

People's Republic of Bangladesh

**Preparatory Survey on BOP
Business on Non-firing Solidified
Brick Technology
Final Report (Summary)**

January 2014

**JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)**

**Kameiseito Co., Ltd
ALCEDO Corporation**

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1. Summary

1-1 Project Background

Brick industry in Bangladesh is the major source of greenhouse gas (GHG) emission because it is dominated by outdated, inefficient and highly polluting technology. This project aims to improve environmental and social issues related to existing brick industry by introducing the latest energy efficient brick manufacturing method that was developed in Japan. As Base of Pyramid (BoP) segment of population are the most vulnerable to environmental pollution and climate change, mitigating these environmental issues will directly benefit those who are in the BoP segment.

1-2 Business Scenario

1) Technology Summary

Its patented “Non-firing Solidification Technology” was developed by combining traditional Japanese ceramic technology and new solidification technology. It can utilize various unused and recycled resource to manufactures building materials such as brick and tile. More than 80% of raw material can come from industrial wastes so the use of clay is significantly reduced. Some usable industrial wastes include coal ash, glass cullet, silica sand, dust, and most inorganic materials.

The fuel cost to manufacture 1 brick for non-fired brick is only 0.08 BDT, compared to 1.80 BDT for traditional kiln. Also, the initial investment for 1 brick is only half of Hybrid Hoffman Kiln (HHK) and requires less land.

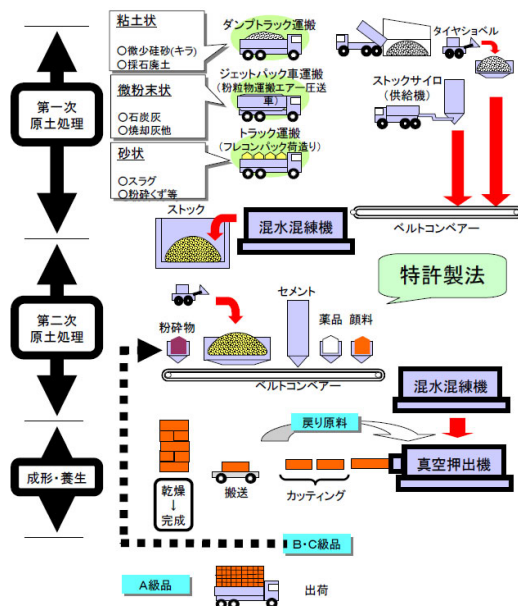


Photo 1-1 Non-fired solidification technology

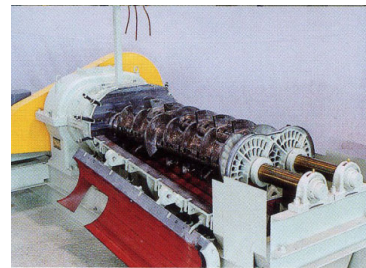


Photo 1-2 Retractable-mixing machine

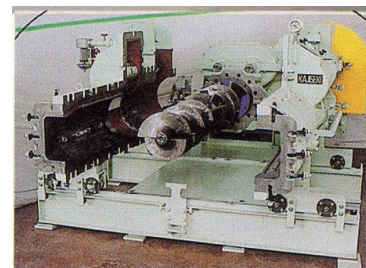


Photo 1-3 Vacuum extruder

2. Investment and Business Environment

2-1 Political and Economic Condition

1) Political Condition

Basic information about Bangladesh is described in Table 2-1.

Table 2-1 Basic data of Bangladesh¹

Area	147,570 km ² (About 40% of Japan)	
Population	152,500,000 (Bangladesh Bureau of Statistics 2013) Average annual growth rate: 1.37% (Bangladesh Bureau of Statistics 2011)	
Capital	Dhaka	
Ethnic groups	Bengalis form the country's predominant ethnic group. In the Chittagong Hill Tracts near the Myanmar border, there are Buddhist-based ethnic minorities like the Chakma tribe.	
Language	Bangla (Bengali) Adult (over 15 years of age) Literacy: 56.8% (Human Development Report 2011)	
Religion	Muslim: 89.7%, Hindu: 9.2%, Buddhist: 0.7%, Christian 0.3% (National Census 2001)	
History	1947	Independence as Pakistan (East Pakistan)
	1971	Independence as Bangladesh
Government Diplomacy	Government	Unitary Parliamentary Republic
	Parliament	Unicameral System (350 members)
	Diplomacy	South Asian Association for Regional Cooperation (SAARC), Non-Aligned Movement (NAM), Organization of the Islamic Conferences (OIC), Commonwealth.
	Military	Volunteer System Soldiers: Army (126,150), Navy (16,900), Air Force (14,000) (The Military Balance 2010)

In Bangladesh, political strikes called "hartal" and labour strike by factory workers are common. Usually the protesters vandalize vehicles and building. In fear of vandalism, most shop, office and factory remain closed during this time. The conflict between ruling Awami league government and BNP-led 18 party alliances has intensified since the beginning of the year. The protest movement, such as hartal and blockade by opposition will most likely continue for some time. The direct influence from hartal to economic condition is uncertain. However, in the last 9 years, the GDP growth rate has maintained at 6% and many experts predicts it will not greatly influence economic condition.

¹ Source: [Ministry of Foreign Affairs of Japan] Regional Affairs: Bangladesh basic data
<http://www.mofa.go.jp/mofaj/area/bangladesh/data.html>

Table 2-2 Basic economic data of Bangladesh (USD) ¹

Major Industry	Textiles and Apparel
Real GDP	\$115.6 billion (2013)
GDP per capita	\$776.5 (2012)
Economic growth (GDP)	6.3% (2012)
Rate of increase in the consumer price index	7.97% (2012)
Work force	53.7 million (2010) Agriculture (48.1%), Service (37.4%), Industrial (14.6%)
GDP breakdown	Service (49.5%), Industrial & Construction (31.3%), Agriculture, Forestry and Fisheries (19.3%) (2012 provisional value)
Total trade	Export : \$23.99 billion Import : \$33.31 billion (2012)
Main trade items	<u>Export</u> : ready-made products (exclude knitwear) (39.5%), knitwear (39.1%), frozen seafood (3.7%), jute products (2.9%), leather products (2.4%), Textile (1.5%) <u>Import</u> : petroleum products (12.3%), fiber (9.5%), pharmaceutical products (6.5%), mechanical machinery (6.3%), cooking oil (5.1%), plastic and rubber (4.3%), iron and steel products (3.8%), cotton (3.8%), yarn (3.1%), cereals (2.8%) (2012)
Major trading partners	Export: USA, Germany, England, France, Spain, Italy, Canada, Belgium, Netherlands, Japan Import: China, India, Singapore, South Korea, Japan, Malaysia (2012)
Remittance	\$14.46 billion
Currency	Taka (BDT)
Exchange rate	1 USD = 79.10 BDT (2012 average)

The real GDP growth rate has remained between 5.7 to 6.5% from 2003 to 2011 with high rate of economic growth, despite affect from financial crisis in Europe. In addition, GDP per capita and consumer price index has shown growth of 2-folds between 2003 to 2011 and 2012. This is due to stable growth in remittance by oversea workers, garment export, agricultural sector and relatively balanced industrial structure.

2-2 Various policies and regulations related to foreign investment

1) Taxes²

① Corporate tax

➤ Listed / Non-listed

- Listed company : 27.5%
- Non-listed company : 37.5%

※For listed company, 24.5% applied for over 20% dividend, while 37.5% applied for under 10% dividend.

② Value-Added-Tax (VAT)

➤ VAT: 15%

² Source: Japan External Trade Organization (JETRO) http://www.jetro.go.jp/world/asia/bd/invest_04/

③ Personal income tax

Personal income tax is divided into 5 categories based on annual income.

The minimum tax is 3,000 BDT.

2) Tax treaty between Bangladesh and Japan

Bangladesh has entered into bilateral tax treaties with Japan on February 1991 on the avoidance of double taxation.

➤ Taxation of interest

- Within 10%

➤ Taxation of dividend

- Corporate : 15%

(10% if company owns at least 25% of the company paying the dividend)

Personal: 10%, Foreign expatriate: 25%

➤ Royalties, Technical fee

- 10%

➤ Taxation of salary, remuneration

- Subject to tax in country spend more than 183 days

3) Import tax for machinery and parts

Import tax of 7.5% is usually applied to import of machinery and parts. The import value of parts is less than 10% of CFR value of the machinery. There is tax exemption to export-oriented companies. VAT is exempt for capital machinery and their parts. [Life Span Certificate] will be required to import used machinery to insure at least 10 years life span.

2-3 Various policies and regulations related to this business

1) Various policies and regulations related to brick business

① Related policies and regulations

(A) Policies and regulations related to brick industry

The government of Bangladesh has been working to improve the brick industry through various policies and regulations. Various policies and regulations related to brick industry are summarized in Table 2-3. The chimney rule has been successfully enforced in the past. However, low efficient technology still dominates the industry and transition to modern technology has been very slow.

(B) Environmental Conservation Act, Environmental Conservation Rules

In accordance with Environmental Conservation Act and Environmental Conservation Rules, all manufacturing projects will require Environmental Clearance Certificate (ECC) from Department of Environment. As brick industry is classified as Orange-B category, feasibility study report, initial environmental examination report and environmental management plan is required.

② Support by International organizations

World Bank, United Nations Development Program (UNDP) and Asia Development Bank (ADB) have been involved in brick industry to help transition to modern and low environmental impact technology. In addition, World Bank has ongoing project to improve the air quality in Dhaka city.

2) Various policies and regulations related to use of industrial waste

① Related policies and regulations

At present, there are no strategies or policy related to waste management that promotes recycling. And without administrative system to monitor, many wastes are disposed improperly. However, it is estimated that 15% of total generated waste in Dhaka, amounting to 475 ton³ is recycled daily by scavengers who sort recyclable materials at waste disposal site.

³ Source: [Waste Concern, Waste Database 2009] <http://www.wasteconcern.org/database.html>

Table 2-3 various policies and regulations related to brick industry

Year	Policies, laws, and regulations	Government responsibility	Details	Remarks
1989	The Brick Burning (Regulation) Act of 1989	DOE, MOEF	Bangladesh's first brick-making law banned the use of firewood for brick manufacturing and introduced licensing for brick kilns.	Use of firewood has large been discontinued, but in remote areas this practice still continues on a limited scale.
2001	Revision of the Brick Burning (Regulation) Act of 1989	DOE, MOEF	The 1989 Act was amended to regulate the location of brick kilns. The new provision required that brick kilns not be set up within 3 km of the upazilla or district center, municipal areas, residential areas, gardens, and the government's reserve forests.	Using the given criteria, it is nearly impossible in reality to find land for brick kilns in Bangladesh. The BBMOA often cites this as a major deficiency in the law. Despite this amendment, the location requirements have not been enforced.
2002 Oct.	Brick Burning rules	DOE, MOEF	The GOB introduced a rule that made the use of 120-ft chimneys for brick kilns compulsory	This requirement was successfully enforced, especially in the vicinity of urban areas, and most Bull's Trench Kilns (BTKs) were upgraded to FCK technology. However, some BTKs continue to operate, albeit illegally.
2013 April	Revision of Brick Burning Act	DOE, MOEF	The revision of Act has the objective to facilitate transition of the brick industry for improved energy efficiency and lesser pollution level.	The Cabinet approved the draft proposal in April 2013.

2-4 Market Condition

1) Brick Industry in Bangladesh

① Brick industry summary

As brick industry in Bangladesh is seasonal and most kilns are built on leased land, it is not formally recognized as an industry. However, the industry is contributing to about 1% of country's GDP and generating employment to about 1 million people.

Table 2-4 Snapshot of Bangladesh's brick industry (2011) ⁴

Parameter	Value
Estimated total number of coal-fired kilns	5,000
Number of natural gas fired kilns	20
Annual brick production	17.2 billion bricks
Value of output	83 billion BDT
Contribution to GDP	~1%
Coal consumption	3.5 million ton
Value of imported coal	22.6 billion BDT
Firewood consumption	1.9 million tons
Emission CO ₂	9.8 million tons
Clay consumption	45 million tons
Total employment (supply of clay and coal, transport of bricks)	~1 million people
Growth rate of the construction industry (1995-2005)	5.6%
Estimated future growth rate of the brick industry over next 10 years	2-3%

The existing brick kiln technologies in Bangladesh is summarized in Table 2-5. Fixed Chimney Kiln (FCK) accounts for nearly 90% of total but is inefficient and has become major source of air pollution. The gas-based Hoffmann kiln and coal-based Zigzag kiln are considered to be cleaner but represents only few percent of the total. Hybrid Hoffmann kiln (HHK) is a hybrid version of the Hoffmann kiln technology that improves energy efficiency and reduce air pollution. It was first introduced to Bangladesh in 2006 under Global Environment Facility (GEF) and UNDP supported project. The dissemination rate has been slow as the initial investment is 10 times higher than FCK.

Table 2-5 Existing brick kiln technologies in Bangladesh (2009) ⁴

Kiln type	Number	Percent of total kilns (%)	Brick production (billion bricks)	Percent of total production (%)
FCK	≤ 4,500	92	15.8	91.4
ZigZag	≤ 150	3	0.6	0.0
Hoffmann(Gas)	≤ 20	0.4	0.2	3.5
HHK	≤ 10	0.2	0.2	1.4
Others	≤ 200	4.0	0.5	0.9
Total	≤ 4,880	100	17.2	100

⁴ Source: The World Bank, Introducing Energy-efficient Clean Technologies in the Brick Sector of Bangladesh, 2011.

2) Other non-fired brick technology

During the 2nd field study (June 10-24, 2013), interview was performed to survey the type and popularity of other non-fired brick technology in Bangladesh. It was found that non-fired brick is considered to be cement based paving tile for footpath. There was little example of non-fired brick used as building materials.

3) Brick market size, distribution system

As there are no official documents related to brick market size and distribution system, questionnaire survey was performed on real estate developers, who are the largest consumer of bricks. Of the top 25 real estate developers based in Dhaka, 10 were selected for the survey. The key findings from the survey are summarized below.

① Market size

The consumption pattern of different brick types is summarized in Table 2-6. It was found that solid clay brick are the cheapest and commonly used building materials in Bangladesh. Face brick was the most expensive but consumption was 2nd to solid clay brick. The consumption of hollow and perforated brick was small and there was no information about the cement brick. The market price by brick type is summarized in Table 2-1.

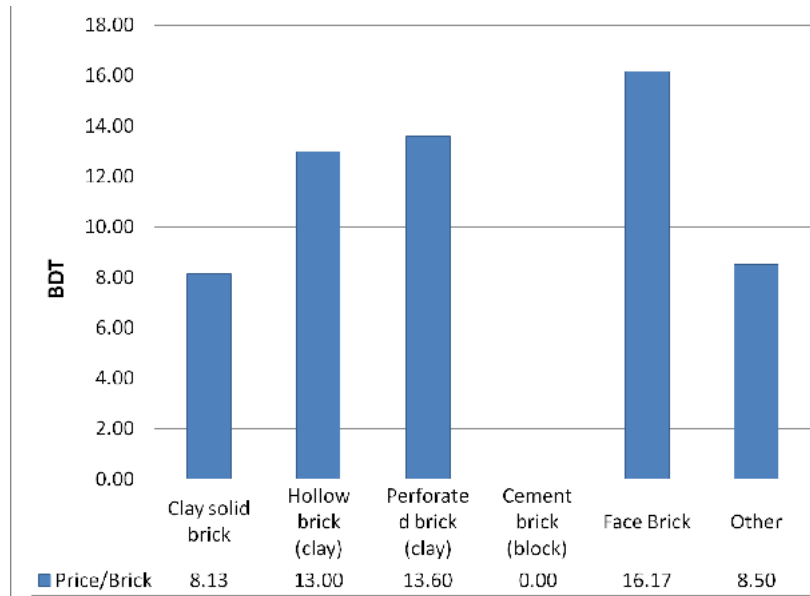
② Distribution system

60% of the developers surveyed purchase their bricks directly from the brick manufacturer. The remaining developers use brick distributor or supplier to purchase their bricks.

Table 2-6 Consumption pattern of different brick types

Brick type	Quantity purchased/year	Average quantity purchased/year	Percentage
Solid clay brick	26,300,000	2,630,000	81.22%
Hollow brick (clay)	770,000	77,000	2.38%
Perforated brick (clay)	1,168,000	116,800	3.61%
Cement brick (block)	0	0	0.00%
Face Brick	3,965,000	396,500	12.24%
Other	180,000	18,000	0.56%
Total Purchased	32,383,000		100%

Figure 2-1 Market price by brick types



2-5 Target Consumers

1) Large Consumers

Real estate developers are the largest consumer of brick in the private sector. According to Real Estate & Housing Association of Bangladesh (REHAB), as of 2010, over 1,081 members have registered to their association.

2-6 Existing infrastructure and related facilities

Due to shortage of natural gas, power outage in Bangladesh is quite common. Use of back-up power generator during power outage is being considered for this business.

3. Business Plan

3-1 Business Site Location

Based on availability of raw materials and close distance from Dhaka, Savar upazila, Dhamrai upzila and Gazipur district has been identified as a potential area. These areas are close to the river and have existing cluster of 700 traditional brick kilns, producing 200,000 bricks per year.

3-2 Needs Survey

As real estate developers are the largest consumer of bricks, questionnaire survey was conducted to determine the specific needs for building material in Bangladesh.

1) Brick preference

The factors affecting brick purchase is described in Table 3-1. The brick color was seen as an important factor as 70% of the respondents said that the traditional red color is a necessary precondition for purchase. Many assume that red color means the brick is properly fired.

Table 3-1 Factors affecting brick purchase

Factors	Ranking (1: Least Important, 5: Most Important)
Strength	5.0
Finishing	4.8
Size	4.5
Shape	4.5
Water Absorption	4.4
Texture	3.8

2) Preferred brick features and future building material

According to the questionnaire survey, lighter brick (60%) and stronger brick (50%) was the preferred improvement. Some developers who answered other, preferred large size brick to reduce the total number of brick required. Many expect future building material to be from waste materials, compressed brick and perforated bricks.

3-3 Product Development Plan

【Product design】

Important points:

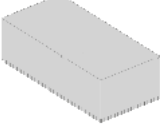
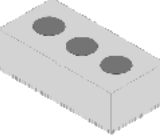
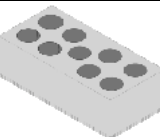
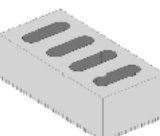
- Develop a high quality product using Japanese technology
- Develop a product using industrial waste as raw material
- Develop a product that is similar to existing clay brick

Existing traditional clay brick was used as base to develop new product. (Table 3-2) After analyzing the needs survey conducted during 1st field study, it was concluded that it would be more beneficial to develop a “new building material” than brick. All the sample bricks were manufactured using raw materials from Bangladesh.



Photo 3-1 Non-fired brick final design

Table 3-2 Brick design and description

Sample	Figure	Feature	Faults
Clay brick		Use of Coal Use of Clay Common, Cheap Weight: 3.0-3.5kg	<ul style="list-style-type: none"> • Size inaccurate • High water absorption rate • Environmental issues
Non-fired brick Design ⊖		Non-fired Weight: 3.1 kg Perforated ratio: 6% Hole: 3	<ul style="list-style-type: none"> • Weight is same as clay brick • Require more mortar due to large hole size
Non-fired brick Design ⊖		Non-fired Weight: 2.5kg Perforated ratio: 24% Hole: 9	<ul style="list-style-type: none"> • Strength of die will be too low with this design • Looks weak due to too many holes
Non-fired brick final design		Non-fired Weight: 2.6kg Perforated ratio: 21% Strength: 200kg/cm ² Water Absorption: 8%	

3-4 Raw materials and procurement of local machinery

1) Availability of raw materials

During the 1st field study, interview was conducted to survey the price and availability of possible raw materials around Dhaka. The results from the interview are summarized in Table 3-3 and Table 3-4. Due to various reasons, it was concluded that using industrial waste as raw material would be difficult at this time. As an alternative to industrial waste, sand and pebble dredged from the river has been identified as great source of raw material as government of Bangladesh is struggling to dispose the dredged materials.

Table 3-3 Interview results of raw material availability

Raw materials	discharge	composition	pollutant	usage	cost	suitable
Dredged sand	○	×	No	filling sand	Low	Yes
Dredged pebble	○	×	No	—	Low	Yes
Rice Husk Ash	○	×	No	waste	Low	Yes
Clay	○	×	No	material for brick	High	Yes
Slag	○	×	—	exported	High	No
Sewerage Sludge	○	×	Heavy metal	waste	Free	No
Coal Ash	×	×	—	—	—	No
Textile Sludge	×	×	Heavy metal	waste	Free	No
Construction material	—	—	—	waste	Low	No

Table 3-4 Survey results of possible raw materials

Raw materials	Suitable	Description
Dredged sand	Yes	As flood control measure, sand is dredged in large quantities Local sample quality: No issue
Dredged pebble	Yes	Same as above
Clay	Yes	Readily available raw material for clay brick Local sample quality: No issue
Rice husk ash	Yes	Discharged in large quantities but no use value Local sample quality: No issue
Slag	No	Exported to China at high rate Local sample quality: No issue
Sewerage sludge	No	Negative image to use as raw material Local sample quality: No issue
Coal ash	No	Discharged in large quantities from brick kiln but difficult to collect.
Textile sludge	No	Discharged in large quantities but only little information available. May contain heavy-metal
Construction material	No	Mixed waste available but difficult to collect and separate.

According to Bangladesh Inland Water Transport Authority (BIWTA), government is prioritizing dredging of 4-ferry routes. (Munshigonj, Mawa, Doulotdia, Patulia) BIWTA predicts 30-40 million m³ of sand will be dredged within the next 5-6 years. The raw material availability is unlikely to be an obstacle in this business. During the field visit, the market price of sand was 5 BDT/1ft³, which is about 0.12 BDT/kg.

3-5 Manufacturing, Distribution and Sales plan

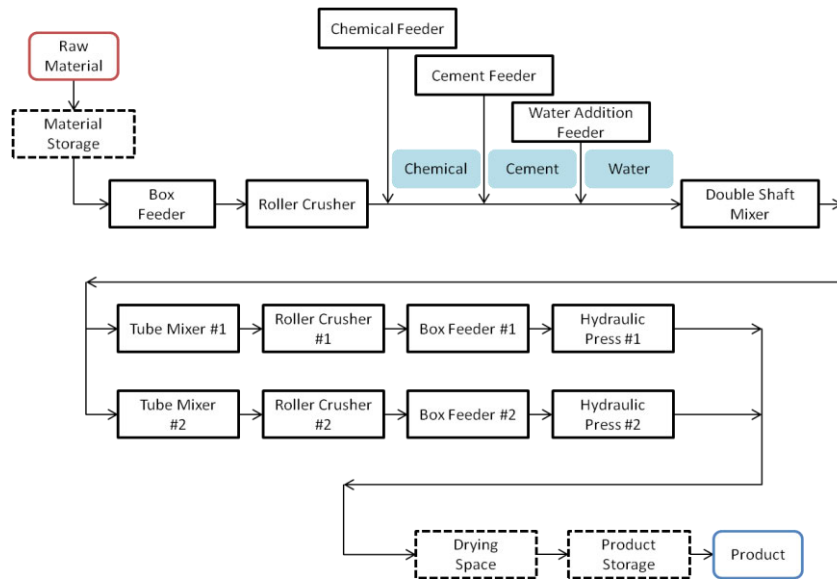


Figure 3-1 Non-fired brick manufacturing flow

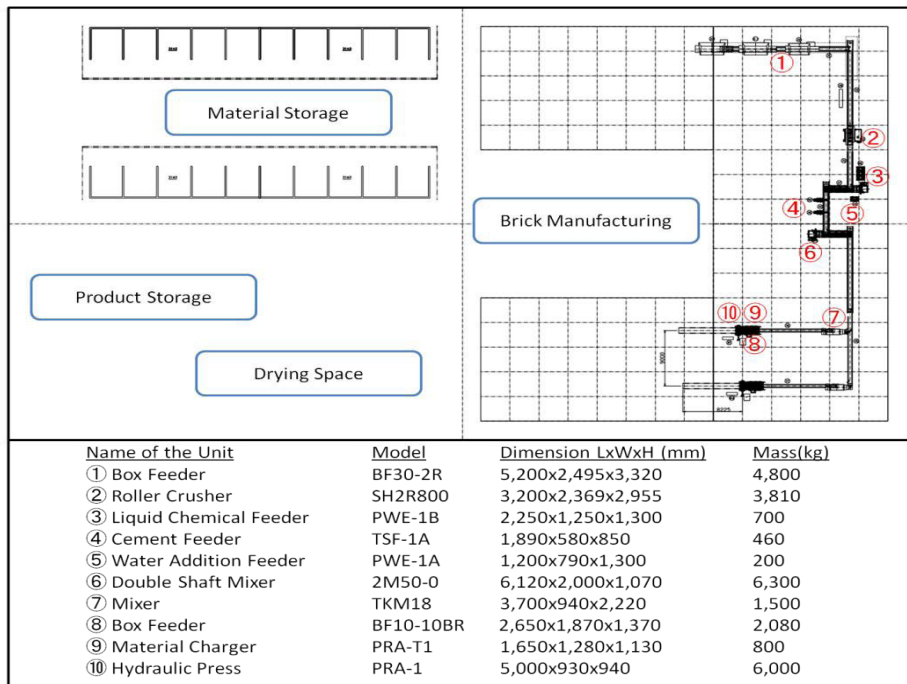


Figure 3-2 Manufacturing factory layout

It is common practice for large brick consumer like real estate developer to purchase brick directly from the brick manufacture. As long as factory is set up near Dhaka, it is probably unnecessary to create a new distribution and sale network. However, as non-fired brick is still relatively new in Bangladesh, adding large real estate developer as strategic partner for this business is being considered.

3-6 Recruiting and Training Plan

Table 3-5 Initial manufacturing and sales management structure

Position	Person
Admin staff	10
Factory worker	75

The estimated number of factory workers required is 75, assuming 3 shifts of 8hrs. The rate of income will differ for day shift and night shift duty.

3-7 Estimated Business Expense

Table 3-6 Initial investments (Unit: JPY)

Description	Price	Unit	Description	Price	Unit
Machinery	167,620,000	JPY	Civil Work	11,488,000	BDT
Shipping Expense	7,343,756	JPY	Shed Construction	11,086,000	BDT
Survey/Trial	5,980,000	JPY	Import Tax (7.5%)	9,670,000	BDT
Installation	4,120,000	JPY	Grid Connection (318kW)	6,000,000	BDT
Export Packing	4,050,000	JPY	Backup Generator (250kW)	2,700,000	BDT
Manufacturing Line Design	2,400,000	JPY	Installation	528,800	BDT
Supplementary Work	1,130,000	JPY			
			Total	40,945,000	BDT
Total	192,643,756	JPY		53,914,541	JPY

Table 3-7 Raw material breakdown

Brick Production							
Annual Production	25,000,000	bricks					
Working Days	300	days					
Daily Production	83,333	bricks					
Annual Production	65,000	ton					
Mass	2.6	kg/brick					
Materials			Total	Total (Unit: 1,000 BDT)			
Sand ratio	57%	1.48	Sand	37,050	ton/year	8,892	BDT/year
Sand price	0.24	BDT/kg		3,088	ton/month	741	BDT/month
Sand cost	0.36	BDT/brick		124	ton/day	30	BDT/day
Pebble ratio	35%	0.91	Pebble	22,750	ton/year	4,323	BDT/year
Pebble price	0.19	BDT/kg		1,896	ton/month	360	BDT/month
Pebble cost	0.17	BDT/brick		76	ton/day	14	BDT/day
Cement ratio	8%	0.21	Cement	5,200	ton/year	40,560	BDT/year
Cement price	7.8	BDT/kg		433	ton/month	3,380	BDT/month
Cement cost	1.82	BDT/brick		17	ton/day	135	BDT/day
Hardening agent ratio	0.24%	0.006	Hardening	156	ton/year	36,036	BDT/year
Hardening agent price	231	BDT/kg		13	ton/month	3,003	BDT/month
Hardening agent cost	1.44	BDT/brick		0.5	ton/day	120	BDT/day
Material cost	3.59	BDT/brick	Material cost	1.38	BDT/kg	89,811	BDT/year

Table 3-9 Expense breakdown

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
COGS		104,737	104,737	104,737	104,737	104,737	104,737	104,737	104,737	104,737	104,737
Sand	0.35	8,855	8,855	8,855	8,855	8,855	8,855	8,855	8,855	8,855	8,855
Pebble	0.17	4,323	4,323	4,323	4,323	4,323	4,323	4,323	4,323	4,323	4,323
Cement	1.62	40,560	40,560	40,560	40,560	40,560	40,560	40,560	40,560	40,560	40,560
Hardening agent	1.44	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000
Electricity	0.60	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000	15,000
Pigment	0	0	0	0	0	0	0	0	0	0	0
O&M		0	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
License		0	0	0	0	0	0	0	0	0	0
Maintenance		0	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
SG&A		11,400	11,400	11,400	11,400	11,400	11,400	11,400	11,400	11,400	11,400
Labor cost (worker)	120	75	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000	9,000
Labor cost (admin)	240	10	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Office		0	0	0	0	0	0	0	0	0	0
Land rent		0	0	0	0	0	0	0	0	0	0
Total expense		116,137	121,137	121,137	121,137	121,137	121,137	121,137	121,137	121,137	121,137

3-8 Financial Analysis

Table 3-10 Revenue plan (Unit: 1,000 BDT)

Kamei Ceramics Bangladesh Limited											
Income Statement	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Net revenue	0	225,000	225,000	225,000	225,000	225,000	225,000	225,000	225,000	225,000	225,000
Excise duties	0	225,000	225,000	225,000	225,000	225,000	225,000	225,000	225,000	225,000	225,000
Total expense	0	130,745	130,745	130,745	130,745	130,745	130,745	130,745	130,745	130,745	130,745
CASH	0	104,255	104,255	104,255	104,255	104,255	104,255	104,255	104,255	104,255	104,255
Maintenance & Repair	0	0	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Marketing & Admins. office	0	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400
Depreciation	0	4,305	4,305	4,305	4,305	4,305	4,305	4,305	4,305	4,305	4,305
Operating income	0	89,255	89,255	89,255	89,255	89,255	89,255	89,255	89,255	89,255	89,255
Interest	0	13,000	11,767	10,329	8,472	6,800	5,305	2,801	0	0	0
Net income before taxes and other adjustments	0	81,255	77,505	78,917	80,612	82,315	84,352	88,854	88,255	89,255	89,255
Total income taxes	0	30,477	26,364	20,654	30,190	30,538	31,632	32,495	33,477	33,471	33,471
Net Income	0	50,788	48,440	49,323	50,522	51,447	52,720	54,158	55,788	55,785	55,785
Balance Sheet	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total assets	154,911	211,312	196,705	182,057	197,486	162,882	158,274	125,606	109,356	94,451	79,843
Current assets	8,334	68,355	68,355	36,355	36,355	68,355	68,355	68,355	68,355	38,355	79,343
Non-current assets	146,077	172,858	128,350	145,702	161,131	94,527	89,919	57,251	41,001	56,096	0
Plant & machinery	130,000	99,198	82,287	70,985	57,197	41,157	36,749	3,496	3,496	3,739	3,739
Current liabilities	0	3,735	3,739	3,733	3,735	3,739	3,739	3,735	3,735	3,739	3,733
Fixed liabilities	130,000	99,385	75,528	87,259	108,386	37,718	20,010	0	0	0	0
Total net assets	54,911	117,184	118,457	111,102	119,562	111,425	114,625	119,927	105,578	90,712	76,104
Capital	130,000	100,300	100,300	100,000	100,000	100,000	100,000	100,000	100,300	130,000	130,000
Retained earnings	0	50,788	48,295	18,548	18,688	28,315	30,034	36,198	41,248	48,739	49,154
Total liabilities and Net assets	154,911	211,312	196,705	182,057	197,486	162,882	158,274	125,606	109,356	94,451	79,843
Cash Flow Calculation	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Pre-tax cash flow	121,137	106,863	108,863	105,863	105,863	108,863	108,863	108,863	108,863	108,863	108,863
Income Tax (PR)	5935										
Cash flows from operating activities	0	38,788	68,348	35,931	34,926	66,054	67,328	68,766	75,392	70,382	70,382
Cash flows from investing activities	191,189	0	0	0	0	0	0	0	0	0	11,489
Cash flows from financing activities	290,000	-9,311	-63,243	-35,931	-34,929	-66,057	-67,326	-68,768	-75,392	-70,382	-70,382
Change in cash and cash equivalents	8,884	29,116	4,862	0	0	0	0	0	0	0	11,489
Opening balance of cash and cash equivalents	0	3,884	36,011	36,011	36,011	36,011	36,011	36,011	36,011	36,011	36,011
Cash and cash equivalents final balance	8,884	36,011	36,011	36,011	36,011	36,011	36,011	36,011	36,011	36,011	47,500

3-9 Financing Plan

From several interviews with private, government and development based financial institution; to raise 100 million JPY in both Japan and Bangladesh is realistic for capital investment. In addition, up to \$50,000 as working capital can be financed by Small Enterprise Assistance Fund (SEAF). The equity ratio of joint venture (KCB) is still under negotiation but expected it to be about 60%. The risk associated with local and foreign financing is summarized in Table 3-11.

Table 3-11 Local and foreign financing comparison

	Japan	Bangladesh
Merit	<ul style="list-style-type: none"> Low interest rate (less than 3% on unsecured long-term loan) 	<ul style="list-style-type: none"> Tax saving (corporate tax is Bangladesh) Future profitability is important than access to collateral Accustomed to financing for brick sector and understanding of brick business.
Demerit	<ul style="list-style-type: none"> Foreign exchange risk (revenue in BDT, repayment in JPY) Repayment from after tax (no tax shield) Credit review will take time as not familiar with Bangladesh and brick sector. Condition for collateral and join liability is severe 	<ul style="list-style-type: none"> High interest rate (10-13% even with access to special loan) Less control by Japan side

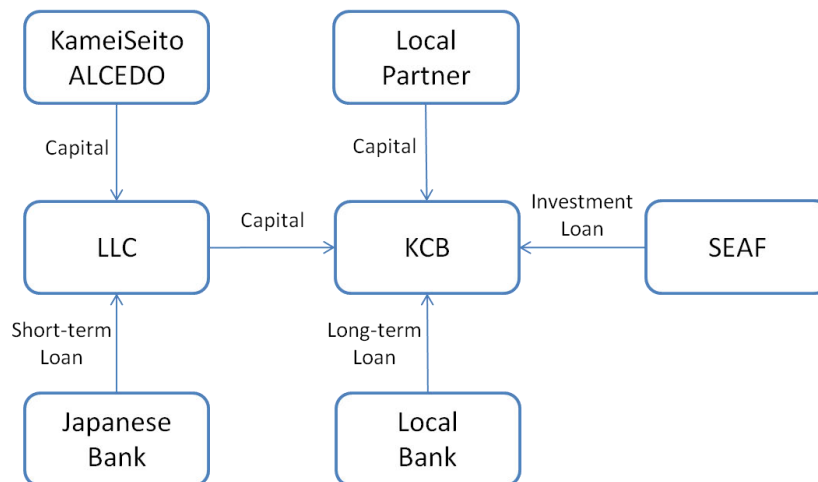


Figure 3-3 Investment Scheme (Initial Stage)

Tax

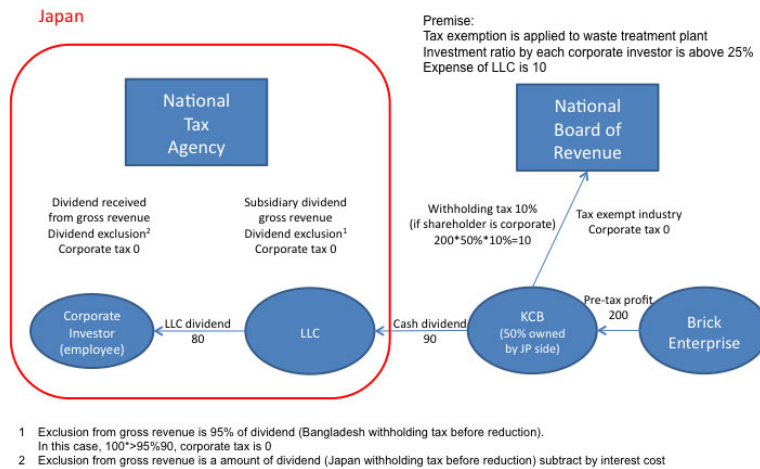


Figure 3-4 Taxation for Investment Scheme

3-10 Licensing related

[BSTI registered certification]

It is mandatory to obtain registration of authentication by BSTI to manufacture, sell and distribute bricks in Bangladesh. The license is valid for 2 years and requires 2 tests per year. The brick standard by BSTI is as follow:

- BDS 208:2009 Specification for Common Building Clay Bricks

After discussion with BSTI and Department of Environment, it was determined that non-fired brick does not fit under this standard, as clay is not used. Since there are no standard for non-fired brick, "No Objection Certificate" will need to be issued by BSTI.

[Certification related to environmental law]

In accordance with Environmental Conservation Act of 1995, all manufacturing projects will require Environmental Clearance Certificate (ECC) from Department of Environment.

3-11 Business Implementation Schedule

Phase 1 (January 2014 – December 2015)

Initial investment: 200 million JPY
 Annual production : 25 million bricks
 Annual sales : 25 million x 11 JPY = 275 million JPY
 Preparation period : January – June 2014 (6 months)

- Establish local subsidiary, hire local staff
- Sign JV agreement with local stakeholders, training of local staff

Contract with raw material supplier, distribution system

- Manufacturing of machinery, manufacturing line design

Launch and deployment preparation phase: July 2014 – December 2015 (18months)

- Coordination of stakeholders by subsidiary, product PR, sales network
- Begin manufacturing and sale of non-fired brick
- Develop Q/A & Q/C, monitoring system by subsidiary and local partners
- Develop franchise model
- Survey for next factory site and raw material procurement

Phase 2 (January 2016 ~)

Initial Investment: 538 million JPY

Annual production: 100 million+ bricks

Annual sales: 1 billion+ JPY

Franchise model: January 2016 – December 2017 (2 years)

- Invitation and selection of franchisee
- Turn-key agreement with franchisee
- Start new operation at subsidiary owned and franchise factories

Outside of Dhaka: January 2018~

- Expand the business to other cities using the franchise model

Same model will be used to expand the business to India, Nepal, Myanmar and other neighboring countries.

3-12 Environmental and Social Consideration

This business will provide improvement in the areas of air pollution, living condition, health, work condition, and provide high quality employment for the local community.

4. Collaboration with JICA projects

4-1 Collaboration Needs

By supporting this project, JICA is able to address development challenges, such as improvement of living condition and reduction of poverty for the BoP segment. Also, financial assistance and network of relevant organizations can be utilized to collaborate with this business.

4-2 Project Scheme (financial support, technical support, volunteer support)

⊖Financial support, ⊖Collaboration with JICA project, and ⊗Japan Overseas Cooperation Volunteers (JOCV), Senior Volunteers (SV).

4-3 Specific Collaboration and Implementation Schedule

1) Financial support (loan, grant)

●Financing in the franchise business

During phase 2 of this project, interested entrepreneur will be invited as franchisee to invest in this business. With existing cluster of brick kilns, Gazipur and Tangail district in Dhaka division has been identified as the target area. By utilizing two-step loan by JICA, franchisees are able to get low interest loan and able to get loan quickly. The idea will be discussed with JICA Dhaka office during development of franchise model.

● Financing in grant aid for vocational and technical training program

In order to achieve the maximum social benefit of employment promotion, collaboration with NGOs for vocational and technical training program was considered. One example would be BRAC's Skills Training for Advancing Resource (STAR) program. However, as most NGOs do not have sufficient facilities and resources, there are many challenges in the implementation of the program. Grant aid such as JICA's grant assistance for cultural grass-roots project will be considered. The idea will be discussed with JICA Dhaka office after appropriate training program for this business has been developed.

2) Collaboration with existing JICA Projects

●Collaboration with waste management project

Since 2000, JICA has been involved in formulating a master plan for solid waste management in Dhaka. From the raw material availability survey, it was concluded that due to small number of industries that discharge usable waste, using industrial waste as raw material would be difficult. However, further research would be conducted to look for other usable industrial waste. The idea will be discussed with JICA Dhaka office and other relevant organizations during Phase 1 of the business.

● **Collaboration with disaster prevention and climate change control project**

Natural disasters, such as a cyclone, flood or earthquake has seriously impacted the BOP segment in Bangladesh. Non-fired brick can be used for existing and future JICA projects. One area of possibility is construction and renovation of cyclone shelter. During 2nd stage of this business, new products, such as facing tile, gravel and large block will be added. The idea will be discussed with JICA Dhaka office after appropriate project has been identified to use the non-fired brick.

● **Collaboration with air quality improvement project**

Due to recent economic development, air pollution from vehicles and brick kilns has uncontrollability increased in urban areas. According to a study conducted by World Bank, air pollution has led to serious health hazard for residents in urban areas.

World Bank is support an air pollution control project called Clean Air & Sustainable Environment. (CASE)⁵ However, air pollution monitoring station is limited and the project is still at its development stage. In Japan, due to strict emission regulation and advanced emission control technology, air quality is constantly observed by Atmospheric Environmental Regional Observation System (AEROS). There are other Japanese technologies that can be used to reduce air pollution in Bangladesh.

3) Japan Overseas Cooperation Volunteer (JOCV) and Senior Volunteer (SV)

● **Technical cooperation for vocational and technical training program**

For this business, dispatch of volunteers for vocational and technical training can be considered. Also, as it relates to mitigation of environmental issues, volunteers can be dispatched for environmental education. The idea will be discussed with JICA Dhaka office after appropriate training program for this business has been developed.

4-4 Collaboration Impact Forecast

The expected impact and index of collaboration are shown below:

Impact ⊖:	Contribute to effectively procure raw materials and solving waste disposable issue in urban areas
Index:	Total amount of waste from urban area used as raw material
Impact ⊖:	Deployment of franchise model
Index:	Total number of franchisee that used low-interest loan
Impact ⊕:	Contribute to skill development of workers through vocational and technical training program
Index:	Total number of workers who completed the programs
Impact ⊕:	Contribute to safety of the poor through cyclone shelter project
Index:	Total number of cyclone shelters built or renovated and total number of non-fired bricks used

⁵ Source: [Ministry of Environment & Forests, CASE project] <http://www.case-moef.gov.bd/>

5. Development Impact

5-1 Condition of BoP segment

The number of BoP segment in Bangladesh has been slowly decreasing. However, 35% of the total population still belongs to this segment. The income of BoP segment is estimated to be less than 1/2 of national average. Many live in poor condition due to lack of access to health and safety information. It is estimated that more than half of people in the BoP segment has no formal education. From economical viewpoint, they are less likely to receive opportunity for higher education. Many children in the BoP segment are asked to work and forced to give up on education. As education and income are closely linked, many children in BoP segment will remain in the poverty cycle. In this business, people in the BoP segment will be given opportunity for high quality employment to improve their living condition.

5-2 Impact indicator for issues to be resolved through this business

The issues to be resolved through this business are divided into 3 parts and summarized below:

●Creation of high quality employment

⊖Creation of high quality employment

The development impact for creation of high quality employment can be evaluated by total number of employment created, income and working condition. The working condition will be evaluated by conducting questionnaire survey to workers to determine whether items from [Health, Hygiene and Safety] of the 2006 Bangladesh Labour Law are being followed.

●Improvement of living condition

⊖Improvement of air pollution and global warming

The development impact for improvement of air pollution and global warming will be evaluated by comparing the SPM and CO₂ emitted during brick manufacturing for non-fired brick and traditional clay brick.

⊕Preservation of agricultural land

The development impact for preservation of agricultural land will be evaluated by comparing the amount of clay consumed to manufacture non-fired brick and traditional clay brick.

- **Development projects for BOP segment**

- Rural development

Providing non-fired brick at affordable price to BOP segment will contribute to improvement of living condition as homes can be built using better building materials. The development impact for rural development will be evaluated by total number of non-fired brick sold and price of brick in rural areas.

5-3 Collection and analysis of baseline data for impact indicator

1) Creation of high quality employment

① Stable employment

Fixed Chimney Kiln (FCK) accounts for nearly 90% of total in Bangladesh but most are small scale and considered to be seasonal. It only operates 5-6 months out of year as it is constructed on low land, where it floods during monsoon season. The baseline will use employment condition of FCK and compared with employment condition for this business.

② Income

As brick industry in Bangladesh is not formally recognized as an industry, official earnings data is not available in the census by Bangladesh Bureau of Statistics. According to a photojournalist, in the outskirts of Dhaka, daily wage for working 12 hours at brickfield is 120 BDT for men and 100 BDT for women.⁶ Based on above figure, the annual income was calculated at 14,400 BDT for men and 12,000 BDT for women. The baseline will use annual income of FCK and compared with income for this business.

③ Work condition

A questionnaire survey will be developed using items from [Health, Hygiene and Safety] of the 2006 Bangladesh Labour Act. The items are as follow:

- (a) No bad odor from sewage, toilet and properly maintained
- (b) Maintain proper temperature and adequate ventilation by circulation of fresh air
- (c) Not inhale exhaust gas, plume, dust or other impure substance
- (d) Not overcrowded to an extent injurious to the health of the workers
- (e) Maintain sufficient and suitable lighting from natural or artificial source
- (f) Maintain sufficient supply of wholesome drinking water. All such points where water is supplied shall be legibly marked 'Drinking water' in Bangla
- (g) Latrines and urinals of prescribed types shall be provided conveniently situated and accessible to workers at all times while they are in the establishment
- (h) Latrines and urinals shall be adequately lighted and ventilated

⁶ Source: Demotix The Network for Freelance Photojournalists, Day life: Bangladesh brick field labor, <http://www.demotix.com/news/1675916/day-life-bangladesh-brick-field-labor>

- (i) Latrines and urinals shall be maintained in a clean and sanitary condition at all times with suitable detergents and disinfectants.
- (j) Maintain sufficient number of dustbins, kept in clean and hygienic condition
- (k) Maintain safety of building, machinery and electrical equipments
- (l) Fire-escape window, door or other exit used in case of fire, shall be distinctively marked in Bangla and in red letters of adequate size
- (m) Maintain sufficient and suitable first-aid boxes
- (n) Provide and maintain adequate number of canteens for the use by the workers
- (o) Provide and maintain suitable room for children under the age of 6 years

2) Air pollution, Global warming

Based on World Bank study, Table 5-1 summarizes the suspended particulate matter (SPM) and CO₂ emission of existing kiln technologies. This data will be used as baseline and will be compared to SPM and CO₂ emission during manufacturing of non-fired brick. If SPM is unavailable for non-fired brick, data for PM₁₀ or PM_{2.5} will be used. In that case, SPM will only be used as reference.

Table 5-1 SPM and CO₂ emission from kiln technologies⁷

Kiln type	SPM concentration (mg/m ₃)	SPM emitted per 100,000 bricks (kg)	CO ₂ emitted per 100,000 bricks (t)
FCK	1,000	171	50
IFCK (Improved FCK)	<500	86	40
Zigzag	270-300	—	40
HHK	20.3	87	30
VSBK	78-187	56	25

3) Preservation of agricultural land

According to HHK CDM⁸ project implemented by World Bank, clay consumption to manufacture 1 brick for FCK is 0.1ft³, while HHK is 0.125ft³. The baseline is the clay consumption per brick by FCK and HHK. The amount will be compared to clay consumption per brick to manufacture non-fired brick.

4) Rural development

The baseline is the average market price of traditional clay brick available in the rural area. Market survey will be conducted to collect the market price.

⁷ Source: The World Bank, Introducing Energy-efficient Clean Technologies in the Brick Sector of Bangladesh and Brick Manufacturing and Public Health Stakeholders Dialogue

⁸ Source: Project 5125 : Improving Kiln Efficiency in the Brick Making Industry in Bangladesh

5-4 Business impact scenario after implementation and Impact indicator

In line with the business goal, the target value of the index will be evaluated 5 and 10 years after the start of business.

1) Creation of high quality employment

① Stable employment

Index: Total number of employment created
Target value: 5 years after start (2019) 3,760 workers
10 years after start (2024) 22,000 workers

② Income

Index: Income
Target value: 5 years after start (2019) 112,500 BDT/year/person
10 years after start (2024) 112,500 BDT/year/person

③ Better work condition

Index: Questionnaire survey by the workers
Target value: 5 years after start (2019) aim to meet all evaluation items
10 years after start (2024) aim to meet all evaluation items

2) Air pollution and Global warming

Index: Total amount of SPM and CO₂ emitted during manufacturing of non-fired brick. (100,000 bricks)
Target value: 5 years after start (2019) CO₂ 9 ton/100,000 bricks
10 years after start (2024) CO₂ 9 ton/100,000 bricks

3) Preservation of agricultural land

Index: Amount of clay used during manufacturing of non-fired brick
Target value: 5 years after start (2019) clay consumption 0 (zero)
10 years after start (2024) clay consumption 0 (zero)

4) Rural development

Index: Number of non-fired brick sold in rural areas and price of brick
Target value: Will be determined during 2nd stage of business (2015)