may be locally available. In this case, the cost will be 30% - 40% lower than that when equipment is procured in Japan[9]. Also, heavy equipment that represents large portions of the equipment cost can be procured locally at a lower price than the present estimates, not to mention cost saving by using second-hand equipment. Therefore, it is unlikely that the equipment cost rises above the estimate. Rather it is realistic to assume that it will decline. If the actual equipment cost is 10% lower than the estimate, IRR will become 35.7%, and if 20%, 39.3%.

The project life is assumed to be 20 years. Even reduction to 15 years, will have a very small effect on profitability .

1.3.5 Banjarnegara feldspar beneficiation and supply project

1.3.5.1 Project concept

Feldspar processed by the dry mixing method has an acceptable grade for tile manufacturers but is not suitable for tableware and sanitary ware production. This project will produce and supply refined feldspar with quality suitable for use as the body and glaze for sanitary ware and tableware. It includes the installation of a beneficiation plant to raise the alkali concentration to 10% and remove iron, titan, and mica to reduce their content below 0.3%.

The project presumes implementation of the Banjarnegara feldspar supply project.

1.3.5.2 Project outline

(1) Project site

The beneficiation plant will be constructed within the secondary stockyard site (or its adjacent site) of the Banjarnegara feldspar supply project.

(2) Project description, equipment, and manpower

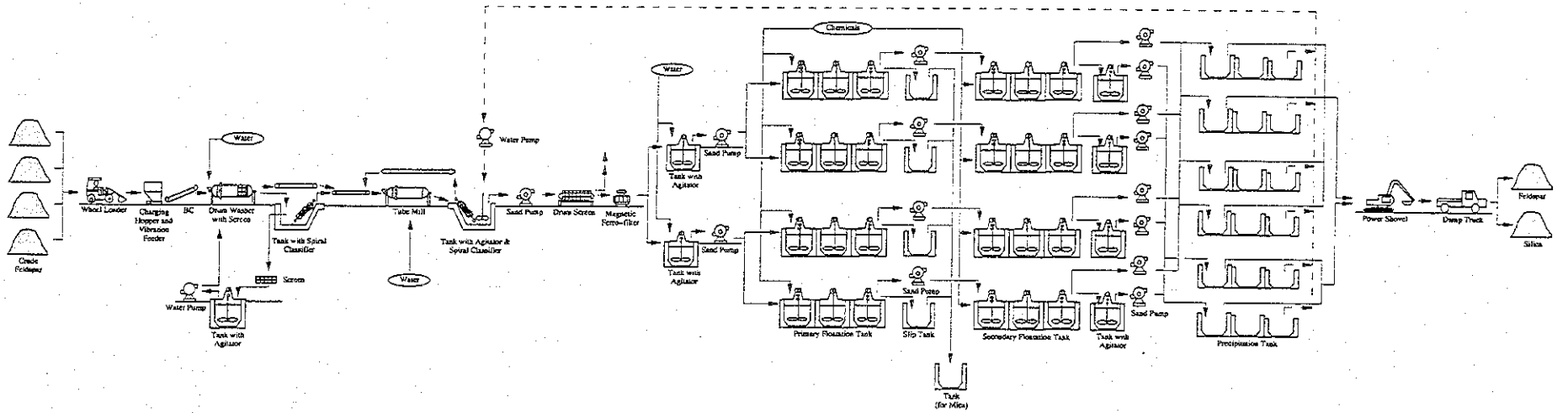
1) Beneficiation plant

Feldspar with consistent quality produced by dry mixing in the preceding project is refined at a plant consisting of crushing, water washing, classification, and floatation processes (Figure 1-6).

Feldspar is transported by a wheel loader from a stockyard to the plant. In the pretreatment process, it is crushed and washed in a drum washer to remove mica and clay minerals. The feldspar content left to settle in the washed materials is raked by

[9] According to information furnished by a local ceramic manufacturer.

Figure 1-6 Banjarnegara Feldspar Refining Process Flow Chart (25,000 t/y)



an Akins' classifier. It is then fed together with over screen to a tube mill for continuous pulverization. In the process, impurities trapped in feldspar and quartz particles are separated. Coarse particles remained in the pulverized mixture are raked by the Akins' classifier and sent to the tube mill again for further pulverization. The pulverized portion is sent by a sand pump to a magnetic de-ironing process. After the de-ironing process, the fluid mixture is sent to the floatation process.

In the floatation process mica is removed first, then feldspar is floated and quartz sand is settled and recovered. Separated feldspar and quartz sand are sent to a settlement tank separately with pressure. After settlement and water are separated, feldspar and quartz sand are transported to the stockyard for storage.

2) Stockyard

The stockyard will be sheltered, and finished with a concrete floor.

3) Quality control

Quality control tests will be conducted by using equipment provided under the feldspar supply project.

1.3.5.3 Project definition

(1) Production capacity

The production capacity of refined feldspar is assumed at 30,000 tons per year. Quartz sand as a byproduct will be produced at the rate of 70,000 tons annually.

The refined feldspar will be primarily used for production of tableware, sanitary ware, and glaze in Java. Total demand for tableware and sanitary ware production is estimated in Table 1-12.

Table 1-12 Estimated Demand for Feldspar for Use of Tableware and Sanitary Ware

Unit: tons

	1995 (*1)	1998 (*2)
For sanitary ware	**13,000**	**18,000**
West Java & Jakarta	9,000	12,000
Central & East Java	4,000	6,000
Others	-	-
For tableware	**94,000**	**142,000**
West Java & Jakarta	46,000	70,000
Central & East Java	18,000	27,000
Others	30,000	45,000
Total	**107,000**	**160,000**

(*1) Estimated actual

(*2) Projected

Sanitary ware production always uses more than two types of feldspars which are blended in varying proportions. Also, it can use only a combination of kaolin, feldspar, and quartz. In the market, the feldspar from Lampung, Lodoyo and imports competes with this feldspar in West Java and Jakarta. However, Lodoyo feldspar, on one hand, has almost been exploited and quality grade is hard to obtain, and the price of imported feldspar, on the other hand, is too high. Therefore, the major sources of feldspar in this region will be the present one and that from Lampung. Thus, assuming that most manufacturers use this feldspar with its expected share of supply being 80%, and that manufacturers use one type of feldspar up to 30%, and further, the combination of kaolin, feldspar, and quartz is used for 50% of production in West Java and Jakarta, then the Banjarnegara feldspar's share in total demand for feldspar from sanitary ware manufacturers in West Java and Jakarta is 12%. On the other hand, production in Central and East Java uses only the kaolin, feldspar, and quartz combination, while there is little competition with feldspars from other local sources. Therefore, assuming the market share of the Banjarnegara feldspar is 30%, the estimated demand will be approximately 3,000 tons in 1998 (or 2,000 tons with demand size in 1995).

For tableware production, the Banjarnegara feldspar is not suitable for high-grade products since it contains mica, though it in very low concentration, and low alkali content (slightly less than 10%). The share of high-grade tableware is expected to increase to 30% in the near future. The percentage of use of imported feldspar for the remaining medium-grade and commodity products, is estimated to decrease to 30% from the present 50% (since the alkali content of local feldspar is low, the tableware manufacturers cannot do without imported feldspar).

On the other hand, the Lampung feldspar will increasingly compete with the Banjarnegara product as mining reaches a deeper layer and the alkali content increases. Assuming that the share of the Banjarnegara feldspar is 40 to 50% in West Java and 80 to 90% in East Java, the share in total demand will be around 20%, which amounts to around 29,000 tons in 1998 (or 19,000 tons based on the 1995 demand).

As a result, total potential sales of the Banjarnegara feldspar for tableware and sanitary ware production are 32,000 tons in 1998 (or 21,000 tons based on the 1995 demand). Some demand for glaze is expected to be added to this amount. In determining the production capacity, however, commercial sales of quartz sand that is separated as a byproduct need to be taken into account. Since quartz sand is mainly used for glass production which has strict requirements for the upper limit of iron content, the feldspar production capacity is assumed to be 30,000 tons (therefore, 70,000 tons of quartz sand).

Profitability for the project, measured by IRR, is -3.9%. The negative feasibility comes from the small production capacity. Table 1-13 shows the results of feasibility analysis based on increased production capacities (125% and 150% of the assumed capacity). As seen in the table, larger capacities will result in some improvements in profitability, but this level of capacity is still below a viable level, even at the 45,000-ton capacity.

Table 1-13 Change in IRR with Change in Production Capacity and Operation Rate (Banjarnegara Feldspar Beneficiation and Supply Project)

		Production Capacity (ton/year)			
		45,000	37,500	30,000	22,500
Operation Rate(*1)	100%	-3.0%	-3.3%	-3.9%	-4.7%
	Low case(*2)	-10.7%	-8.9%	-6.7%	

(*1) Operation rate in the 2nd year. The operation rates are 65% for the 1st year in both cases.

(*2) The maximum saleable volume is assumed at 24,000tons.

(2) Beneficiation

The Banjarnegara feldspar has the following four disadvantages:

1) The alkali content ($K_2O + Na_2O$) ranges between 6% and 8%, and still below 10% of required content for porcelain production.
2) The content of iron (Fe_2O_3) - a discoloring agent - is high at 1.0% to 1.6%.
3) Mica is deeply incorporated into the ore.
4) Quality varies with the mine, pit, and face.

Among them, the fourth problem can be overcome by using feldspar after dry mixing.

The following are the possible alternatives for beneficiation, taking into account the properties of Banjarnegara feldspar, the target of beneficiation, and number of treatment processes involved:

1) Water washing and floatation
2) Water washing and magnetic iron removal
3) Water washing and acid treatment

According to the laboratory test conducted on the feldspar samples, by selectively crushing optimum particle sizes and separating mica from feldspar and quartz, followed by water washing, the iron content can be reduced to around 0.2%, and color after firing can be improved to the level of standard grade of the Masuda feldspar in Japan. However, a part of feldspar, which is relatively soft, is also crushed in the crushing process and removed as undersize in the classification process. In this case, the over size alone cannot achieve sufficient sinterability. Also, this method alone does not

improve color after firing.

Magnetic de-ironing (25,000 Gs) can reduce the iron content to 0.15% or less and color after firing is improved to that of the Masuda feldspar. However, the method is not capable of raising the alkali content.

Acid de-ironing is another effective method of reducing the iron content, and laboratory test results indicate possibility of improving the iron removing effect and color after firing. However, problems remain in terms of the long hours required for acid treatment, high cost, and need for neutralization or recovery of acid after treatment.

Further, it has been confirmed that floatation can increase the alkali concentration to nearly 10%.

Based on the above laboratory test results, a beneficiation process has been adopted to combine crushing, water washing, classification, magnetic de-ironing, and floatation processes, not including acid treatment. Also, undersize obtained after water washing is recycled to the process after removing clay and iron contents. The process flow is summarized as follows:

1) To use feldspar which is dried mixed for consistent quality;
2) To crush it in a drum washer, while washing away impurities such as clay and iron contents;
3) To pulverize (150 -200 meshes) the washed feldspar and quartz;
4) To remove an iron content from the pulverized feldspar and quartz by strong magnetism of 20,000 Gs.;
5) To increase the feldspar content in the slurry after iron removal through the floatation process; and
6) To recover feldspar in the slurry settled and separated in a pit.

(3) Stockyard

To encourage natural dehydration from the feldspar-contained slurry, the stockyard will be sheltered and finished with concrete floor with a 5 to 6 degree slop.

(4) Quality control equipment

Quality control tests to be conducted at field will mainly cover grain size analysis and melting test. Other tests will be conducted by BBK or other public organizations. Testing equipment for the feldspar supply project will be used for this purpose.

1.3.5.4 Required fund, profitability, and risk related to the project

(1) Estimated initial fund requirements

The estimated initial funds required for the project are summarized in Table 1-14. 94.4% of the total fund requirement is the cost of beneficiation facilities.

Table 1-14 Estimated Initial Fund Requirement
(Banjarnegara Feldspar Beneficiation & Supply Project)

	Rp. million	US$ 000
(1) Land acquisition & preparation	560.5	240.6
(2) Building & warehouse	435.0	186.7
(3) Facilities	67,333.5	28,898.5
1) Machine & equipment	64,917.7	27,861.7
2) Vehicles	2,415.8	1,036.8
(4) Others (*)	81.2	34.8
Total	68,410.2	29,360.6

(*) Including pre-operating expenses, initial working capital, etc.

(2) Profitability

The projected revenue and expenditure for the project up to the seventh year of operation are summarized in Table 1-15. Although revenues will exceed total production costs in the second year and after, they will not cover depreciation expenses for equipment. Thus, profitability measured by IRR show a negative value of 3.9% before tax, indicating that the project is not feasible.

As mentioned earlier, the small production capacity is a major factor in poor profitability, which is further deteriorated by a low yield of refined feldspar (30%; the remaining portion will be separated as quartz sand).

Even if sales prices of refined feldspar and quartz sand increase 20%, IRR will be still negative at 1.2% (Table 1-16).

Therefore, the project cannot be justified unless the conditions change so that production capacity is increased.

Table 1-15 Sales Revenue and Production Costs
(Banjarnegara Feldspar Beneficiation & Supply Project)

(Unit: Rp. 000)

Year of operation:	1st	3rd	5th	7th
Sales revenue total	2,967,244	4,980,000	4,980,000	4,980,000
Production costs				
Variable costs	243,770	375,030	375,030	375,030
Labor costs	75,000	75,000	75,000	75,000
Overhead costs	60,000	60,000	60,000	60,000
Maintenance costs	677,685	2,033,055	2,033,055	2,033,055
Tax & insurance	683,900	546,572	441,192	357,088
Other fixed costs	525,458	525,458	525,458	525,458
Fixed costs	2,022,043	3,240,085	3,134,705	3,050,601
Direct manufacturing costs	2,265,813	3,615,115	3,509,735	3,425,631
Depreciation	7,477,998	5,569,238	4,438,712	3,545,816
Total manufacturing costs	9,743,811	9,184,353	7,948,447	6,971,447

Table 1-16 Change in IRR with Change in Major Factors Affecting Profitability
(Banjarnegara Feldspar Beneficiation & Supply Project)

Change in Sales Price				Change in costs of vehicles and facilities	
Sales Price (Rp./kg)		Deviation from the base case	IRR before tax	Deviation from the base case	IRR before tax
Refined feldspar	Silica sand	(%)	(%)	(%)	(%)
148.8	21.6	+20	-1.2	-20	-1.3
136.4	19.8	+10	-2.5	-10	-2.7
124.0	18.0	0	-3.9	0	-3.9
111.6	16.2	-10			
99.2	14.4	-20			
86.8	12.6	-30			

Note: (*) Operational rate in the 2nd year and onwards.
The operational rates in the 1st year are 65% for all the cases.

1.3.6 Small-scale body and glaze premixing project

1.3.6.1 Project concept

The project will manufacture and supply premixed body and glaze to a localized community (cluster) of novelty manufacturers.

Most novelty manufacturers are small enterprises or microenterprises, who form clusters throughout the country. They blend raw materials as required; the grade of those

materials varies with delivered lot, making proper blending difficult. Also, raw materials often contain constituents unsuitable for ceramic production, which adversely affects the quality of final products. For this reason, novelty manufacturers will welcome availability of premixed body with consistent quality. In addition, they anticipate that the premixed body of better quality leads to the improvement of product quality.

Under the project, the body and glaze will be prepared on the basis of the existing ones at the initial stage and will be gradually modified. The project will serve as a model case to launch similar projects in other clusters of small ceramic manufacturers.

1.3.6.2 Project outline

(1) Project site

The project will be implemented in Kiara Condong. It is desirable to establish the facility within BBK partly because the pilot nature of the project requires continuous technical support, and partly because some of BBK's facilities and equipment can be used.

Novelty manufacturers in Kiara Condong produce a variety of ceramic products including Chinese-style pots, large plates, vases, and ashtrays and dolls for gift and souvenir use. They are family-operated or similar small enterprises and prepare blanks on their own. Characteristically, most company owners in the areas are relatives, so that they feel benefits from the premixed body more readily than small manufacturers in other area and can easily agree on uniform blending standards. Also, the proximity to BBK facilitates communication related to technical assistance. For these reasons, Kiara Condong is best suited as the site of the pilot project.

Other candidate clusters were dropped from the final list:

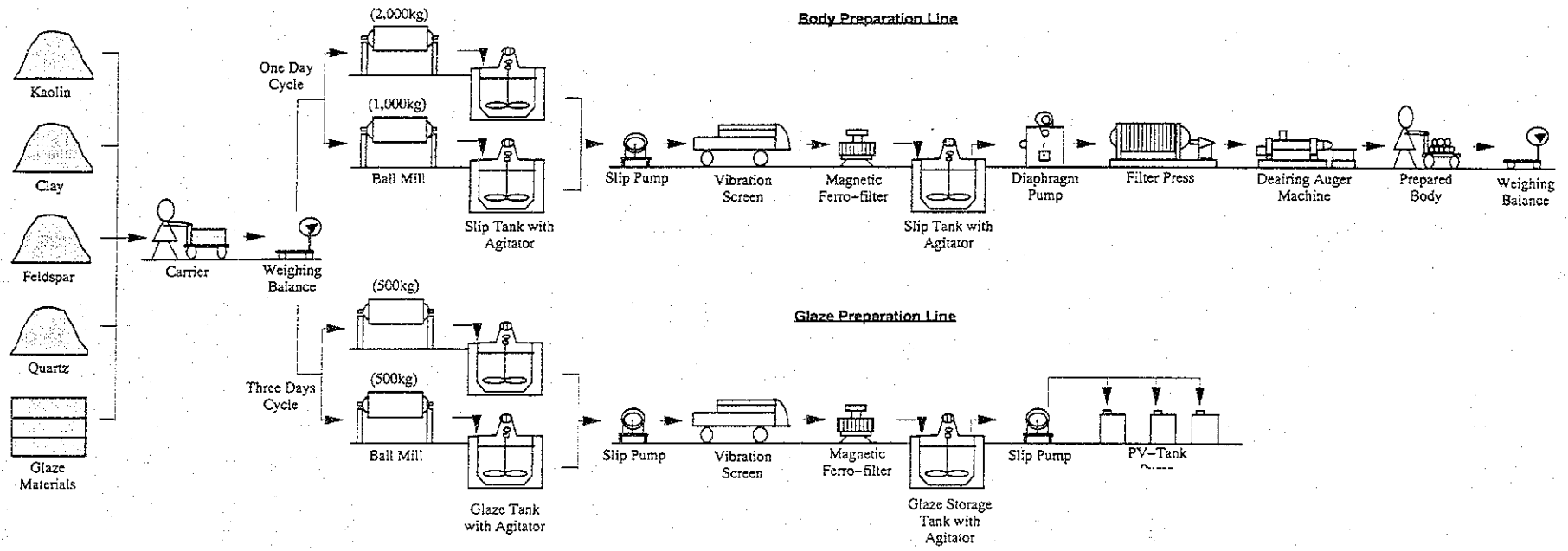
1) Malang is a production center where the manufacturers are aggressive in improvement of product quality, but has its own supply system in place.
2) Plered, although relatively close to BBK (next to Kiara Condong), does not have serious quality concern because of the type of product (terra-cotta) and further, they have their own supply system of the premixed body.

(2) Production equipment

1) Premixed body production plant

Raw materials (kaolin, clay, feldspar, quartz, etc.) are batched according to specified blending proportions and fed to a ball mill for wet crushing and blending. The slip produced from the process passes through a screen to remove uncrushable portions, is subject to iron removal and dehydrated in a filter press to form a cake. It is shipped as the premixed body or is deaerated through a deaeration extruder before shipment (Figure 1-7).

Figure 1-7 Body and Glaze Preparation Process Flow Chart (Body 700t/y, Glaze 70t/y)



2) Glaze production plant

Raw materials are batched according to specified proportions and fed to the ball mill for wet crushing and blending. The glaze so prepared passes through a 200-mesh screen to remove uncrushable portions, and after iron removal, it is packed in a polyvinyl tanks (30 liters).

(3) Quality control

The necessary equipment will be installed for the following tests to be conducted.

1) Grain size analysis
2) Measurement of water content
3) Firing test
4) Reaction between the body and glaze

1.3.6.3 Project definition

(1) Production capacity

The annual production capacity is set at 700 tons for premixed body and 70 tons for glaze.

Major customers are novelty manufacturers in Kiara Condong. Shipment to other areas is not feasible while the existing blend is used. In the future, production activity may be diversified if required, with the improvement of the premixed body and production of the premixed body for other clusters.

In Kiara Condong, approximately 40 tons/month (480 tons/year) of body are consumed. The production capacity is set to meet future growth as well as supply to other areas. Glaze consumption is generally around 10% of body consumption, so that the production capacity is assumed to be 70 tons.

The relationship among the production capacity, operating rate, and profitability is shown Table 1-17. The assumed production capacity is not large enough to make the project viable. Even if the capacity increases 40%, IRR is relatively low at 10.8%. The production volume in this range does not justify commercial production.

Table 1-17 Change in IRR with Change in Production Capacity and Operation Rate
(Small-scale Body and Glaze Premixing Project)

		Production Capacity (*3) (ton/year)			
		980	840	700	560
Operation Rate(*1)	100%	10.8%	9.3%	7.5%	5.0%
	Low case(*2)	1.0%	2.1%	3.5%	

(*1) Operation rate in the 2nd year. The operation rates are 65% for the 1st year in both cases.

(*2) The maximum saleable volume is assumed at 560tons.

(*3) Production capacity of body premix. The production capacity of glaze is assumed as 1/10 of body premix in each cases.

(2) Production facility

The production process is fairly simple, mainly consisting of batching, crushing, and blending. Given the small scale of production, manual work will be mainly used, except for necessary equipment such as the ball mill, mixer, filter press, and vacuum kneading machine. The de-ironing machine included here is designed to remove iron that will be mixed during transportation or crushing, and not to remove iron inherently contained in the raw material.

(3) Quality control equipment

Testing equipment for quality control purposes should be capable of performing the following tests. Other tests will be entrusted to BBK or other public organizations:

1) Grain size analysis: Standard sieves
2) Measurement of water content: Dryer and electronic weighing machine
3) Firing test: Electric furnace
4) Body/glaze reaction test: Pot mill, etc.

1.3.6.4 Required fund, profitability, and risk related to the project

(1) Preliminary estimate of initial fund requirements

The estimated initial funds required for the project are summarized in Table 1-18.

Table 1-18 Estimated Initial Fund Requirement
(Small-scale Body and Glaze Premixing Project)

	Rp. million	US$ 000
(1) Land acquisition & preparation	97.9	42.0
(2) Building & warehouse	27.0	11.6
(3) Facilities	1,149.0	493.1
1) Machine & equipment	1,149.0	493.1
2) Vehicles	-	-
(4) Others (*)	29.8	12.8
Total	1,303.7	559.5

(*) Including pre-operating expenses, initial working capital, etc.

(2) Profitability

Projected revenue and expenditure for the project up to the seventh year of operation are summarized in Table 1-19. Although revenues will exceed total production costs in the second year and after, profitability measured by IRR shows 7.5% before and after tax, that is not attractive enough for private investment.

Alternatively, if the project is implemented by BBK and UPT at BBK's site, cost savings can be expected in the following areas, and IRR improves to 11.0%:

1) Equipment cost
   a) Two ball mills currently in use will be used for body production, they are to have rubber inner lining.
   b) No testing equipment for quality control will be required.
2) Land acquisition and preparation costs will not be required
3) Interest payment will be saved by relying on government assistance for initial funds.

Furthermore, if the project is managed by UPT/BBK, labor cost and overhead will be financed by government budget. As a result, IRR improves to 15.5%.

Modified financial projection for the project up to the seventh year of operation are summarized in Table 1-20. Although profitability is not high enough to attract private investment, positive cash flow will be generated in the second year and after.

Table 1-19 Sales Revenue and Production Costs
(Small-scale Body and Glaze Premixing Project)

(Unit: Rp. 000)

Year of operation:	1st	3rd	5th	7th
Sales revenue total	222,930	373,800	373,800	373,800
Production costs				
Variable costs	89,271	137,150	137,150	137,150
Labor costs	24,000	24,000	24,000	24,000
Overhead costs	19,200	19,200	19,200	19,200
Maintenance costs	11,760	35,281	35,281	35,281
Tax & insurance	12,963	10,441	8,596	7,127
Other fixed costs	13,017	13,017	13,017	13,017
Fixed costs	80,940	101,939	100,094	98,625
Direct manufacturing costs	170,211	239,089	237,244	235,775
Depreciation	145,219	96,810	79,431	60,858
Total manufacturing costs	315,430	335,899	316,675	296,633

Table 1-20 Sales Revenue and Production Costs
(Small-scale Body and Glaze Premixing Project - Alternative Case)

(Unit: Rp. 000)

Year of operation:	1st	3rd	5th	7th
Sales revenue total	222,930	373,800	373,800	373,800
Production costs				
Variable costs	89,271	137,150	137,150	137,150
Labor costs	0	0	0	0
Overhead costs	0	0	0	0
Maintenance costs	11,760	35,281	35,281	35,281
Tax & insurance	9,720	7,198	5,353	3,883
Other fixed costs	13,017	13,017	13,017	13,017
Fixed costs	34,497	55,496	53,651	52,181
Direct manufacturing costs	123,768	192,646	190,801	189,331
Depreciation	145,219	96,810	79,431	60,858
Total manufacturing costs	268,987	289,456	270,232	250,189

(3) Risks

It is assumed that the project is managed by the government within BBK's site. Changes in profitability due to variation of major influencing factors are summarized in Table 1-21. As discussed later, there are few factors that adversely affect profitability,

so as to jeopardize the project's viability.

Table 1-21 Change in IRR with Change in Major Factors Affecting Profitability
(Small-scale Body and Glaze Premixing Project - Alternative Case)

Change in Sales Price			Change in Operational rate		Change in costs of vehicles and facilities		Change in Project Life	
Sales Price(*1) (Rp./kg)	Deviation from the base case (%)	IRR before tax (%)	Operational rate(*2) (%)	IRR before tax (%)	Deviation from the base case (%)	IRR before tax (%)	Project Life (years)	IRR before tax (%)
540	+20	22.0			-20	19.4		
495	+10	18.9			-10	17.3		
450	0	15.5	100	15.5	0	15.5	20	15.5
405	-10	12.0	90	13.6	+10	14.0	15	14.3
360	-20	8.1	80	11.5	+20	12.7		
315	-30	3.5	70	9.2				

Note: (*1) Sales price of pre-mixed body.
(*2) Operational rate in the second year and onwards.

The sales price is the primary factor that affects profitability. However, the assumed price is based on the body made in Malang that is purchased in Bandung, and the premixed body supplied under the project can lead to a lower rate of product rejection due to quality improvement; thus, a price decline will not be probable. Rather a 20% increase in sales price is highly likely.

Considering the annual consumption of 480 tons in Kiara Condong, the low operating rate assumed here may be possible, in which case IRR falls to 9.2%.

The equipment cost is expected to decline below the level of present estimates which are based on the assumption that most of equipment will be procured in Japan and will be transported to Indonesia for installation. In reality, high performance is not required for and this equipment may be locally available. In this case, the cost will be some of equipment listed, 30% to 40% lower than that when equipment is procured in Japan[10]. If the actual equipment cost is 20% lower than the estimate, IRR will become 19.4%,

The project life is assumed to be 20 years. Even reduction to 15 years, will have very little effect on profitability.

In any of the above cases except for a 30% decline in sales price, positive cash flow will be generated from the second year (from the sixth year, in the case of a 30% decline in sales price)

[10] According to information furnished by a local ceramic manufacturer.

1.3.7 Project to build up technical assistance capabilities related to ceramic raw material supply

1.3.7.1 Project concept

The project is designed to provide the technical assistance for ceramic raw material supply and to build up technical capabilities in this connection. The project consists of the following three programs:

1) Implementation of a supplementary technical study to support promotion of the recommended project to develop ceramic raw materials
2) Strengthening of the functions of BBK in its provision of continuous assistance in development of ceramic raw materials, and
3) Establishment of international training courses on ceramic raw material development in BBK for BBK to keep up with the updated technologies

1.3.7.2 Project outline

(1) Project implementation body

BBK is assumed to be primarily responsible for the project. However, as the project involves matters related to the mining of ceramic raw materials, BBK will request support, as required, from Geological Research and Development Center of Development of Mineral Resources (DSM) under the Directorate of Mineral Resources, and Mining Technology Research and Development Center (MTRDC) under the Directorate General of Geology and Mines, both of the Ministry of Mineral and Energy.

(2) Activities

Activities to be conducted under the project are summarized as follows.

1) Implementation of a supplementary technical study to support promotion of the recommended project to develop ceramic raw materials

To conduct boring surveys for the Sukabumi clay resources and the Banjarnegara feldspar resources, to collect and provide technical data required for the selection of mining sites, the development of mining and grading plans, and the establishment of technical conditions for blending and beneficiation facilities

2) Strengthening of functions of BBK in providing continuous assistance in development of ceramic raw materials

To strengthen the functions of BBK to conduct R&D related to the preparation, implementation, and improvement of each project that constitutes an integral part of the plan. The R&D required for this aim includes;

(To meet the immediate needs)

a) To establish the basis of quality control, including the standardization of raw material testing methods, whereby businesses on both the raw material supply side and the customer side can operate with consensus on standards of quality

b) To provide technical guidance for future improvement of the small-scale premixed body supply project which will start from the currently used blending proportions, on the basis of research on conditions of small-scale body production in detail and possible quality improvements

(In view of long-term needs)

c) To conduct product development research within limitations of each raw material

(Provision of day-to-day support service)

d) Raw material analysis and testing service

e) Technical consultation and guidance

f) Information service

g) Human resource development

3) Establishment of international training courses on ceramic raw material development in BBK

1.3.7.3 Project definition

(1) Supplementary technical study to support promotion of the recommended project to develop ceramic raw materials

1) Objective

Since for the present study there is still an insufficiency in detailed technical data available to enable potential investors to make a decision on implementation, it is recommended to conduct the supplemental technical study that is outlined in the following, and collect the technical data required.

2) Sites to be surveyed

Sukabumi clay and Banjarnegara feldspar mine sites

3) Implementation body

The study committee will be organized under the leadership of BBK, including representatives from DSM and MTRDC.

Under the committee, (1) a boring subcommittee will be organized for coordination of boring surveys, and (2) a raw material evaluation subcommittee will be organized to evaluate suitability of raw materials to be obtained from the projects.

The boring subcommittee will be organized by government agencies and related

organizations to meet the following requirements:

a) the government agency budgeting the surveys will supervise and coordinate the team.
b) MTRDC will play a central role in establishing basic and execution plans for boring surveys as well as supervising actual activities. Thus, MTRDC should assign at least two full-time staff for this.
c) BBK will analyze and evaluate core samples and provide the results to the team to ensure that the boring plan is adjusted accordingly. For this purpose, BBK should assign at least one full-time staff member.
d) Actual boring will be carried out by a selected contractor(s).
e) Expatriate engineers (or a exploration team) having experience in boring surveys for ceramic raw materials will be invited for technical assistance.

Related organizations include, in addition to the above, DSM, Directorate of Non-metallic Mineral Industry, MOIT, prefectural governments in Sukabumi and Banjarnegara, ASAKI, Sukabumi mining cooperative, and miners currently operating in Banjarnegara. While it is desirable to have the broadest participation of related organizations to collect relevant information and disseminate survey results, it would require much time and effort to coordinate them, and efficiency is reduced if a large number of organizations and groups are involved. Thus, the boring subcommittee should be organized by the minimum-required number of organizations to meet the above objectives and ensure organizational flexibility. At the same time, to ensure effective communication to other organizations not included in the subcommittee, it should establish a mechanism to ensure periodical reporting.

The raw material evaluation subcommittee will be organized by engineers of user industries who will use raw materials supplied under the plan, under the leadership of BBK which will be responsible for planning and implementation of analytical and evaluation work. User industries should include not only manufacturers of tiles, tableware, and sanitary ware, but also of refractory, insulator, and glass. Expatriate engineers (or a team) having experience in beneficiation of ceramic raw materials will be invited for technical assistance.

4) Contents of study

a) Preliminary survey

Collection of data and information useful for planning of boring surveys, such as detailed geological conditions and geographical distribution of mines

b) Preparatory survey

The survey will be conducted to determine the scope of the boring survey and the basic plan. As the basic plan will affect the success of the actual survey, a detailed survey is required. The basic plan should not be confined to general terms. Rather it should be more detailed, including assumption of bench cut operation, taking into account the probable quarrying conditions including the limitation of mining depth to be established in consideration of drainage limitations, and the type of mining equipment to be used, etc.

c) Boring and core sampling

Since there is an apparent lack of detailed data and information on the Sukabumi clay deposits, the range of boring surveys will have to be determined on the basis of overall evaluation by the boring survey team. The survey area should be 40ha if continuous mining for the next 20 years is assumed. However, it can be limited to 8ha if expansion or relocation every five years is assumed.

In Banjarnegara, the Kalitengah feldspar mine is suitable for large-scale development in terms of reserves, continuity of feldspar-contained layers, and topography, and boring surveys should focus on this mine area. Since deposits are 60m deep, the survey area equivalent to 20-year operation is around 3ha.

The boring plan should be flexible enough to meet the requirements expected from the survey; e.g., bore samples obtained from the bore hole should be evaluated in the field, and the result should be reflected in the subsequent boring plan as required.

d) Evaluation of core samples

Core samples collected by boring surveys will be analyzed and evaluated. The main purpose of evaluation is to determine mining policy and define criteria for grading, conditions for beneficiation, and blending. Evaluation items, therefore, include chemical composition analysis, mineral analysis, grain size analysis (for clay), and color after firing.

e) Evaluation of raw materials and research on mining and beneficiation conditions

Evaluate the ceramic raw materials in view of use, and obtain technical data and information required for determining the blending and beneficiation processes.

Research activities will be led by BBK. Major areas of research are as follows:

1. Evaluation of marketability of the Sukabumi clay and the Banjarnegara feldspar (in view of use for tile);
2. Detailed examination of beneficiation conditions for the Banjarnegara feldspar;
3. Evaluation of marketability of the refined Banjarnegara feldspar (in view of use for sanitary ware and tableware); and
4. Evaluation of marketability of quartz sand as byproduct of the Banjarnegara

feldspar (in view of use for glass manufacturing)

The evaluation of marketability will be conducted at manufacturing plants or pilot plants of ceramic manufacturers under arrangement of the subcommittee.

f) Preliminary environmental impact assessment

Preliminary environmental impact assessment required for large-scale development of a new mine.

g) Data analysis and reporting

5) Resources required by the project implementation body

a) Manpower

BBK's and MTRDC's staff will be assigned as the key members for implementing the study. In addition, it is desirable to invite a study team from abroad consisting of engineers having expertise in the following areas for technical assistance (or conducting joint study);

1. Boring surveys on ceramic raw materials
2. Beneficiation of ceramic raw materials

b) Equipment

Assumes installation of the following additional testing equipment (for details, see the latter part of this section)

- X-ray fluorescence analyzer
- Glass bead manufacturing equipment

For boring, MTRDC or DSM equipment will be used. Further, for examination of beneficiation condition of feldspar, chemicals for the floatation process, including the modifier, frothier, and collector (several types for each), will be required.

c) Estimated cost

Preliminary cost estimates for the boring surveys are as follows:

- Sukabumi clay mine: US$1,050,000 (or US$270,000 if limited to deposits covering first 5 years of mining)
- Banjarnegara feldspar mine: US$370,000
- Other costs and expenses related to daily activities and sample analysis

6) Estimated required period for the survey: Approximately 15 months

(2) Strengthening of functions of BBK in providing continuous assistance in development of ceramic raw materials

1) Main themes for technical assistance

a) Standardization of raw material testing methods

Objective

The project aims to develop standards for ceramic raw material testing methods, to thereby standardize various testing methods to be adopted and practiced by quarry miners, suppliers and customers. The standardization will enable the supply side to perform quality control on the basis of the results obtained from the standard testing methods, while customers will be able to use test results received from suppliers for blending control at their facilities.

Activities

1. Organization of the draft standards development committee

   The draft standards development committee will be organized by appointing the members from engineers of ceramic manufacturers mainly of ASAKI and other leading manufacturers, and representatives of BBK and PUSTAN. It is desirable, if possible, to have representation from raw material suppliers.

2. Development of draft standards

   The committee will develop draft standards which are based on applicable standards used in other countries with necessary adjustments and modifications according to local conditions in Indonesia. As required, BBK will perform various tests using actual materials and provide test data for examination. Also, manufacturers will be asked to provide relevant data.

   Draft standards so developed will be published as ASAKI or BBK standards for field application and will be revised from time to time as required. They may be adopted as national standards in the future. Standards which are considered to be useful and applicable to the industry are related to quality verification tests conducted on the raw material supply side, including the following:

   - Sampling methods for raw materials stored in the stockyard; and
   - Methods for preparing and testing specimen for evaluation of color after firing, refractoriness and ignition loss of clay and feldspar, and evaluation criteria.

b) Research on quality improvement of premixed body for small-scale novelty manufacturers

Objective

Under the project to supply premixed body to small-scale novelty manufacturers, the body will be initially produced on the basis of the blending ratio currently in use. Meanwhile, it is important to make efforts to improve the quality of the body in an attempt to change raw materials for the improvement of product quality, profitability, and/or consistent quality.

Activities

1. Analysis to obtain an understanding of technical properties of the currently used body

At present, technical properties of the body currently used are not analyzed. The data to be collected will form the basis of quality improvement efforts.

2. Research on quality improvement of the currently used body

Quality improvement will be by the following process:

- Establish of target levels for product improvement through extensive discussion with novelty manufacturers;
- Change of the current blending ratio for each raw material and identification of technical properties; and
- Repetition of the process until the body achieves the target levels.

c) Product development making most of available local materials and dissemination of them

It is important to recognize limitations of locally available raw materials and develop products which make most use of properties and characteristics peculiar to such materials.

Tableware and sanitary ware currently produced in the country are mostly products developed on the basis of high-grade white wares popular in industrialized countries, and primarily imported materials are used. Therefore, an attempt to develop ceramic materials making most of the locally available materials is still risky since there is no demand (or no potential demand has materialized) for such products at present. However, for the future demand to be created, it is important that the product development efforts make most of the locally available materials, together with efforts at dissemination of such products among potential consumers. As for tableware, glass and metal products are widely used in most households, and will be largely replaced with ceramic products in future. At the same time, the low-cost tableware is imported from China at present. Taking into account these conditions, efforts should be made to develop and disseminate non-white tableware. Japanese tableware is a primary example and is widely used for its unique design, color and tone. For sanitary ware, demand for which will soon grow, it is highly possible to promote products with non-white body (inclusion of some black particles) by emphasizing durability, new designs, low prices, and other features appealing to consumers. Such efforts should be led by extension service offices specializing in industrial technology. To provide incentives for R&D staff may be one of the measures to encourage such

efforts, e.g., part of the royalty may be paid back to the developer when the product is well accepted by the market.

d) Continued exploration efforts of ceramic raw materials

During the study, there were some resources which were not selected by the study team as promising, due to the lack of data. In particular, the following resources are recommended to be made the objective of further study and research;

1. Clay resource surveys around the Sukabumi clay mine, particularly nearby valleys and flat areas, should be conducted in order to identify prospective sites for future development. Mining sites in Sukabumi are currently concentrated on the hill top or hillside. Local topography suggests, however, the presence of clay sediments in the valleys and flat areas, which were washed away from original deposits. Generally, sedimentary clays have often higher quality and are easy to excavate. Some of the prospective areas are occupied by houses, but other areas that are used as farm land which may be commercially exploitable.
2. Pottery stone samples, collected by the study team from the outcrop in the lower part of pyrophyllite in Pacitan, which is currently excavated, are believed to be promising for sanitary ware production. It was not selected for development under the plan, partly because pottery stone reserves are reportedly small in quantity, partly because of difficulty in using mining equipment at the field, and remoteness to the market. However, if sufficient reserves are identified in more accessible locations, this source would have a high commercial value. In this connection, further resource survey is recommended.

e) Raw material analysis and testing service

Objective

To build the capability to perform analyses and tests on raw materials produced at the beneficiation and blending factories, which cannot be performed at these factories; to provide assistance for maintaining the precision of testing equipment at the factories; and to develop resources and skills to provide technical guidance for quality improvement and stabilization based on test results.

Activities

Activities contemplated for the service are as follows:

- Calibration of electronic scales and thermometers for electric kilns at the factories;

- Verification tests for grain size analysis, water content analysis, ignition loss, color after firing, firing shrinkage, and melting property tests; and
- Analyses and tests which cannot be performed at the factories on the following:

Samples for analysis and testing

1. Crude materials graded at the mining site
2. Product materials blended and beneficiated
3. Samples from various processing stages

Analysis and test items

1. Chemical analysis
2. Mineral analysis
3. Thermal analysis
4. Blending test

f) Technical consultation and guidance service

Objective

To provide technical consultation and guidance service on the basis of the results of the above analyses and tests.

Activities

The following activities are contemplated:

- Inspection and acceptance of analytical instruments and testing equipment to be installed at the factories upon the start of commercial operation;
- Skill training for workers related to analysis and testing to be conducted at the factories;
- Transfer of techniques and skills related to statistical analysis of testing and inspection data;
- Troubleshooting in plant operation; and
- Support for day-to-day quality control activity.

g) Information service

Objective

To publish and provide research and study results to scientific journals and internal organs of various organizations.

Activities

The following activities will be conducted:

1. The results of technical study in this study, and general research obtained from

the ordinary research activities will be published in the following scientific journals:

- Ceramic and Glass Technology Journal (issued quarterly)
- Indonesian Ceramic and Glass Journal (issued bi-annually)

2. Periodical review and upgrading of data bank operated among DSM, MTRDC, and BBK, particularly about the results of the above-mentioned boring surveys and property data on mineral materials, etc. with their publication

h) Human resource development

Objective

To train BBK's staff to perform work required for the above activities.

Activities

Staff will gain practical experience through the above activities and will have an opportunity to absorb latest technological trends on a continuous basis.

In addition, a design train should be implemented. For example, in Japan, Tajimi City Design Institute (Gifu Prefecture) emphasizes research activities to increase marketability and commercial value of ceramic products through design improvement, rather than raw materials and body. In Indonesia where raw materials are not of particularly high grade, it is important to raise the value of ceramic products through designs that reflect Indonesian cultural heritage, while leveraging properties of local raw materials, in addition to the improvement of raw material quality. In this connection, the following courses are proposed;

1. Training for research managers
   - Description: Introduction to design research and methodology
   - Period: 2-3 weeks
2. Practical training for researchers and/or assistants
   - Description: Practical design techniques and skills
   - Period: Around 6 months

3) Resources required by the project implementation body

a) Manpower

BBK's present staff will basically be responsible for the implementation of these research projects. Nevertheless, expatriate engineers are recommended to be invited for technical transfer at the initial certain period of time (1 to 2 years), particularly for the following purpose:

1. Research on quality improvement of premixed body for small-scale novelty manufacturers
2. Technical consultation and guidance service

b) Additional testing equipment required

In the process of present study, BBK could build up the equipment required for development of ceramic raw materials to a considerable extent. To conduct the above activities, most of the required testing equipment is available at BBK, and only the following equipment needs to be added[11].

- X-ray fluorescence analyzer and specimen molding equipment

The X-ray fluorescence analyzer now used for evaluation of crude clay is old, making reliable data difficult to obtain. In the tests conducted during this study, also, e.g., total constituents varied between 95 - 105%, and data on Na_2O and K_2O were not reliable.

Further, proper molding of a specimen also holds the key to data accuracy. The glass bead method is more reliable in making a specimen than the powder method. BBK still uses powder molded specimens, and introduction of glass bead manufacturing equipment is recommended.

The required funds for the project are estimated as follows:

- X-ray fluorescence analyzer: US$ 95,200
- Glass bead manufacturing equipment: US$ 28,600

c) Expenses

Expenses required for these projects may be covered by BBK's operating budget. Nevertheless, the following requires special consideration with regard to additional budget allocation, or allocation of revenue from the services to the relevant expenses.

1. Standardization of raw material testing methods: allocation in budget
   - Expenses related to the draft standards development committee
   - Expenses of tests required for developing the draft standards
2. Raw material analysis and testing service

   Expenses required for the services will be met by service fees collected from clients.

[11] For boring, the equipment owned by DSM and MTRDC, which are in change of this function is assumed to be used, since BBK alone does not have the boring function.

3. Information service

Publication in scientific journals is within the scope of BBK's regular work and should be covered by its operating budget. Data bank information will be provided to the public with charge, which will recover part of the expenses. Any deficit will be covered by BBK's operating budget.

d) Other areas requiring improvement

Other issues related to BBK's equipment and management, which need to be improved in performing a variety of tests, are described in the following sections. All of them are the problems to be solved either by operational improvement or a small investment which can be made within BBK's ordinary budget.

Ensuring the continuous operation of the pot mill

In evaluating ceramic raw materials, the crushing of ores and blended materials by using a pot mill for a long period of time (usually 10 hours or longer) is essential in the beneficiation test and the body blending test. BBK does not allow operation of electrical installations at night, stops the pot mill in the evening, and resumes crushing operation in the next morning. However, the ore or the blended slip in the form of fine particles solidifies in the pot mill overnight, which necessitates the loosening of the slip before starting the pot mill, significantly affecting work efficiency. The operational system needs to be reviewed for possible improvement to ensure continuous operation of necessary equipment.

Stable supply of municipal water

Municipal water supply is often interrupted during the tests hindering efficient work. Although water is stored in a concrete tank, the tank must be cleaned to prevent entry of foreign matter, otherwise the test's reliability is affected. Effective measures need to be taken to secure a stable supply of municipal water.

Need to equip a low-temperature dryer for the gypsum mold

Drying the gypsum mold used for the cast-in mold test is an important matter to ensure the ease of clay thickening to the mold. In drying the mold, it is required to dry it at a lower temperature of 40-50℃ for a long period of time (10 hours), since water of crystallization is excluded from the gypsum mold, causing deteriorating of water absorption ability and lowering the test data's reliability if the drying temperature rises over 60℃. In the study, a substitutive dryer was used using a rack and vinyl sheet in which an electrical heater was placed. However, since it could not be used at night, it

deteriorated work efficiency significantly. Thus, a drying rack to allow night operation is required.

Need to equipped with a pH meter

To ensure accurate evaluation of clay's dispersibility and the beneficiation test for raw materials, the quality of water used must be strictly controlled. In the present study, since strict evaluation was not required, it was not used. However, a pH meter (with functions, priced at around 200,000 yen in Japan) is required for BBK to provide adequate technical support for industries, including commercial tests, tests required for setting operating conditions, and operational troubleshooting.

Need to equipped with refractoriness measuring equipment

To enable BBK to conduct tests on refractory, refractoriness measuring equipment needs to be equipped.

(3) Establishment of international training courses on ceramic raw material development in BBK

1) Objective

The establishment of such training courses will contribute not only to nurturing the manpower required for raw material development, but also to stimulating efforts to raise BBK's own technology levels, leading to reinvigoration of the research institute itself through working with foreign trainers and professionals.

The training courses on ceramic raw materials at the international level used to be held in Japan, but discontinued. BBK is one of the best institutes in terms of its linkage with the industry among those in Asia, and has been active in dispatching their staff to universities and colleges as the lecturers, and receiving trainees locally to the institute. If these activities are further developed by inviting a part of lecturers from abroad, the establishment of training courses at the international level will be feasible.

2) Content of activity

The example of the training courses are given in Table 1-22.

3) Resources required by the project implementation body

a) Manpower

It is necessary to organize the planners and coordinators within the BBK for the course management, and also necessary to organize lecturer team by the staff, while requesting other relevant companies and institutes for providing lecturers to support the BBK. Further, it is recommended to invite the lecturers from abroad, if necessary.

Table 1-22 Example of Training Courses for Ceramic Raw Material Development (1/2)

Name of Training Courses	Subjects	Contents	Type of course	Duration
1. Basic course in ceramic raw materials	(1) Minerals for ceramic raw material; kind, classification, and properties	Learn about the basics of ceramic raw materials in general; kinds, classifications, properties (1) Silica, (2) Clay, (3) High alumina, (4) Feldspar, (5) Limestone, (6) Magnesia, (7) Chrome, (8) Carbon	Lectures and practices	Around 2 months
	(2) Minerals for ceramic raw material; origin, endowment	Learn about the basics of deposits of ceramic raw materials; geographic origin, endowment in Southeast Asia (1) Geological classification (2) Mineral classification : a) Igneous rocks, b) Sedimentary rocks, c) Metamorphic rocks (3) Size of deposit : a) General classification, b) Ceramic raw materials		
	(3) Minerals for ceramic raw material; chemical & physical properties	Learn about the basics of chemical and physical properties of ceramic raw materials (1) Chemical composition, (2) Crystal structure, (3) Shape, (4) Color, (5) Specific gravity, (6) Hardness, (7) Optical property		
	(4) Basics of evaluation methods of raw material minerals	Learn about the basics and practical evaluation methods of chemical and physical properties of ceramic raw materials (1) Chemical analysis : a) Fluorescent X-ray analysis, b) Atomic absorption spectrometry, c) Spectrochemical analysis, d) Flame photometric analysis, e) Chromatography (2) Microstructure analysis : a) X-ray diffraction, b) Electro microscope, c) Photo microscope (3) Other physical property : a) Specific gravity, b) Particle size distribution, c) viscosity, d) Hardness, e) Differential thermal analysis		

Table 1-22 Example of Training Courses for Ceramic Raw Material Development (2/2)

Name of Training Courses	Subjects	Contents	Type of course	Duration
2. Practical course in ceramic raw materials	(1) Orientation for ceramic products manufacturing	Learn about the outline of manufacturing and technologies of the ceramic products (1) Tile, (2) Sanitary ware, (3) Tableware, (4) Novelty goods	Lectures, factory visits, and practices	Around 2 months
	(2) Quality requirements and methods of quality control by type of ceramic products	Learn about the outline of manufacturing and technologies of the ceramic products (1) Principal materials : a) Clay/Kaolin, b) Silica, c) Feldspar, d) Toseki, e) Agalomaterite (2) Glaze/Pigment		
	(3) Practical technology in ceramic raw material evaluation	Learn about the practical evaluation technologies and exercises about the quality of ceramic raw materials (1) General chemical and physical property (2) Mixing test (Clay plasticity & viscosity, slip castability, dry strength & shrinkage) (3) Firing test (Firing coloration, firing strength & shrinkage, deformation, water absorption)		
3. Beneficiation technology for ceramic raw materials	(1) Mining technology and quality control	Learn about the practical technologies for preparation of body	Lectures, mining site visits, factory visits, and practices	Around 2 months
	(2) Beneficiation technology	Learn about the beneficiation technologies and their practices; crushing, washing by water, classification, de-ironing, floatation		
	(3) Body manufacturing technology	Learn about the exploration and mining technologies of ceramic raw materials and quality control technologies		

b) Facility

As for the facilities, the training facilities under construction by BBK under the assistance of Asian Development Bank, may be used for this purpose.

c) Other requirements

For assistance in recruitment of trainees abroad, invitation of foreign lecturers, and filling a deficit in expenses for establishment of the courses, the request for foreign organizations for technical cooperation will be desirable. Also, for the training of BBK's staff for planning and designing the courses, invitation of foreign experts for course planning is recommended.

1.4 Economic Effect of the Plan[12]

1.4.1 Economic internal rate of return

Economic internal rate of return (EIRR) on investment was estimated by assessing the economic costs and benefits for projects comprising the plan from national economic standpoints of Indonesia.

The results are summarized as follows.

1) Sukabumi clay supply project

EIRR is 24.3%, which is sufficiently high to indicate that the project will produce a significant economic effect.

2) Banjarnegara feldspar supply project

EIRR is 4.6%, which represents a very small economic effect from the project. This is because the cost for required equipment is relatively large, and additional costs for raw materials are considered to be zero (not negative as in the case of the Sukabumi clay), whereas the increase in economic value obtained from the project is relatively small. Notably, FIRR for the project is fairly high at 32.7%, because the feldspar price is high at Rp.43/kg though the price of crude feldspar is also assumed zero at the mining site.

3) Banjarnegara feldspar beneficiation and supply project

EIRR for the project is -3.5%, and no economic effect is expected.

[12] For detail, see III-5 and III-6.

4) Small-scale body and glaze premixing project

EIRR for the project is 11.5%. FIRR is 7.5% if it is implemented as an independent project without government assistance, and 15.5% if government assistance is obtained. Thus, in consideration of its indirect benefits and other economic contribution, it will generate positive value to the national economy.

The costs and benefits are assessed for each individual project in the above. The method of evaluation of costs and benefits varies depending on the type of project. Further, indirect benefits are difficult to quantify in an objective and accurate manner, and if included in the EIRR calculation, they could cause overestimation of the project's effect. Thus, they are separately accounted for, as discussed below, and excluded from IRR calculation.

Projects which constitute the plan are divided into three types. The first consists of the Sukabumi clay supply project and the Banjarnegara feldspar project, where present mining and supply operations will continue even if the projects are not implemented. Thus, these projects are considered as a type of rehabilitation project.

The second consists of the refined Banjarnegara feldspar supply project and the small-scale premixed body and glaze supply project, which are regarded as newly developed projects.

The third type is the technical support capability build-up project, from which direct benefits cannot be expected.

Direct benefit expected from the first type of project is the economic value of clay and feldspar which will be increased by implementation of these projects. To determine the increase in the economic value, the economic value produced without the projects must be deducted from the economic value to be produced by the projects.

As for the second type of project (new projects), the entire economic value of raw materials to be produced is regarded as direct economic benefit of the projects. In the case of the refined feldspar production project, the output will replace only imported products and will not reduce other economic value produced locally. On the other hand, in the case of the small-scale premixed body and glaze supply project, the body to be supplied by the project will replace raw materials now blended for body which is currently used. Thus, the economic value of the raw materials will be reduced due to the decrease in production of the materials. At the same time, however, the project consumes raw materials in more or less equal amount to that of the blended materials to have been used. Thus, the decline in economic value is offset by the same amount of

increase, so that the net increase in economic value created by body production is equivalent to the entire economic value of body to be produced.

The glaze produced from the project replaces the imported glaze. As a result, the entire economic value produced by the project is regarded as the direct benefit from the project.

The economic costs were assessed as follows.

1) Equipment cost

Since domestic and foreign currency portions for equipment cost are not clear at this stage, they are equally divided. From foreign currency portions, a 5% import duty and a 10% value added tax are deducted. From domestic currency portions, the 10% value added tax is deducted. As for the economic value of locally procured goods and services, since reasonable quantification is difficult, the prices used in the financial analysis are regarded as the economic values.

2) Land acquisition cost

Land to be used for all the projects, except for the small-scale premixed body and glaze production project, is unlikely to be used for any other purposes apart from these projects, and thus, its value is evaluated to be null. The land to be used for the small-scale premixed body and glaze production project will be used for some other purpose, unless the land is used for this project. Thus, the land value used in the financial analysis is also used in the economic analysis.

The site preparation cost is directly borrowed from the financial analysis.

3) Labor cost

In any of the projects, the labor cost is considered as a new input under each project.

The total unemployment rate in a recent 10 years period was in the range between 2 to 3%, with the 1994 figure being 1.6%[13]. However, the underemployment rate (the percentage of persons working for less than 35 hours a week) is high at 36.6% and the percentage of employees in total jobholders is only 32.7%. Because of these facts, the shadow wage rate of unskilled workers is assumed to be 75% of that adopted in the financial analysis.

As for salaries of managers and engineers, the true economic value is difficult to measure and those in the financial analysis are used without any adjustment.

If the above shadow wage rate is assumed to be 50% or 25% of the financial wage

[13] Provisional. IMF, International Financial Statistics, Feb. 1996.

rate (in other words, the unemployment rate or underemployment rate is assumed to be higher without the projects), the corresponding EIRR will be shown in Table 1-23. Since the portion of labor costs in the total costs is not high, the impact of change in the labor costs on the EIRR is insignificant.

Table 1-23 Change in EIRR with Change in Accounting Labor Cost

	Change in EIRR (%)		
Ratio (*):	75%	50%	25%
Project	(Base Case)		
Sukabumi Clay Supply Project	24.30	24.70	25.10
Banjarnegara Feldspar Supply Project	4.60	5.00	5.30
Banjarnegara Feldspar Beneficiation & Supply Project	-3.50	-3.40	-3.30
Small-scale Body & Glaze Premixing Project	11.30	12.10	12.80

Note: (*) Ratio of economic wage rate to the financial wage rate.

4) Crude clay and feldspar prices

The economic value of raw material clay/feldspar used in the Banjarnegara feldspar supply project and the Sukabumi clay supply project is the difference in the economic value of it with the projects and without the projects.

Both projects will use lower-grade materials which are currently discarded, blending it with grade of materials currently used. The economic value of lower-grade materials is considered as zero because they will not be used without the projects.

5) Other costs

Such other costs as building cost and utilities costs are regarded as new input costs of implementation of the projects. Since their economic values are difficult to ascertain, prices assumed in the financial analysis are used without any adjustment.

6) Foreign exchange rate

Since there is no restriction on foreign exchange in Indonesia, and the foreign currency and local currency are exchangeable each other without limitation, the foreign exchange rate prevailing in the market was applied to the above EIRR calculation.

Table 1-24 estimates the change in EIRR accompanying change in the foreign exchange rate, assuming that the above exchange rate does not manifest the true value of willingness to pay in Rupiah for the foreign currency, and that the true value of Rupiah may be depreciated by 20% or 10%. According to the estimate, the economic costs expressed in Rupiah will increase with depreciation of the Rupiah, since all the projects have to spend foreign currency to procure their equipment from abroad. In

actuality, most of the prices of project outputs expressed in Rupiah are formed on the basis of international market prices, and will rise with depreciation of the Rupiah. However, since the increase in import costs of equipment exceeds that of the product sales revenue, the profitability tends to decline in all the projects.

Table 1-24 Change in EIRR with Change in Accounting Exchange Rate

Ratio (*): / Project	Change in EIRR (%) 100% (Base Case)	90%	80%
Sukabumi Clay Supply Project	24.30	21.80	19.20
Banjarnegara Feldspar Supply Project	4.60	3.20	1.70
Banjarnegara Feldspar Beneficiation & Supply Project	-3.50	-3.40	-3.20
Small-scale Body & Glaze Premixing Project	11.30	9.70	8.00

Note: (*) Ratio of economic foreign exchange rate to the financial rate.

1.4.2 Indirect benefits and other economic contributions

1.4.2.1 Indirect benefits and other economic contribution

Major indirect benefits created by the projects are estimated as follows:

1) Increase in employment opportunity

The increase in employment opportunity created by construction and operation after completion:

1. Sukabumi clay supply project: 30 persons
2. Banjarnegara feldspar supply project: 21 persons
3. Banjarnegara feldspar beneficiation and supply project: 30 persons
4. Small-scale body and glaze premixing project: 8 persons

(The multiplier effect is not considered in the above.)

2) Trickle-down effect on related industries

The effect includes increased consumption of construction materials, such as steel materials and cement, and other materials used for commercial operation.

3) Contribution to the development of regional economy

Construction activities and commercial operation after completion will stimulate the transportation and commerce sectors, contributing to regional development.

These indirect benefits, however, are difficult to quantify in a reasonable and accurate manner.

1.4.2.2 Other economic contributions

Other economic contributions include the savings in foreign exchange expected from

the refined Banjarnegara feldspar supply project. Based on the previous assumption of domestic and foreign currency portions, the balance of payments resulting from projects over a 20 year period is estimated in Table 1-25;

Table 1-25 Estimated Saving of Foreign Exchange
(Banjarnegara Feldspar Beneficiation & Supply Progject)

(Unit: US$'000)

Year	Inflow (A)	Outflow (B)		Balance (A)-(B)
		Cost for machine & equipment	Substitution of imported feldspar	
-1	0.0	14,449.2	0.0	-14,449.2
1	0.0	0.0	-951.3	951.3
2	0.0	0.0	-1,550.0	1,550.0
3	0.0	0.0	-1,596.6	1,596.6
4-20	0.0	0.0	-1,596.6	1,596.6
Total	0.0	14,449.2	-31,240.1	16,790.9

In addition, all of the projects will create opportunities for new product development through supply of stable and improved raw materials, which will indirectly result in foreign exchange earning, e.g., the tableware industry may be able to enter medium- and high-grade product markets, and the novelty product industry can develop export-oriented products.

At the mining sites, the projects contribute to alleviation of environmental damage by consumption of lower-grade materials currently disposed as waste.

1.5 Plan Implementation System and Schedule

1.5.1 Plan implementation system

The implementation of each project comprising the ceramic raw material development plan is assumed as follows:

1) The clay and feldspar supply projects are assumed to be implemented by private initiatives. In establishing companies supplying raw materials, it is desirable to obtain equity participation of many ceramic companies, which will help improve communication between suppliers and users, while securing the market for new products.

2) The supply of premixed body to small ceramic manufacturers should preferably be implemented as a pilot project by UPT under the Directorate of Small Industry Development, the Ministry of Industry and Trade, and with technical assistance by BBK. In future, the service will be expanded to major ceramic production centers in the rest of the country, while inducing investment broadly from the private sector.
3) BBK will be primarily responsible for building up the technical assistance functions.

Projects comprising the ceramic raw material development plan can be divided into two groups according to their nature.

The first group includes projects which will directly benefit the industries that already operate under a market mechanism, and which can rely on the market mechanism for their implementation. The Sukabumi clay supply project, the Banjarnegara feldspar supply project, and the refined feldspar supply project belong to this category. The success of these projects is governed by the needs on the user side and profitability of the project. Among the projects, the Sukabumi clay and the Banjarnegara feldspar supply projects show high levels of profitability which can attract private investment. On the other hand, the refined feldspar supply project is relatively small in scale due to infant phase of domestic demand, and therefore, is not profitable enough. It may be reasonable to evaluate this type of project as having an opportunity that has not yet matured. For these projects, excluding unprofitable projects, the first step is to make information on projects available to the public and invite investment from the private sector, which will thus be a major driving force for project implementation.

While these projects may be left to the local government or cooperative organized by miners, various difficulties will inevitably involve, e.g., fundraising, grade control, and quality control. As for ceramic raw materials, the government policy is that it is a responsibility of local government. Therefore, it is difficult to obtain direct support specifically designed for the ceramic raw material project from the government (including subsidy, low interest rate loans, and tax incentives). In the case of a regional government, the support will be expected to be hard to obtain due to this financial constraints. Therefore, it seems to be more realistic to rely on the private sector and its vitality for competition.

Nevertheless, these projects require public support in part. In particular, while there are highly feasible projects, formal decision will require additional data and information, which may be difficult for private enterprises to collect due to required scale of survey. Also, development of infrastructure has still to be provided to support these projects. In these areas, the public sector should take initiatives prior to project implementation.

On the other hand, the small-scale body and glaze premixing project must be positioned as a pilot project which should be implemented under public support, although it should, in principle, be implemented as part of commercial activity. There are several reasons for this. First of all, the project is the first of this type in Indonesia and needs to be continuously improved through practice. Secondly, the project aims to foster small enterprises and microenterprises which lag behind larger enterprises in technical capabilities and the ability to collect information, so that public support is a must for its smooth implementation. Finally, the project is not commercially viable in terms of profitability.

The success of the pilot project will encourage other areas to launch similar projects, where private investment will be invited. This way, public support can be limited to projects which are not commercially viable.

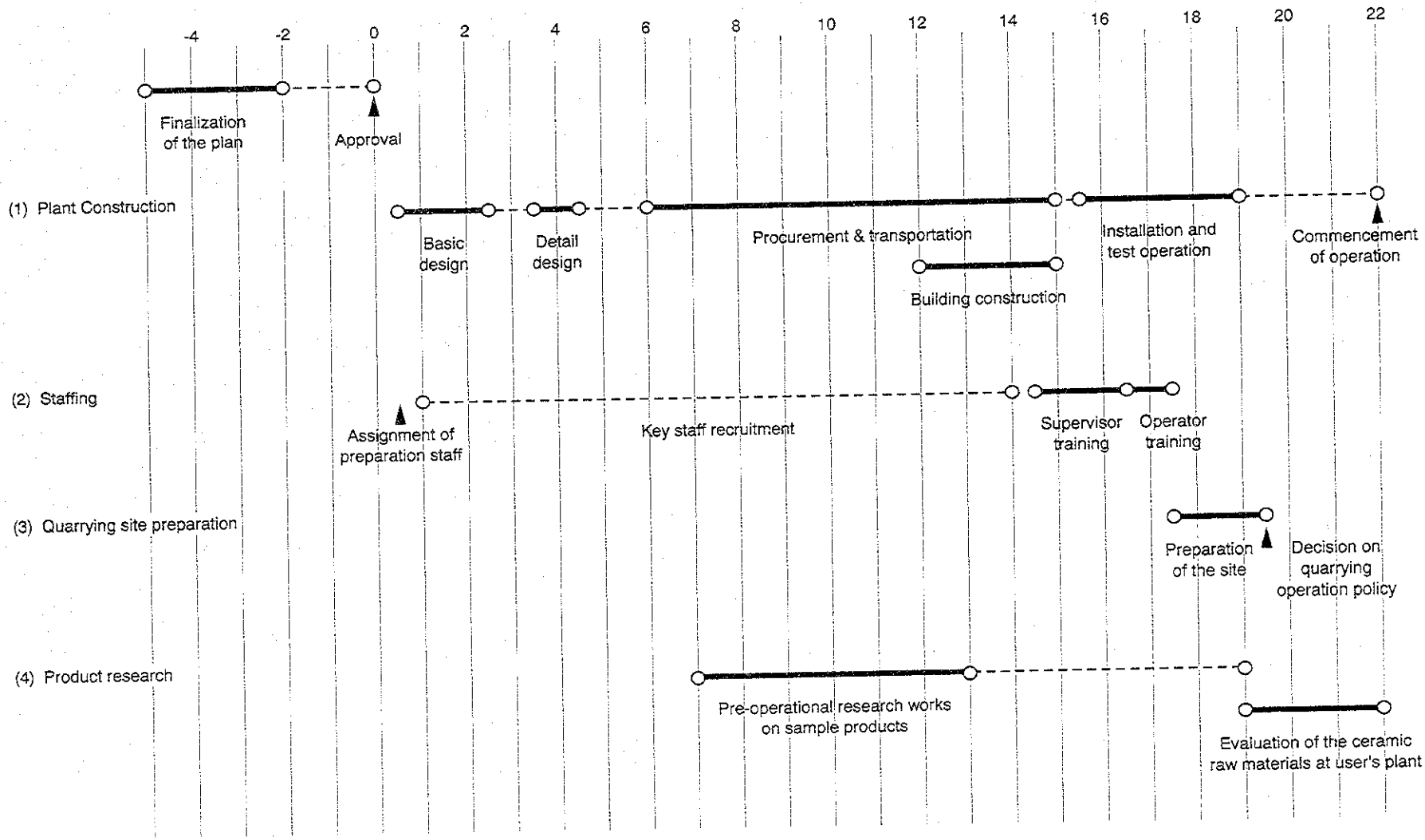
1.5.2 Plan implementation schedule

The preliminary implementation schedule for the plan is shown in Figure 1-8. It is expected to take 22 months after the project concept is finalized and a final decision is made, until commercial operation starts.

None of the projects use complex equipment, and the entire process from the decision on the project plan to the start of operation is expected to be relatively short. Nevertheless, it is conceivable that unforeseeable factors may be encountered during detailed technical study and the process of finalizing the project concept.

A primary example is collection of technical data required for final design of technical elements, which is discussed in detail in 1.3.7.

Figure 1-8 Implementation Schedule



2 Recommendations

2.1 presents the recommendations on implementation of the ceramic raw material development plan. 2.1.1 deals with recommendations directly related to the plan implementation, and 2.1.2 recommends the matters required to be finalized before the plan implementation. 2.2 makes recommendations complementary to the plan, besides a comprehensive plan for ceramic raw material development, which was proposed in chapter 1. These complementary recommendations are made from two standpoints. The first one is that of the recommendations which are not accommodated within the framework of the ceramic raw material development plan but are considered to be important from the viewpoint of promoting the ceramic industry. The second one covers the matters which have not been finalized in the form of a concrete recommendation during the study due to time constraints and the lack of basic data, and nevertheless, which need to be examined in future. Further, 2.3 presents the recommendations related to strengthening of BBK as an organization to support plan implementation in the technical area (Table 2-1).

2.1 Recommendations on Implementation of the Ceramic Raw Material Development Plan

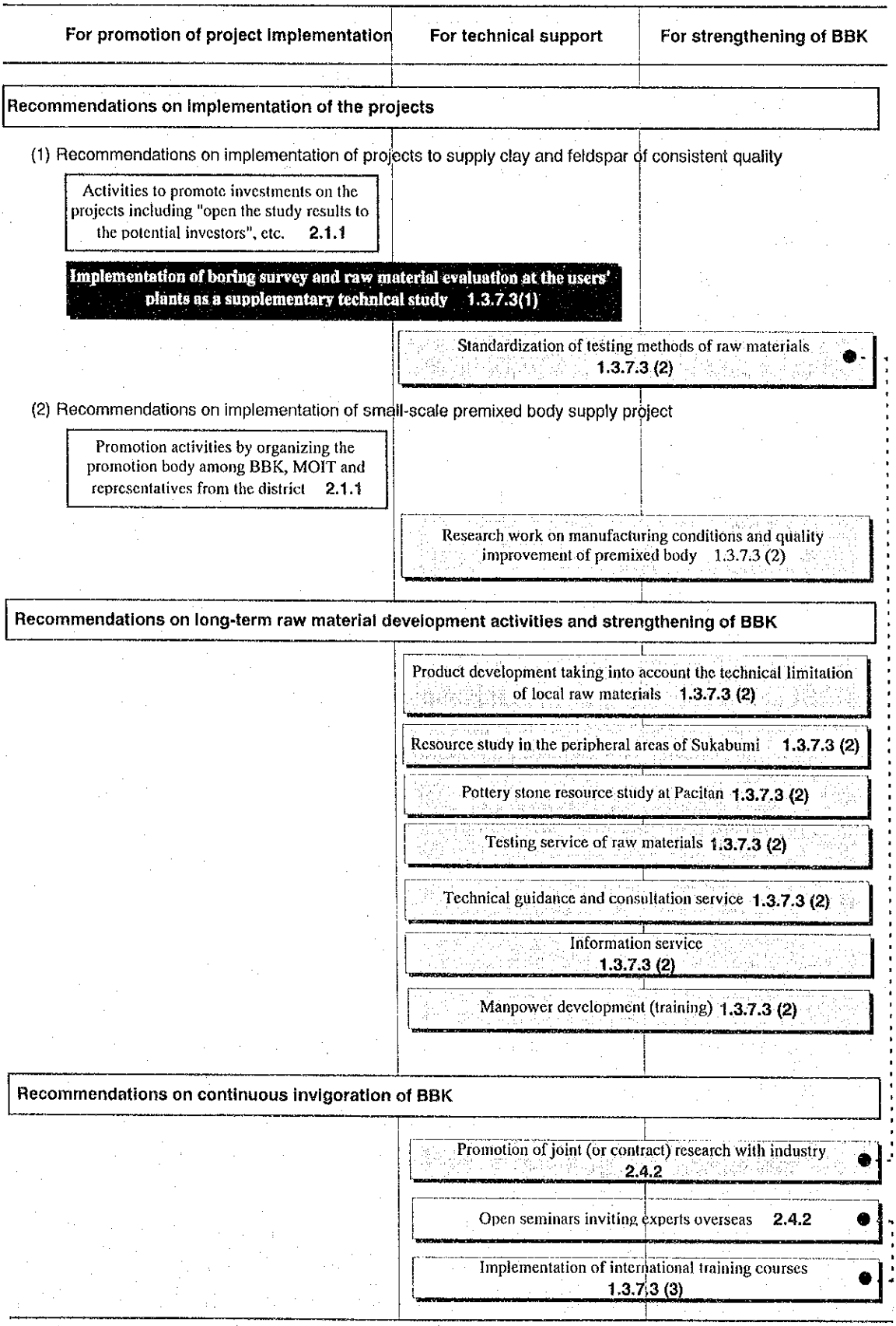
2.1.1 Recommendations on implementation

The ceramic raw material development plan proposed in the present study is comprised of five projects that will contribute to sustainable growth of the ceramic industry and the development of the ceramic raw material industries engaged in mining and supply. It is recommended that the government take immediate action to implement all the projects except for the Banjarnegara feldspar refining and supply project.

Actions required for implementation of the clay and feldspar supply projects are as follows:

1) To make the results of this study known to the public and take broad initiatives to encourage project implementation;
2) To conduct supplemental studies and research to collect detailed technical information required for final decisions on the projects, provide it for potential investors, and to promote finalization (for detail, see 1.3.7);
3) To establish an organizational setup capable of providing adequate technical support for a variety of challenges and issues to be encountered during the finalization of the plan, start-up of operation, and full-scale operation (for detail, see 1.3.7); and

Table 2-1 Summary of Recommendations



* Figures mean item number in the main text (Part II).

4) To provide necessary assistance in upgrading access roads between mining sites and stockyards.

Actions required for implementation of the small-scale premixed body and glaze supply project are as follows:

1) To establish a project promotion body by having discussions among BBK, Directorate of Small Industry Development, MOIT, and representatives from Kiara Condong on implementation as a pilot project; and
2) To finalize the project concept by reviewing and discussing technical factors of the project among BBK and representatives of Kiara Condong.

Actions required for implementation of the project to build up ceramic raw material research and development and technical assistance capabilities are as follows:

1) To establish an implementation body with related organizations to mobilize resources to provide technical support for ceramic raw material development; and
2) To formulate a technical support plan, secure manpower and budget.

2.1.2 Recommendation on implementation of supplemental technical study required for implementation of the plan

It is recommended to conduct the supplemental technical study which is outlined in the following, while promoting the projects, since the present study is still insufficient in detailed technical data to enable potential investors to make decisions on implementation.

To promote implementation of the proposed projects, the results of the study will be announced to invite participation of ceramic manufacturers, ceramic material distributors, and government authorities and organizations. Yet, technical information required for final investment decisions is still incomplete. In particular, data on raw materials deposits, which are the basis for project implementation, are fairly limited, and boring surveys are required to collect site-specific data and information. Further, it is also necessary to collect data required for final project proposal, on the basis of samples collected from the specific candidate mining sites which will be identified on the basis of such boring survey. The proposed content of the supplemental technical study is given in 1.3.7.

2.2 Other Recommendations Related to Ceramic Raw Material Development

Indonesia has high potential and resources to spur further development of the ceramic industry. To leverage these resources to promote the industry, the following are recommended in the area of activity related to ceramic raw material development (for detail, see 1.3.7).

1) Product development making most of properties and characteristics peculiar to local materials available while recognizing limitations of them
2) Continued exploration efforts of ceramic raw materials, for the resources which were not selected by the study team as promising, due to the lack of sufficient data for evaluation, but have potentiality for development

The major factor restricting development of ceramic materials in the country is the absence of high quality mineral resources in Java which is the largest market for such materials. Nevertheless, there are a number of favorable factors to justify promotion of the industry in the country:

1) There is large potential demand for ceramic products owing to the large population, and in fact, demand for tile products is burgeoning. In addition, consumption of tableware and sanitary ware is expected to grow steadily with the rise in income levels.
2) As tourism grows and foreign visitors to the country increase, together with the rise in personal income, demand for novelty products is expected to rise.
3) The country has an abundant labor force to support ceramic production, large enough to fend off a rapid rise in labor cost resulting from industrial development as seen in Malaysia and Thailand. In fact, foreign ceramic manufacturers have built or plan to build production bases in the country to capitalize on low cost labor and manufacture products for export markets (sanitary ware manufacturers are already operating in the country, and now investment in the tableware area is increasingly seen).
4) While it seems to be difficult to discover high-grade ceramic materials in Java, there are rich reserves in Sumatra, Kalimantan, Bangka, and Belitung, which are suitable for production of medium-to-high grade products.

These are the recommendations which focus on promotion of ceramic industry in view of raw material development, indirectly.

2.3 Recommendation on strengthening of BBK

2.3.1 Strengthening of BBK for raw material development

The expected roles to be played by BBK in development of ceramic raw materials are still large. It is recommended, in this context, to build up its capacity for the institute to have sufficient capability to undertake its responsibility as anticipated in 1.3.7.

2.3.2 Recommendation on continued efforts of BBK to keep its ability

The continued effort of BBK is recommended to enable BBK to keep its technical ability and facilities abreast of technological advancement in the ceramic industry.

The role of BBK in preparation, implementation and improvement of the proposed raw material development plan is discussed in the foregoing sections. The following recommendation indicates the general direction of BBK to make efforts in the future besides those for fulfilling the functions required in the development plan.

At present, BBK does not always lead the ceramic industry in the country, but it still maintains technical leadership among some of local tableware and tile manufacturers as well as novelty manufacturers. Yet, it faces a risk of losing its raison d'etre if the industry makes rapid advancement by introducing foreign technology, while the research institute fails to upgrade its equipment due to the lack of adequate budget allocation, and its staff does not have an opportunity to be exposed to advanced technology.

There is no doubt, however, that the public research institute plays and will play an important role in conducting R&D activities which are beyond the ability of the private sector due to the high risk, initiating research activities which are mandated on the basis of the public interest, and providing technical support for small- and medium-sized enterprises and microenterprises who lag behind in technology. In fact, the research institute has a large number of staff who have received training overseas. It offers education and training courses in collaboration with universities and other institutions. It also provides technical assistance for private enterprises.

On the other hand, it seems not to have established strong ties with foreign-affiliated companies which are continuously upgrading their technology. However no matter how vigorously efforts are made, it seems to be very difficult for BBK to improve the situation, since the foreign-affiliated companies are tend to be in terms of technology.

Rather, the following approaches are recommended as effective ways to accomplish the intended objective in the form of indirect effect:

1) To encourage inflow of information from outside : For instance, public lectures by outside experts on a periodical basis will help BBK to maintain contact with the

industry[1] and help BBK to keep up to date regarding technical information.

2) To take leadership in technological initiatives: For example, undertake research either independently or jointly with industry on the matters required for promotion of standardization (for detail, see 1.3.7).
3) To receive trainees from other countries: Working with foreign trainees and professionals stimulates efforts to raise one's own technology levels, leading to reinvigoration of the research institute itself (for detail, see 1.3.7).

Through these activities, BBK should make consistent efforts to maintain close linkage with outside and upgrade its levels of technological ability and facilities.

[1] The study team believes that Ceramic Research Institute is maintain close contact with the industries. However, principal contacts are often limited to sales departments, and we are emphasizing the need for forward-looking activities that make the industries feel the need for organizing technical committees.