,392	95,238	107,004	95,043
Senior high school	–	35,970	61,022	95,238	107,004	95,043
University/college	–	–	–	–	–	34,065
(5) Malang City						
Primary school	–	371,553	385,211	378,382	424,910	405,530
Junior high school	–	37,900	60,360	99,499	102,246	111,558
Senior high school	–	15,423	32,950	56,888	69,601	51,487
University/college	–	–	11,646	–	–	17,887

APPENDIX 1

(3) GDP (Gross Domestic Product) - 1

Unit: 10^9 rupiahs

	1965	1970	1975	1980	1985	1990	1993
3.1 Provinces							
3.1.1 Whole Indonesia	23.7	3,340.0	12,643.0	45,445.7	95,707.0	196,919.2	304,017.8
(1) Agriculture	–	1,475.0	4,003.4	11,290.3	22,290.3	42,148.7	55,745.5
(2) Industry	–	263.0	1,453.3	5,287.9	12,983.2	40,029.7	67,441.4
(3) Services		327.0	472.8	5,124.0	14,366.7	24,126.3	41,453.0
(4) Others	–	1,275.0	6,713.5	23,743.5	46,066.8	90,614.5	139,377.9
3.1.2 Kalimantan	–	135.3*	989.3*	4,519.5	8,832.0	17,150.8	25,450.2*
3.1.3 Sumatra	–	849.6*	3,590.8*	13,543.6	24,977.0	46,860.3	66,463.6*
3.1.4 Sulawesi	–	167.7*	622.9*	2,028.1	3,987.0	7,761.9	11,979.3*
3.1.5 West Irian	–	17.6*	188.9*	706.4	933.0	2,183.8	3,620.5*
3.1.6 Java Island	–	1,670.9	6,082.7	20,007.3	51,070.4	106,963.7	160,623.2*
(1) Agriculture	–	675.4	2,062.6	5,547.4	10,700.0	21,404.7	31,262.7*
(2) Industry	–	239.3	687.2	2,658.5	9,706.5	24,227.9	42,762.1*
(3) Services	–	163.3	918.6	4,079.6	8,358.6	14,752.7	22,412.9*
(4) Others	–	592.9	2,414.3	7,721.8	22,305.3	46,578.4	64,185.5*
3.1.7 Others	–	–	3,992.1*	4,640.8	5,907.6	15,998.7	33,881.0*
3.2 Java Island							
3.2.1 West Java	–	683.9	2,757.7	9,639.6	25,935.7	54,213.0	82,953.7*
(1) Agriculture	–	187.1	618.9	1,538.0	3,096.8	6,824.6	10,237.0*
(2) Industry	–	82.7	253.9	1,278.2	5,157.3	12,509.3	19,497.5
(3) Services	–	60.7	422.0	2,298.7	3,777.2	6,997.5	10,773.4*
(4) Others	–	353.4	1,462.9	4,524.7	13,904.4	27,881.6	42,445.8*
3.2.2 Central Java	–	363.1	1,471.6	4,409.5	11,117.9	23,589.8	38,502.7*
(1) Agriculture	–	191.7	602.4	1,818.0	3,294.3	7,152.4	10,731.5*
(2) Industry	–	77.5	212.2	460.0	2,199.2	5,603.9	11,250.3*
(3) Services	–	47.2	200.2	928.3	2,210.4	3,577.3	4,895.4*
(4) Others	–	46.7	456.8	1,203.2	3,414.0	7,256.2	11,625.5*

APPENDIX 1

(3) GDP (Gross Domestic Product) - 1

Unit: 10^9 rupiahs

	1965	1970	1975	1980	1985	1990	1993
3.2.3 West Java	–	623.9	1,853.4	5,958.2	14,016.8	29,160.9	39,166.8
(1) Agriculture	–	296.6	841.3	2,191.4	4,308.9	7,427.7	10,294.2
(2) Industry	–	79.1	221.1	920.3	2,350.0	6,114.7	12,014.3
(3) Services	–	55.4	296.4	852.6	2,371.0	4,177.9	6,744.1
(4) Others	–	192.8	494.6	1,993.9	4,986.9	11,440.6	10,114.2
3.2.4 Brantas Basin	–	330.5*	982.3*	3,177.0	7,524.3*	16,110.2	24,858.4
(1) Agriculture	–	191.0	308.3	671.0	1,687.6	2,619.6	3,739.9
(2) Industry	–	41.9	117.2	416.4	1,732.8	4,463.6	7,422.7
(3) Services	–	–	–	–	447.1	781.8	1,178.5
(4) Others	–	97.6	556.8	2,089.6	3,656.8	8,245.2	12,517.3
3.3 Cities							
3.3.1 Jakarta	–	270.3*	1,036.9	3,988.0	11,282.6	22,830.2	35,989.9*
(1) Agriculture	–	20.4*	21.7	57.2	126.7	240.9	197.6*
(2) Industry	–	20.2*	115.3	732.3	2,689.0	6,026.0	8,869.6*
(3) Services	–	38.3*	105.3	698.0	1,827.3	3,463.0	5,320.3*
(4) Others	–	191.4*	794.6	2,500.5	6,639.6	13,100.3	21,602.4*
3.3.2 Surabaya	–	105.2	262.5*	1,004.5	1,903.1	4,310.6	6,984.9
(1) Agriculture	–	–	–	26.4	61.7	124.5	140.6
(2) Industry	–	–	–	205.3	463.9	1,181.4	2,049.3
(3) Services	–	–	–	144.2	135.3	237.3	361.9
(4) Others	–	–	–	628.6	1,242.2	2,767.4	4,433.1
3.3.3 Medan	–	–	–	–	1,110.3	2,588.3	3,978.4
(1) Agriculture	–	–	–	–	42.8	117.0	217.9
(2) Industry	–	–	–	–	169.4	429.9	735.4
(3) Services	–	–	–	–	75.8	591.8	705.6
(4) Others	–	–	–	–	822.3	1,449.6	2,319.5

Remarks: 1) Figures for 1993 are estimated from data for 1992.
2) Values marked by an asterisk are estimated from the previous and following years.

APPENDIX 1

(4) Agriculture - 1 (land use)

Unit: 10^3 ha

	1960	1965	1970	1975	1980	1985	1990	1993
4.1 Land use								
4.1.1 Whole Indonesia	–	–	–	–	47,222	66,956	70,021	55,854
(1) Urban area	–	–	–	–	4,453	4,735	4,967	5,143
(2) Farming fields	–	7,324	7,225	–	8,892	11,982	13,110	11,775
(3) Rice fields	–	5,804	6,679	–	7,059	7,613	8,228	8,499
4.1.2 Java Island	–	–	–	–	12,174	9,551	9,739	9,457
(1) Urban area	–	–	–	–	1,531	1,537	1,626	1,722
(2) Farming fields	–	–	–	–	2,914	3,155	3,130	3,080
(3) Rice fields	3,545	2,650	–	–	3,491	3,561	3,644	3,426
4.1.3 East Java	–	–	3,553	3,596	4,176	3,192	3,228	3,205
(1) Urban area	–	–	510	–	538	526	568	581
(2) Farming fields	–	–	1,103	1,226	1,082	1,188	1,195	1,181
(3) Rice fields	–	–	1,129	–	1,191	1,236	1,171	1,175
4.1.4 Brantas Basin	–	–	1,180	1,180	1,180	1,180	1,180	1,180
(1) Urban area	–	–	210	–	–	–	212	227
(2) Farming fields	–	–	393	–	–	–	315	293
(3) Rice fields	300	–	314	312	316	317	325	324

APPENDIX 1

(4) Agriculture – 2 (yield)

Unit: ton

	1960	1965	1970	1975	1980	1985	1990	1993
4.2 Yield								
4.2.1 Whole Indonesia								
(1) Rice (in the husk)	17,534,000	17,754,000	26,392,175	29,201,619	29,773,962	39,032,945	45,178,751	48,181,087
(2) Maize	2,460,000	2,364,000	2,602,494	2,902,887	4,012,075	4,329,503	6,734,028	6,459,737
(3) Cassava	11,876,000	10,031,000	10,689,691	12,545,544	13,532,487	14,057,027	15,829,635	17,285,385
(4) Others	–	–	283,773	379,683	475,795	527,852	650,560	638,708
4.2.2 Java Island								
(1) Rice (in the husk)	10,110	9,799	16,228,348	17,943,039	18,536,899	24,225,280	27,177,422	28,296,673
(2) Maize	11,793,000	1,704,000	2,100,750	2,177,460	2,826,426	2,872,257	4,496,867	3,956,658
(3) Cassava	8,688,000	10,073,000	8,074,691	9,309,449	9,626,466	9,297,018	10,019,834	10,037,712
(4) Others	–	–	223,789	296,789	342,900	343,575	440,910	405,220
4.2.3 East Java								
(1) Rice (in the husk)	3,437	2,998,000	4,663,703	5,376,269	6,276,783	7,595,374	8,234,714	8,627,748
(2) Maize	1,047,000	1,034,000	1,048,644	1,288,774	1,692,806	1,701,120	2,578,286	2,363,252
(3) Cassava	2,959,000	3,073,350	3,333,221	3,938,068	4,026,527	3,752,853	3,710,594	3,625,712
(4) Others	–	–	100,145	126,448	135,204	135,251	147,040	158,958
4.2.4 Brantas Basin								
(1) Rice (in the husk)	–	–	1,428	1,970	2,290	2,535	2,426	2,667
(2) Maize	–	–	29	154	399	589	486	580
(3) Cassava	–	–	89	125	1,025	1,140	861	1,211
(4) Others	–	–	115	210	175	185	185	191

(5) Industry – 1 (number of operating offices)

	1970	1975	1980	1985	1990	1993
5.1 Number of operating offices						
5.1.1 Whole Indonesia	–	1,347,818	1,536,324	1,526,377	2,213,733	2,496,768
5.1.2 East Java	–	243,413	373,553	438,189	465,169	478,590
(1) Heavy industries	–	73	265	323	466	560
(2) Food production	–	–	–	–	–	–
(3) Light industries	–	242,651	367,781	431,139	456,978	469,814
(4) Electronics	–	–	–	–	–	–
(5) Others	–	689	5,507	6,727	7,725	8,216
5.1.3 Brantas Basin	–	823	2,062	26,709	46,693*	48,231
(1) Heavy industries	–	19	63	137	*	155
(2) Food production	–	1	29	43	*	113
(3) Light industries	–	431	1,336	25,316	43,788	44,788
(4) Electronics	–	–	–	–	–	–
(5) Others	–	372	634	1,213	2,905	3,175

(5) Industry – 2 (production and number of employees)

	1970	1975	1980	1985	1990	1993
5.2 Production (10^9 rupiahs)						
5.2.1 Whole Indonesia	–	1,652.2	5,979.0	22,533.6	96,334.5	148,293.5
5.2.2 East Java	79.1	130.0*	1,676.0	3,219.5	12,239.0	24,085.3
5.2.3 Brantas Basin	41.9*	68.9	–	941.4	3,756.4	7,072.0
5.3 Number of employees (people)						
5.3.1 Whole Indonesia	972,024	4,904,698	4,491,887	5,175,843	6,417,875	8,337,983
5.3.2 East Java	341,932	754,896	1,166,843	1,587,748	2,019,115	2,214,704
5.3.3 Brantas Basin	–	29,986	65,277	202,362	401,625	1,310,410

Remark: Asterisked figures are estimated ones from data for the previous and following years.

(6) Electric power – 1 (installed capacity)

Unit: 10^3 kW

	1960	1965	1970	1975	1980	1985	1990	1993
6.1 Power station capacity								
6.1.1 Whole Indonesia	314*	331*	526	1,159	2,505	5,635	9,118	13,600
(1) Thermal	41	41*	101	256	741	2,486	3,941	8,102
(2) Hydraulic	113*	113*	190	329	371	1,066	2,095	2,179
(3) Diesel	160	135*	193	282	514	936	1,870	2,128
(4) Gas	–	42*	42	292	879	1,117	1,072	996
(5) Geothermal	–	–	–	–	–	30	140	195
6.1.2 Java Island	–	331*	359	795	1,853	2,695*	6,248	10,138
(1) Thermal	–	41*	169	436*	706	–	3,500	7,262
(2) Hydraulic		113*	190*	238*	338	–	1,814	1,879
(3) Diesel	–	135*	–	92*	74	–	127	115
(4) Gas	–	42*	–	29*	735	–	667	687
(5) Geothermal	–	–	–	–	–	–	140	195
6.1.3 East Java	52	110	115	252	449	773	1,177	3,632
(1) Thermal	21	50	50	50	150	450	750	3,129
(2) Hydraulic	31	40	45	152	205	210	239	275
(3) Diesel	–	20	20	22	26	22	76	96
(4) Gas	–	–	–	28	68	91	112	132
(5) Geothermal	–	–	–	–	–	–	–	–
6.1.4 Brantas Basin	–	–	–	–	–	–	–	–
(1) Hydraulic	31	31	31	134	188	193	222	258
(2) Thermal	21	50	50	50	150	450	750	1,350

Remarks: 1) Asterisked figures have been estimated from data of previous and following years.
2) For the Brantas Basin thermal power, data are presented only from Surabaya and Gresik Thermal Power Stations.

(6) Electric power – 2 (generated energy)

Unit: 10^6 kWh

	1960	1965	1970	1975	1980	1985	1990	1993
6.2 Electric energy								
6.2.1 Whole Indonesia	1,213	1,584	2,125	4,147	8,420	15,312	34,879	46,719
(1) Thermal	–	–	412	915	2,491	9,781	22,296	29,579
(2) Hydraulic	–	626	697	1,177	1,247	2,417	5,675	7,859
(3) Diesel	–	–	925	1,010	1,728	1,897	3,608	5,582
(4) Gas	–	–	91	1,045	2,954	1,000	2,175	2,609
(5) Geothermal	–	–	–	–	–	217	1,125	1,090
6.2.2 Java Island	–	–	752	1,972	7,502	12,102	28,060	37,935
(1) Thermal	–	–	–	638	3,901	9,344	20,046	27,666
(2) Hydraulic	–	–	–	772	1,345	1,999	5,048	6,655
(3) Diesel	–	–	–	142	1,205	54	1,041	1,400
(4) Gas	–	–	–	420	1,051	488	800	1,124
(5) Geothermal	–	–	–	–	–	217	1,125	1,090
6.2.3 East Java	202	408	421	684	1,251	2,975	5,038	9,656
(1) Thermal	142	264	264	129	431	1,978	4,080	8,251
(2) Hydraulic	60	107	120	514	707	941	707	1,050
(3) Diesel	–	37	37	40	64	47	145	172
(4) Gas	–	–	–	1	49	9	106	183
(5) Geothermal	–	–	–	–	–	–	–	–

APPENDIX 1

(7) Exchange rates (yen and rupiah to dollar) and GDP deflator

1960's

		1960	1963	1964	1965	1966	1967	1968	1969
US$1.0	Yen	360	360	360	360	360	360	360	360
	Rupiah	45	1,080*	1,548*	7,200*	–	149.6	296.3	326.0
GDP deflator	1990 = 100	3.0	–	–	0.07	0.7	2.0	4.5	5.5

1970's

		1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
US$1.0	Yen	360	349.33	303.17	271.7	292.08	296.79	296.55	268.51	210.44	219.14
	Rupiah	362.8	391.9	415.0	415.0	415.0	415.0	415.0	415.0	442.0	623.1
GDP deflator	1990 = 100	6.3	6.4	7.3	9.7	14.3	16.0	18.3	20.7	23.0	30.5

1980's

		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
US$1.0	Yen	226.74	220.54	249.08	237.51	237.52	238.54	168.52	144.64	128.15	137.96
	Rupiah	627.0	631.8	661.4	909.3	1,025.9	1,110.6	1,282.6	1,643.8	1,685.7	1,770.1
GDP deflator	1990 = 100	39.3	46.7	49.1	58.5	63.3	66.7	66.7	77.2	87.5	91.0

1990's

		1990	1991	1992	1993	1994
US$1.0	Yen	144.79	134.71	126.65	111.20	102.21
	Rupiah	1,842.8	1,950.3	2,029.9	2,087.1	2,160.8
GDP deflator	1990 = 100	100.0	108.3	116.7	125.8	–

Source: IFC Yearly Report (1993, 95)

Remarks: Regarding the conversion rate for rupiahs,

1) for 1963, the value for January is given
2) for 1965, the value for February is given; and
3) for 1960, the market rate is provided.

Appendix 2

Memories of Brantas Spirit

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BRANTAS RIVER BASIN DEVELOPMENT

Where Men build dams and Dams build men

Prof. Ir. Suryono*

I am very pleased to have learnt that Japan International Cooperation Agency (JICA) has been undertaking a Study on Comprehensive Management Plan for the Water Resources of the Brantas River Basin, and JICA is going to publish a book of "Development of the Brantas River Basin" under this study.

The Brantas Project has been recognized widely by international organizations as well as Indonesian nationals as one of the most successful development project, a first success story of the water resources development in the country in view of its economic values and more importantly human resources development.

The idea to develop the water resources of the Brantas River Basin did not grow out of an "engineer's dream" only, but was also felt as an urgent need at that time. With a catchment area of almost 12,000 km^2 consisting of 60% agricultural area, and by the fortuitous combination of the availability of much water, fertile soil and favourable topography, this area had been developing to become the granary of Java. Besides all that, the Brantas River has a great potential for power generation, although it was still "an idle giant" but in some instances a destructive one.

However, the condition of the Brantas River was exceedingly getting worse. The existence of the Kelud Mountain in the centre of the river basin created a particular problem to the river. This mountain is an active volcano, which erupts about every 15-30 years, by which millions of cubic meter of lava will be thrown down to its slopes, and directly or gradually washed away by rain down into the river. Therefore, the riverbed was continuously raising so that the capacity to discharge the flood water continued to decrease, especially in the middle and lower course of the river. The worsening condition of the river brought about flood every rainy season, so that the term "routine flood" was created. In addition to this routine flood, drought also threatened every dry season due to this worsening condition of the river and the non-existence of water works which might check and control the water flow.

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* 1961 - 1975: Brantas Project General Manager

Toward such a condition something had to be done. It was then felt necessary to undertake serious and fundamental efforts because only with such efforts it was possible to improve the condition; by patchwork undertakings it would be wasting money only. As a first step, in 1959, a comprehensive plan for the development of the Brantas River was drawn up with the assistance of a Japanese consultant company, where as foreign financing was received from the Japanese War Reparation Fund. By this step, gigantic works were started, consisting of a flood diversion tunnel, the constructions of a series of multipurpose dams diversions dams, strengthening and heightening of embankments, river improvement works, together with efforts to control the sand flow at the basin (sabo works) and all based upon a river basin development concept, namely "one river, one plan."

Systematic implementation of the Brantas Basin development began with the construction of the South Tulungagung Drainage Tunnel as the first step to mitigate the regular yearly flood in that area and to drain the vast swampy areas. The name Tulungagung tells its story: big cry for help (Tulung = cry for help, Agung = big), but at present the area has become a fertile farmland and free from floods. Within a short time, what used to be the flood water, will generate electricity.

The next construction works started with the large scale Karangkates Multipurpose Dam in parallel with the design works of Selorejo Multipurpose Dam also known as Kali Konto Project (Karangkates, Kali Konto and Riam Kanan Project was known among Japanese circles as the 3-K Project).

At that time, water resources development as well as construction of large dams were relatively a new field in Indonesia. Therefore, it was expected that the big construction works at the Brantas River Basin might serve as a training ground as well as a place for transfer of knowledge and technology in the field of water resources engineering so that the Indonesians could handle themselves the development of so many river basins in Indonesia.

Transfer of Knowledge and Technology

About 35 years ago, an experiment took place in the valley of the Brantas River in view of mastering the know-how of water resources development through the transfer of knowledge and technology from Japanese professionals. That effort began at the project level and not at the top while the responsibility was laid on one group of men who can be held accountable with some directives from the Government.

Efforts for those transfer were undertaken through several stages. The first stage was to observe and absorb the knowledge owned by the Japanese expatriates in carrying on the works. During this stage all works were completely contracted, the design works as well as the implementation. These works covered the construction of the Karangkates Diversion Tunnel and Cofferdam, covering the period from 1962 - 1964.

The second stage was to try to participate actively in the execution of the works with the full assistance of the Japanese professionals. Starting from this stage the actual experiment started; the works were not contracted any longer, but were carried out by "direct force", meaning that the Brantas Project Management could directly recruit, select, hire, train and supervise the workmen and be responsible for the policies governing the wages and condition of work. The almost practice is otherwise. Government construction projects are generally "let out to contract". Works during this stage covered the construction of Karangkates Dam and Powerplant, the Selorejo Dam and Powerplant as well as the New Lengkong Diversion Dam, covering the period 1964 - 1972.

The third stage was to try to execute the works by the Indonesians themselves and to play a bigger role by minimizing the assistance and number of the Japanese professionals. Works during this stage covered the construction of Lahor Dam, Wlingi Dam and Powerplant, river improvement works of Kali Porong and Kali Surabaya, the middle reach of Kali Brantas and the construction of Widas Dam, covering the period of 1972 - 1980.

To give a picture in the effort of minimizing the assistance and number of Japanese professionals: in the first project the Karangkates Dam, the total input of Japanese was over 150,000 man-days and at the peak of the construction there were 150 Japanese at work. However during the construction of the fourth dam, the Wlingi Dam (1974 - 1978), there were only 10 Japanese engineers of equivalent to 12,000 man-days. It means that for the project was needed only 1/15 of the total number of expatriates needed for the Karangkates Dam.

Success of the Brantas Project does not stand alone. It is indebted to the cooperation and support of so many parties and institutions. First of all, the Ministry of Public Works who renders positive policies and facilities to the transfer of knowledge and technology. In the region, the Governor of East Java and the local officials render assistance to facilitate custom formalities, land compensation works and other administrative support. Also the Military Commander of East Java helped the Brantas Project to get quotas of cement and his Corps of Engineers gave support whenever necessary.

Human Relations

Good cooperation was being established between the Japanese and Indonesian parties in facing gigantic works as well as difficulties, especially in the 1960's, during which financing was limited and local inflation rate was very high. It was quite possible that the term "war reparation" brought spirit and a sense of responsibility that the fund should be materialized and returned to the Indonesian people appropriately.

On site, the Japanese and Indonesian parties willingly lived in below-standard environments and houses. They did not complain; they worked driven by the desire that as much as possible of resources available should be invested in the main works. At the time it was possibly due to their office regulations that the Japanese did not bring their families. Through personal contacts, it was understood that the Japanese staff missed their families and their environment. Some efforts were done to make them feel at home such as, efforts to import Japanese food, and through joint effort, a Japanese clubhouse was built in Karangkates with its Japanese garden. A golf course was also made to be used during leisure time; land was available, heavy equipment and operators could be used to make hazards and hills, etc.

Human relations were opened between "teachers" and "students". Discussions were held, either party appreciated the other's superiority and capabilities. To transfer knowledge they owned or to receive the knowledge as much as possible became a game and even a spirit. It was then often difficult to distinguish as to which was the main objective, to build a dam or to learn a profession. A spirit which was difficult to formulate had grown: The Brantas Spirit; a work culture of professional pride and responsibility.

Further Development

As time went on, the task of the Brantas Project increased not necessarily in line with construction works. Some feasibility study projects and its reports had been prepared by the Brantas people themselves such as Lahor and Wlingi Dam Project, which were accepted by the donor country, in this case by the Japanese Government.

Since first of all the Brantas Project was the one and only river development project at that time and secondly it was executed by direct force and therefore it was necessary to set up its own regulations, not according to the already existing rules and regulations at that time. The Brantas Project become a model and example with all its rules and regulations especially within the circle of the Directorate General of Water Resources.

The Brantas Project also established cooperation with some research institutions and universities, among others with the Institute of Tropical Biology (in ecological studies) and the Brawijaya University, Faculty of Engineering. Dozens of Brantas Project engineers gave their time in lecturing at the Faculty of Engineering and many of the graduates had been using the Brantas Project to practice engineering or for their thesis work. A new department at the Faculty of Engineering was established, namely the Department of Water Resources Engineering. This department was the only one in Indonesia and its first students were graduated in August 1981.

Brantas Project was also asked to give consultation/guidance to several projects, among others: Klara Irrigation Project (Sulawesi), Tajum and Nawangan Dam (Cental Java), Rora besar Dam (West Nusa Tenggara), Parakan Kondang and tunnel rehabilitation of Lamajan Hydropowerplant. Brantas Project was also asked for a total management aid in the execution of the Batujai Dam Project and Jurang Sate Irrigation Project in Lombok Island. Manu Brantas Project people starting from its skilled labourers, professions and posts who left the Brantas Project, either on new assignment or on their own request, got important jobs of positions, proofs of appreciation of their achievements.

The Brantas Project then has sprouted a consulting company (PT. Indra Karya) and a contracting company (PT. Brantas Abipraya) and lately followed by a public corporation: Jasa Tirta, a river basin management corporation. The management here is based on a total system with a holistic approach and by way of telemetering which covers the whole basin for water management and its water quality by testing water samples along the Brantas River.

As written in Kompas newspaper, dated February 17, 1993, on having control of "the destructive giant", it has been wondering: "Why is it that in the year 1993 there are floods in many places, even in the Citarum River Basin with 3 big reservoirs, but in the Brantas River Basin no floods occur". The same thing happened in the rainy season of the year 1994 and the years afterwards. There was also a statement from the Minister of Public Works on facing the dry season in 1994, as written in Kompas newspaper, August 2, 1994: "The Brantas River still can supply enough water in this dry season and no floods occur in the rainy season".

In the dry season of the year 1997, in the beginning of the month of October, the water level of the Karangkates reservoir is still 2m above the projected water level.

By the establishment of Jasa Tirta, the development concept becomes complete: "one river, one plan, one management". We think back of Mr. A.T. Akkerman's statement (a dam expert), due to what is happening in Indonesia: "Men build dams and Dams build men".

Transfer of Knowledge and Technology

From Management by changes to Management of changes

Almizan Abdullah

Management by changes

Ever since its birth management changes at the Brantas have been a daily chore. The Brantas people became the subject as well as the object of organizational changes which occurred seemingly without end. Together with it came about all the decrees or regulations which at a certain time caused confusions, since one was just about to be implemented another one came to replace it. But this was a necessity. First, it was because the Brantas Project was the first river basin development Project of its kind in Indonesia at that time. Second, because the Brantas Project was managed by the direct management method or force account basis not common for a large scale project. As a consequence separate regulations had to be generated which can not be referred to prevailing rules and regulations.

Application of the force account method was the reflection of the keen desire of Professor Suryono and his colleagues to implement transfer of knowledge and technology in the construction of large scale river basin development projects. Funds and resources can be directed and redirected more flexibly often demanded by design changes or shift of priorities, since the transfer of knowledge and technology was in itself an experiment advancing from one phase to the next (observe → learn → try → do) as situations and conditions permit which had frequently to be adjusted to cope with actual reality deviating from original expectations. Another reason was, at that time, Indonesian contractors lacking experience were either not familiar or not competent in constructing large scale projects, so that the force account method of management was assumed to be the practical way for the transfer of knowledge and technology. Although argued to be more costly by those who opposed application of the method, it produced many fruitful side products especially trained personnel, from construction workers to managers and from draftsmen to design engineers which otherwise could not have been obtained from a sublet method.

The Brantas River Basin Development Project of that time, was in essence a large and full scale laboratory implementing one experiment to another, sometimes under adverse situations and conditions requiring tactful management to keep going. Originally it draw its

basic financial needs from the Japanese War Reparation Fund. But at the collapse of the Old Order, as the Fund was declared exhausted, it had to rely on the sporadic very meager government allocations. Dramatic effort was required to convince the government that suspension of work would endanger the principle project i.e. the Karangkates Project, which had reached completion of its cofferdam intended only as a preliminary structure in advance of the main dam. Keeping it standing alone, would place it under a dangerous condition by risking overtopping if a more than 100 year flood swept the diversion facilities since it could only discharge no bigger than such a flood. The newly installed Minister of Public Works and Electricity, the late Ir. Sutami, was convinced of the danger and gave his support for the continuation of the almost suspended works. Later that year the Japanese Emergency Loan was signed and part of it was allocated to the Karangkates Project. This was to be a kind of bridging finance before the implementation of the Japanese OECF Loan arranged under the IGGI scheme part of which was provided to complete the Karangkates Project as well as other projects within the Brantas which came up later.

Management changes was also the result of frequent changing of institutions governing the Brantas Project. At its initiation the Karangkates Project was under PLN (State Electricity Corporation) belonging to the Department of Public Works and Power. In 1964 it was joined by the Selorejo Project (originally under the East Java Provincial Irrigation Office) to form the Brantas Project subordinated under the Department of Basic Water Resources. Later in 1967 after the collapse of the old order and the formation of a new cabinet the Brantas was put again within the Department of Public Works and Power. Nevertheless, thanks to God, throughout all these changes, Prof. Suryono remain the head of the Brantas, holding its orientation as a river basin development project on the right course : one river, one plan, one management.

Management of changes

Ever since the early 70's, at an inspection visit to the Selorejo Dam and Power Station Project, the late Minister Sutami, had expressed his view that an autonomous body should be envisioned to undertake the operation and maintenance of the coming completed projects within the Brantas Project. His view was based essentially on the fact that :

1. the Brantas project was developed on the "one river, one plan, one management" principle and to be managed by people who understand and live with it.

2. if the completed projects are handed over to the Provincial Public Works it would have not enough funds and manpower to operate and maintain.

3. as an autonomous body it would be able to generate its own funds from the sales of electricity and water, thereby releasing it from burdening the state budget.

4. later it would be possible to collect enough funds to finance the development of other remaining projects through the establishment of profit oriented units engaged in contracting, consulting, recreation, etc.

Although the basic concept seemed to be quite straight forward it was not easy to materialize his view. First, the legal aspect to support the establishment of an organization with such a vast authority was nonexistent. Second, such an organization would in many instances come against the interest of the Provincial Government or other government deparmental organizations. On the other hand, although very much different in scope and authority, a somewhat similar existing organization, the Jatiluhur Authority in West Java, was considered unsuccessful. And as PLN was the single authority in charge of the commercial operation of public utilities it would certainly not release the power stations constructed by the Brantas Project to this type of organization.

A long lapse of time of uncertainty went on while one by one the projects are completed and still relying their financing for operation and routine maintenance from state budget for construction. Pressure came from Bappenas who wanted to cut their budget allocation to the Brantas Project as they considered completed project should be released from project status: a project should not endlessly exist

The breakthrough came, on 14th August 1979, when Dr. Ir. Suyono Sosrodarsono, then Director General of Public Works suggested to split up the Brantas Project into three organizations referring to Snowy Mountain Project in Australia as a model. The idea was to set up three separate organizations :

1. a project development agency managing the construction of ongoing projects as well as operation and maintenance of completed ones.

2. an engineering and consulting group which could be integrated into an existing state owned engineering and consulting company.

3. a construction group which could be integrated into a state owned construction contracting company.

It was also envisaged that while establishment of the two latter organizations could be easily realized, the first one may take some time to process. When this transformation would be completed the project development agency then would sublet all its work previously done on a force account basis to the other two organizations, concentrating itself on project management and supervision.

The idea of splitting up was later proposed to the Minister of Public Works, then the late Dr. Poernomosidhi Hajisarosa, who was in full support and requested to prepare a more concrete proposal to obtain approval from the government.

Instead of integrating the construction group into an existing state owned construction contracting company, i.e. PT Buana Karya, a new company was established on November 12th 1980, the birth of PT Brantas Abipraya, which also earmarked the splitting up or more sentimentally called the "unfolding" of the Brantas. This was later followed by the integration of the engineering and consulting group into PT Indra Karya and the transfer of power stations to PLN together with the operation and maintenance personnel.

It would take almost another decade to realize the project development agency, however with a somewhat limited authority, Perum Jasa Tirta which was established on February 12th 1990. Its scope of work is mainly the operation and maintenance of completed structures, while new projects although quite decreasing in number are still to be managed by Brantas Project.

The long and full of turmoil history of the Brantas project has shown the firm determination of the Brantas people which they proudly call the Brantas Spirit. It was with this spirit that they were able to conduct management by changes during the pre"unfolding" period and it was with the same spirit that they were able to conduct management of changes during the unfolding period and afterwards. In fact, the name of the newly established construction contracting company, "Brantas Abipraya" was derived from Old Javanese, meaning Brantas Spirit.

It is worth to mention that throughout the whole transformation the Brantas People were accompanied by their Japanese partners from Nippon Koei Co. Ltd., who were first their consultant, then their guidance consultant during the pre"unfolding" period and finally became their associate at PT Indra Karya after the unfolding. It is ironical that their partners

in construction works, Kajima Corporation, who were first their construction contractor, then their guidance engineer during the pre"unfolding" could not become their partners at PT Brantas Abipraya after the unfolding, because they had earlier cooperated with PT Waskita Karya (Persero) to form a joint venture PT Waskita Kajima.

"Push the Top and Pull the Toe" System

Ir. H. Mardjono Notodihardjo

I began working for the Brantas Project in 1964, requested by Prof. Ir. Suryono. During the period in the Brantas Project, I was appointed as the Chief of Brantas Representative Office in Surabaya (Surabaya Office), managing heavy equipment and other instrument coming from Japan, while at the same time I worked for Steam Power Plant in Perak. The office, located on Jl. Teluk Kumai, was also our resident. During my period in Surabaya Office, the monumental event I had was unstable condition (mainly in the field offending) when the movement of September 30th broke out in 1965 to the beginning of 1968. By all efforts, the project development could be continued.

In 1968 I moved to Malang Main Office and was in charge of planning. This was the first point of my career. Many lessons and experiences I got in the field of planning such as preparing Master Plan (Brantas Basin Overall Plan). This Master Plan introduced the integrated and sustainable plan for Brantas river basin. The "push the top and pull the toe" system was used.

By the assistance of Nippon Koei Consultant, the Brantas Project kept on promoting water resources development through the approach of river basin unit and it is still relevant till now even.

By the approach of river basin plan and development in integrated and sustainable manners, the efforts to improve water supply had been done, such as constructing dams and reservoirs, forest preservation, regreening and reforestation for critical area as well as other comprehensive efforts of river basin management.

Due to my idea on river basin development, once I was assigned to represent Indonesian Government to give speech in the International forum of the experts on water resources development issues.

Actually water resources management plan is not something new in Indonesia. Since the middle of 19th century during "cultuursteisel" period in 1853, it had been introduced by supplying water for agricultural plantation in Central Java, but it was done in piece meal and only for single-function purpose.

Facing the recent development, new idea to rearrange the water resources planning in an advance manner is required. This is based on the consideration that the river basin condition is developing, water demand is increasing, water supply is decreasing, destruction to natural preservation, and exploitation on water resources and other resources such as land resources and forest resources are getting uncontrolled.

Due to the above cases, the Brantas Project has implemented a comprehensive and integrated planning system since 1961 and it is continued by Jasa Tirta Public Corporation as the Brantas river basin management agency.

During working for the Brantas Project I got opportunity to transfer knowledge and technology from foreign consultant and spread them to other institution such as Universities. Staffs of the Brantas Project were giving guidance to Brawijaya University, especially Engineering and Economics Faculties. One of departments of the Technical Faculty (Water Resources Engineering) was the pioneering work with our colleagues in the Brantas Project.

Deep impression from the Brantas project were the **establishment** and the **development** which have **pioneering** sound and inspired by megalomania spirit (in positive sense), since it encouraged and developed a rare thing within the period. Something which we should muse is if we have capability to improve the Brantas Spirit as launched by the President, Mr. Soeharto around 25 years ago on the inscription in Karangkates Dam (1972) as follows:

> "The spirit to develop voluntarily was inspired by lofty subservience through cooperation in giving direction and developing our capability to carry out the task and responsibility for river basin exploitation for public welfare of present and future generations".

One River, One Plan, One Management

Ir. Putra Duarsa

I was appointed to the Brantas Project at the Malang Main office by a letter of a appointment from the Ministry of Public Works, commencing the end of 1968 until middle of 1979.

I am proud being one of the so-called "Brantas-men" which were directly involved in the effort to develop Brantas River Basin in a planned, integrated and sustainable manner. The Brantas River development itself could be titled as a pilot project for dam and hydropower plant development in Indonesia.

The project was carried out in a force account system, assisted by Japanese consultant and guidance (Nippon Koei Co. Ltd. & Kajima). Initially, Indonesian engineers and labour force could only observe, before they start to learn, try and finally do all the things themselves. All of these had been made possible through the Brantas project. The force account system had not only produced skilled human cadres, but also solid management system (personnel, operation, logistic and finance), as well as a river development system with the philosophy of "one river, one plan, one management".

Based on a survey conducted by Dr. A. Pekerti and Cullen Ph. D (management consultant) which had made known to me, all of the Brantas project staff (even supervisors on site) have understood and inspired by the project goals. An open and participative management system was implemented at the project. The labour force, as well as the managers, are actively involved in plan formulation and decision making. Therefore, the consultant had suggested the Brantas project to apply a Management By Objective (MBO) System.

Beside physical construction activities - dams, tunnels, hydropower plants, dikes and water resources infrastructures - the Brantas project has also developed skilled labour in the design and construction engineering field, widely used all over Indonesia. Our heavy equipment operators were employed in Irian (Freeport), Sulawesi (Soroako) and Sumatra (Asahan); while our experts were employed at various Directorate General of Water Resources Development project, as well as prominent state owned consultant and contractors.

All of the professional skills mentioned above were apprehended through a technology transfer process that has taken place during Karangkates, Selorejo, Wlingi, Lengkong Porong, Tulungagung and other project construction activities, from the Japanese expert (Nippon Koei, Kajima, etc.). Those capabilities and skills are widely applied throughout dam and hydropower plant development in Indonesia.

This signifies that technology transfer does not only mean capability/skill absorption, but also disseminating the expertise to other sides in the frame work of Indonesian human resources development. The afore mentioned values (innovation, creativity, willingness to learn, and handing out the experience, as well as hard work) are a few of the known "Brantas spirit", and were recognized as a monumental achievement, which should be preserved.

During the period in which I led the Brantas project (1974-1979) - replacing Prof. Ir. Suryono - the Brantas Project has been on a development stage in term of management system and technology; and the project was starting to establish a permanent Brantas River Management Institution.

Unfortunately, the obsession to establish a management agency in form of a public corporation did not come to realization until the end of my appointment. The Minister of Public Work had suggested to operate an agency which resembles the Snowy Mountains River Basin Agency (Australia), by means of preparing shareholding consultant and contractor companies as a media to develop consultancy and construction capabilities. This plan was realized in 1980. Alas, after I left Brantas Project, the effort to create a public company was carried out by the next generation, and finally 10 years later - pertaining the Brantas Spirit - Jasa Tirta was finally established.

As my final word, I would like to underline that the most suitable form to retain the Brantas Spirit is Jasa Tirta- which is the final brick to fulfill the philosophy "one river, one plan, one management".

Overcome with Discipline

Ir. Abdul Madjid, Dipl. HE

I was detailed to Karangkates project by Directorate General of Electric Power under Ministry of Public Works and Electric Power in 1964, and it was the beginning of my career. During working for Brantas project I had been involved in 3 (three) projects of Dam and Hydro Electric Power Plant namely Karangkates, Selorejo and Wlingi which had different characteristic in terms of field, equipment, human resources and financial condition. I could say that Karangkates was the place for hardening discipline both physically and mentally due to my involvement in the development process since the initial dam construction in critical remote area (at that time). Moreover, Karangkates (likewise Selorejo Project) was the first large Dam Project established by Indonesian Government and financed by war reparations fund. The fund was used to pay Japanese Experts as the "Guidance" and Consultant (to assist Indonesian Experts and Supervisors) as well as heavy equipment and other supplementary equipment.

Less than a year working, movement of September 30th broke out that brought the political, economical and financial situation into unstable condition. As the engineer appointed to be the Chief of Quarry Section, I was faced to both technical and non technical issues. Even though the movement broke out in 1965, but the impact to the project smoothness kept lasting till 1968. Work discipline deteriorated everywhere. Heavy equipment operators just operated in two trips a day in average.

The most terrifying event was in 1967, in which work accidents happened almost everyday due to the carelessness of the employees and unreasonable things sometimes. Efforts had been taken as the preventive actions such as regulations on Security and Work safety as well as holding ceremonial meal to chase away the evil spirit known as "White Tiger". By the informal leader's help, non technical issue gradually could be overcome.

For the technical issue, Guidance and Consultant (at that time were from Kajima and Nippon Koei) had important role so that I could transfer considerable knowledge and experience as my valuable foothold when I was authorised to lead Selorejo project (1971-1974) and Wlingi Project (1974-1980). However transfer of technology was not so simple as written on the contract stating the obligation for transferring technology from foreign engineers to local engineers. Local engineers should be proactive to absorb it with

strong spirit and good approach. The transfer of technology involved technical and management aspects (such as method of explosion examination, preparing reports, etc.)

During unstable condition of economic and political situation, the development of Karangkates Project once was threatened stop. Payment for the employee wage was done by selling second-hand goods and processed limestone (to Soda factory in Waru).

The above cases became the difficult challenges with special impression. Then during in Selorejo Project in 1970s, economic condition began to improve that no significant handicap was faced in addition that the project was already on the final completion stage.

Likewise the Wlingi Project, it was faced to difficult technical issues, such as geological condition which was hard to be predicted and caused seepage and it disturbed the dam embankment work. However, due to technology improvement and strong will to achieve the specified target, all handicaps could be solved.

To young generation, I would like to appeal for not giving up easily in facing handicaps. This is one of vital characteristics of BRANTAS SPIRIT.

APPENDIX 2

"Chief of Stone"

Ir. Hartono Pramudo, Dipl. HE

In going through the experience of life we always face choices requiring decision making and followed by the consequence. When I was assigned by Ministry of Public Works in Cilegon Project in the beginning of 1964, in the same time I was offered another job in Karangkates Project, East Java. Thinking about the challenges, I chose Karangkates Project which is more suitable with my subject. As a consequence of my choice, my salary was suspended for three months. However my decision gave me blessing afterward.

Starting my career in Karangkates Project in April 1964, I really faced difficult challenges in terms of field condition (critical and remote area) and resources condition (human resources, equipment, financing). As an engineer, I was assigned to lead site activities such as road infrastructure preparation, equipment operation, railway relocation, tunneling (for train and turbine), Quarry work (incl. exploding) and dam work. I was then transferred to planning and controlling section and finally I was appointed to be Main Assistant of Civil Engineering coordinating all project activities in the civil field up to August 1972.

From Karangkates I was appointed to lead the New Lengkong Dam Project (August 1972 to November 1974), Brantas Lower Reaches Project (November 1974 to February 1975), Main Office of Brantas Project as Manager for Operation and Management By Objective advisor (February 1975 to October 1975). During my career in Karangkates to Main office of Brantas Project I had valuable experience as my foothold for my following assignment in Bengawan Solo Project as chief of staff for Planning, O&M, 1975-1980 and in Directorate General of Water Resources, as Sub Directorate, Directorate Rivers for supervision & guidance of O&M, East Region, 1980-1983, and later on as Director of Rivers, 1983-1991.

The most impressive experience I still recall is my sobriquet as the "Chief of Stone" (this could be Indonesian derogatory term for stubborn) since I lead Quarry section to collect stones by exploding the hills for dam embattlement. The explosion was done by trial and error guided by Kajima such as using Coyote system in which explosive material should be put into a narrow tunnel (1×1.5 meter in size) along ± 100 meter including the wings. Considering hard target, the work should be conducted rapidly with assured work safety.

Therefore, well-planned action was required with firm sanction for any disobedience, likewise the Tunnel construction work (Connection tunnel and railway). For railway tunnel, term on windowed tunnel was introduced.

In the condition of critical and remote area, I was also troubled by technical and non technical problems [non technical problem in this case were such as unreasonable mysteries as the impact of the movement of September 30th in 1965 to 1968, water storage up stream of cofferdam was full with trees ±2 meter piled up, due to flood, detonators theft, many kinds of accidents (heavy equipment and blastings etc.), irrational stories about ghost, unmovable huge stone, a big snake crossing the dam etc.]

Hard working under hard target brought me under pressure. To release it, I collected cockle shell fossils and amazing-shaped stones as my hobby in the spare time.

In 1972 to 1975 I was assigned to lead new Lengkong Dam Project and Brantas Lower Reaches Project. I had a complicated trouble in Lengkong, when the old Lengkong Dam was destroyed by the flood and it was nearly collapsed (October 1973). If the dam had been broken down, the structure of New Lengkong Dam would have been damaged for nothing (in fact, a huge number of development fund had been invested). On the other hand, if the gate had been opened, the structures in the downstream area would have got the impact and Surabaya would have been destroyed by flood. I had to make the best decision in such a condition. By careful consideration in opening the gate the impact due to the flood could be minimized. I was also in dilemma to decide the location of the Brantas Lower Reaches Office. I should find strategic place with the limited fund. Finally I decide Wiyung as the location for Main Office of Brantas Lower Reaches Project.

During working in the Brantas Project, I was always assisted by Japanese Consultant and Guidance (Nippon Koei and Kajima) whose role was reduced gradually both in quantity and intensity in line with project activities. From my memory, I find the poetry which I wrote in September 1967 as follows:

THRILL OF THE DEVELOPING SPIRIT
(development period of Karangkates Project)
The hills are thundering, cracking the earth
Howl and dust come in turn
Muddy feet
Heat on the skin

Sweaty clothing
Yet, Keep going forward
For our Nation and our Country improvement

Karangkates, September 1967

The poetry inspires the Brantas Spirit which is hard to say in a word, but it is experienced by related ones.

Appendix 3

Survey on Track Record of "Brantas People"

1. Purpose of the Survey
2. "Brantas People" Surveyed
3. Analysis of the Result of Questionnaires Survey
4. Summary and Conclusion
5. A Few Profiles of Ex-Brantas People

APPENDIX 3

Survey on Track Record of "Brantas People"

1. Purpose of the Survey

The JICA Study Team made a survey on the track record of "Brantas People" with the cooperation of PJT staffs. The main purpose of the survey is to investigate the impact of the Brantas Projects to the technology dissemination in Indonesia. The job record and the training record in both domestic and overseas were analyzed for this purpose. The survey may give a handhold to know what was the cause of success of technology transfer and dissemination in the Brantas Projects.

2. "Brantas People" surveyed

The survey has been done through mailing a set of questionnaire to 542 persons of former employees of the Brantas Project. They were selected at random from the staff directory of 1976 and 1990. Out of 542 survey sheets, 113 were collected with the collected ratio of 21%. The areas distributed include the following 6 (six) in total:

1) Java
2) Bali
3) Central Kalimantan
4) West Nusatenggara
5) Sulawesi
6) East Timor

The offices addressed include the following 19 in total:

1) Perum Jasa Tirta
2) PKB
3) PPRP of East Region
4) PPLG (Million hectare Project), Central Kalimantan
5) Provincial Offices of MPW in West Nusatenggara, East Timor, Bali, Sulawesi, Central Java and East Java
6) PT. PLN
7) Water Resources Service, Kabupaten Malang
8) Local Govt., Malang municipality
9) Local Govt., Mojokerto municipality
10) PT. Abi Praya, Malang
11) PT. Indra Karya, Malang
12) Office of Education and Culture, Malang

13) Office of Assistant Governor, Malang

3. Analysis of the Result of Questionnaire Survey

The result of the collected 113 questionnaires is analyzed and depicted in the Figure of "Results of Questionnaire Survey for 'Brantas People'".

3.1 Respondents' Information

As shown in Figure 1.1, most of the respondents are at the age of 40-49 (52% of the total) and of 50-59 (41%). The persons at the age of more than 40 years old accounted for 97% of the total respondent. The average age of the whole respondent is 48.9 years old.

Nearly 73% of the respondent are graduated from university or postgraduate level education. Of them, 12% are graduated from postgraduate level education (Figure 1.2).

As for the specialty in the school education, 71% of the total is engineers and the remaining 29% are non-engineers including those specialties of law, economics and accounting (Figure 1.3).

The present (at the time of the survey i.e. October 1997) annual income level per head by educational level is as shown in Figure 1.4. The income disparity among educational level is rather large. The highest is that of postgraduate level with the income of Rp.20 million per year while that of university level is Rp.6 million per year i.e. less than one third that of the postgraduate. The average is Rp.11 million per year. (The number of respondent to the question on income amount was naturally few: 73 replies toward 113 respondents in total. It is deemed that the result shows some deviation to higher amount since low-income respondents are reluctant to reply their incomes.)

3.2 Overseas Experience

The overseas experience including studying abroad and training abroad is analyzed in Figures 2.1 to 2.4.

74% of the total respondent has no overseas experience at all. Among the respondent with overseas experience, the most people has the overseas experience of 1-5 times in their lifetime (Figure 2.1) and its total length is within 1-5 months (Figure 2.2).

The countries where the respondent had stayed longest are depicted in Figure 2.3. In terms of the number of persons, Japan is the highest followed by Netherlands, USA, Canada and France. While in terms of the total length (month), Netherlands is the highest followed by Canada, USA and France. The length of stay would increase when a study abroad is included. Actually, study abroad is included in such countries as

Netherlands, France, USA and Canada. While no study abroad is included in case of Japan where short-term training are dominant.

The overseas experience is analyzed by educational level in Figure 2.4. As shown in the figures, the overseas experience is concentrated in the respondent with the educational level of postgraduate.

3.3 Employment in Brantas

The length of service in Brantas of the respondent is 25.3 years in average (Figure 3.1). While the length of service longer than 31 years occupies 17% of the total.

Among the total respondent to this question of 66, the persons with the employment of Brantas only are 29 (Figure 3.2 (1)). When the persons with the employment of Brantas and state corporation is added, the same figures will be 49 (Figure 3.2 (1) & (2)), which counts for two thirds of the total respondents. This means that Brantas people who has quitted outside the Brantas is not so many yet.

3.4 Job Record

The job record and the training record constitute major survey items. The Figure 4.1(1) shows the organization employed at specific ages. For example, out of the total respondents, 48 persons had worked at Brantas and only 6 persons had worked at other organizations than Brantas at their age of 35. The number of employment of other-than-Brantas increases after 40 years of age. This is depicted more clearly in Figure 4.1(2) in which the number is replaced by percentages. It shows that the share of Brantas people is decreasing and that of state corporation and private company is increasing as they get old. The share of government related employment also increases along with ages. This figure shows well that Brantas people had been transferred from Brantas to other government offices i.e. state corporation and/or private sectors as they become older.

Figure 4.2 shows the change of position in the organization. The number of section chief is the most through all ages. The age of 35 is the peak of the number of administrative positions. The Figure 4.3 shows the number of his men worked under them at their specific ages. As a whole, the number of his men is not so many. The number of respondent with his men of less than 10 is the most through all ages. The average, however, shows 120 at the age of 40 for instance. This is caused by the big number of his men of a few respondents; 3000 staffs had worked under a manager at his age of 40. The Brantas has experienced this when many construction works have been undergoing at the sites.

Figure 4.4 shows annual income at the specific ages. The amount is an average income of respondent at his specific age in the past. Since the current price level in stead of a constant price level expresses this, it naturally increases as time passes. The increase rates do not show an annual average but a simple increase between the five-year interval. Therefore it includes the price escalation caused by annual inflation.

3.5 Training Record

The training record includes both the training for professional know-how and the studying at a university abroad. Out of the total 113 respondents, 6 persons experienced studying abroad and domestic after having entered their office works. Most of them studied 2 years with one exception of 3 years in Indonesia. The countries include Canada (2 persons), Netherlands, India and Indonesia. The study objective was engineering related matters in all cases.

The term "training" includes in this section both the training for professional skills and the study at university abroad/domestic for 2-3 years. Figure 5.1 shows the age and the number of times of participation in training. The number is largest when they were 41-45 years of age followed by 36-40. The average number of participation to training is 3.6. Figure 5.2 shows the contents of training. The training on engineering was naturally attended mostly by engineers. It is to be noted, however, that many engineers attended the training course of administration/accounting/management.

Figure 5.3 shows countries for training including/excluding studying at university abroad/domestic. It is a matter of natural that the training opportunity in Indonesia is the largest among these countries in terms of both length of training and number of times. Except for Indonesia, it is found in Figure 5.3 (1) that such countries as Netherlands, Canada and France are high in terms of length of training. This is due to the studying abroad to these countries. While it is found in Figures 5.3 (1) and 5.3 (2) that Japan has offered many opportunities of training which is the largest among these countries in terms of number of times of training. However the training in Japan was rather short in terms of the length of training.

Figure 5.4 shows the length of a training course including studying at university abroad/domestic. As shown in the figure, most of the training course were implemented for less than one month probably less than half a month. The average length of engineer's training was inflated by the inclusion of study at university abroad/domestic.

4. Summary and Conclusion

1) The following can image the typical respondent of the "Survey on Brantas people":

   - Average age : 48.9 years old
   - Education level : 72.6% of the total is graduated from higher education than University level.
   - Specialty : 70.8% of the total is engineer.
   - Present income per head : Rp. 11.4 million per year
   - 74.3% of the total has no overseas experience.

- The longest-stay country is Japan (10 persons) followed by Netherlands (8 persons).

2) The job record shows that 29 out of 66 respondents have worked only for Brantas (Figure 3.2).

The share of employment in Brantas is reducing as they are getting old and that of the employment in state corporation and/or private company is increasing (Figure 4.1(2)). This seems to imply the dissemination of technology accumulated in the Brantas development works.

3) Training record shows that the average times of training is 3.6 per head (Figure 5.1) and the average length of the training is less than one month (Figure 5.4).

The number of person who experiences studying at universities abroad/domestic after entered in government office is only 5 (five).

Such countries as Netherlands, Canada and India have been preferred for studying abroad while Japan has offered the most opportunity for short term training.

Through scrutinizing the detailed entry on the evaluation of individual training result, it is clarified that almost all participators of training appreciated their training very high. Training abroad is to be promoted as far as possible in the future. The business development of water resources management body in the Brantas may provide a good opportunity for training abroad for both engineers and administrators.

5. A Few profiles of Ex-Brantas People

Among Ex-Brantas People with whom the Study Team tried to get touch, the followings are profiles of people who accepted the interview.

Profile of Mr. Almizan Abdullah

(1) Summary of curriculum vitae

- Date of birth : March 15, 1934
- March 1959 : Graduated from Faculty of Engineering of University of Indonesia in Bandung (later called as Bandung Institute of Technology)
- March 1959 - May 1960 : Virginia Polytechnic Institute, USA, Master of Science of Electric Engineering (MSEE)
- 1960-1962 : Illinois Institute of Technology, USA: Post graduate study
- 1962-May 1963 : Department (Ministry) of Small Scale Industry,
- June 1963-1964 : PLN (Brantas Project: At Karangkates dam site as an Employee of PLN)
- 1964, Project Brantas started. (At that time, Karangkates was managed by PLN, and Selorejo dam was managed by Dinas Pengairan).
- 1964-1979 : Karangkates Project
- 1979-1981 : General Manager of Project Brantas
- 1980-1991 : President of P.T. Brantas Abipraya (Persero)

(2) Rewards and Prize:

-Satya Lencana Karya Penbangunan (Development)

- Satya Lencana Kekaryaan (Engineering)

(3) Writings:

- "Transfer of Knowledge and Technology at the Brantas" (Indonesian version) 1979, pp.50

(4) Memories of the Brantas

-Encouragement by Mr. Suryono

"When I returned from the States, I was disappointed to see many bad things in this country. During my time of working at Tanjung Perak thermal power plant in Surabaya, I met Mr. Suryono and he told me "Go to the field. I will assign you to Karangkates." He was a teacher of life and a good adviser to me. He was such a person to whom I made up my mind to do my best to make him satisfied.

-Encouragement by my father

Several days after starting the work in Karangkates, we had a meeting with railway people regarding the relocation of the railway running near around the Karangkates. At the meeting, I was introduced as the Chief of Mechanical and Electrical Engineering section. At that time, I was just a freshman and knew very little of the Karangkates. At that morning, my father showed an article of a newspaper on the Karangkates and told me to read the article. It was very much useful for me to get the minimum information of Karangkates. I felt a hearty encouragement of my father."

-Most sorrowful event:

"In 1975, when I was the General Manager of Karangkates, the track crane accident had happened. It was during the time of construction of the penstock bridge for the third unit of Karangkates power plant. The winch of the truck crane was cut and the crane fell down. One operator was killed by this accident. It was really a nightmare to me."

-Most happiest memory:

"After the completion of Karangkates, the Project had held a traditional dance party with 200 people including the family of Karangkates staff. A stage was prepared at the quarry site and amateurs of staff people performed the Lamayana dance. At the night, it was raining at Malang but the moon was shining at the site. It was really a fantastic performance."

(5) From the point of view of technology transfer (A view of JICA Study Team)

Mr. Almizan Abdullah can be said as a typical disseminator of the Brantas technology to private sectors in Indonesia. Encountered with Mr. Suryono after returned from studying in the United States, he had started his career of an engineer at Karangkates construction works. He was then less than 30 years old. After having experienced many construction sites, he was appointed as the General Manager of Project Brantas in 1979 at the age of 45. After the dissolution of the Project Brantas in 1980, he moved to the newly established P.T. Brantas Abipraya (Persero) together with 200 Brantas engineers. He maintained the office of the President in this private company for 10 years. In 1991, he shifted to the academic field: National Institute of Technology Malang where he lectures on Water Resources Engineering to 200 students. Now he is the vice-dean of Industrial Technology in the Institute. His knowledge and experiences accumulated in the Brantas Projects have been widely disseminated to private sectors and then to young students.

Profile of Mr. Mardjono Notodihardjo

(1) Summary of curriculum vitae

- Date of birth : February 5, 1930
- 1960 : Graduated from Faculty of Civil Engineering of Gajamada University
- 1960 : Entered PLN Head office, Training & Construction Dpt. Sub-division of Thermal Power (with more than 100 staffs)
- 1962 : PLN Diesel Power Plant in Sunayan (15 MW)
- 1961 : Tanjun Priok Steam Power Plant (25 MW) with 50 staffs.
- 1961-1966 : Tanjun Pera Power Plant.
- 1964 : Participated in the Project Brantas for Logistics Department. (With staff of less than 10)
- 1966-1972 : Transferred from Logistics to Planning and Design Department. With staffs of 15.
- 1971 : Project Manager of Kali Porong River Improvement Project.
- 1972 : Transferred to Jakarta (DPW) by the request of DG. In charge of river basin planning including Cisadane, Tirebon, Timor, Sunbawa, CTI and Tenpereck (by JICA). In charge of Biliran and Vila irrigation Projects. With staff of about 200.
- 1979 : Director of Planning and Programming DGWRD. Assistant to the Minister. With staffs of 400.
- 1979-1983 : Chief of Division of Planning DGWRD. With staffs of 100.
- 1983-1988 : Chief of Bureau of Planning MPW
- 1988-present : President of P.T. Bina Karya (Persero): Architects and Consulting Engineers. Annual turn over: $10million. Number of employees: 600. Number one engineering consultant in Indonesia followed by Inda Karya and Indra Karya.

(2) Study abroad

- University of Roorkee in India: Training Center of Water Resources development

- 1976 : Conference of Civil Engineering of USA

(3) National membership

- Indonesian Institute of Engineers : 1963- present
- Indonesian Water Resources Association : 1978-
- Indonesian Association of Hydraulic Engineers (one of founders and Chairman for 1981-92)
- Indonesian National Committee of Large Dams: 1972-
- Indonesian National Committee for Irrigation and Drainage: 1972-83
- National Research Council (under Ministry of Research and Technology):
- Expert Team on the Environment (assist to the State Minister for Environment): 1995-2 years
- National Association of Indonesian Consultants (INKINDO)
- National Coordinator for the Construction of Infrastructures
- Indonesian Management Consultant Association
- Indonesian Association for Building Maintenance

(4) Lecturer

- Head of Water Resources Laboratory, Civil Engineering Department of Dharma Negara University (private run in Jakarta)
- Lecturer of Hydraulic Structures in the same university
- Examiner of Engineer graduates of the same university

(5) Prize/Award

- Gerilya War Medal awarded by the President in 1967.

  Obtained the permission to be buried at National GraveYard.
- Two medals for:
  i) Independence War for 1945-1947 for fighting with Dutch army in Central Jawa near Surakarta
  ii) After cease fire for 1948-1950

- Legion for Veteran of Republic Indonesia awarded by Ministry of Defense in 1988.
- Development Medal by President in 1974 after the completion of 1st 5 year National Development Plan together with many other Brantas People including Messrs. Suryono, Putra, Almizan, Suharno and Surisabarno.
- Great Achievement Medal by President in 1986
- Civil Servant Medal for 25 years dedication in 1986

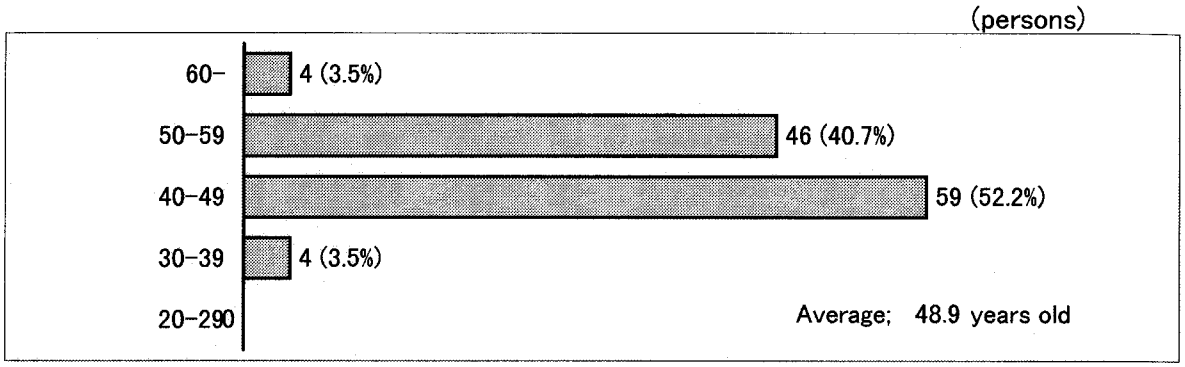
(6) From the point of view of transfer of technology (A view of JICA Study Team)

Mr. Mardjono Notodihardjo had participated in the Project Brantas from its beginning in 1964 for eight (8) years. In 1972, he was transferred to Ministry of Public Works in Jakarta. His major work field has been planning of water resources development in MPW. Many river basin development plans in Indonesia including Cisadane, Tirebon, Timor, Sunbawa, CTI and Tenpereck have been made up during the time when he was the Head of Planning Bureau in DGWRD. After quitting Government office, he shifted to a private consulting engineers company which expanded to the biggest one in Indonesia in this field. Now he is the president of P.T. Bina Karya whose annual turn over exceeds more than $10 million with 600 employees. The planning technology accumulated in the Brantas has been elaborated and applied in the Government planning and now it is being harvested in the private sector. In addition, many former staffs of Mr. Mardjono in the office of MPW have achieved many prominent works in the respective fields. They include Government officials in MPW, professors in University of Indonesia, Project Manager of ADB Project and so on.

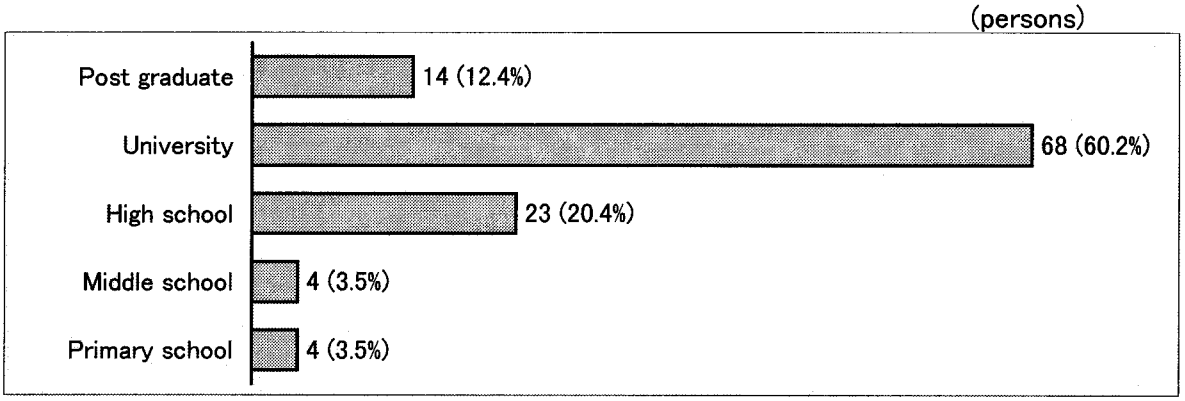
Results of Questionnaire Survey for Brantas People

1. Respondents' Information

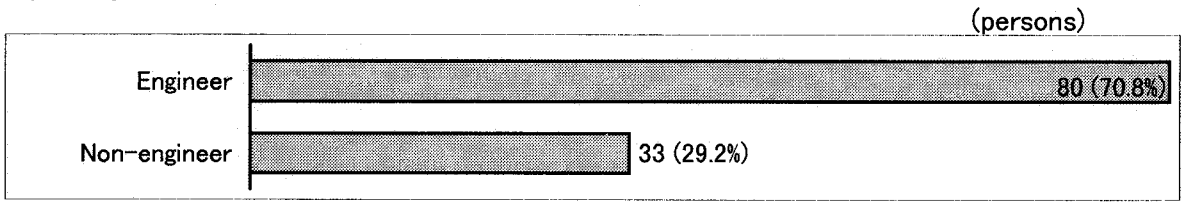
1.1 Age Composition



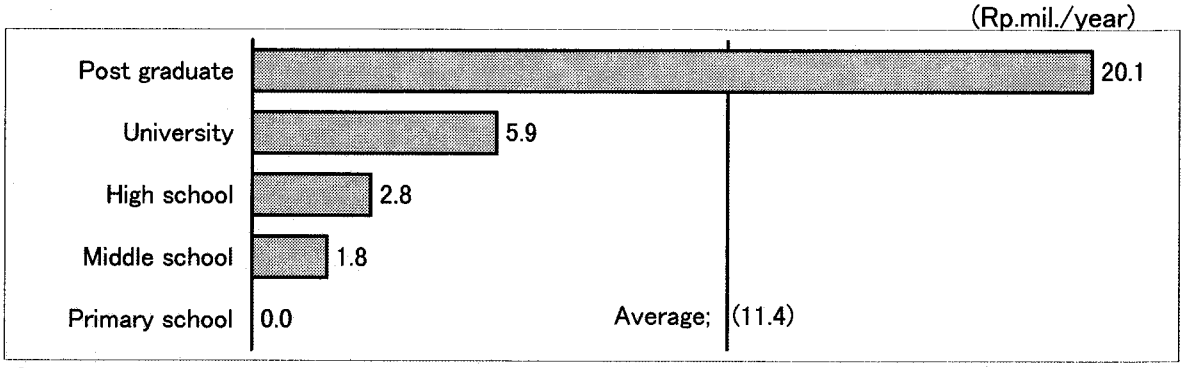
1.2 Last Education Level



1.3 Specialty

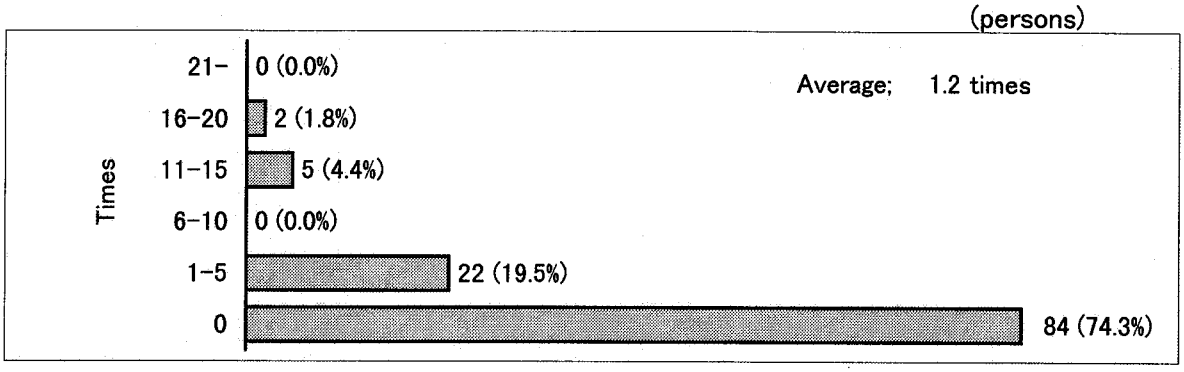


1.4 Present Income per Head by Education Level

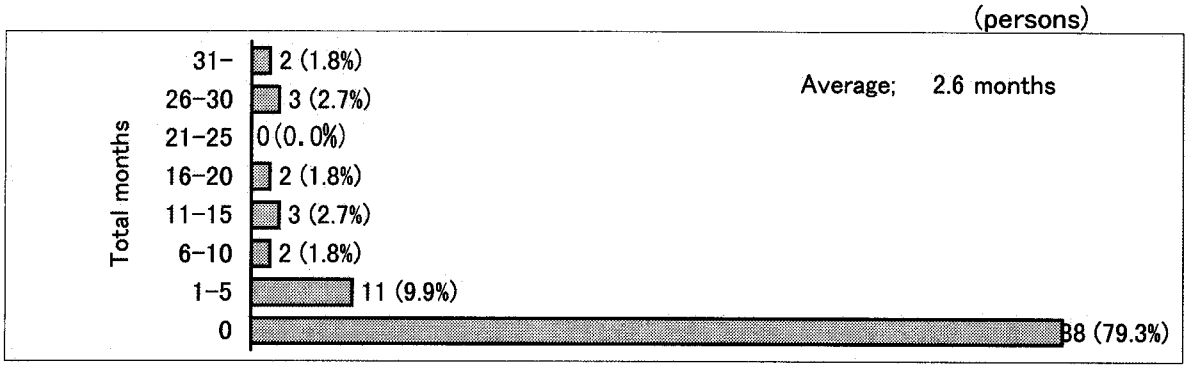


2. Overseas Experience

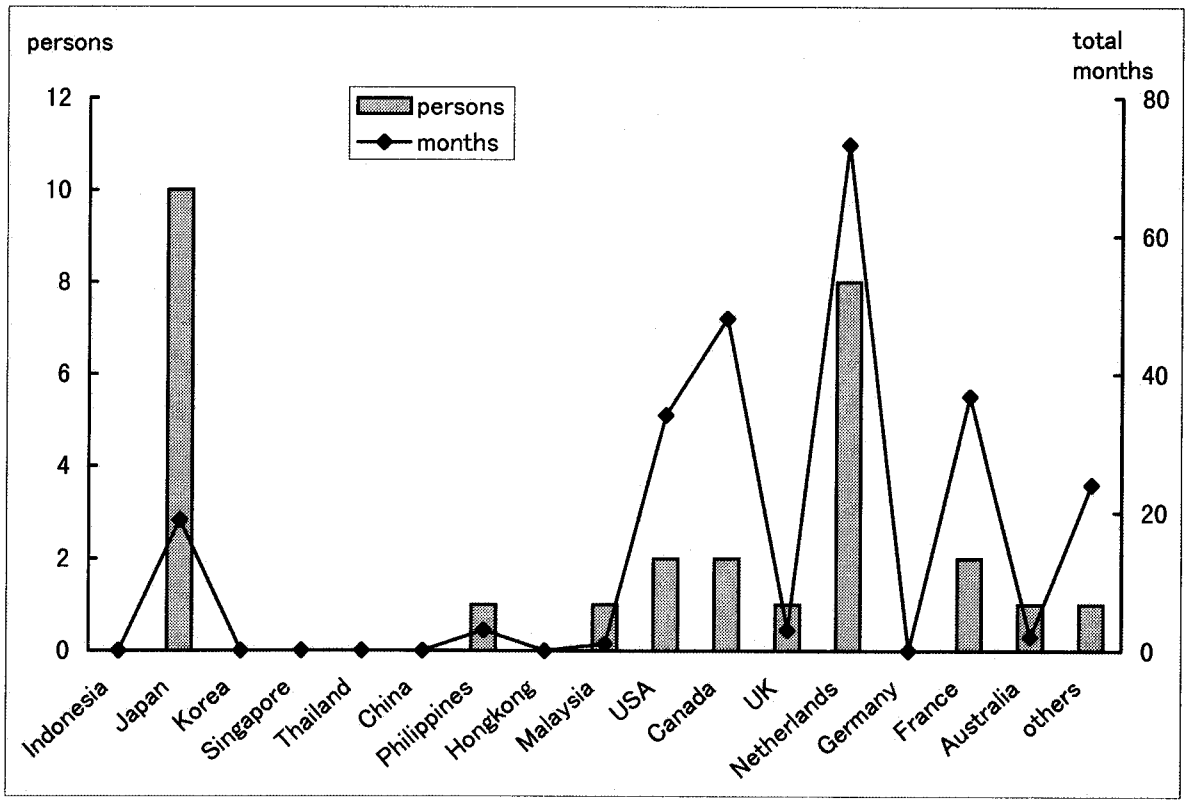
2.1 Overseas Experience (times)



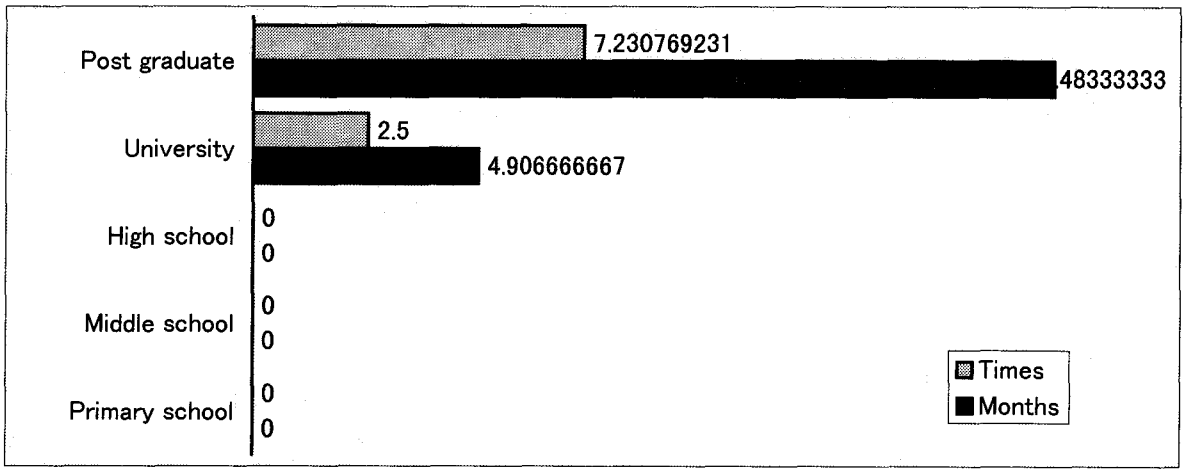
2.2 Overseas Experience (total months)



2.3 Longest-stay Country



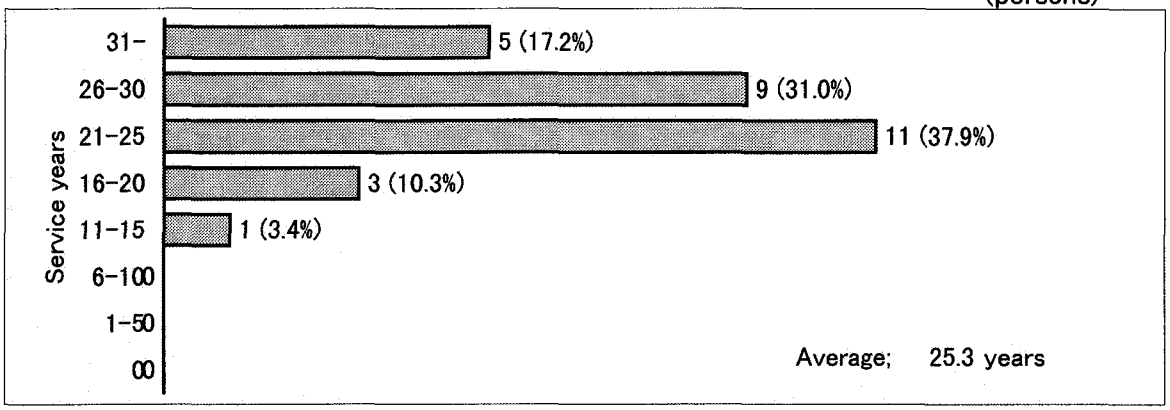
2.4 Overseas Experience: Average per Head by Education Level


Post graduate
7.230769231
48333333
University
2.5
4.906666667
High school
0
0
Middle school
0
0
Primary school
0
0
Times
Months

3. Employment in Brantas

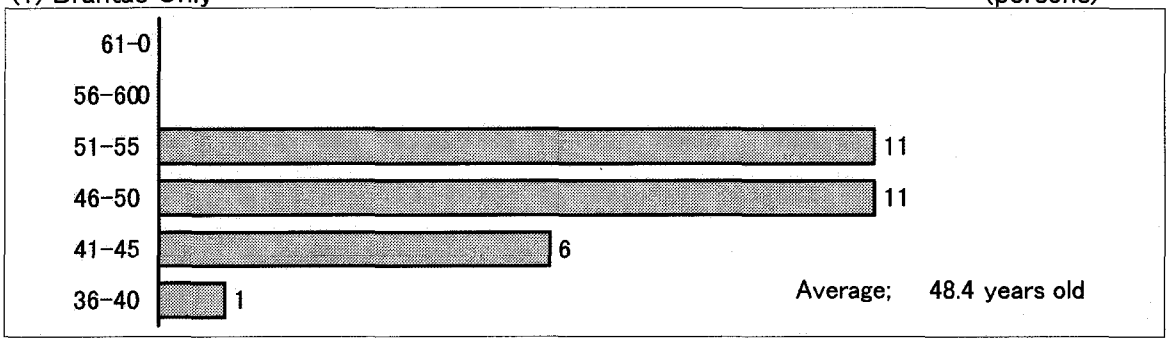
3.1 Brantas Only (by service years)

(persons)

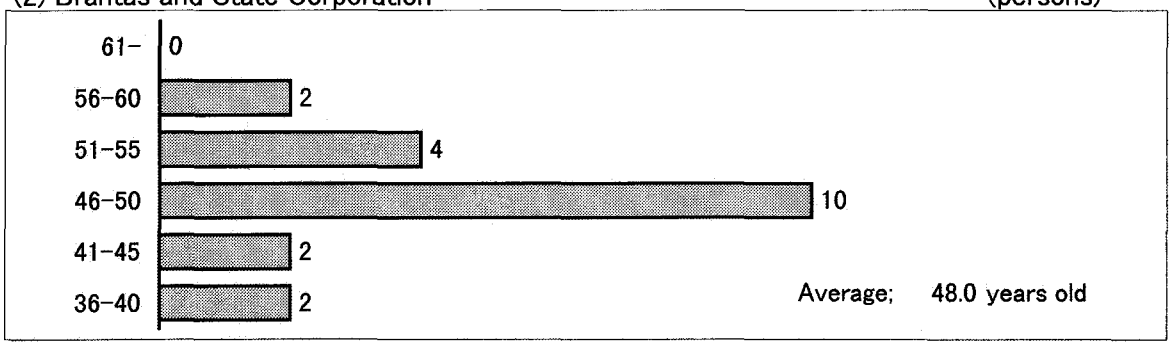


3.2 Employment by Age

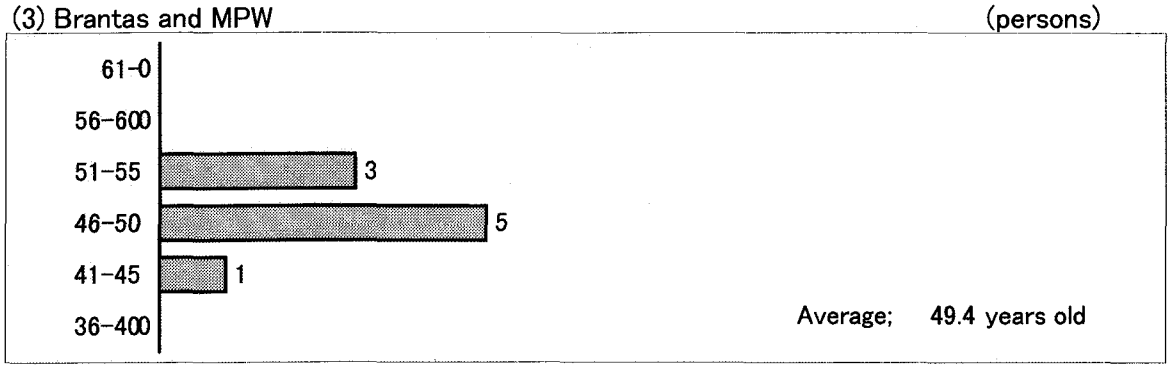
(1) Brantas Only (persons)



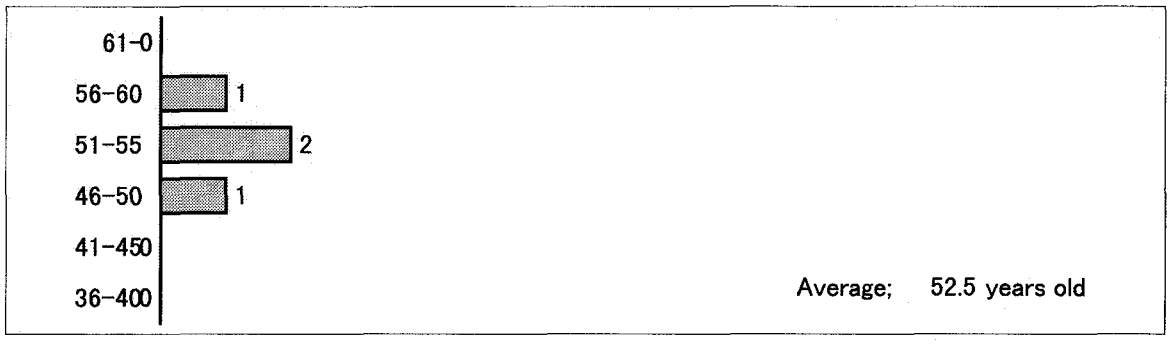
(2) Brantas and State Corporation (persons)



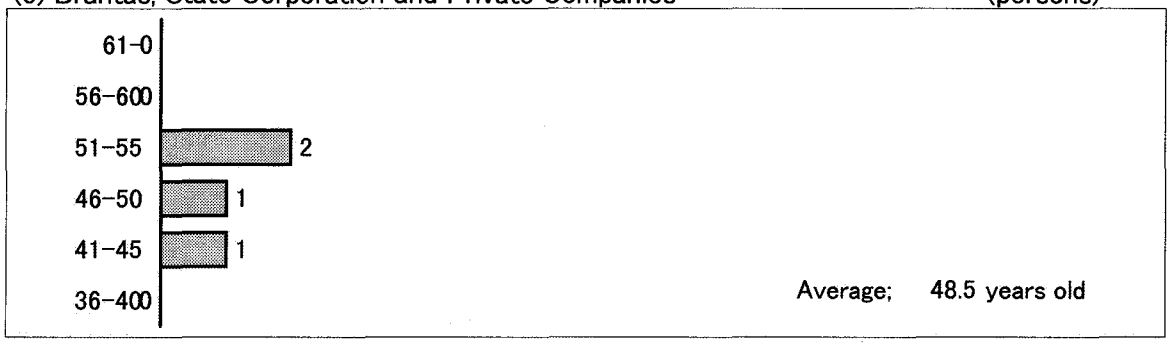
(3) Brantas and MPW (persons)



(4) Brantas, MPW and State Corporation (persons)



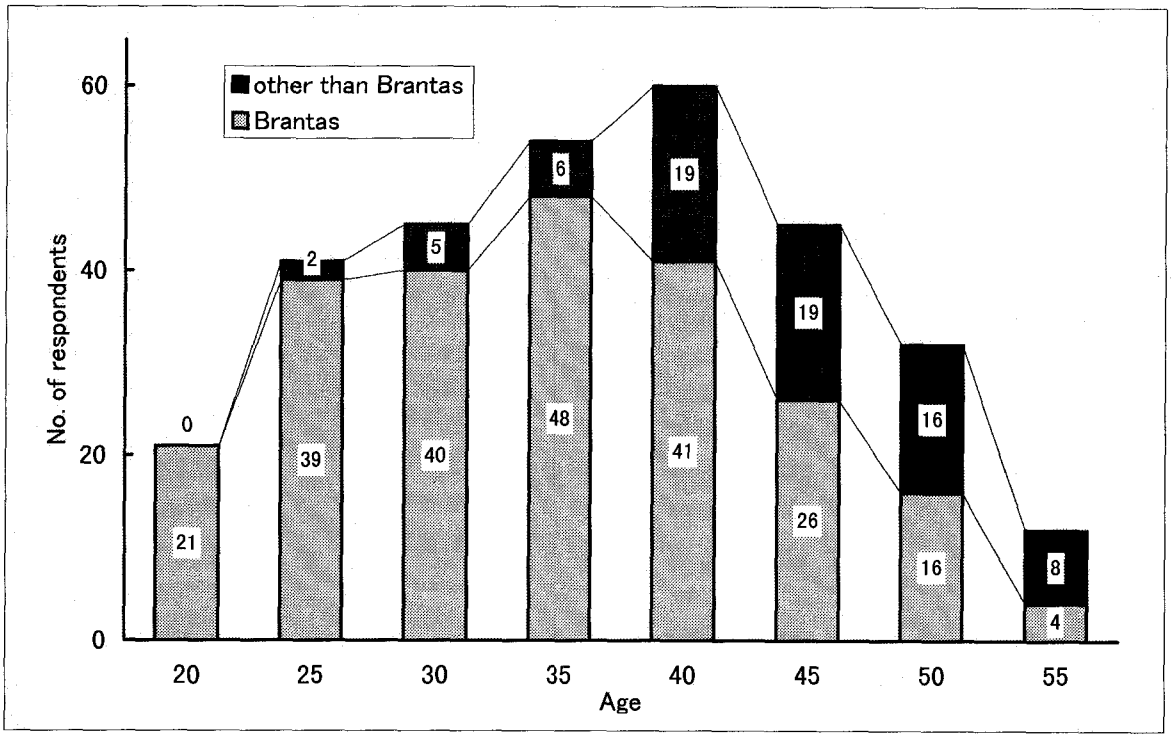
(5) Brantas, State Corporation and Private Companies (persons)



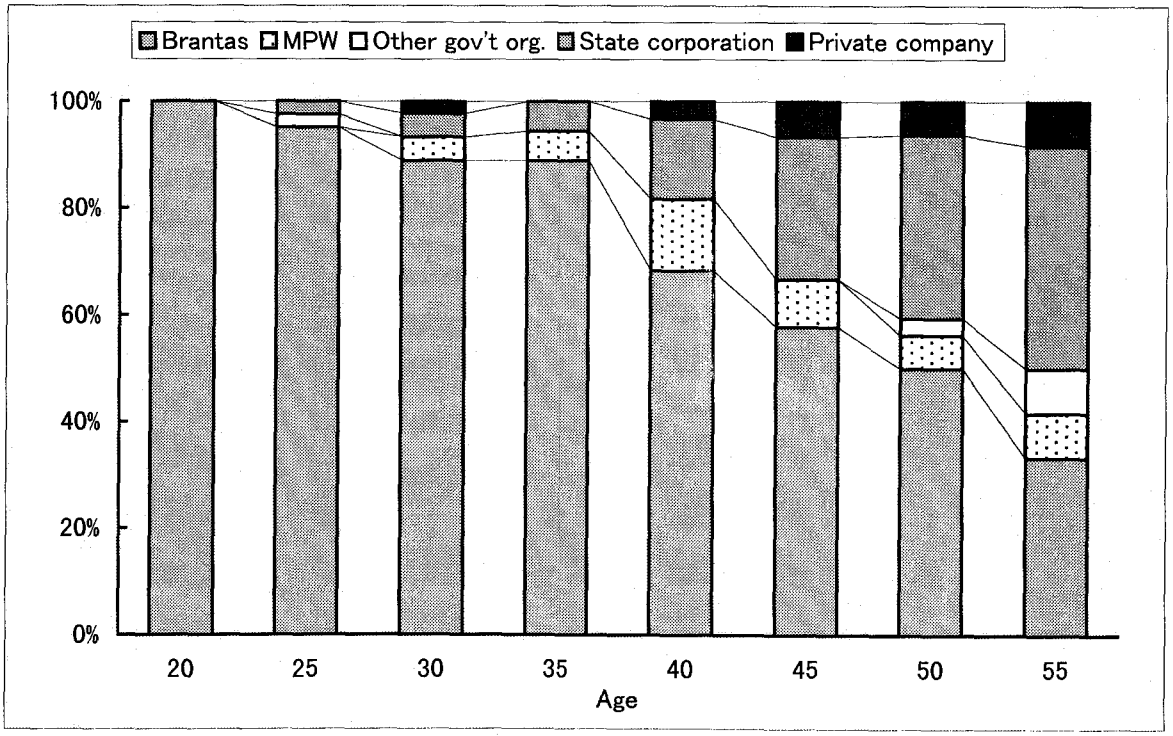
4. Job Record

4.1 Organization at Specified Age

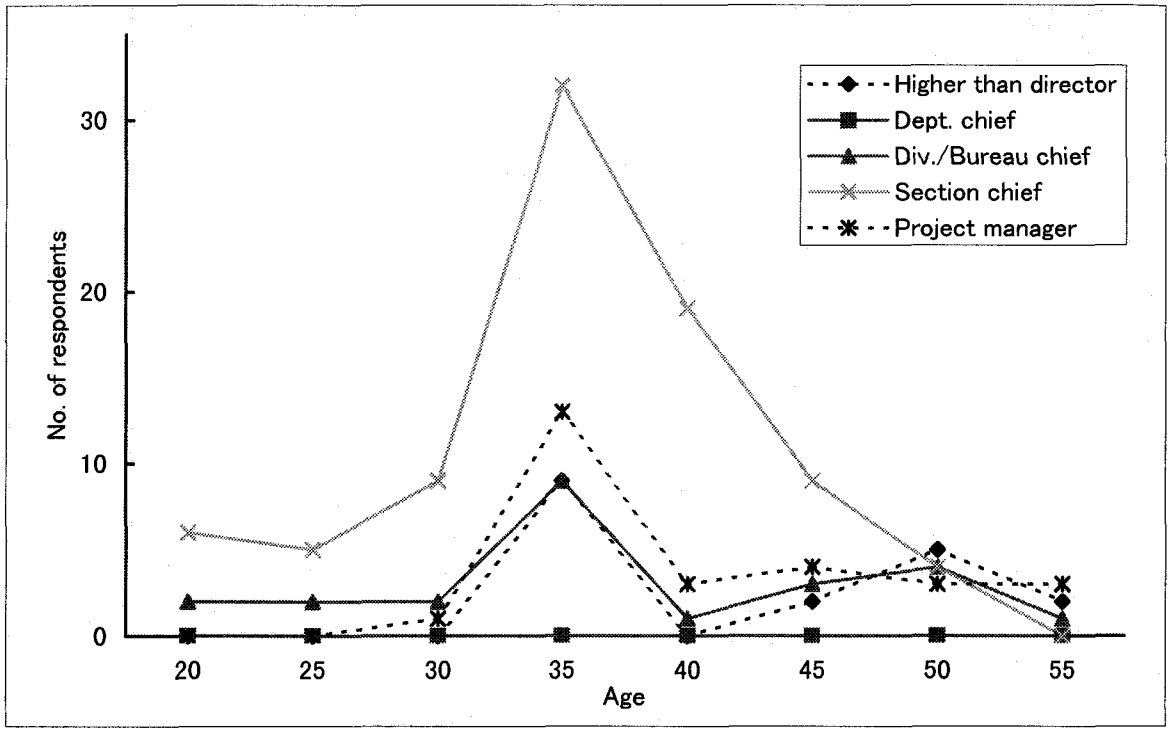
(1) No. of respondents



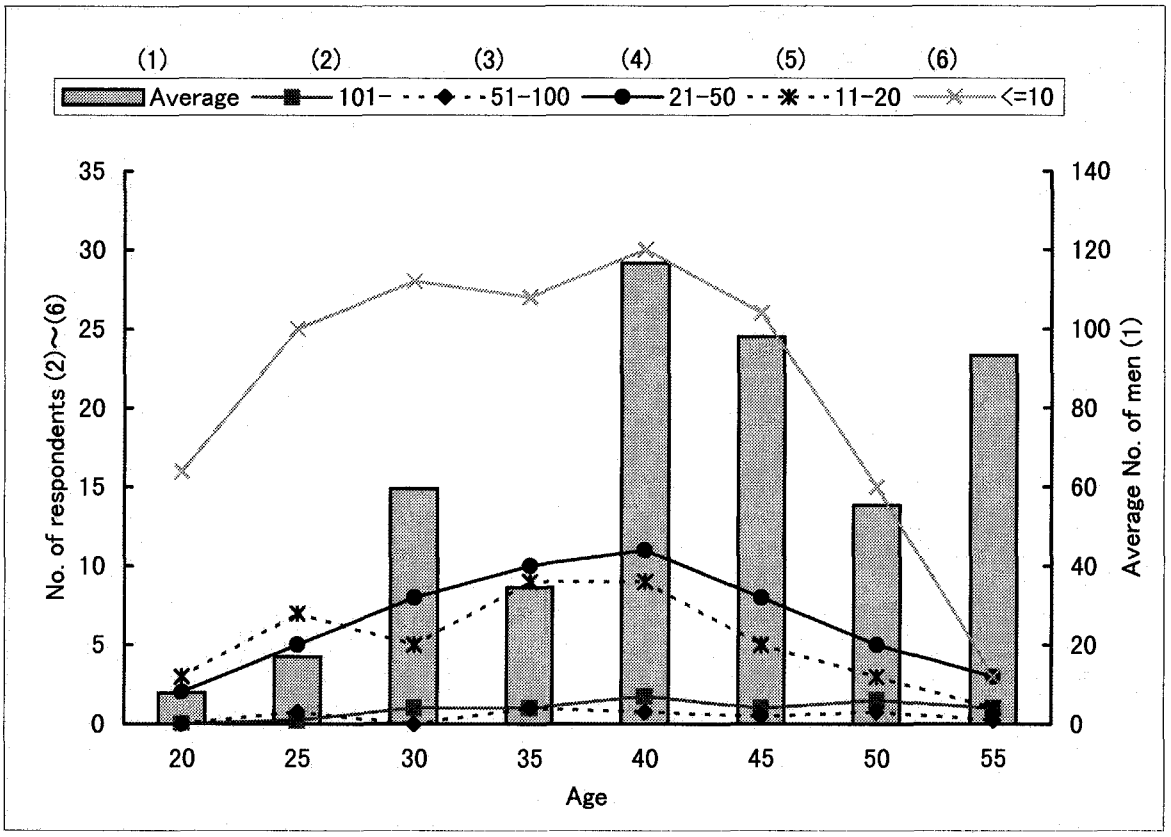
(2) Percentage of respondents



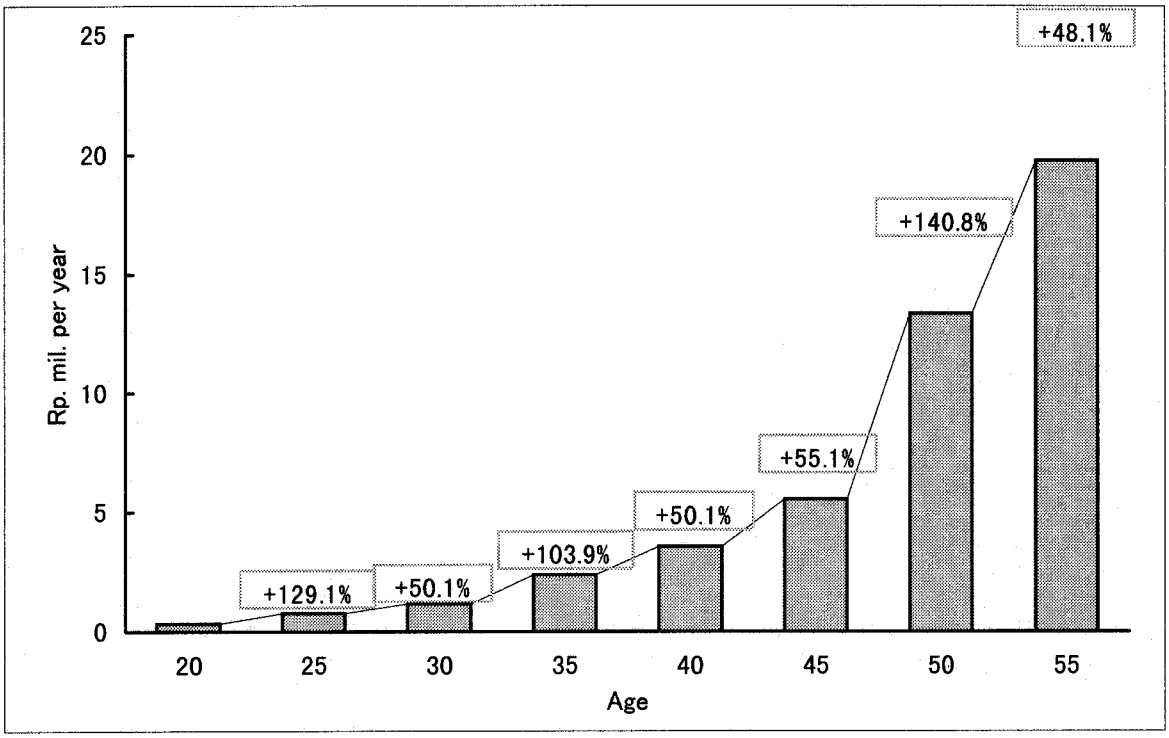
4.2 Position at Specified Age



4.3 Number of Men at Specified Age

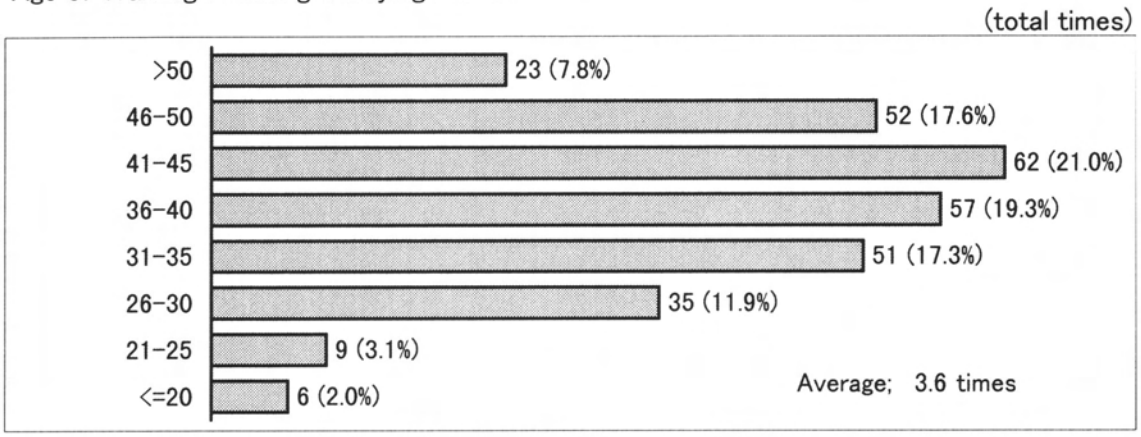


4.4 Income at Specified Age (average)

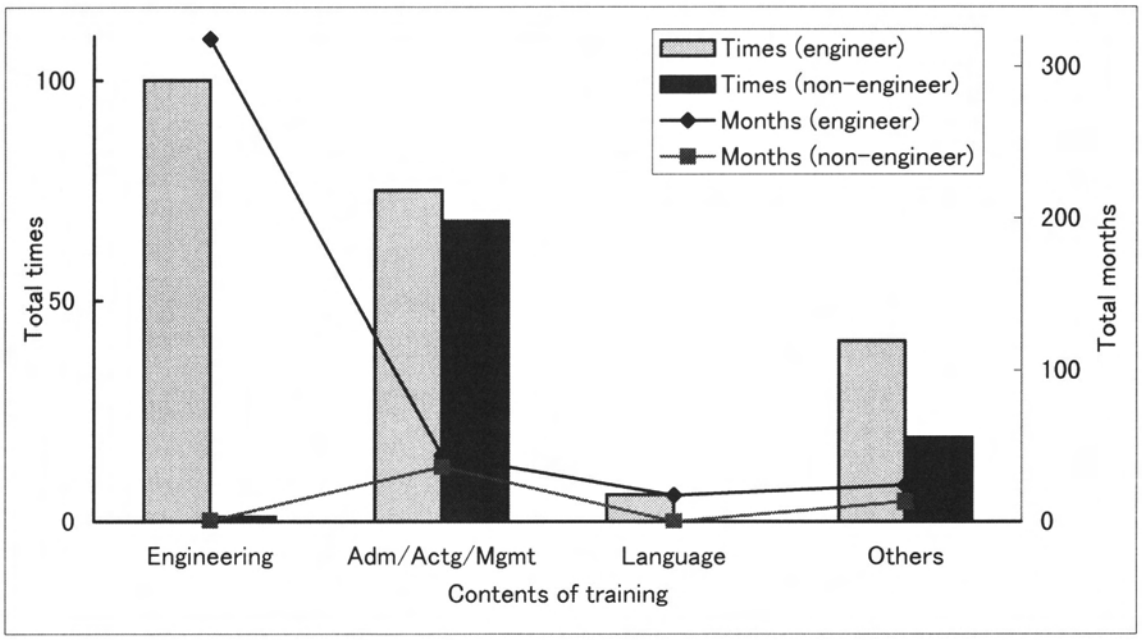

25
20
15
10
5
0
Rp. mil. per year
+129.1%
+50.1%
+103.9%
+50.1%
+55.1%
+140.8%
+48.1%
20
25
30
35
40
45
50
55
Age

5. Training Record

5.1 Age of Training including Studying Abroad

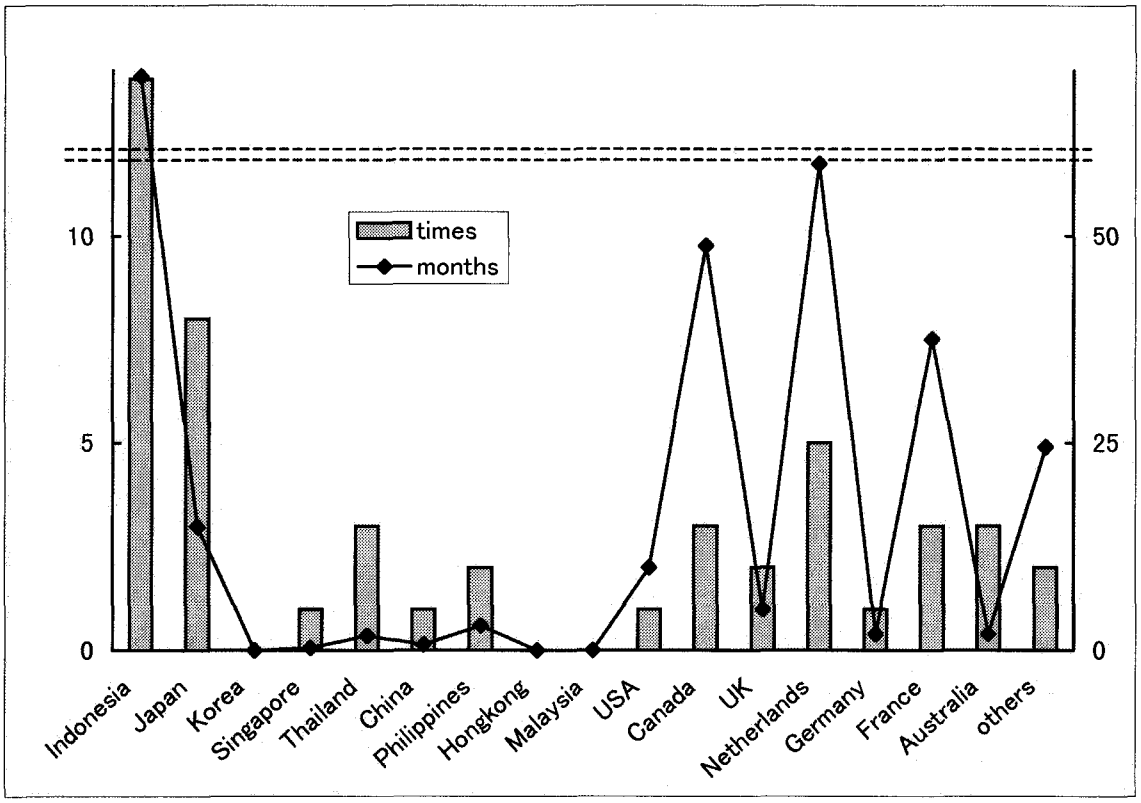


5.2 Contents of Training including Studying Abroad

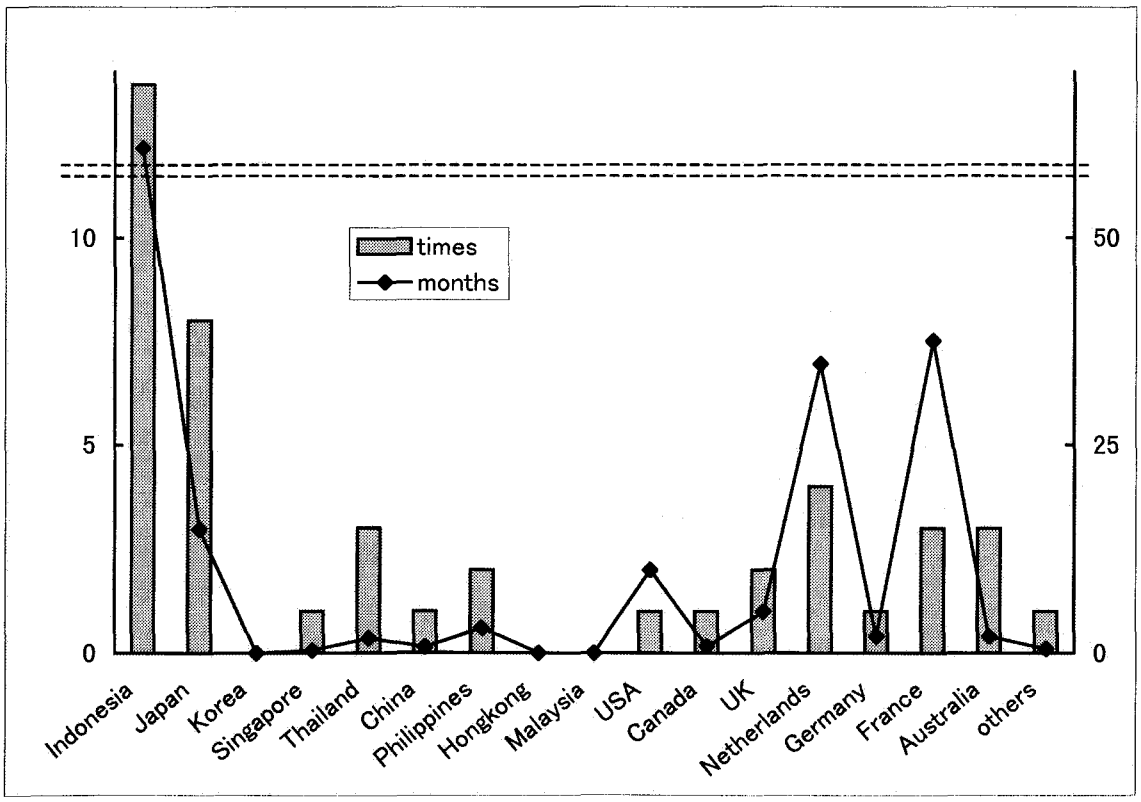


5.3 Country for Training

(1) Including studying abroad



(2) Excluding studying abroad



5.4 Length of Training including Studying Abroad