Understanding the Value Chain of Affordable Housing Construction

Materials and Market Development Strategy for Increasing the Demand for Affordable Housing Construction Materials in Rural India

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Content

Acronyms

AHCM	Affordable Housing Construction Materials
BDO	Block Development Officer
CCB	Copper Chrome Boron
CDO	Chief Development Officer
CGI	corrugated galvanised iron
CSEB	Compressed Stabilized Earth Block
BIS	Bureau of Indian Standards
EY	Ernst & Young LLP
Ft.	Foot
IAP	Integrated Action Plan
IAY	Indira Awas Yojana
IRR	Internal Rate of Return
JE	Junior Engineer
Km	Kilometre
MGNREGS	Mahatma Gandhi National Rural Employment Generation Scheme
MoRD	Ministry of Rural Development
MSME	micro, small and medium enterprises
NGO	non-governmental organization
NPV	net present value
PMAY– G	Pradhan Mantri Awas Yojana-Gramin
PMU	Project Monitoring Unit
R&D	research and development
RCC	reinforced cement concrete
SBM-G	Swachh Bharat Mission-Gramin
SHG	self-help group
sq. m	square metre
TPP	thermal power plant
UNDP	United Nations Development Programme

Executive Summary

To improve the rural housing scenario and to provide 'Housing for All' by 2022, the Government of India restructured the Indra Awas Yojana (IAY) into Pradhan Mantri Awas Yojana-Gramin (PMAY-G)[1]. This programme aims to provide a "pucca" house, with basic amenities, to all houseless households and those households living in "kutcha" and dilapidated houses. By 2021-22, the objective of PMAY-G is to construct 29.5 million households with the immediate objective of covering 10 million households in rural areas that are houseless or living in "kutcha" or dilapidated houses, in three years from 2016-17 to 2018-2019. The minimum unit (house) size proposed in the PMAY-G guidelines/framework is 25 square metre including a dedicated area for hygienic cooking. The unit assistance has been increased from INR 70,000 to INR 120,000 in the plains and from INR 75,000 to INR 130,000 in the hilly states, difficult areas and Integrated Action Plan districts.

To complement the objectives of the programme, the United Nations Development Programme (UNDP) in partnership with the Ministry of Rural Development (MoRD) has prepared a comprehensive compendium of more than 130 rural housing typologies to address the gaps identified in Indira Awas Yojana by studying a range of rural housing technologies, based on the locally available materials and skills of 18 states.[2]

Gradually and progressively, the endeavour has now reached the stage of technology transfer and implementation of affordable housing, utilizing alternative, cost-effective construction material, through state agencies. It is also imperative to develop strategies to facilitate adoption of these designs and materials across the selected states while addressing the challenges of demonstration and adoption of the design and construction recommendations on a large scale. It is, therefore, essential to upscale the production of alternative construction material, streamline the supply chains of affordable building materials, disseminate information on aspects related to provision of technical support to beneficiary households, financing options, skill development and monitoring systems.

To move these efforts forward, Ernst & Young LLP (EY) has been appointed by UNDP to identify and understand the value chain of some Affordable Housing Construction Materials (AHCM) in six states, namely, Assam, Jharkhand, Madhya Pradesh, Maharashtra, Odisha and Uttar Pradesh.

EY has analysed the designed rural housing typologies and, based on secondary research, identified around 52 AHCM which were further shortlisted to 14 products based on scoring on the socio-economic and institutional criteria developed.

Ten categories of stakeholders were identified for carrying out the primary study. Standard questionnaires were developed to identify the gaps across the value chain with respect to availability of raw materials, plant set up, market access, policy gaps, etc. The categories of stakeholders include policy makers, manufacturers, traders, suppliers, implementers and representatives of research institutes, associations, financial institutions, non-governmental organizations as well as beneficiaries.

Based on the data from stakeholder consultation, the list of final AHCM has been modified and value chains have been mapped. For the final shortlisted products, bankable business models and investment required for establishment of manufacturing units have been prepared, based on primary survey data and secondary research material. These models have been developed with a focus on micro and small enterprises and self-help groups (SHGs) to maximize employment generation

1 http://pmayg.nic.in/netiay/English_Book_Final.pdf

2 While the Government of India has developed more than 130 typologies for 18 states, the Pahal report illustrates designs of 65 typologies across 11 states which includes the target states of this study as well. The 10 states are Assam, Chhattisgarh, Jharkhand, Rajasthan, Himachal Pradesh, Manipur, Odisha, Madhya Pradesh, Maharashtra, Uttar Pradesh, Tripura and West Bengal.

in rural areas. Table ES1 describes the product-wise economic feasibility of a dwelling unit, overall set up cost (includes investment in plant and machinery, working capital for one cycle and marketing cost for one year) and financial feasibility of manufacturing units.

Furthermore, Table ES2 provides a summary of the social benefits of AHCM apart from summarizing the manufacturing units to be established and employment generated by these units through reduction of prices of the houses constructed.

Table ES1: Economic feasibility factor, set up cost and financial feasibility of manufacturing units

S. No.	Product	Economic Feasibility of Dwelling Unit	Set up Cost of Proposed Model (In INR)	Financial Feasibility of Manufacturing Unit
1	Treated bamboo	Lower maintenance	180,000	• NPV – 11,517 • IRR – 13% • Break-even: 0.43 years
2	Bamboo mat wall and floor boards	Lower overall cost	108,100,000	• NPV – -10.9 million • IRR – 3% • Break-even: 8.47 years
3	Fly ash bricks	Lower overall cost	1,760,000	• NPV – - 800,000 • IRR – 1% • Break-even: 2.8 years
4 (a)	Precast hollow concrete blocks (manual)	Lower overall cost	170,000	• NPV – 8,051 • IRR – 1% • Break-even: 2.8 years
4 (b)	Precast hollow concrete blocks (electric mixer)	Lower overall cost	240,000	• NPV – 36,385 • IRR – 15% • Break-even: 1.2 years
5	Compressed stabilized earth blocks	Lower overall cost	570,000	• NPV – 130,000 • IRR – 17% • Break-even: 1.0 year
6	Micro concrete roofing tiles	Lower cost	330,000	• NPV – 67,056 • IRR – 16% • Break-even: 1.5 years
7	Ferro cement door and window frames	Lower cost	380,000	• NPV – 80,911 • IRR – 17% • Break-even: 1.4 years
8	Ferro cement wall panel	For this product, preferred manufacturing procedure would be on-site preparation. Hence, business model cannot be prepared.		
9	Ferro cement roofing channel	Lower overall cost	729,000	• NPV – 73,908 • IRR – 14% • Break-even: 0.99 years
10	CGI sheets	Lower cost	60,071,000	• NPV – 61.9 million • IRR – 38% • Break-even: 1.3 years

NPV: net present value, IRR: internal rate of return

Table ES2: Year wise, state-wise manufacturing units to be established and employment generated

State	State-wise New Manufacturing Units of all AHCM Prescribed in the States to be Established Annually						Total Employment Generated
	2017	2018	2019	2020	2021	2022	
Assam	2	111	116	564	797	1472	25,570
Jharkhand	2	87	91	442	623	1,154	28,367
Odisha	4	221	229	1,120	1,578	2,918	61,066
Madhya Pradesh	4	191	200	974	1,373	2,539	56,467
Maharashtra	2	94	98	479	675	1,248	30,368
Uttar Pradesh	4	187	196	953	1,345	2,485	53,912

Due to the unintended importance given through various schemes to concrete and burnt clay brick based construction, the knowledge of using locally available materials and techniques in housing construction has become dormant. Concrete-based construction has taken a deeper root in the minds of people to an extent that these materials are considered as traditional materials. For this reason, beneficiaries are more conversant with their usage while there is still a major lack of confidence in using AHCM and of awareness of their advantages. Therefore, to encourage the usage and production of these materials, we have tried to capture holistic recommendations to provide a thrust to the AHCM sector. Table ES3 presents issues identified during the stakeholder consultation programme and recommendations to overcome them.

To accelerate the pace of adoption of AHCM, successful implementation of the dedicated programme becomes imperative. Hence, we have further estimated the cost of conducting/implementing these activities up to 2022 to understand the fiscal requirements of each of the target states. To implement the recommendations, two implementation structures have been suggested. In Option 1, central and state-level Project Management Units (PMUs) shall be established at the centre and respective state departments, which will be responsible for implementing the recommendations. In Option 2, the responsibility for implementing the recommendations would be with the competent authorities of existing central and state departments. The estimated budget which may be allocated under Option 1 is INR 2,460.87 and under Option 2 is INR 2,393.49 (centre and states

Table ES3: Issues and recommendations based on stakeholder consultations

Issues	Description	Recommendations	Proposed Activities
Implementation gap	Though research on these products started 20 years ago, AHCM have not picked up the desired pace of upscaling. No dedicated programme focussing on usage of affordable housing materials in the rural housing context existed. In some cases, there are guidelines for improving the usage of these products. For example, the Supreme Court has released a notification specifying that thermal power plants have to bear the transportation cost of fly ash within a radius of 50 kilometres. But enforcement has been minimal.	• Initiation of dedicated AHCM Mission	• Development of strategy roadmap and mission monitoring & evaluation • Setting up of a PMU and technical cell • Deploying dedicated technical personnel at the block level • Preparation of reference material such as technical guides, field handbooks, etc.

Issues	Description	Recommendations	Proposed Activities
Skill gap	Limited availability of knowledge about the products and additional skills required in installation of AHCM makes conditions unfavourable for upscaling of AHCM. Also some of the AHCM require a greater degree of quality control compared to traditional materials leaving a smaller window for error. Buildings constructed using AHCM under improper supervision compromise safety, making the strength of AHCM itself questionable in the minds of end users.	• Conducting incremental learning activities • Training on Infrastructure development	• Collation and updation of a central knowledge repository • Workshops at different levels of administrations and public • Investing in research and development • Distribution of reference materials • Partnerships with institutions/skilling centres • Establishment of new exclusive training institutes • Revival of inoperative building centres
Perception gap	There is a strong perception among beneficiaries that traditional materials are more durable than the proposed AHCM. Some misconceptions such as fly ash bricks leaching toxic materials make the product questionable in the minds of end users.	• Marketing activities • Fiscal incentives to beneficiaries	• Promotion through print media, advertisements, hoardings, etc. • Development of marketing collaterals such as product profiles, vendor lists, etc. • Organization of trade fairs, conferences, exhibitions, etc. • Construction of demonstration buildings • Organization of awards for best practices • Creation of brand ambassadors at the Panchayat level • Incentives to early adopters
Reluctance to adopt	The status quo of using traditional materials doesn't help the adoption of new technologies as it will require additional efforts by builders, masons, labourers, etc., in learning the usage of new technologies. This creates reluctance among construction workers and the monitoring government officials to adopt AHCM and related technologies.		
Barriers for market entry	A new entrant in manufacturing of AHCM has to face strong entry barriers from long established traditional material manufacturers. This makes the task of acquiring market share extremely difficult without support from the government.	• Fiscal incentives to manufacturing units • Infrastructure development	• Establishment of common manufacturing facilities • Creation of AHCM-specific policy • Policy creation and changes such as inclusion of AHCM in the schedule of rates, lowering Gods and Service Tax rates • Subsidies to manufacturing units • Support to SHGs

included) to be spent over a period of a period of five years (until 2022) as a mission fund.

Pucca housing built using traditional materials is more of an aspiration than a necessity for many people. If existing methods and materials are to be used to meet the entire demand for housing, it would play havoc on the environment by depleting natural resources to critical levels. Adopting alternative affordable housing materials would play a prominent role in achieving this aspiration at a low cost, without compromising on quality. The major barrier to adoption is lack of knowledge of the benefits of these materials. Hence, active measures should be undertaken to facilitate adoption of these materials.

"Our future generation is watching today and tomorrow will judge us by the choices we make in the years ahead."

1. Context

With the aim to provide 'Housing for All' by 2022 and to improve the rural housing scenario, the Government of India re-structured the Indra Awas Yojana (IAY) into Pradhan Mantri Awas Yojana-Gramin (PMAY-G)[3] in 2016. PMAY-G aims to provide a "pucca" house, with basic amenities, to all houseless households and those households living in "kutcha" and dilapidated houses. By 2021-22, the objective of PMAY-G is to construct 29.5 million households. The immediate objective was to cover 10 million households in the first three years (2016-17 to 2018-19) and enable construction of quality houses by beneficiaries using local material, designs and trained masons.

The minimum unit (house) size proposed in the PMAY-G guidelines/framework is 25 square metre (sq. m) including a dedicated area for hygienic cooking. The unit assistance has been increased from INR 70,000 to INR 120,000 in the plains and from 75,000 to 130,000 in the hilly states, difficult areas and Integrated Action Plan (IAP) districts. The beneficiary is entitled to 90/95 person days of unskilled labour under the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS). Further assistance for construction of toilets shall be leveraged through convergence with Swachh Bharat Mission-Gramin (SBM-G). Convergence for piped drinking water, electricity connections, cooking gas connections, etc., under different government programmes will also be attempted.

It was observed that the beneficiaries attempted to build larger houses than prescribed/proposed design as per the guidelines under the IAY which lead to incomplete houses; in some cases, the beneficiaries used inferior quality products to manage within the budget provided for construction of larger houses. Apropos it was decided that there is a need to design region-specific model, durable and affordable houses.

To complement the efforts of the government, United Nations Development Programme (UNDP) has been supporting PMAY-G to develop appropriate, affordable, rural housing designs through a Ministry of Rural Development (MoRD)-UNDP partnership on 'Governance and Accelerated Livelihoods Support'. Under the purview of this programme, more than 130 design typologies and pilots of housing prototypes[4] have been developed. The programme has now reached the stage of transfer of technology and implementation by state agencies and is in the process of developing strategies to facilitate adoption of these designs across the selected states while addressing challenges of demonstration and adoption of the design and construction recommendations on a large scale.

To upscale these efforts, UNDP has appointed Ernst & Young LLP (EY) to ***'Understand the value chain of Affordable Housing Construction Materials (AHCM) and market development strategy for increasing the demand for AHCM in rural India'***. Six states, i.e., Uttar Pradesh, Maharashtra, Jharkhand, Assam, Madhya Pradesh and Odisha, have been selected by UNDP to carry out value chain analysis and develop policy recommendations to increase the acceptance of AHCM at the end-consumer level as well as provide executable strategies at the state level.

3 http://pmayg.nic.in/netiay/English_Book_Final.pdf
4 http://pmayg.nic.in/netiay/Pahal.pdf

2. Approach

To understand the value chain of AHCM and market development strategy for increasing the demand for AHCM in rural India, the following activities were undertaken in the four phases/stages:

Stage 1: Identify and shortlist AHCM

Based on secondary research from various sources, it was observed that around 52 varied types of AHCM are/were either being used or research study has been undertake in India. From the list of these AHCM, 18 products have been shortlisted based on the existing usage and proposed design typologies/prototypes specific to the selected six states for the study. These 18 AHCM have been further evaluated on the basis of rationale, socio-economic environment and institutional criteria to arrive at 14 preferred/ideal products for the study.

Stage 2: Value chain analysis

Ten categories of stakeholders were identified for carrying out the primary study. And to standardize the process across the six states, standard questionnaires were developed to identify the gaps across the value chain with respect to availability of raw materials, plant set up, market access, policy gaps, etc. The categories of stakeholders include policy makers, research institutes, associations, manufacturers, traders, suppliers, implementers, financial institutions, non-governmental organizations (NGOs) and beneficiaries.

Stage 3: Developing business models

Based on the gaps analysis from the stakeholder interviews of the select products across six states, business models have been designed. These models encompass the rural socio-economic environment and expected/projected demand which is to be met by 2022 demand projection for the AHCM.

Stage 4: Recommendations

To encourage investment in and access to AHCM, a product-wise market development and penetration strategy has been proposed so that AHCM are developed with locally available materials by the local self-help groups (SHGs), women entrepreneurs, micro, small and medium enterprises (MSME), etc. And to facilitate market penetration initiatives that can be undertaken by the respective state governments have also been suggested.

Figure 1: Study approach

	Identify and shortlist alternative AHCM	Select alternative material and conduct value chain analysis	Estimate size/scale of selected value chains in each stage	Identify customer segments & policy hurdles
State-specific Activities	• Secondary research to **identify existing and alternative construction material** • **Identification of stakeholders** —rural/low cost housing construction materials • Define objectives and a **matrix for prioritization** of construction materials • **Consensus building** with UNDP	• **Identification of current processing units, along with production capacity and key suppliers** • **Structured interviews** with stakeholders • **SWOT (strengths, weaknesses, opportunities and threats) analysis** of all shortlisted materials • Current availability, perception, gaps on demand side, existing trade channels, quality standards, policy hurdles • Financial, economic & social analysis of identified products	• **6-7 year demand forecasting** plan for 6 states • Calculation of the demand in the coming 7 years • **Projection of requirement of the number of processing units** required to meet the projected demand • **Investment required** for setting up a processing unit of different materials or production mix producing multiple materials	• **Policy recommendations for 6 states** • Identifying **further areas of policy interventions** • **Market development strategy** • Final recommendations on **product development strategies** for MSMEs and women's SHGs • **Market penetration** and development

Identify and shortlist AHCM

3.1 Identification of AHCM available for affordable housing in India

An elaborate list of materials covering various components of construction of the house such as the wall, floor and roof were identified through study of secondary sources such as research journals and construction industry reports. These materials were then mapped against selected states to arrive at a list of 52 AHCM (see Annexure 1).

3.2 Shortlisting the AHCM based on study of developed prototypes

With the support of research institutes and private organizations, UNDP has developed prototypes for states. The target states are divided into zones based on three principles: vulnerability to natural hazards, physiography and access to building materials, and cultural compatibility. Each zone is then given design options based on the local conditions and traditional housing designs in that region. These designs are customized to promote usage of AHCM that improve the durability of the overall construction in local climatic conditions. Using these alternate materials in the designs further reduced the construction cost. For instance, instead of a using only a bamboo wall or a concrete wall or a brick wall, a composite of a brick wall in the lower half and bamboo mat sandwiched between concrete plaster on the upper half is used in one of the prototypes in Tripura. This increases the resistance to extreme weather in local conditions (thermal insulation to extreme temperatures in this case) in addition to reducing the overall cost of construction. The report on rural housing typologies for 10 states is available on the PMAY-G website.

Prototypes for the six target states have been studied to understand the materials that can be/is being used in these states for affordable housing. Based on the study, 18 materials have been shortlisted from the list of 52 AHCM (see Annexure 2).

3.3 Scoring criteria for evaluation

The 18 shortlisted products have been evaluated based on the parameters suitable for rural housing using weightage (matrix) system under four heads: state-wise distribution, economic impact, social impact, and institutional factors. The five guiding principles on the basis of which the criteria for scoring have been developed are shown in Figure 2.

The parameters devised to develop weightage system are:

a) State-wise Distribution

The scoring system of the materials on the basis of 'Product Availability/ Distribution' (D1)[5] in the selected states is shown in Table 1.

Figure 2: Guiding principles for shortlisting AHCM

Table 1: Weightage for state-wise distribution

Criteria (with Code)	Weightage
D1. Product availability	Available in 5, 6 states – 5
	Available in 1, 2 states – 4.5
	Available in 3, 4 states – 2.5

Rationale: On a scale of 5, products available in all or at least five of the target states are given 5 points, as they can be promoted in all target states. Products available in either one or two states are given a score of 4.5 because these materials are very region specific. For example, bamboo construction is a prominent type of construction in Assam and hence rather than trying to create demand for different products, it is better to improve the value chain for bamboo products.

b) Economic Impact

The parameter 'Economic Impact' has been further classified into three criteria: type of production unit (E1), skill required for production process (E2) and skill required for installation of the product (E3). The scoring system of the materials on the basis of 'Economic Impact' in the selected states is shown in Table 2.

Table 2: Criteria and weightage for Economic Impact

Criteria (with Code)	Weightage
E1. Type of production Unit	Micro – 3
	Small – 2
	Medium – 1
E2. Skill required in production of the product	Unskilled – 3
	Semiskilled – 2
	Skilled – 1
E3. Skill required in installation of the product	Unskilled – 3
	Semiskilled – 2
	Skilled – 1

Rationale: The scoring is in accordance with the guiding principles. The smaller the size of the investment (E1) needed for setting up the unit, the easier it is to improve the network for availability of the products. The ease of production of the product (E2) lowers the skill barrier for SHGs and micro entrants into the market whereas the lower skill required for installation of the product (E3) increases the market access for the material.

c) Social Impact

The parameter 'Social Impact' has been developed on the basis of the scope/possibility of setting up a manufacturing unit by SHG (S1) and exposure to hazardous situations during the production process (S2). The scoring system of the materials on the basis of 'Social Impact' in the selected states is shown in Table 3.

Table 3: Criteria and weightage for Social impact

Criteria (with Code)	Weightage
S1. SHG can produce the product	Yes – 1
	No – 0
S2. Does production process involve exposure to hazardous situations?	Yes – 0
	No – 1

Rationale: These criteria ensure the participation of the women and SHG (S1) as well as the safety of workers in the production unit (S2). The criteria also factors in the scope for the product to be adopted by the local community as a safe and durable construction material since it is produced by the people belonging to the local community. This enhances the demand for the alternate material in the rural market.

d) Institutional Factors

Institutional factors include the existence of Indian standards codes (I1) for the AHCM or the family related to AHCM in manufacturing and installation of the product.

Table 4: Weightage for Institutional Factors

Criteria (with Code)	Weightage
I1. Does Bureau of Indian Standards (BIS) code exist for the material?	Yes – 1
	No – 0

Rationale: The existence of BIS codes ensures that a predefined set of guidelines in layman terms, when followed, will ensure a minimum quality of the product.

5 Product availability/distribution is considered based on the products specified in the Pahal report even though some of the products are currently not in use.

3.4 Scorecard

Table 5: Product Score Card (weightage matrix)

S. No.	Materials	D1	E1	E2	E3	S1	S2	I1	Total
1	Cement stabilized earth blocks	5	3	3	3	1	1	1	17
2	Treated bamboo elements for beam, column and roofing elements	5	3	2	3	1	1	1	16
3	Bamboo mat walling panels	4.5	3	2	3	1	1	1	15.5
4	Bamboo mat corrugated roofing sheets	4.5	3	2	3	1	1	1	15.5
5	Bamboo mat flooring	4.5	3	2	3	1	1	1	15.5
6	Stabilized adobe	4.5	3	3	3	1	1	0	15.5
7	Compressed earth block	4.5	2	3	3	1	1	1	15.5
8	Fly ash – sand – lime brick	5	3	2	3	1	0	1	15
9	Micro concrete roofing tiles	2.5	3	3	3	1	1	0	13.5
10	Precast hollow concrete blocks	4.5	2	2	3	0	1	1	13.5
11	Ferro cement door, window frames	5	2	2	2	0	1	1	13
12	Ferro cement wall panels	4.5	2	2	2	0	1	1	12.5
13	Ferro cement roofing channels	4.5	2	2	1	0	1	1	11.5
14	Precast channel unit for floors/ roofs	4.5	1	1	1	0	1	1	9.5
15	Timber frames	2.5	2	1	1	0	1	1	8.5
16	Reinforced cement concrete (RCC)	2.5	2	1	1	0	1	1	8.5
17	Clay tiles	2.5	1	1	2	0	0	1	7.5
18	Corrugated galvanised iron (CGI) sheets	2.5	1	1	2	0	0	1	7.5

3.5 Products shortlisted for value chain analysis

Thirteen products that have scored the highest in the weightage matrix have been shortlisted for the study. However, CGI sheets has been considered in addition to the products that scored high for the study in spite of the lower score, as this product is widely used and available in abundance across India. The final products/product family and their strengths are provided in Table 6.

D1. Product availability
E1. Type of the production unit; E2. Skill required in production of the product; E3. Skill required in installation of the product
S1. Can the SHG produce it?; S2. Does the production process involve exposure to hazardous situations?
I1. Does any BIS code exist for the material?
Products of the same family are coloured in the same shade.

Table 6: Final shortlisted products and their strengths

Product	Materials
Treated bamboo for structural elements	• Easy access to raw material in most of the selected zones • Minimal training required for production and installation • The unit can be established by SHG • Has a life span of 25-40 years
Bamboo mat walling panels	• Specific to North-Eastern states • Minimal training required for initial processing of raw material as bamboo weaving is common in these states • Uses naturally available materials • Lighter in weight
Bamboo mat corrugated roofing sheets	• Specific to North-Eastern states • Minimal training required for initial processing of raw material as bamboo weaving is common in these states • Uses naturally available materials • Lighter in weight
Bamboo mat flooring	• Specific to North-Eastern states • Minimal training required for initial processing of raw material as bamboo weaving is common in these states • Uses naturally available materials • Lighter in weight
Micro concrete roofing (MCR) tiles	• Minimal additional training required for production and installation • Can be produced in all the selected regions • Easier and cheaper to set up a production unit • Less damage to the environment as there is no need for burning during the production process
Stabilized adobe	• Minimal training required for production and installation • Lower or minimal investment needed for establishing the manufacturing unit • The manufacturing unit can be established by SHG
Cement stabilized earth blocks	• Easier access to raw materials • Minimal training required for production and installation • Lower or minimal investment needed for establishing manufacturing unit • The manufacturing unit can be established by SHG • Uses lower quantities of mortar at joints due to size
Compressed earth blocks	• Easier access to raw materials • Minimal training required for production and installation • Lower or minimal investment needed for establishing the manufacturing unit • The manufacturing unit can be established by SHG
Precast hollow concrete blocks	• Minimal training required for production and installation • Lower or minimal investment needed for establishing the manufacturing unit • The manufacturing unit can be established as micro or small enterprise • Uses lower quantities of mortar at joints due to size
Fly ash sand lime bricks	• Medium additional training required for the production and installation process • Investment needed for establishing a manufacturing unit is smaller

Product	Materials
Ferro cement door-window frames	• Minimal training required for production and installation of the product • Investment needed for establishing a manufacturing unit is lower • Diverse products can be manufactured with minimal modifications in set up
Ferro cement wall panels	• Medium additional training required for the production and installation process • Investment needed for establishing a manufacturing unit is smaller
Ferro cement roofing channel	• Used in designs of two of the states • Reduces the cost and time of construction significantly
CGI sheets	• Widely used product • Can be used for different applications such as roof, compound wall, etc. • Has a large network of dealers and wholesalers • Available in most of the places across the country

Stakeholder Consultation Programme

4.1 Stakeholders Consultation Approach

The gap analysis and identification of current issues across the value chain of AHCM was done through a primary survey of products being manufactured and secondary research methods for products which are being developed by research institutes. The primary survey involved consultation with stakeholders and secondary survey involved study and findings from research journals.

4.2 Stakeholders across Value Chain

The type of stakeholders involved in the value chain can be divided into two categories:

a. **Dependent:** Stakeholders who are directly involved in the production process of the value chain of AHCM such as suppliers of the raw materials, manufacturers, traders, developers/ implementers/ builders and end users/customers. Any change by one of the stakeholders affects the other stakeholders in the value chain. For example, if thermal power plants (TTPs) stop supplying fly ash for brick manufacturing, the rest of the stakeholders in the chain are directly affected by the decision as it influences the availability of the product.

b. **Independent:** Stakeholders who are not involved directly in the value chain/production process such as research and development (R&D) institutes, policy makers, financial institutes, associations and NGOs. Any changes/decisions by one of the stakeholders does not directly affect the value chain of the AHCM. For example, if financial institutes stop financing manufacturing units of AHCM, alternative source of financing can be used for setting up manufacturing units. However, alternative sources of financing are costlier and reduce the profitability of the business.

Thus, stakeholders can be categorized on the basis of the interest and influence that they have across the value chain of the selected products (Table 7).

Figure 3: List of stakeholders categories

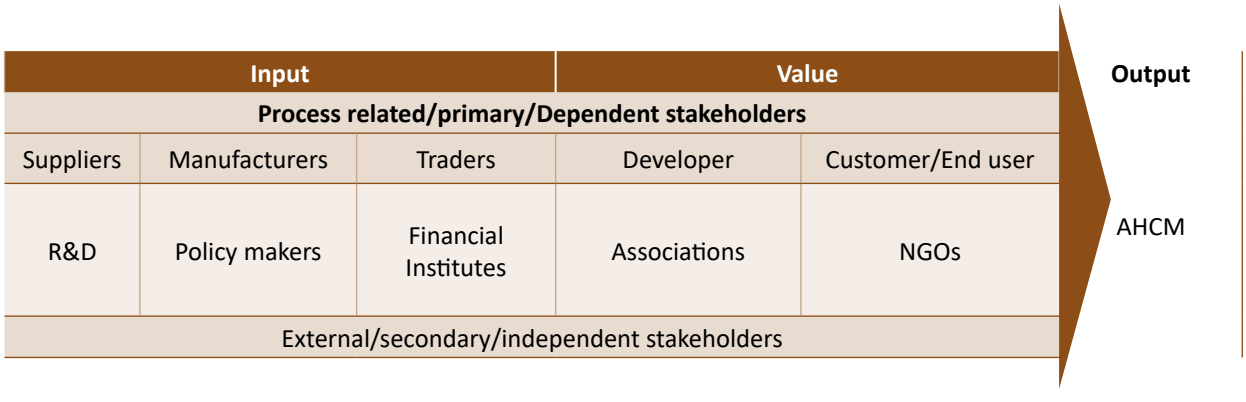


Table 7: Category of stakeholders based on influence and interest

Interest			
Influence		High	Low
	High	Beneficiary, manufacturer, supplier, trader	Implementers, policy makers, financial institutes
	Low	Associations, NGOs	R&D institutes

4.3 Structured Interview Format

Questionnaires have been designed to capture data regarding existing processing units, size of the manufacturing unit, unit economics, existing market segment for each AHCM, requirements for financing manufacturing units, and so on. The questionnaires were tailored specifically to the task/responsibility of the respective stakeholders in the value chain. A secure online platform for survey of respondents approved by UNDP was used. The portal facilitated recording of on-the-spot survey information and generated customised questionnaires relevant to the respondent once the details of the respondents were filled. This information was used to generate analytical reports of the result of the responses as well as identify areas of intervention for the future course of action (see Annexure 3). A snapshot of the interview format is provided in Table 9.

Table 8: Number of stakeholders consulted

Stakeholder	Number of interviews
Suppliers	19
Manufacturers	70
Traders	15
Developer/ Implementer	25
End User	10
R&D	8
Policy Makers	26
Associations	6
Financial Institutes	2
NGOs	5
Total	**186**

Table 9: Snapshot of the stakeholder interview format

Stakeholder		Questions (Illustrative)
Policy makers	• MoRD • State line departments	• Policy interventions • Acceptance of alternative materials • Specific expectations from this study • List of R&D institutes, associations, manufacturers, traders, implementers, NGOs, suppliers and financial institutions
R&D	• Building Material and Technology Promotion Council • Council of Scientific and Industrial Research	• Cost effectiveness of the product • Durability and eco-friendliness • Regulatory issues
Associations	• South Asia Bamboo Foundation • World Bamboo Organization • Bamboo Society of India • Cane and Bamboo Technology Centre Ferro Cement Society	• Potential alternative construction materials • Increase scalability, replicablility • Material with the highest growth potential • Major players - manufacturers, traders, implementers, suppliers
Manufacturers	• Collate list from state line departments - MSME, industries	• Availability of raw materials • Timely completion of projects • Delay due to regulatory approvals • Financing options • Policy interventions required
Traders	• Local developers using AHCM in construction • Local developers using AHCM in construction	• Steps in supply chain • Problems in supply chain • Scarcity of materials • Transportation & logistics • Hurdles in government incentives

Stakeholder		Questions (Illustrative)
Supplier	• Organizations supplying raw material for selected products, such as National Thermal Power Corporation Ltd. for fly ash	• Delay due to regulatory approvals • Steps in supply chain • Problems in supply chain • Transportation & logistics • Hurdles in government incentives
Implementers	• Local developers using AHCM in construction	• Constraints hampering growth • Utilization and growth
NGOs	• Local NGOs	• On-ground scenarios • Hurdles in adoption of AHCM
Financial institutions	• State Gramin Bank	• Criteria for bankability of the project • Past performance and records of borrowers – SHGs, MSMEs, etc., for investing in AHCM • Government support

Box 1: Modifications in shortlist of products for value chain analysis based on field study

Post interaction with the stakeholders in the field, the following modifications have been incorporated in the study:

a. **Stabilized adobe** has been eliminated from the study as during the stakeholder consultation programme it was found that the production of this product has been discontinued.
b. **Bamboo mat corrugated roofing sheet** has been eliminated as the only manufacturer of the product is in Meghalaya and was unwilling to disclose any information with respect to the value chain and the business model of the industry.
c. **Bamboo mat walling panels and bamboo mat flooring** have been clubbed as **'bamboo mat wall and floor boards'** because, in most cases, it was observed that these products are manufactured jointly.
d. **Compressed earth blocks and cement stabilized earth blocks** have been clubbed as the product is known as **Compressed Stabilized Earth Blocks (CSEB)** in the field/market.
e. **Fly ash – sand – lime bricks** has been henceforth termed as **'fly ash bricks'** as, during the study, it was observed that across the six states either **'fly ash – lime – gypsum – sand' and 'fly ash – cement – sand bricks'** are being manufactured based on the low-cost availability of either of the raw materials — cement, gypsum and lime — for respective states during the production period.

Henceforth, in the subsequent sections, we have covered details related to 10[6] products after excluding/clubbing the products mentioned in Box 1.

6 For ferro cement wall panel, the Ferro Cement Society was consulted for the study, and it was brought to the researchers' notice that there were limited contractors who cast in-situ (on site). A list of such contractors is not readily available, due to which the bankable business model and required investment forecast cannot be developed because of lack of availability of information on unit economics through stakeholder interviews or in research journals. Also, CGI sheets have already captured a large market and the investment size required for the product is very high. The investment requirement in CGI is unviable to for SMSE entrepreneurs and SHGs, therefore its demand forecast has not been done.

Product-wise Value Chain Analysis

The value chain and utility of each of the selected AHCM varies significantly. Therefore, it becomes important to study underlying factors across the value chain of each respective product. This chapter presents product-wise manufacturing processes adopted by the manufacturers. Considering that there is already an existing market and demand for traditional materials, a comparative study with respect to costs and benefits between traditional material and AHCM have been illustrated.

Based on the primary survey (see Annexure 4) and secondary research, product-wise business models have been developed which factor in the unit economics, economic and financial feasibility, ease of adoption by SHGs and bankability (see Annexure 5). To derive economic and financial feasibility of a unit until year 2022, forecasting of unit production has been done. In addition to this, product-wise demand projections until the year 2022 have also been done to estimate the scope of market penetration.

5.1 Treated Bamboo

Treated bamboo has been prescribed in typologies of five of the states selected for the study, namely, Assam, Jharkhand, Odisha, Madhya Pradesh and Maharashtra. Untreated bamboo is widely available in many regions across the country making it a viable AHCM. However, currently the number of treatment units is limited.

5.1.1 Value Chain Overview

Stage 1: Raw material requirements

The raw materials required for this AHCM are different types of bamboo *(Bambusa balcooa, Dendrocalamus hamiltonii, Bambusa tulda/Jati, Dendrocalamus strictus)* and treatment chemicals such as borax and boric acid / copper chrome boron (CCB). Most common treatment methods use a mixture of borax and boric acid in a 1:1.5 ratio.

Stage 2: Manufacturing process

Process I: There are multiple technologies for treating bamboo products. These processes are used to remove the sap (which contains sugar and attracts insects) from the bamboo. The easiest method to remove sap is the Boucherie method. In this process, the borax and boric acid solution (1:1.5) is pumped in from one end till the solution comes out of the other end. This takes approximately one hour after which the bamboo poles are kept aside horizontally for drying. However, this method has to be performed on freshly cut bamboo to make the process economical.

Process II: The most widely followed process is the dip diffusion process. In this method, holes are drilled at the internodes of the bamboo using a drill machine. These bamboo poles are then immersed in a tank containing borax and boric acid solution. This tank can be heated to maintain a temperature of 60 degree centigrade (optional). The bamboo poles are left in the tank for a week and then are stacked horizontally for drying. However, this method requires large tanks for immersing the bamboo and longer treatment process.

Process III: The other method involves vacuum pressure impregnation of CCB. In this method, bamboo is drilled at internodes and loaded in the vacuum impregnation machine which is fed with CCB solution and kept for an hour. After the treatment, the bamboo is stacked horizontally for drying. The bamboo treated with this method has a life time of more than 25 years if not exposed to water. A coating of cashew nut shell liquid has to be applied for increasing its life and water resistance. Though this method is faster than other treatments, even for dry bamboo, the investment requirement in the machinery is way higher.

Process IV: One of the most scarcely used methods involves injecting heavy creosote oil between the nodes through holes drilled and closing them with wax or putin. However, the unit cost of treating the bamboo with this method is very high compared to other methods.

Figure 4: Treatment process for bamboo

5.1.2 Key Findings from the Stakeholder Consultation Programme

Manufacturer

- Lack of awareness of the treatment process and benefits of treatment in rural areas;
- Traditionally, the bamboo is treated by keeping it in running water; harvesting is based on the lunar cycle. These products are not as durable as chemically treated bamboos; and
- Burnt clay brick manufacturers have a strong lobby and do not allow the treated bamboo product manufacturers to enter the market.

Box 2: Unique feature that can be adopted from the Nagaland Case Study

The bamboo treatment plant in Dimapur, Nagaland, uses the vacuum impregnation method for treating bamboo. The machinery required for treating bamboo in this method needs higher investment compared to other methods. In this case, Nagaland Bamboo Development Agency has set up the plant and operations have been outsourced to a private operator. Bamboo used for different purposes ranging from construction of villas to woven hats is treated in this unit

Consumer

- There is a perception in some states that the life of treated bamboo is only 10 years as compared to its actual durability of 25-40 years;
- Since the number of treatment plants is are limited, currently manufacturers /users to have the bear the cost of transportation to the treatment facility site, which pushes up to the overall cost of treated bamboo products in the rural housing context;
- Treated bamboo costs more than normal bamboo treated with traditional methods; and
- Untreated bamboo is available for free as well in North Eastern states.

Marketing

- Apart from the company's websites and online marketplaces such as JustDial and Indiamart, existing manufacturers do not engage in any proactive marketing. Most of them partner with the government for initiatives but do not use aggressive marketing.

Wholesalers

- There are no wholesalers who sell treated bamboo across the targeted states.

Developers

- Currently there are no specific developers in rural housing using bamboos across the targeted states.

Policy makers

- Effective promotion of treated bamboo is required else the beneficiaries may end up using untreated bamboo which lacks longevity; and
- There is a need to provide additional incentives for utilization of treated bamboo products for construction.

5.1.3 Business Model

In the suggested model, the manufacturing unit will use the dip diffusion model of treating bamboo. The tank needed for the process would be prepared by digging a trench of the required length and covering it with a trampoline sheet. This substantially reduces the set up cost. This model/ method of treatment is chosen over other methods because of its operational as well as the time window this method provides between harvesting and treating of bamboo. Raw material costs are based on market costs in Maharashtra and Assam.

Figure 5: Bankable business model for a bamboo treatment plant

Set-up Cost

Plant and Machinery	Working Capital for 45 Day Cycle	Marketing Cost for 1 Year	Annual Production	Break-even Point	Internal Rate of Return till 2022	Net Present Value till 2022
INR 20,000	INR 156,000	INR 2,000	2,400 treated poles	0.43 years	13%	INR 11,517

Operation Cost

Raw material	Manufacturing Progress	Marketing	Consumer
Bamboo Cost=INR 2,16,000 pa	**Manufacturing overhead cost** Cost=INR 2,16,000pa	**Advertisements** Cost = INR 2000pa	Wholesaler*
Borax Cost=INR 5,616	**Labour cost** Cost=INR 1,44,000pa		**Transportation within 100 km** Cost = INR 10 per pole
Boric acid Cost=INR 4,032 pa			
Cashewnut shell liquid (CNSL) Cost=INR 7,038 pa			
Direct material Cost = INR 2,32,686 pa ***Cost per running foot = INR 5.7***	**Processing cost** Cost = INR 1,89,800 pa ***Cost per running foot = INR 4.7***	**Marketing cost** Cost = INR 2000 pa	**Transportation** Cost per pole = INR 10

Assumptions

- 2,400 treated poles of 17 feet are sold annually
- Cost of bamboo = INR 90 per 17 foot pole
- Cost of borax = INR 65/kg
- Cost of boric acid =INR 70/kg
- Cost of CNSL =INR 23/liter

- Basic machinery required for treating the poles like drilling machines, tanks for borane solution are repaired/ replaced once in 5 years
- 6 labour at daily wage of INR 200 for 15 days a month for the 4 operational months for handling the 6 batches treated each month
- 1 incharge at a monthly salary of INR 6,000 for 12 months
- An overhead cost of INR 1 per runing foot is considered for all other costs like electricity, maintenance, water, etc.

- Cost of transportation within 100 km is INR 10/pole as per the customers location
- Minimal marketing activities

Value per pole
Cost of running foot = INR 10.4
Selling price excluding transport cost = INR 11.5
(Margin = INR 1.1)

***No need of wholesalers as the model have been designed for local small entrepreneurs and women's self-help qroups to cater to the local community**

5.2 Bamboo Mat Floor and Wall Boards

These boards have been proposed in the typologies of two target states - Assam and Jharkhand - as the raw material is widely available here. When treated bamboo is used, these boards can be used as partition walls.

5.2.1 Value Chain Overview

Stage 1: Raw materials

Raw materials used for bamboo mat floor and wall boards are the sewn bamboo mats and phenol formaldehyde. Bamboo mats are procured from various small villages, traders and SHGs depending on availability. The bamboo used in preparation of the mats is not treated.

Stage 2: Manufacturing process

There are two kinds of bamboo mats used in the production of the two types of boards: face boards and core boards. Face boards are of superior quality and hence the cost is comparatively high. The difference in quality is that there are fewer spaces between flattened bamboo strands in the face boards, while the core boards have a larger spacing. These boards are subjected to phenol formaldehyde resin treatment on each face. Around eight layers of resin are used as coating while preparing the board. The sheets are then allowed to dry and are stacked.

5.2.2 Key Findings from the Stakeholder Consultation Programme

Manufacturer

- Since planned bamboo clusters are not being developed, there is concern that there may be shortage of bamboo;
- A strong lobby of existing traditional product manufacturers exists; and
- The existing market is focussed on building resorts and villas.

Consumer

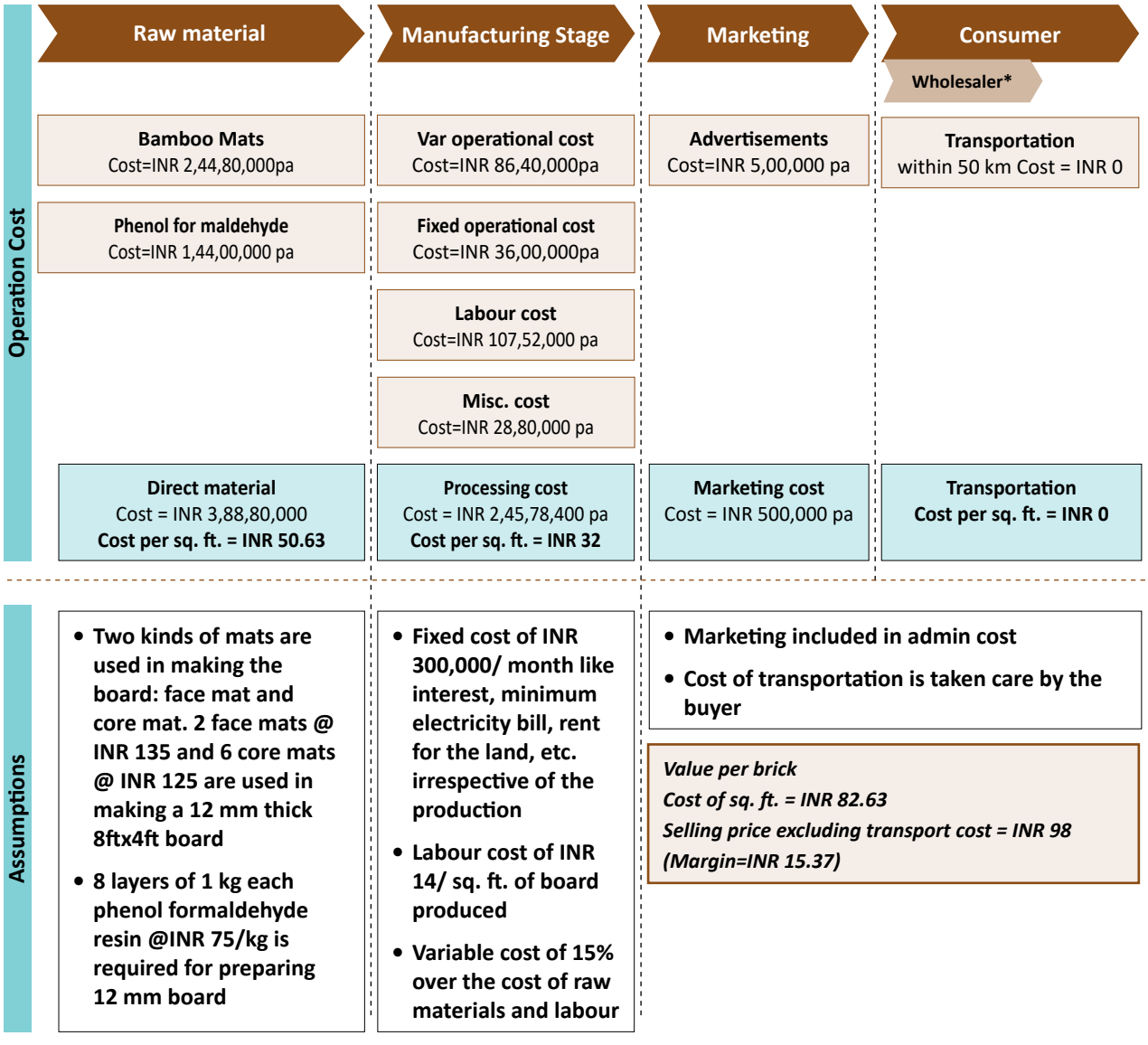
- Bamboo mat floor and wall boards are expensive when compared to the locally available bamboo products; and
- Bamboo is available for free in the North Eastern states.

5.2.3 Business model

This model is based on a case study. The investment in the plant is INR 100 million. The negative net present value (NPV) and lower internal rate of return (IRR) are attributed to the plant running at 40 percent of its optimal capacity. If the plant were to run at 50 percent (a 10 percent of marginal increase) of its optimal capacity,

Figure 6: Bankable business model for bamboo mat floor and wall boards

Set-up Cost			Annual Production	Break-even Point	IRR till 2022	NPV till 2022
Plant and Machinery	Working Capital for 45 Day Cycle	Marketing Cost for 1 Year				
INR 100 million	INR 7,584,000	INR 500,000	7.68 lakh sq. ft.	8.47 years	3%	INR 10.9 million



*No need of wholesalers as the model has been designed for local small entrepreneurs and women's SHGs to cater to the local community.

the NPV and IRR would be 15 percent and INR 3 million, respectively. Though the model has been illustrated in Figure 6, due to the high investment required for the plant set up, it is not viable for SHGs. Raw material costs are based on market cost in Assam.

5.3 Fly Ash Bricks

Fly ash raw material is available in almost all states of the country as most have TTPs. Fly ash bricks are prescribed in the typologies of all target states: Assam, Jharkhand, Odisha, Madhya Pradesh, Maharashtra and Uttar Pradesh.

5.3.1 Value Chain Overview

Stage 1: Raw materials required

Raw materials used in most manufacturing processes include fly ash, cement or limestone, gypsum and sand

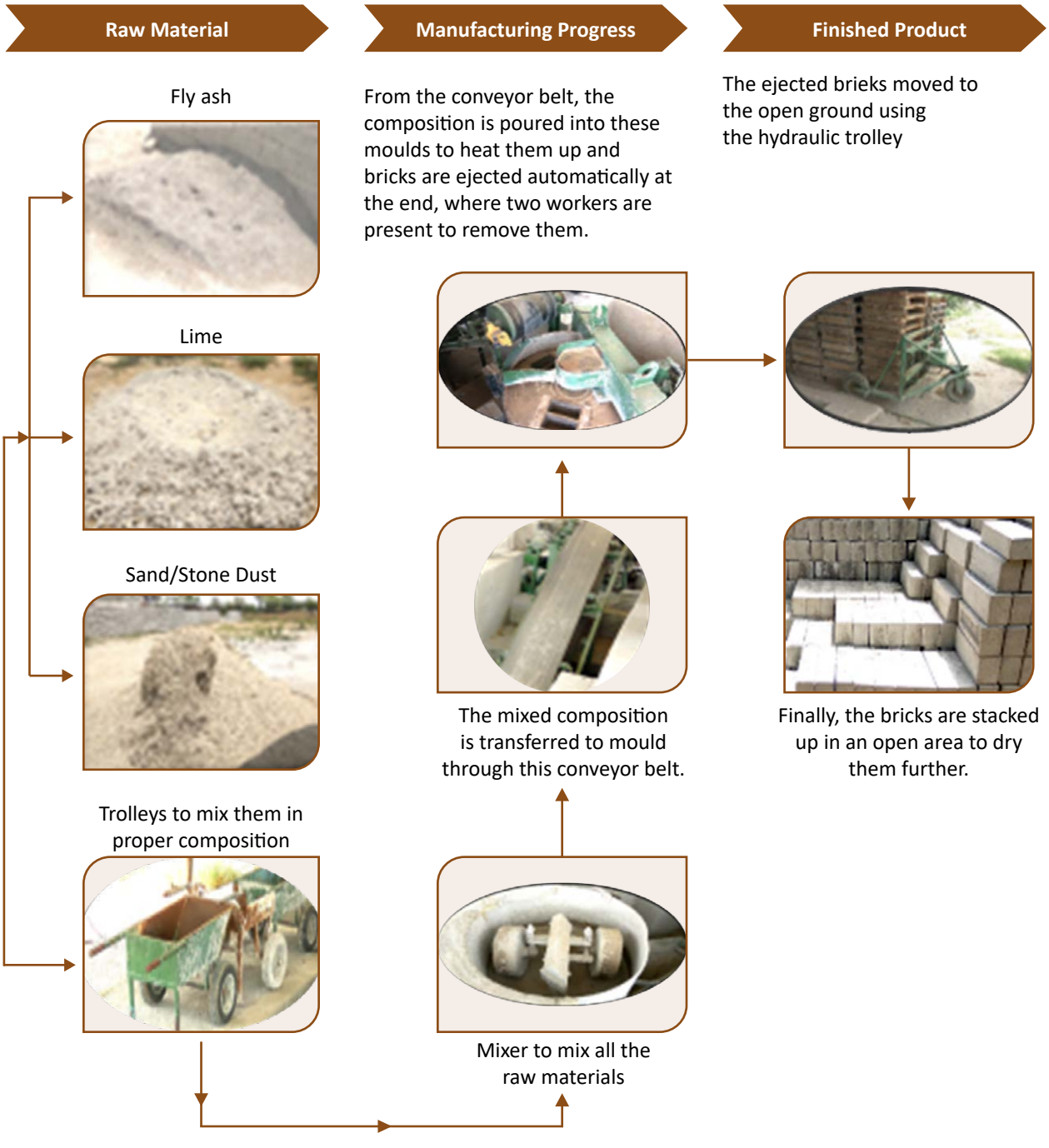
or crusher dust. Class 'F' fly ash is used as filler and class 'C' fly ash is used as bonding material in conjunction with lime and gypsum mix or cement. Fly ash can be procured from the local TPP as well as steel companies or industries where large amounts of coal are used as fuel.

Stage 2: Manufacturing process

The manufacturing process includes preparation of the mix, compression of the bricks in the machine and curing. The differences in various manufacturing processes exist at the preparation of the mix stage. For fly ash to start bonding, activation with lime is required. This is achieved by mixing of lime and gypsum or cement. The strength of the bricks depends on the percentage of cementitious material produced from the reaction of fly ash with lime.

The ratios of various raw materials are determined as per the requirement of the manufacturer and the mix is then pulverised in the mixer machine. This mix is fed into the brick press machine which compresses the mix in the given mould shape and ejects the bricks which are stacked and left for curing for a period of seven to 21 days depending on the chemicals added, if any, during the mixing to reduce water or strengthen faster.

Figure 7: Manufacturing process for fly ash bricks



5.3.2 Key Findings from the Stakeholder Consultation Programme

Manufacturer

- The main issue faced by the consumer is the long lead time of around six days for fly ash bricks as compared to burnt clay bricks which take just two days for delivery after the order is placed. Most manufacturers start making the bricks once the order is placed which leads to delay of six days required for curing;
- MSMEs that manufacture fly ash bricks are not provided with any additional support, facilities or loans by the government or banks;
- Fly ash bricks do not have visibility and due to lack of awareness are used only by the large construction industry. According to the manufacturers, the government should promote the product through various channels; and
- Lastly, the Gazette notification *(REGD. NO. D. L.-33004/99 dated 14 September 1999 as amended on 25 January 2016)* states that TPP must bear the cost of transportation of fly ash within a radius of 100 kilometre for any fly ash product manufacturing. However, in reality, the fly ash brick manufacturer pays for the transportation as well as a facilitation fee to the TPP employees for processing the request for fly ash quickly.

Box 3: Unique feature from Odisha case study

The fly ash brick manufacturing unit in Bhubaneshwar, Odisha, uses cement in the manufacturing process. Cement companies sell the cement at a non-trading price of INR 205 per bag to this plant because of the assured continuous demand. The requirement for this non-trading price is the registration certificate of the company and assurance that the cement is not resold at a higher price.

Box 4: Unique feature that can be adopted from the Jharkhand case study

The manufacturer has partnered with the transport companies/ truck drivers for transporting fly ash from TPP at a very low price on their (truck) way back after delivering coal to TPP. This reduces the overall material transportation cost.

Consumer

- The cost (Including manufacturing cost, transportation cost and taxes) of a fly ash brick is around INR 4 which is more than that of a burnt clay brick that comes for INR 3 (in a few states);
- Due to the unavailability of wholesalers in this category, the product has to be purchased by the end-user directly; and
- The benefits of using fly ash bricks such as smoother walls, less mortar to be used, etc., are not widely known.

Marketing

- In the current scenario, active marketing by the manufacturers is not widely practiced. Most manufacturers use their personal network to promote the sale of the product. The other channel that is widely used is online marketplaces such as Indiamart and JustDial. Some manufacturers use other channels such as marketing in fairs, etc.

Wholesaler

- In the market, the role of a wholesaler is minimal. Manufacturers sell the bricks directly to consumers. This reduces the overall price of the bricks but limits their reach due to the minimum quantity requirements during production.

Developer

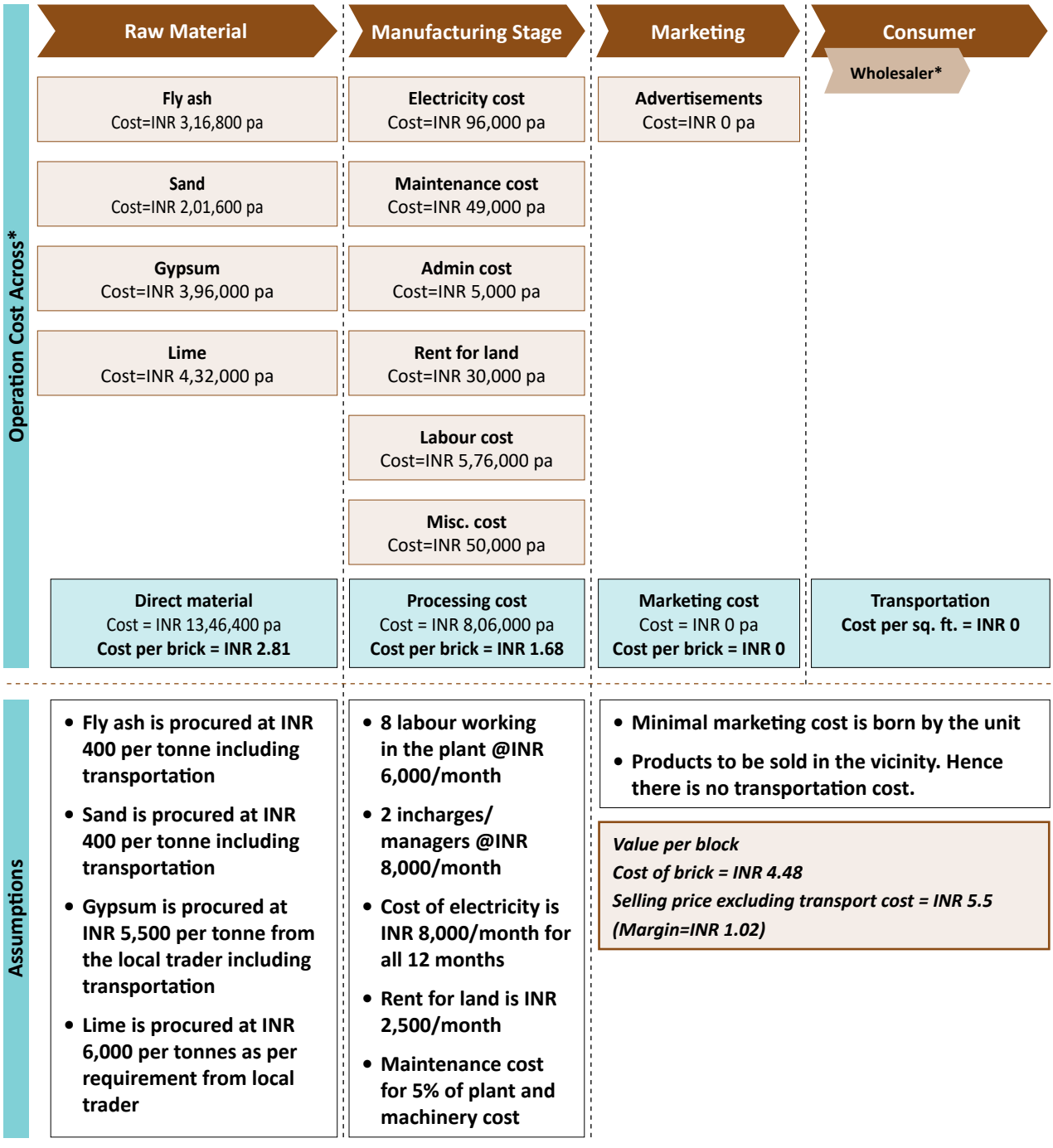
- Due to the smooth finish of the fly ash brick, the composition of the mortar has to be appropriately developed to meet the requirements of the bricks; and
- At present, the usage of the fly ash bricks is prevalent in the private developers' circle due to the overall cost savings. Since the scale of the projects is large, approximately 15-20 percent of the cost is reduced due to the usage of fly ash bricks through savings on plaster. Putty can be directly applied on the wall without plastering when fly ash bricks are used.

5.3.3 Business Model

In the suggested model, the plant uses a semi-automatic machine for efficiency and substantially low investment. If the government provided support to SHGs/ manufacturers by permitting them to set up the plants near existing transformers, set up cost would be reduced by almost 50 percent and IRR and NPV would be 24 percent and INR 424,000, respectively, with a break-even period of 1.3 years. Raw material costs are based on the Jharkhand market cost.

Figure 8: Bankable business model for fly ash bricks

Set-up Cost			Annual Production	Break-even Point	IRR till 2022	NPV till 2022
Plant and Machinery	Working Capital for 45 Day Cycle	Marketing Cost for 1 Year				
INR 1,343,000	INR 393,000	INR 26,860	480,000 Bricks	2.8 years	1%	800,000



*No need of wholesalers as the model has been designed for local small entrepreneurs and women's SHGs to cater to the local community.

5.4 Precast Hollow Concrete Block

These blocks, made out of concrete, reduce the weight of the building as well as its overall dead weight. Hence, in places where cement and sand are available, these blocks would be a cheaper option. Among the target states, the typologies prescribe usage of precast hollow concrete blocks in Assam only but they can be easily manufactured wherever concrete is easily available.

5.4.1 Value Chain Overview

Stage 1: Raw materials required

Raw materials used in the production of these blocks are same as those needed in preparing cement concrete and include cement, sand and stone chips or coarse aggregates.

Stage 2: Manufacturing process

Depending on the required strength, permeability, durability, etc., of the blocks, the concrete mix is prepared with varied proportions of cement, sand and aggregates. The raw materials are mixed in determined proportions in the concrete mixer along with the appropriate amount of water and poured into moulds and left for curing. Blocks should be water cured or steam cured. These blocks are then stacked for storage and sale.

Figure 9: Manufacturing process for precast hollow blocks

5.4.2 Key Findings from the Stakeholder Consultation Programme

Manufacturer

- There is a lack of awareness among the rural population about the product and overall savings that can be achieved by using it; and
- At present, private developers use these blocks for making compound walls.

Consumer

- Though the individual cost of the material is higher than that of traditional materials, the overall cost of construction is lower than that with traditional materials, as the quantity of mortar required is much less; and
- Better thermal resistance due to air pockets inside the block.

Market

- The current market for this product is the private developers who use it in compound walls for the construction site or project.

Wholesaler

- In the existing market, there are no wholesalers for the product; customers buy directly from the manufacturing units.

Developers

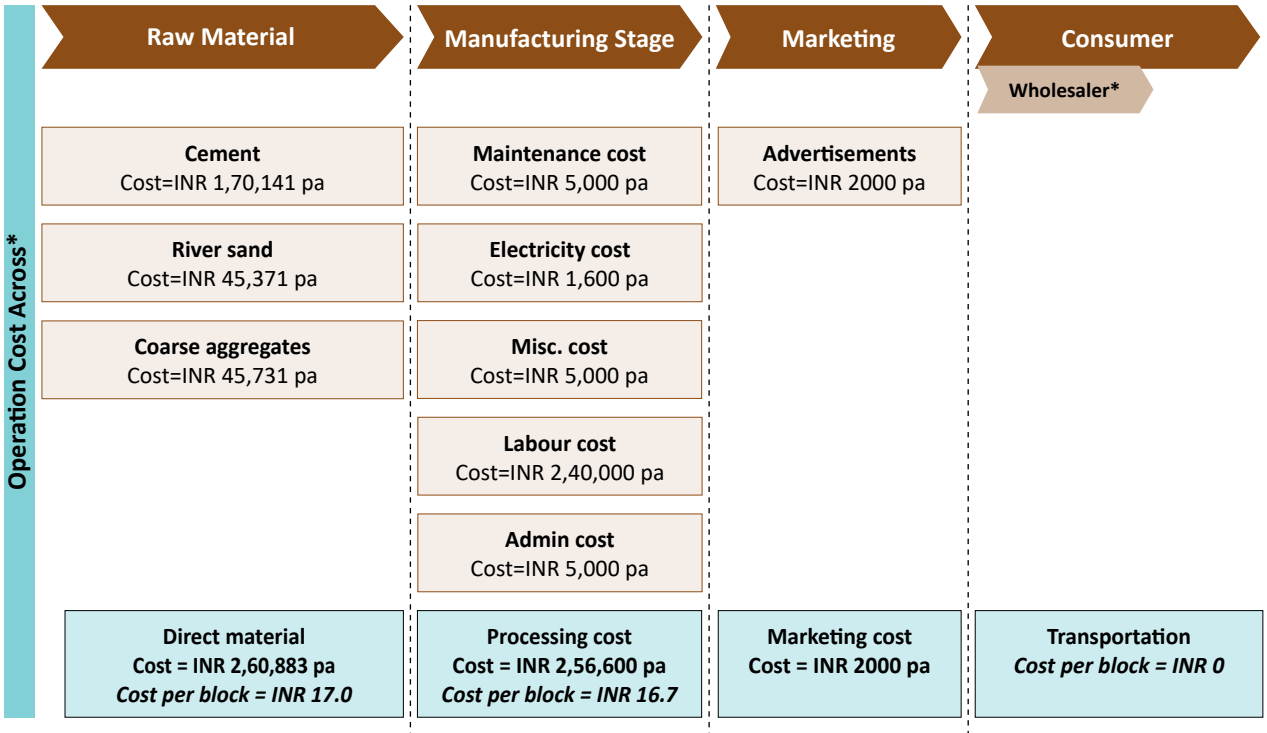
- The overall cost of making the wall decreases when these blocks are used in construction;
- Lighter in weight compared to an equivalent number of burnt clay bricks, they lower the dead load of the building; and
- Sometimes, these blocks are made at construction sites themselves for use in the compound walls.

5.4.3 Business Model

There are two kinds of models that have been designed; one uses a labour-intensive manual mixer and the other uses an electric mixer which is less labour-intensive but has higher productivity. The electric mixer model is preferred because of its higher productivity though it slightly higher investment. Since the products are assumed to be produced in remote locations and on less productive set up, the cost of each block increases substantially compared to the market price because raw material cost depends on availability, access, cost of transportation, etc. The negative NPV and lower IRR are attributable to a higher cost of raw materials and lower margins. If cement alone could be procured at the market rate of INR 330 per bag as opposed to INR 400 used in the model, the NPV and IRR would increase to INR 85,379 and 31 percent for the manual mixer model and INR 10,929 and 14 percent for the electric mixer model, respectively. Raw material costs are based on the market cost in Odisha and Jharkhand.

Figure 10: Bankable business model for precast hollow concrete blocks using a manual mixer

Set-up Cost			Annual Production	Break-even Point	IRR till 2022	NPV till 2022
Plant and Machinery	Working Capital for 45 Day Cycle	Marketing Cost for 1 Year				
INR 73,000	INR 95,153	INR 2,000**	15,360 blocks	1.10 years	13%	INR 8,051



Assumptions

- **Cost of cement per bag (50 kg)= INR 360 which is inclusive of transportation cost**
- **Cost of river sand per m^3 = INR 400**
- **Cost of coarse aggregate per m^3 = INR 400**

- **Annual maintenance cost of approximately 5,000 if machine is used regulary and in the prescribed manner**
- **Labour of 1.5 person days for operating the machine @INR 250 per day and 2.5 person days for plant operations @ INR 200 per day**
- **1 supervisor @INR 6,000 per month**
- **Electricity required for nominal operation of the plant like lights, etc. @INR 200 per month**

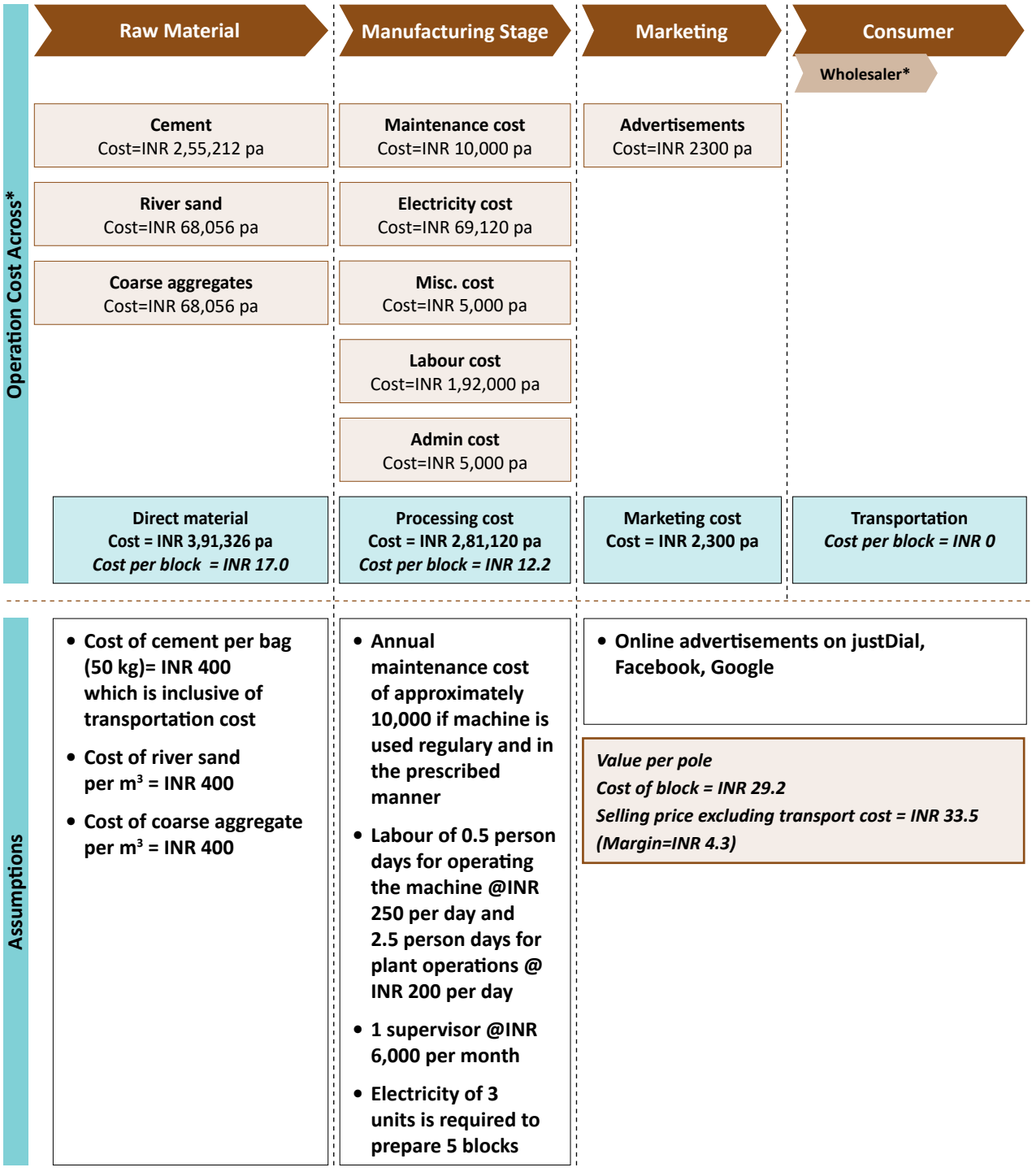
- **Online advertisements on JustDial, Facebook, Google**

Value per pole
Cost of block = INR 33.7
Selling price excluding transport cost = INR 38
(Margin=INR 4.3)

*No need of wholesalers as the model has been designed for local small entrepreneurs and women's SHGs to cater to the local community.

Figure 11: Bankable business model for precast hollow concrete blocks using an electric mixer

Set-up Cost			Annual Production	Break-even Point	IRR till 2022	NPV till 2022
Plant and Machinery	Working Capital for 45 Day Cycle	Marketing Cost for 1 Year				
INR 115,000	INR 124,000	INR 2,300	23,040 blocks	1.16 years	15%	INR 36,385



*No need of wholesalers as the model has been designed for local small entrepreneurs and women's SHGs to cater to the local community.

5.5 Compressed Stabilized Earth Blocks

When prepared on site with locally available soil, CSEBs would be significantly cheaper due to the absence of transportation cost. This AHCM can be produced in all the six target states.

5.5.1 Value Chain Overview

Stage 1: Raw materials required

Raw materials used in the manufacturing process are soil, stone dust and cement. Only soils with clay content can be used in the manufacturing process. Cement can be procured from the local market.

Stage 2: Manufacturing process

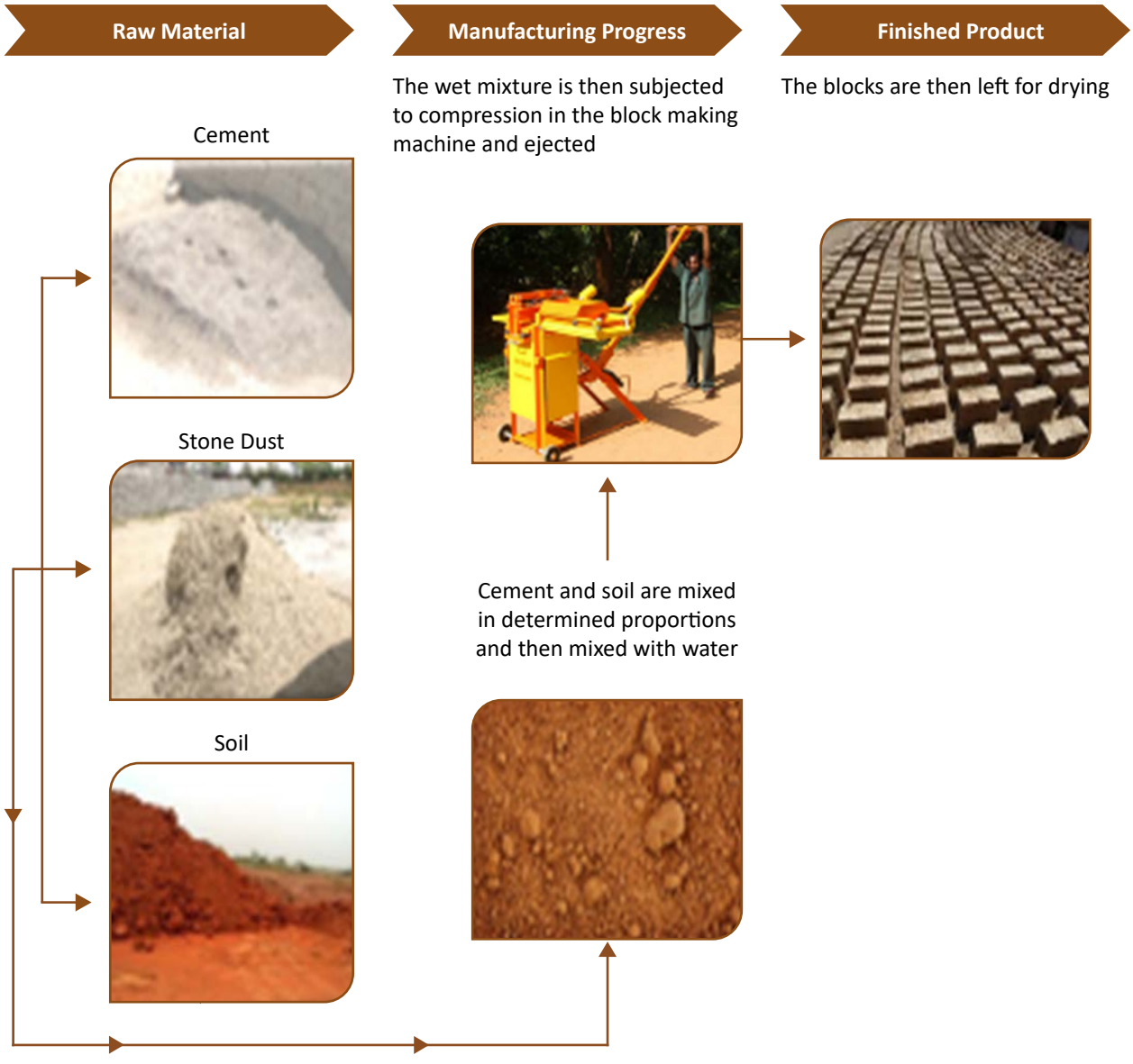
Cement, soil and stone dust are mixed in the predetermined proportions depending on the characteristics of the soil along with water. This mixture is subjected to compression to prepare blocks. These blocks are then ejected and stacked for drying.

5.5.2 Key Findings from the Stakeholder Consultation Programme

Market

- At present, most contractors manufacture this product on site where clayey soil is excavated for

Figure 10: Manufacturing process for CSEBs



foundations because this reduces the transportation cost of raw material and finished product; and

- In most cases, it was found that there are dealers and wholesalers in the chain before the product reaches the consumer. This leads to additional respective margins stakeholders in the value chain and so the cost of construction becomes high using CSEB.

5.5.3 Business Model

The proposed model has to be set up in regions where sufficient quantities of clayey soil are available. If the soil is available in the region, the cost of processing is low which leads to a lower selling price of the blocks.

5.6 Micro Concrete Roofing Tiles

Among the target state, MCR tiles have been proposed in Odisha and Uttar Pradesh by typologies. If the tiles are manufactured locally, the cost will be significantly lower compared to traditional Mangalore tiles.

Figure 13: Bankable business model for CSEBs

Set-up Cost			Annual Production	Break-even Point	IRR till 2022	NPV till 2022
Plant and Machinery	Working Capital for 45 Day Cycle	Marketing Cost for 1 Year				
INR 280,000	INR 282,000	INR 5,600	84,000 blocks	1.00 years	17%	INR 130,000

Operation Cost Across*	Raw Material	Manufacturing Stage	Marketing	Consumer
				Wholesaler*
	Cement Cost=INR 3,62,880 pa	**Maintenance cost** Cost=INR 10,000 pa	**Advertisements** Cost=INR 5,600 pa	**Transportation within 50 km** As per distance
	Stone dust Cost=INR 40,320 pa	**Misc cost** Cost=INR 10,000 pa		
	Soil Cost=INR 3,02,400 pa	**Labour cost** Cost=INR 5,04,000 pa		
	Lime Cost=INR 12,096 pa	**Admin cost** Cost=INR 5,000 pa		
	Direct material **Cost = INR 7,17,696 pa** ***Cost per block = INR 8.54***	**Processing cost** **Cost = INR 7,66,200 pa** ***Cost per block = INR 9.12***	**Marketing cost** **Cost = INR 5,600 pa**	**Transportation** ***Cost per block = INR 0***

Assumptions			
	• Every 1,000 tiles use • 12 CUM of soil @INR 300 per CUM • 1.2 CUM of sand/cluster dust @INR 400 per CUM • 12 kg of lime @INR 12 per kg	• 9 workers working with soil @INR 200 per day • 4 workers working on machine @INR 300 per day • 1 plant incharge @ INR 8,000 monthly salary	• Minimal marketing cost born by the unit due to location • Transportation is taken care by the buyers/ customers ***Value per block*** ***Cost of block = INR 17.67*** ***Selling price excluding transport cost = INR 21*** ***(Margin=INR 3.33)***

*No need of wholesalers as the model has been designed for local small entrepreneurs and women's SHGs to cater to the local community.

5.6.1 Value Chain Overview

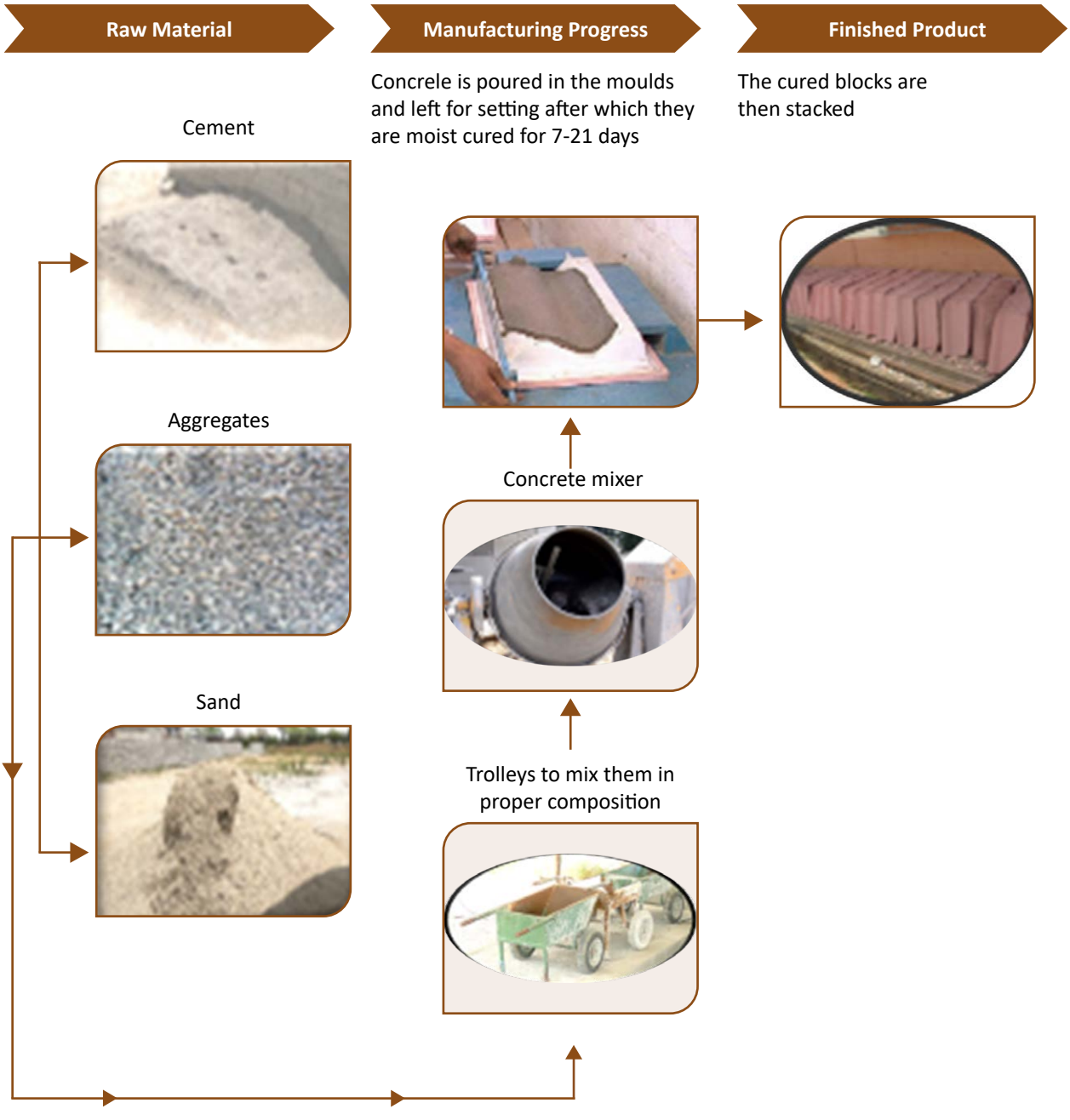
Stage 1: Raw materials required

Raw materials used in the manufacturing process are cement and sand. These materials are procured from the local market.

Stage 2: Manufacturing process

Moulds for making the tiles are sufficiently lubricated before use in the manufacturing process. The cement and sand are mixed in the concrete mixer and poured in moulds. The concrete is compacted using the vibrator machine and the moulds are allowed to set. The tiles are stacked vertically for curing after a day and are subjected to either steam curing or water curing for seven to 21 days depending on the requirement.

Figure 14: Manufacturing process for micro concrete roofing tiles



5.6.2 Key Findings from the Stakeholder Consultation Programme

Market

- There is a strong lobby of burnt clay tile manufacturers against MCR tiles, making market entry difficult;
- Strong promotion and skill development support is required from the government; and
- Knowledge and skills are not readily available for the production of tiles.

End User

- This AHCM has an advantage over traditional products in terms of cost, quality and consistent properties such as thermal conductivity.

Figure 15: Bankable business model for MCR tiles

Set-up Cost			Annual Production	Break-even Point	IRR till 2022	NPV till 2022
Plant and Machinery	Working Capital for 45 Day Cycle	Marketing Cost for 1 Year				
INR 257,000	INR 70,645	INR 4,640	60,000 tiles	1.51 years	16%	INR 67,056

Raw Material	Manufacturing Stage	Marketing	Consumer
			Wholesaler*
Cement Cost=INR 2,28,960 pa	**Maintenance cost** Cost=INR 5,000 pa	**Advertisement** Cost=INR 4,640 pa	**Transportation within 50 km** As per distance
Steel Cost=INR 14,400 pa	**Labour cost** Cost=INR 2,40,000 pa		
Stone chips Cost=INR 28,800 pa	**Electricity cost** Cost=INR 30,000 pa		
Lime Cost=INR 12,096 pa	**Admin cost** Cost=INR 5,000 pa		
	Rent for land Cost=INR 18,000 pa		
	Misc. cost Cost=INR 10,000 pa		
Direct material **Cost = INR 2,72,160 pa** ***Cost per tile = INR 4.54***	**Processing cost** **Cost = INR 3,08,000 pa** ***Cost per tile = INR 5.13***	**Marketing cost** **Cost = INR 4,640 pa**	**Transportation** **Cost per tile = INR 0**

Operation Cost Across*

Assumptions

- Ratio of cement, sand and stone chips is 1:1:2
- Cost of cement is INR 360/ bag
- Cost of sand and aggregates INR 4,000/truck
- Vibrating tables and moulds are used in the production process

- 1 machine operator/ skilled labour @INR 8,000 per month and 2 unskilled labour @ INR 6,000 per month
- Electricity cost of INR 2,500 per month
- Land rent of INR 1,500 per month
- Admin and misc. costs of INR 5,000 and 10,000 respectively

- Minimal marketing cost born by the unit as it is located in rural area
- Transportation is taken care of by the buyers/ customers

Value per tlie
Cost of tile = INR 9.67
Selling price excluding transport cost = INR 12.5 (Margin =INR 2.83)

*No need of wholesalers as the model has been designed for local small entrepreneurs and women's SHG to cater to the local community.

5.6.3 Business Model

The proposed model requires the manufacturing unit to operate two vibrating machines to produce 5,000 tiles per month. Alternate products such as paver blocks could be produced using the same machinery with investment in additional moulds. Raw material costs are based on the market cost in Jharkhand and Madhya Pradesh.

5.7 Ferro Cement Door and Window Frames

With increasing scarcity of good quality timber and growing environmental concerns, ferro cement frames are gaining in prominence. Among the target states, typologies prescribe this AHCM apply to Assam, Odisha, Madhya Pradesh, Maharashtra and Uttar Pradesh.

5.7.1 Value Chain Overview

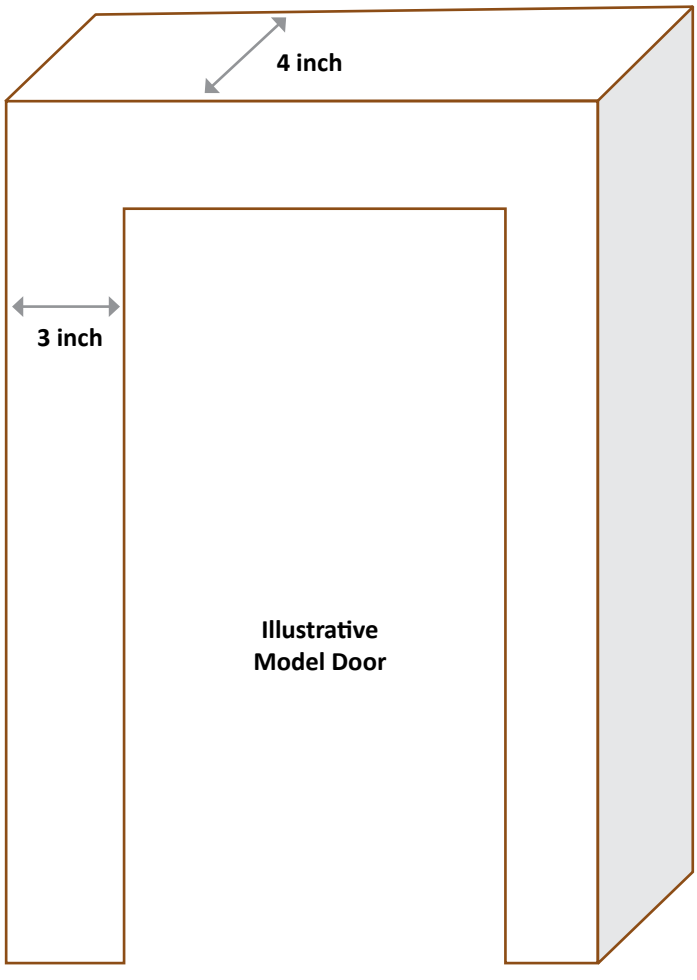
Stage 1: Raw materials required

The raw materials used in the production of these frames are cement, sand, stone chips and galvanized iron (GI) mesh. These are readily available in any construction materials market.

Stage 2: Manufacturing process

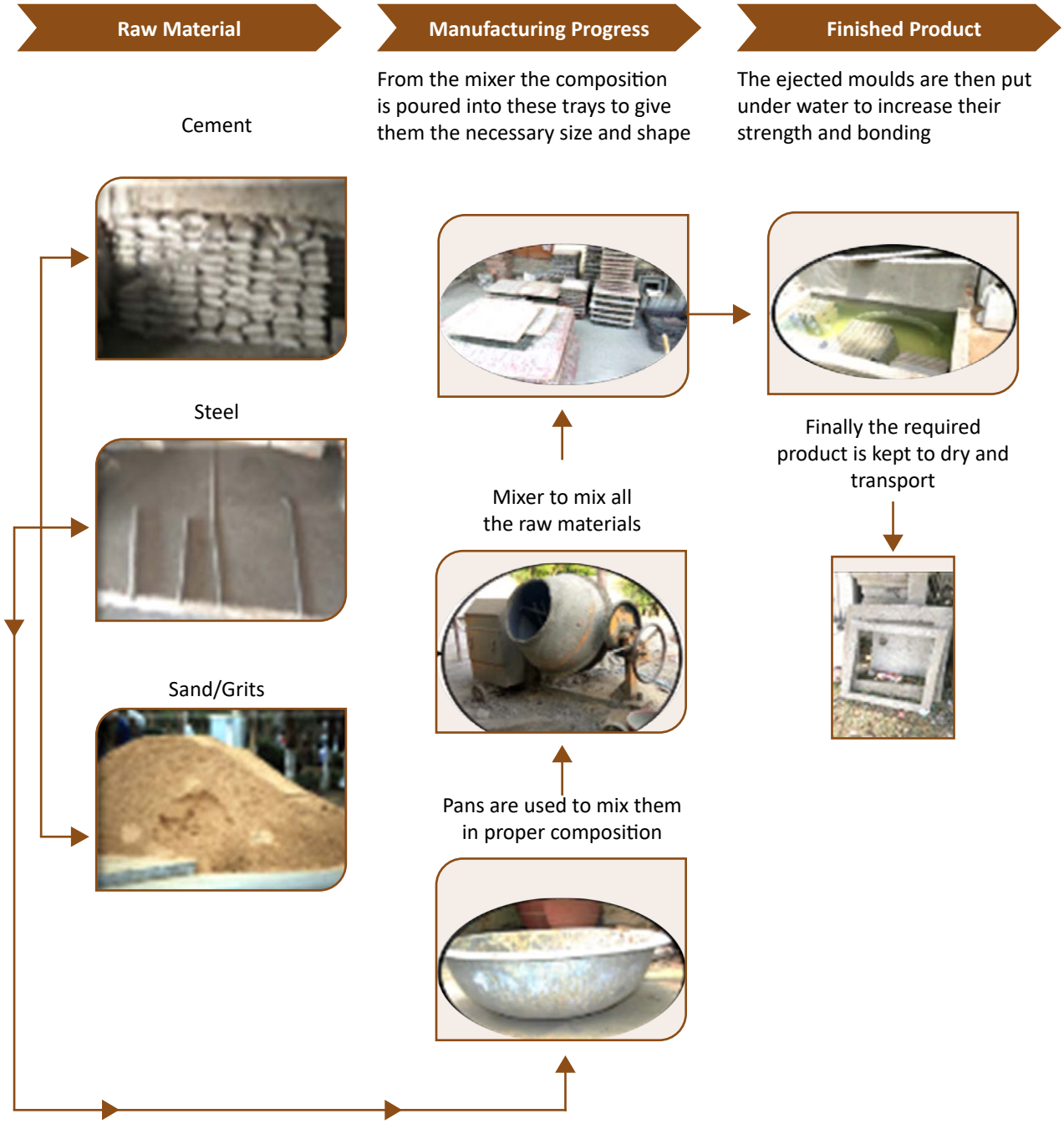
Pre-determined composition of the raw materials for preparing concrete are mixed in the mixer. The GI mesh is then placed in the mould and set in place. Once the mesh is prepared, the concrete is poured into the moulds with the mesh and allowed to set. After the concrete sets, the frames are stacked and left for curing.

Figure16: Illustrative model door



Note: The four steel reinforcements are of different sizes and strengths. From left, they are 8 millimetre, 5 millimetre, 16 gauge hard steel, 12 gauge hard steel.

Figure17: Manufacturing process of ferro cement door and window frames



5.7.2 Key Findings from the Stakeholder Consultation Programme

Market

The market for this product has recently been growing steadily through a network of dealers and direct sale at the plants. A major part of the sale for the small manufacturers happens at the plant directly to the customers whereas, for the large plants, it is through a network of dealers.

Wholesaler

Wholesalers have a higher profit margin (30 percent) compared to manufacturers (5-7 percent).

Policy Makers

Wooden frames lead to cutting of trees which ultimately results in deforestation and stone frames are procured from stone blasting, which is not eco-friendly. Hence ferro cement door and window frames can be promoted as eco-friendly products.

5.7.3 Business Model

In the proposed model, a total of 400 doors and 400 window frames are produced every year. This plant can be used to build other cement precast products such as precast concrete columns and rings. Raw material costs are based on market costs in Odisha.

Figure 18: Bankable business model for ferro cement door and window frames

Set-up Cost			Annual Production	Break-even Point	IRR till 2022	NPV till 2022
Plant and Machinery	Working Capital for 45 Day Cycle	Marketing Cost for 1 Year				
INR 250,000	INR 122,000	INR 5,000	400 units	1.40 years	17%	INR 80,911

	Raw material	Manufacturing Stage	Marketing	Consumer
Operation Cost Across*				Wholesaler*
	Cement Cost=INR 1,46,865 pa	**Direct labour cost** Cost=INR 1,53,600 pa	**Advertisement** Cost=INR 0 pa	**Transportation within 50 km** As per distance
	Steel Cost=INR 1,92,000 pa	**Maintenance cost** Cost=INR 35,518 pa		
	Grit Cost=INR 8,159 pa	**Misc cost** Cost=INR 5,000 pa		
	Sand Cost=INR 8,159 pa	**Indirect labour cost** Cost=INR 72,000 pa		
		Electricity cost Cost=INR 36,000 pa		
		Admin cost Cost=INR 2,000 pa		
	Direct material Cost = INR 3,55,184 pa Cost per frame = INR 26.1 per ft.	**Processing cost** Cost = INR 3,04,118 pa Cost per frame = INR 22.4 per ft.	**Marketing price** Cost = INR 5,000	**Transportation** Cost per frame = INR 0

Assumptions

- Composition of the grit, cement and sand is in the ratio of 1:1:1, which is for the M30 strength
- Cost of cement per bag (50kg) = INR 360
- Cost of sand per tonne = INR 400
- Cost of grit per tonne = INR 400
- Cost of steel (reinforcement bars and chicken mesh) = 47/ kg
- The plant runs for 8 months in an year, with 4 months' seasonal halt

- Direct labour involves 6 workers directly working to produce the doors at INR 200/day
- Indirect labour involves 1 managers at INR 6,000/month.
- Electricity cost is INR 3,000/month throughout the year
- Water is sourced from borewell located on site
- Maintenance cost is the cost to repair slabs and safeguarding the plant at 10% the material used
- Miscellaneous cost in INR 5,000 pa

- Minimal marketing cost as it is rural based
- For wholesalers, the manufacturer only get around 5-6% profit margin after taxes and negotiations
- To consumers, the wholesaler sells at 30-35% profit margin

Value of frame per foot
Cost per foot of frame = 48.5/ft.
Selling price to customer = INR 61.6/ft. (Margin = INR 13.1/ft)

*No need of wholesalers as the model has been designed for local small entrepreneurs and women's SHGs to cater to the local community.

5.8 Ferro Cement Wall Panel

The product has been designed to use the tensile strength of steel reinforcement effectively and therefore has great strength and is light in weight. This material also significantly reduces the cost of construction by minimizing the dead weight on the foundation and columns. Among typologies, this product has been prescribed in Assam.

5.8.1 Value Chain Overview

Stage 1: Raw materials required

For manufacturing ferro cement wall panels, raw materials required include cement, sand, 6 millimetre steel reinforcement and chicken mesh. All raw materials can be procured from the local construction material market.

Stage 2: Manufacturing process

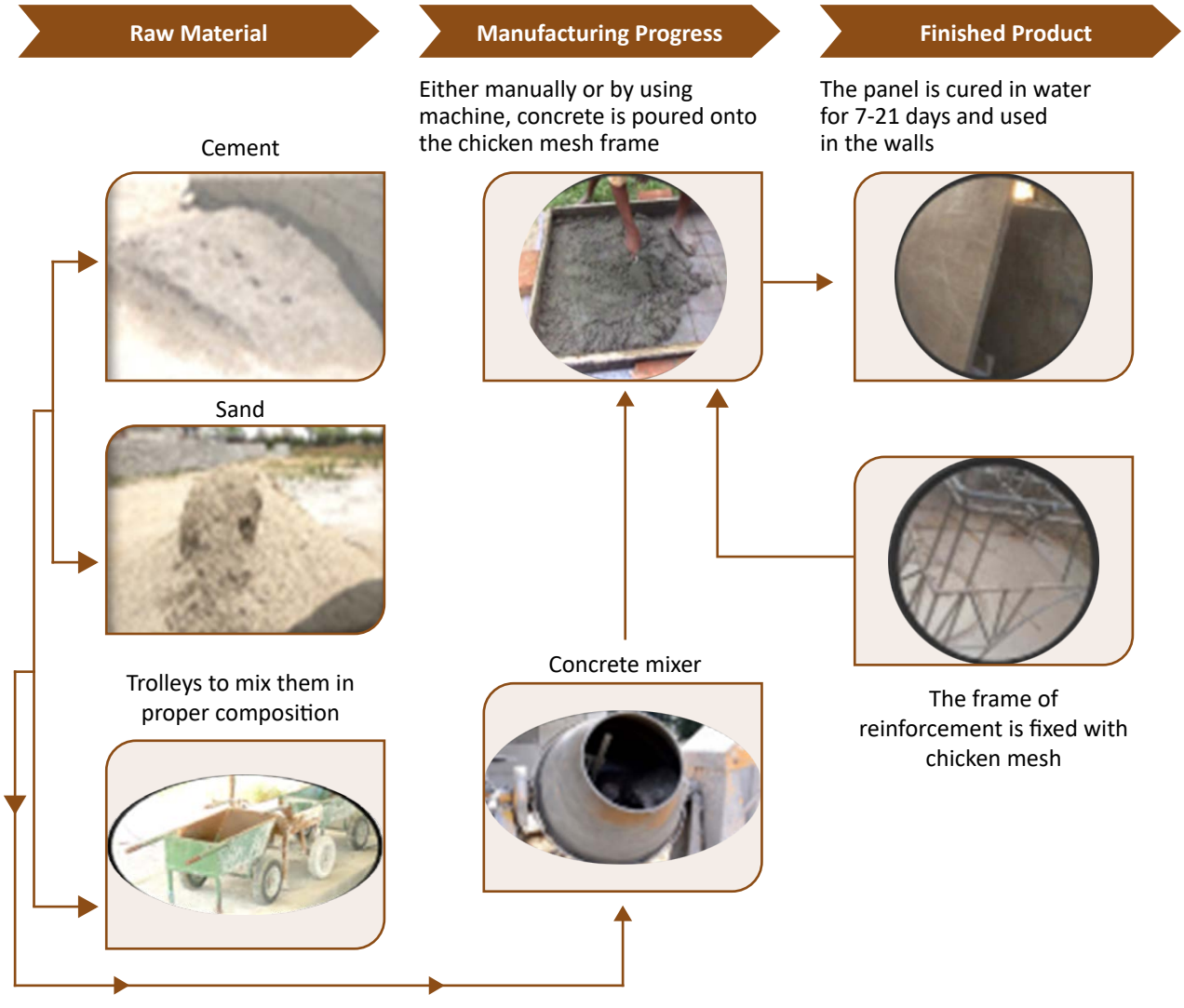
The steel reinforcement is prepared in the required shape and then the chicken mesh is fit on the reinforcement bars. Cement and sand are mixed in the cement concrete mixer. The mortar is then either pumped on to the frame or manually applied. This is then cured using water for a period of 21 days. Factory made panels are subjected to steam curing for seven days to maximize strength. These panels are then transported to the construction site for installation.

5.8.2 Key Findings from the Stakeholder Consultation Programme

Manufacturer

- For offsite (factory/plant) manufacturing of products there is a need for good transportation infrastructure

Figure 19: Manufacturing process of ferro cement wall panel



from the plant to the construction site and there is a need for heavy machinery to handle the product on site. Furthermore, there is requirement of highly skilled workers to operate machines;

- In case of cast in-situ (prepared directly on site) manufacturing, there is a need for skilled workers for construction and preparation of the wall panel, which eliminates the requirement of heavy machinery; and
- The time required for construction is lower than in traditional methods.

Consumer

- The cost of the ferro cement wall at face value is higher than that of a traditional brick wall; and
- There is a misconception about the strength of panels since they are thinner than a traditional brick wall, which is one of the major barriers in adoption of this AHCM.

5.9 Ferro Cement Roofing Channel

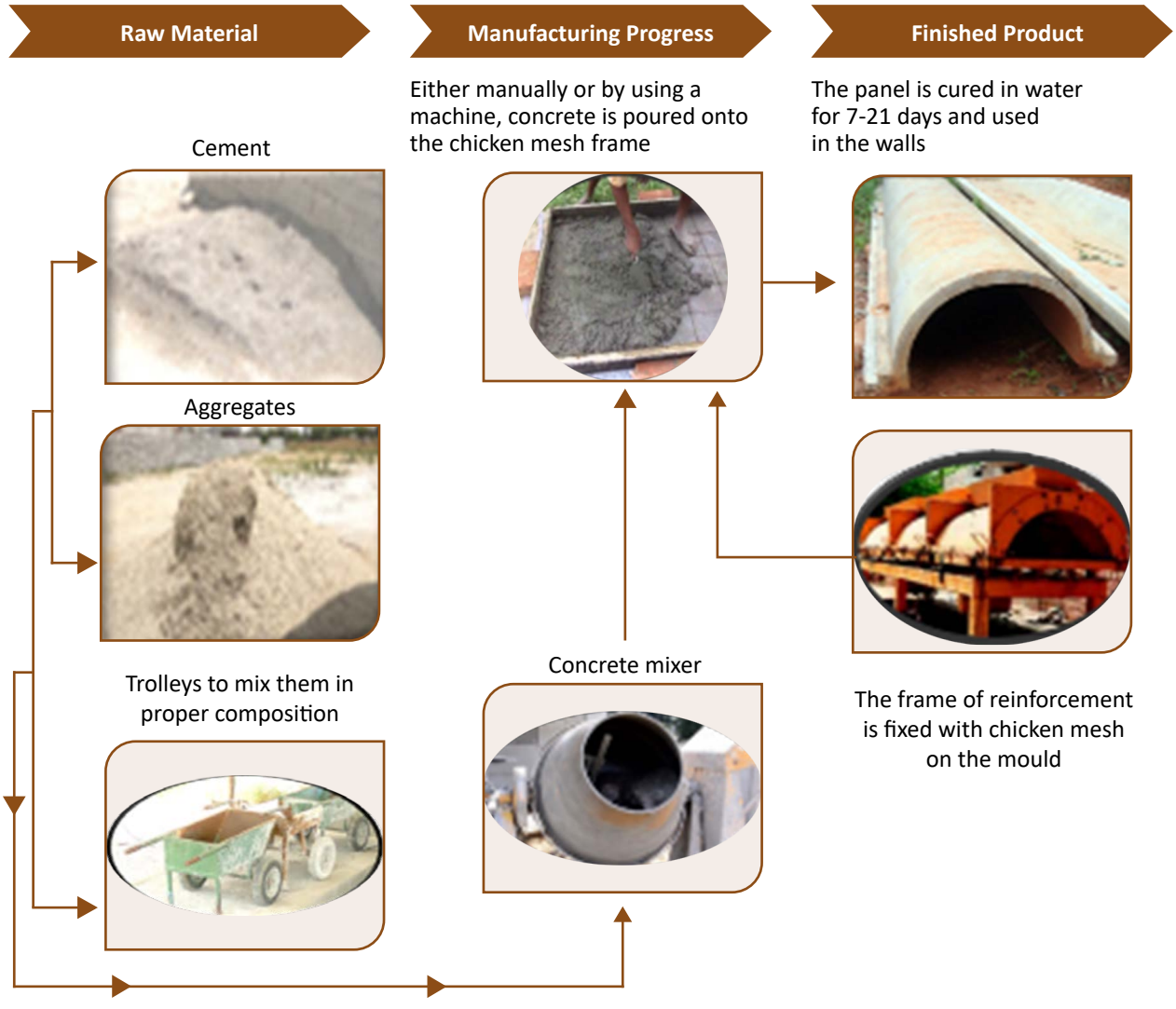
This product uses minimal materials compared to traditional RCC roofing and costs substantially less. Among the six states, this product is prescribed in the typologies of two states: Odisha and Uttar Pradesh.

5.9.1 Value Chain Overview

Stage 1: Raw materials required

Raw materials used in the production process are cement, sand, steel reinforcement and chicken mesh. These materials can be procured from the local market.

Figure 20: Manufacturing process of ferro cement roofing channel



Stage 2: Manufacturing process

The cement concrete is prepared by using cement and sand in the required proportions. The reinforcement and chicken mesh are laid on the mould as per design. The concrete is then poured into the mould and compacted using a vibrating machine or manually applied on to the mould. The concrete is allowed to set for a day and the channels are then allowed to cure either by steam curing or by water.

5.9.2 Key Findings from the Stakeholder Consultation Programmes

Market

Lack of awareness about the technology at the user end leads to an absence of demand resulting in manufacturers not producing the product.

5.9.3 Business Model

The proposed model produces larger quantities of ferro cement roofing channels. The profitability of this model is dependent on the quantity of sale of the product. Raw material costs are based on the market costs in Odisha.

5.10 CGI Sheets

Due to the popularity of the product, high supply and awareness levels, the product has reached remote areas, resulting in multiple dealers and retailers selling it; CGI sheets are readily available across India. Among the target states, this material is proposed in the typology of four: Assam, Odisha, Madhya Pradesh and Maharashtra.

5.10.1 Value Chain Overview

Stage 1: Raw materials required

The raw material used in the production of CGI sheets is galvanized iron roll, easily obtained from steel manufacturing companies.

Stage 2: Manufacturing process

In the manufacturing process, plain galvanized iron rolls are subjected to cold pressing multiple times for the required levels of corrugation. These corrugated sheets are then separated into various sizes and lengths suitable for transportation

Figure 21: Bankable business model for ferro cement roofing channel

Set-up Cost			Annual Production	Break-even Point	IRR till 2022	NPV till 2022
Plant and Machinery	Working Capital for 45 Day Cycle	Marketing Cost for 1 Year				
INR 250,000	INR 474,000	INR 5,000	1,000 channels	0.99 years	14%	INR 73,908

Operation Cost Across*

Raw Material	Manufacturing Stage	Marketing	Consumer
			Wholesaler*
Cement Cost=INR 4,90,680 pa	**Maintenance cost** Cost=INR 2,71,744 pa	**Advertisement** Cost=INR 5,000 pa	**Transportation within 50 km** As per distance Cost=INR 0 per channel
Sand Cost=INR 1,21,600 pa	**Misc cost** Cost=INR 10,000 pa		
Steel Cost=INR 5,11,200 pa	**Admin cost** Cost=INR 5,000 pa		
Chicken mesh Cost=INR 5,52,000 pa	**Indirect labour cost** Cost=INR 80,000 pa		
Welded mesh Cost=INR 1,09,407 pa	**Direct labour cost** Cost=INR 3,68,000 pa		
Binding wire Cost=INR 26,680 pa			
Direct material **Cost = INR 18,11,630** ***Cost per channel = INR 1,811.63***	**Manufacturing cost** **Cost = INR 7,34,744 pa** ***Cost per channel = INR 734.74***	**Marketing cost** **Cost = INR 5,000 pa**	**Transportation** ***Cost per channel = INR 0***

Assumptions

- **Composition of brick is 55% flyash, 30% sand, 10% lime and 5% gypsum**
- **Cost of cement = 330/bag**
- **Cost of sand = INR 6,000/ 10 tonne**
- **Cost of steel = 60/kg**
- **Cost of chicken mesh = 60/kg**
- **Cost of welded mesh = 89/kg**
- **Cost of binding wire = 58/kg**

- **15% of material cost and labour cost is taken as the maintenance cost including electricity, water and other charges**
- **Direct labour includes 2 skilled workers @ INR 8,000/month, 5 unskilled workers @ INR 6,000/month and indirect labour includes 1 supervisor @ INR 10,000/month**
- **Admin cost includes stationary, telephone and internet charges**
- **Miscellaneous cost includes cleaning, damages or wastages**

- **Minimal marketing is done by the firm**
- **Transportation is taken as per the distance**

Value per channel
Cost of channel = INR 2,546.37
Selling price excluding transport cost = INR 2,800
(Margin=INR 253.63)

*No need of wholesalers as the model has been designed for local small entrepreneurs and women's SHGs to cater to the local community.

Figure 22: Manufacturing process for CGI sheets

5.10.2 Key Findings from the Stakeholder Consultation Programme

Market

- Due to the large network of dealers and retailers spread across the country, availability of CGI sheets even in remote areas has been very high; and
- The aggregate of all margins of multiple stakeholders involved in the value chain, after manufacturing and before reaching the end user, increases the sales.

Manufacturers

- CGI sheets have excellent corrosion resistance, making it the most preferred product for various purposes such as roofing and walling; and
- The sheets can be used as decorative items due to their ability to be moulded into different shapes and their availability in different colours.

Consumer

- The product's cost makes it the most favourable option for roofing in low cost housing; and
- Properties of the material such as high thermal conductivity leading to increased temperatures in the house during summers and sounds made by droplets hitting on the sheet during rainy season are the disadvantages in using this product.

5.10.3 Business Model

In this business, a large sum of money is needed as working capital. In the presented case, though the plant set up cost is INR 15.5 million, the approximate monthly working capital required is INR 30 million. Hence, this model is not viable for SHGs. Raw material costs are based on the market costs in Rajasthan.

Figure 23: Bankable business model for CGI sheets

Set-up Cost			Annual Production	Break-even Point	IRR till 2022	NPV till 2022
Plant and Machinery	Working Capital for 45 Day Cycle	Marketing Cost for 1 Year				
INR 15.5 million	INR 44.4 million	INR 171,000	1,300,000 metres	0.51 years	38%	INR 61.9 million

Operation Cost Across*

Raw Material	Manufacturing and Marketing Stage	Wholesaler	Retailer/Consumer
			Wholesaler*
GI Coil Cost=INR 35,40,00,000 pa	**Insurance cost** Cost=INR 7,500 pa	**For wholesaler** Price = INR 290 m^2	**For Customer** Price = INR 308/m^2
	Direct labour cost =INR 4,80,000 pa	**Transportation** Cost=Included in the cost	**For Retailer** Price = INR 292.5/m^2
	Indirect labour cost =INR 11,40,000 pa		**Transportation within 50 km** Cost = As per consumer
	Admin cost =INR 37,000 pa		
	Electricity cost =INR 2,47,500 pa		
	Marketing cost =INR 5000 pa		
	Water cost =INR 16,500 pa		
	Maintenance cost =INR 10,000 pa		
	Miscellaneous cost =INR 2,500 pa		
Direct material Cost = INR 35.4 crore pa Cost/sheet = INR 265.5/m^2	**Processing and marketing Cost = INR 19,46,000 pa Cost per Sheet = INR 1.5 per m^2**	**Wholesaler price Cost per sheet = INR 290/m^2**	**Consumer Price Cost per Sheet = INR 308/m^2**

Assumptions

- 500 tonnes of GI sheet is processed each month in the plant for the corrugation process
- Cost of GI sheet is INR 59,000 per tonne
- The GI sheets are processed in an automatic roll forming machine whose cost is INR 38,000
- The machine has the capacity to process 20 tonnes of GI sheet per 8 hour working day

- Direct labour involves 2 skilled workers and 2 helpers at INR 12,000 and INR 8,000 per month, respectively.
- Indirect labour includes 1 plant in-charge, 1 supervisor, 1 accountant and 3 watchmen, all at different salaries.
- Electricity cost is of the 150 units of power consumed/day @INR 5.5/unit.
- Water cost consist of the water and compressed air charges of INR 1,375 monthly on an average.
- Maintenance cost is of the timely maintenance of the machine at regular intervals.
- Annual Insurance premium of INR 7,500 is given & administrative cost includes postages, telephone and internet bills, stationary, etc.
- Marketing is done through newspaper ads and posters.

- For wholesalers, the manufacturer only gets around INR 25 per sq. m profit margin after taxes and negotiations.
- To retailers, the whoesaler sells at 2.25% profit margin.
- To consumer, the retailer sells at around INR 15 profit margin.

Value of CGI sheet per Sq. m
Cost of CGI sheet = INR 267 per Sq. m
Selling price to wholesaler = INR 290 per Sq. m
Selling price to Retailer = INR 292.5 per Sq. m
Selling price to customer= INR 308 per Sq. m

*No need of wholesalers as the model has been designed for local small entrepreneurs and women's SHGs to cater to the local community

Demand Forecasting

In this section, state-wise demand has been projected for all proposed/prescribed AHCM in each states. This demand has been estimated using the number of houses to be constructed in the state through PMAY-G and other state housing schemes in conjunction with the projected market share to be acquired by each AHCM. Also, investment needed for manufacturing each AHCM has been calculated using the proposed bankable business models for small entrepreneurs and women's SHGs. Market share acquired by each AHCM would be dependent on various factors such as investment attracted by the sector, enhanced market linkages, implementation of sector-specific regulatory reforms and policy formulation, etc. Hence, the states may prepare or further allocate funds to support the adoption of these products by investing in the aforementioned factors on which the industry is dependent. In the calculation, it is assumed that the current market share is 0.01 percent and increases to 5 percent over the course of time till 2022. Depending on the factors mentioned here, the actual market share acquired might vary.

Box 5: How to read the demand forecast table

a. Product (unit): The product prescribed in the typologies of the state (units used for expressing quantity of the product, e.g., sq. m, feet)

b. Units required per house: The number of units of the product required per each house constructed

c. Market share: The percentage demand covered by the product

d. Product demand: The total quantity of the product required for building houses

e. Investment required: Investment needed in INR million per year to cater the demand

f. Target houses (2017-2019): The annual target houses for each state under PMAY-G and other state housing schemes until 2019

g. Target houses (2020-2022): The annual target houses for each state under PMAY-G and other state housing schemes from 2020-2022 assuming the state targets double to cover the rest of the 19.5 million houses as per PMAY-G guidelines

h. Investment by the state: Investment to be made by the state government for promotion of materials through investment subsidies

Formulae used:

Product demand = total annual target houses in the year * number of units of the product required per house *market share in the year

Number of new manufacturing units to be established = (product demand/capacity of the proposed model) – (manufacturing units established in the previous year)

Investment needed in plant and machinery = number of new units to be established in the year * cost of plant and machinery in the proposed model

E.g., product demand of fly ash bricks in 2018 = target houses in 2018* number of units of AHCM per house * market share in 2018 = 164245 * 10500* 0.05% = 8,622,863

6.1 Assam

A total of 3,061 manufacturing units of the prescribed AHCM manufacturing units would be needed across the state to meet the projected demand, creating employment for 25,570 individuals.

Table 10: Demand forecast and investment required for Assam until 2022

Product (unit)	Units Required Per House	Market Share	0.01%	0.50%	1.00%	1.50%	3.00%	5.00%	Total
		Year	2017	2018	2019	2020	2021	2022	
Fly ash bricks (no.)	10,500	**Product demand**	172,457	8,622,863	17,245,725	51,737,175	103,474,350	172,457,250	
		Number of units to be established	0	18	18	89	126	233	485
		Investment needed (in million INR)	0.5	23.6	24.6	120.1	1694	31.32	65.14
		Employment generated	4	176	183	895	1,261	2,332	4,850
Precast hollow blocks (no.)	1,313	**Product demand**	21,557	1,077,858	2,155,716	6,467,147	12,934,294	21,557,156	
		Number of units to be established	1	46	48	233	328	607	1,263
		Investment needed (in million INR)	00.1	5.3	5.5	26.8	37.8	69.8	145.3
		Employment generated	4	183	191	932	1,314	2,429	5,052
CSEB (no.)	3,500	**Product demand**	57,486	2,874,288	5,748,575	17,245,725	34,491,450	57,485,750	
		Number of units to be established	1	34	35	170	240	444	924
		Investment needed (in million INR)	0.4	18.8	19.5	95.4	134.5	248.7	517.4
		Employment generated	10	469	489	2,386	3,363	6,218	12,934

Product (unit)	Units Required Per House	Market Share	0.01%	0.50%	1.00%	1.50%	3.00%	5.00%	Total
		Year	2017	2018	2019	2020	2021	2022	
Treated bamboo (feet)	500	**Product demand**	8,212	410,613	821,225	2,463,675	4,927,350	8,212,250	
		Number of units to be established	0	10	10	51	72	133	277
		Investment needed (in million INR)	0.0	0.2	0.2	1.0	1.4	2.7	5.5
		Employment generated	1	70	73	358	504	933	1,940
Bamboo mat floor and wall boards (sq. m)	75	**Product demand**	1,232	61,592	123,184	369,551	739,103	1,231,838	
		Number of units to be established	0	0	0	0	1	1	2
		Investment needed (in million INR)	0.2	7.9	8.2	39.9	56.3	104.1	216.5
		Employment generated	0	9	18	53	106	71	256
Ferro cement door & window frames (no.)	2	**Product demand**	33	1,642	3,285	9,855	19,709	32,849	
		Number of units to be established	0	4	4	20	29	53	111
		Investment needed (in million INR)	0.0	1.0	1.0	5.1	7.2	13.3	27.7
		Employment generated	0	20	21	102	144	266	554
Target houses (2017-2019)			164,245	Target houses (2019-2022)			328,490		

6.2 Jharkhand

A total of 2,399 manufacturing units for the prescribed AHCM would be required across the state to meet the projected demand, creating employment for 28,369 individuals.

Table 11: Demand forecast and investment required for Jharkhand until 2022

Product (unit)	Units Required Per House	Market share	0.01%	0.50%	1.00%	1.50%	3.00%	5.00%	Total
		Year	2017	2018	2019	2020	2021	2022	
Fly ash bricks (no.)	10,500	**Product demand**	245,057	12,252,870	24,505,740	73,517,220	147,034,440	245,057,400	
		Number of units established	1	25	26	127	179	331	689
		Investment needed (in million INR)	0.7	33.6	35.0	170.7	240.7	445.0	925.6
		Employment generated	5	250	260	1,271	1,792	3,313	6,892
CSEB (no,)	3,500	**Product demand**	81,686	4,084,290	8,168,580	24,505,740	49,011,480	81,685,800	
		Number of units established	1	48	50	242	341	631	1,313
		Investment needed (in million INR)	0.5	26.7	27.8	135.6	191.1	353.4	735.2
		Employment generated	14	667	694	3,390	4,779	8,836	18,379
Treated bamboo (feet)	500	**Product demand**	11,669	583,470	1,166,940	3,500,820	7,001,640	11,669,400	
		Number of units established	0	14	15	73	102	189	394
		Investment needed (in million INR)	0.0	0.3	0.3	1.5	2.0	0.3.8	7.9
		Employment generated	2	100	104	508	717	1,325	2,757
Bamboo mat floor and wall boards (sq. m)	75	**Product demand**	1,750	87,521	175,041	525,123	1,050,246	1,750,410	
		Number of units established	0	0	0	1	1	1	3
		Investment needed (in million INR)	0.2	11.2	11.6	56.8	80.0	147.9	307.7
		Employment generated	0	12	13	62	88	163	338
Target houses (2017-2019)			233,388	Target houses (2019-2022)			466,776		

6.3 Madhya Pradesh

A total of 5,281 manufacturing units for the prescribed AHCM would be needed across the state to meet the projected demand, creating employment for 56,476 individuals.

Table 12: Demand forecast and investment required for Madhya Pradesh until 2022

Product (unit)	Units Required Per House	Market Share	0.01%	0.50%	1.00%	1.50%	3.00%	5.00%	Total
		Year	2017	2018	2019	2020	2021	2022	
Fly ash bricks (no.)	10,500	**Product demand**	470,554	23,527,718	47,055,435	141,166,305	282,332,610	470,554,350	
		Number of units established	1	48	50	244	344	636	1323
		Investment needed (in million INR)	1.3	64.5	6.71	32.78	46.21	85.45	177.74
		Employment generated	10	480	500	2,441	3,441	6,362	13,234
CSEB (no.)	3,500	**Product demand**	156,851	7,842,573	15,685,145	47,055,435	94,110,870	156,851,450	
		Number of units established	2	91	95	465	655	1212	2521
		Investment needed (in million INR)	1.0	51.2	53.3	260.4	367.0	678.6	1,411.7
		Employment generated	26	1,281	1,333	6,509	9,176	16,966	35,292
Treated bamboo (feet)	500	**Product demand**	22,407	1,120,368	2,240,735	6,722,205	13,444,410	22,407,350	
		Number of units established	1	27	29	139	197	364	756
		Investment needed (in million INR)	0.0	0.5	0.6	2.8	3.9	7.3	15.1
		Employment generated	4	192	200	976	1,376	2,545	5,294

Product (unit)	Units Required Per House	Market Share	0.01%	0.50%	1.00%	1.50%	3.00%	5.00%	Total
		Year	2017	2018	2019	2020	2021	2022	
Ferro cement door & window frames (no.)	2	**Product demand**	90	4,481	8,963	26,889	53,778	89,629	
		Number of units established	0	11	11	56	79	145	302
		Investment needed (in million INR)	0.1	2.7	2.9	13.9	19.7	36.4	75.6
		Employment generated	1	55	57	279	393	727	1,512
MCR tiles (no.)	750	**Product demand**	33,611	1,680,551	3,361,103	10,083,308	20,166,615	33,611,025	
		Number of units established	1	13	15	69	99	181	378
		Investment needed (in million INR)	0.1	3.5	3.7	17.9	25.3	46.6	97.2
		Employment generated	2	40	44	208	296	544	1,134
Target houses (2017-2019)			448,147	Target houses (2019-2022)			896,294		

6.4 Odisha

A total of 6,070 manufacturing units for the prescribed AHCM would be needed across the state to meet the projected demand creating employment to 61,066 individuals.

Table 13: Demand forecast and investment required for Odisha until 2022

Product (unit)	Units Required Per House	Market Share	0.01%	0.50%	1.00%	1.50%	3.00%	5.00%	Total
		Year	2017	2018	2019	2020	2021	2022	
Fly ash bricks (no.)	105,00	**Product demand**	477,463	23,873,168	47,746,335	143,239,005	286,478,010	477,463,350	
		Number of units established	1	49	51	248	349	646	1343
		Investment needed (in crore INR)	0.13	6.55	6.81	33.26	46.89	86.70	180.35
		Employment generated	10	487	507	2,477	3,491	6,456	13,429
CSEB (no.)	3,500	**Product demand**	159,154	7,957,723	15,915,445	47,746,335	95,492,670	159,154,450	
		Number of units established	2	93	97	472	665	1230	2,558
		Investment needed (in million INR)	1.1	52.0	54.1	264.2	372.4	688.6	1,432.4
		Employment generated	27	1,300	1,353	6,605	9,311	17,215	35,810
Treated bamboo (feet)	500	**Product demand**	22,736	1,136,818	2,273,635	6,820,905	13,641,810	22,736,350	
		Number of units established	1	28	29	142	200	369	767
		Investment needed (in million INR)	0.0	0.6	0.6	2.8	4.0	7.4	15.3
		Employment generated	4	195	203	991	1,397	2,582	5,371

Product (unit)	Units Required Per House	Market Share	0.01%	0.50%	1.00%	1.50%	3.00%	5.00%	Total
		Year	2017	2018	2019	2020	2021	2022	
Ferro cement roofing channel (no.)	8	**Product demand**	364	18,189	36,378	109,134	218,269	363,782	
		Number of units established	0	12	12	60	85	157	327
		Investment needed (in million INR)	0.1	3.0	3.1	15.1	21.3	39.3	81.9
		Employment generated	3	94	100	482	682	1,258	2,619
Ferro cement door & window frames (no.)	2	**Product demand**	91	4,547	9,095	27,284	54,567	90,945	
		Number of units established	0	11	12	57	80	148	307
		Investment needed (in million INR)	0.1	2.8	2.9	14.2	20.0	36.9	7.6.7
		Employment generated	1	56	58	283	399	738	1,535
MCR tiles (no.)	750	**Product demand**	34,105	1,705,226	3,410,453	10,231,358	20,462,715	34,104,525	
		Number of units established	1	28	29	142	200	369	767
		Investment needed (in million INR)	0.0	7.3	7.3	36.5	51.1	94.9	197.2
		Employment generated	2	84	87	425	599	1,107	2,302
Target houses (2017-2019)			454,727	Target houses (2019-2022)			909,454		

6.5 Maharashtra

A total of 2,596 manufacturing units for the prescribed AHCM would be needed across the state to meet the projected demand, creating employment for 30,368 individuals.

Table 14: Demand forecast and investment required for Maharashtra until 2022

Product (unit)	Units Required Per House	Market Share	0.01%	0.50%	1.00%	1.50%	3.00%	5.00%	Total
		Year	2017	2018	2019	2020	2021	2022	
Fly ash bricks (no.)	10,500	**Product demand**	265,514	13,275,675	26,551,350	79,654,050	159,308,100	265,513,500	
		Number of units established	1	27	28	138	194	359	747
		Investment needed (in million INR)	0.7	36.4	37.9	185.0	260.8	48.2.1	1,002.9
		Employment generated	6	271	282	1,377	1,942	3,590	7,468
CSEB (no.)	3,500	**Product demand**	88,505	4,425,225	8,850,450	26,551,350	53,102,700	88,504,500	
		Number of units established	1	52	54	262	370	684	1422
		Investment needed (in million INR)	0.6	28.9	30.1	146.9	207.1	382.9	796.5
		Employment generated	15	723	752	3,673	5,178	9,573	19,914
Treated bamboo (feet)	500	**Product demand**	12,644	632,175	1,264,350	3,793,050	7,586,100	12,643,500	
		Number of units established	0	15	16	79	111	205	427
		Investment needed (in million INR)	0.0	0.3	0.3	1.6	2.2	4.1	8.5
		Employment generated	2	108	113	551	777	1,436	2,987
Target houses (2017-2019)			252,870	Target houses (2019-2022)			505,740		

6.6 Uttar Pradesh

A total of 5,170 manufacturing units for the prescribed AHCM would be needed across the state to meet the projected demand, creating employment for 53,912 individuals.

Table 15: Demand forecast and investment required for Uttar Pradesh until 2022

Product (unit)	Units Required Per House	Market Share	0.01%	0.50%	1.00%	1.50%	3.00%	5.00%	Total
		Year	2017	2018	2019	2020	2021	2022	
Fly ash bricks (no.)	10,500	**Product demand**	451,566	22,578,308	45,156,615	135,469,845	270,939,690	451,566,150	
		Number of units established	1	46	48	234	330	611	1,270
		Investment needed (in million INR)	1.3	61.9	64.4	314.6	443.5	820.0	1,705.7
		Employment generated	9	461	480	2,342	3,302	6,106	12,700
CSEB (no.)	3,500	**Product demand**	150,522	7,526,103	15,052,205	45,156,615	90,313,230	150,522,050	
		Number of units established	2	88	91	446	629	1163	2419
		Investment needed (in million INR)	1.0	49.2	51.2	249.9	352.2	651.3	1,354.7
		Employment generated	25	1,229	1,279	6,247	8,806	16,281	33,867
Ferro cement door & window frames (no.)	2	**Product demand**	86	4,301	8,601	25,804	51,608	86,013	
		Number of units established	1	10	12	53	76	139	290
		Investment needed (in million INR)	0.0	1.3	1.4	6.7	9.4	17.4	36.3
		Employment generated	4	49	58	264	381	695	1,451
Ferro cement roofing channel (no.)	8	**Product demand**	344	17,203	34,405	103,215	206,430	344,050	
		Number of units established	0	17	18	86	121	223	464
		Investment needed (in millon INR)	0.1	2.8	2.9	14.3	20.1	37.2	7.74
		Employment generated	3	135	140	685	966	1,786	3,716
MCR tiles (no.)	750	**Product demand**	32,255	1,612,736	3,225,473	9,676,418	19,352,835	32,254,725	
		Number of units established	1	26	27	134	189	349	726
		Investment needed (in million INR)	0.3	14.5	1.5.1	73.6	103.8	191.9	39.92
		Employment generated	2	79	82	402	566	1,047	2,177
Target houses (2017-2019)			430,063			Target houses (2019-2022)	860,126		

Recommendations

7.1 Issues and Recommendations

Based on feedback received during the stakeholder consultation programme, reasons for the slow growth of the AHCM sector have been grouped into categories and recommendations are suggested to accelerate the sector's growth.

Table 16: Issues and recommendations based on the stakeholder consultation programme

Issues	Description	Recommendations	Proposed Activities
Implementation gap	Though research on these products started 20 years ago, AHCM have not picked up the desired pace of upscaling. A dedicated programme focussing on usage of affordable housing materials in the rural housing context was never implemented. In some cases, guidelines for improving the usage of these products exist. For example, the Supreme Court has released a notification specifying that TPPs must bear the transportation cost of fly ash within a radius of 50 kilometre. But enforcement has been minimal.	• Initiation of a dedicated AHCM Mission	• Development of a strategy roadmap and mission monitoring & evaluation • Setting up of a Project Monitoring Unit (PMU) and technical cell • Deployment of dedicated technical personnel at the block level • Preparation of reference material such as technical guides, field handbooks, etc.
Skill gap	Limited availability of knowledge about the products and additional skills required in installation of AHCM makes conditions unfavourable for upscaling of AHCM. Also some of the AHCM require greater degree of quality control compared to traditional materials, leaving a smaller window for errors. Buildings constructed using AHCM under improper supervision compromise safety making the strength of AHCM itself questionable in the minds of end user.	• Incremental learning activities • Training programmes on infrastructure development	• Collation and updation of a central knowledge repository • Workshops at different levels of administrations and public • Investment in R&D • Distribution of reference materials • Partnerships with institutions/skilling centres • Establishment of new exclusive training institutes • Revival of inoperative building centres

Issues	Description	Recommendations	Proposed Activities
Perception gap	There is a strong perception among the beneficiaries that traditional materials are more durable than the proposed AHCM. Some misconceptions such as fly ash bricks leaching toxic materials make the product questionable in the minds of end users.	• Marketing activities • Fiscal incentives to beneficiaries	• Promotion through print media, advertisements, hoarding, etc. • Development of marketing collateral such as product profiles, vendor lists, etc. • Organization of trade fairs, conferences, exhibitions, etc. • Construction of demonstration buildings • Organization of awards for best practices • Creation of brand ambassadors at the Panchayat level • Incentives to early adopters
Reluctance to adopt	The status quo of using traditional materials doesn't help the adoption of new technologies as it will require additional efforts by builders, masons, labours, etc., in learning the usage of new technologies. This creates a reluctance among construction workers and monitoring government officials towards adoption of AHCM and related technologies.		
Barriers to market entry	A new entrant in manufacturing of AHCM faces a strong entry barrier from long established traditional material manufacturers. This makes the task of acquiring market share extremely difficult without support from the government.	• Fiscal incentives to manufacturing units • Infrastructure development	• Establishment of common manufacturing facilities • Creation of affordable housing material specific policy • Policy creation and changes such as inclusion of AHCM in the schedule of rates, thus lowering Goods and Service Tax rates • Subsidies to manufacturing units • Support to SHGs

7.2 Market Development Strategies and Policy Recommendations

To increase the acceptance of the AHCM by various customer segments, our recommendations have been classified based on the implementing agency and stakeholders influenced by a respective strategy/recommendation illustrated in Table 17.

Table 17: Classification of recommendations and strategies based on implementing agencies and stakeholders

Implementing Agency	Responsibility of Implementation Agency	Stakeholders Influenced
Market Development Strategies		
Central level monitoring committee/PMU	Organize workshops with state departments – annually	State level policy makers
State level PMAY-G committee/PMU	Organize workshops by state line departments to districts – annually	District level officials & engineers and technical personnel such as PMAY-G PMU and engineers

Implementing Agency	Responsibility of Implementation Agency	Stakeholders Influenced
District level technical personnel	Organize workshops by district authorities to block level officers – half yearly	Block level officials such as Block Development Officers & technical personnel like PMAY-G PMU and Junior Engineers (JEs)
Block level technical personnel such as JE	Organize workshops with SHGs, women entrepreneurs, MSME representatives, rural area residents, house owners/end users	Beneficiaries/house owners, entrepreneurs at village level, NGOs
Block level technical personnel such as JE	Organize workshops at block level for engineers, masons, artisans, etc.	Engineers, masons, artisans, developers
State level PMAY-G committee/PMU	Organize trade fairs, conferences, exhibitions, etc.	Manufacturers, traders, suppliers of raw materials, NGOs
Central and state level committee/PMU, R&D institutes	Maintaining a knowledge repository & database regarding AHCM and related practices	Policy makers, manufacturers, traders, developers, R&D institutes, engineers, masons, artisans, developers
State level committee/PMU, R&D institutes	Preparation of reference materials such as information guides, material handbooks, etc.	Manufacturers, traders, developers, R&D institutes, engineers, masons, artisans, developers
State level committee/PMU	Development of marketing collaterals such as product profiles in English and in Hindi, strategies for marketing and increasing acceptance	Manufacturers, traders
State level committee/PMU	Establishment of common manufacturing facilities	Manufacturers
State level committee/PMU, district & block level policy makers	Construction of demonstration buildings	Beneficiaries/house owners, engineers, masons, artisans, developers, NGOs
State level committee/PMU	Organize awards for best practices	Beneficiaries/house owners, engineers, masons, artisans, developers, manufacturers, traders, NGOs
Block level officials	Creation of brand ambassadors at the Panchayat level	Beneficiaries/house owners, engineers, masons, artisans, developers, manufacturers, traders
Policy Recommendations		
Central level committee/ PMU	Support for reviving closed down building centres	Policy makers, engineers, masons, artisans, developers, R&D institutes
State level committee/PMU	Partnerships with institutions/skilling centres	Policy makers, engineers, masons, artisans, developers, R&D institutes
State level committee/PMU	Creation of affordable housing material-specific policy	Manufacturers, traders, financial institutes
State industries departments	Provide subsidies to manufacturing units	Manufacturers, financial institutes
State industries departments	Provide support to SHG	Manufacturers, women entrepreneurs, SHGs, financial institutes, NGOs
State rural development departments	Distribute incentives to early adopters	Beneficiaries/end users/house owners

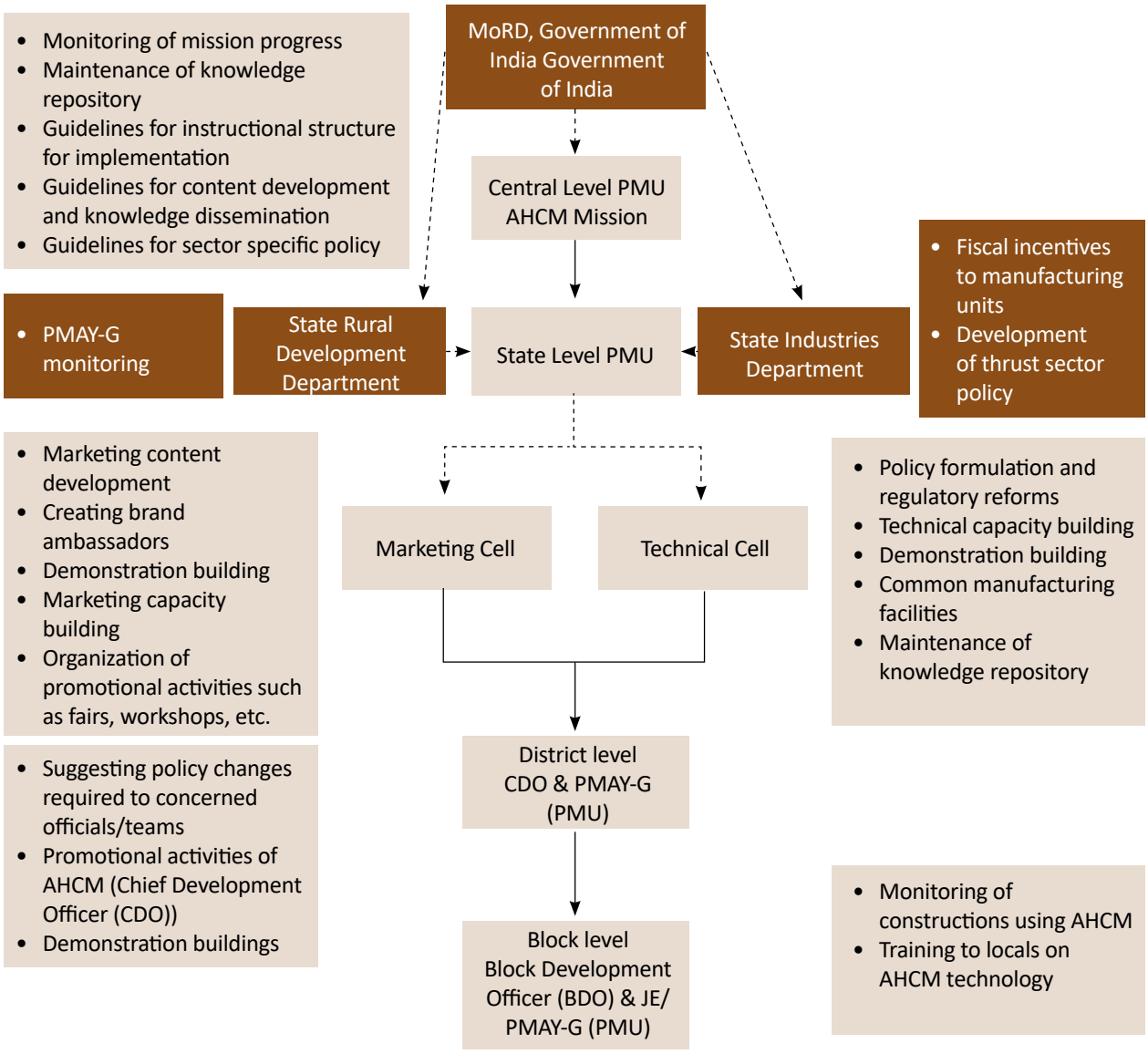
7.3 Implementation Structures

The implementation structure for the mission is envisaged as a stratified structure. Two structures are proposed for implementation of the project with Option 1 centred on the PMU model and Option 2 driven by competent authorities of the respective departments.

Option 1: PMU Model

A central-level PMU would prepare guidelines and reference material for the mission and monitor its progress while the state-level PMU along with its district and block-level subordinates will focus on implementing mission objectives, tailoring the guidelines and reference material to the state's geographical requirements. This structure would be driven by the PMU with focused and clear guidelines for the promotion of AHCM in the construction industry. Figure 24 illustrates the structure.

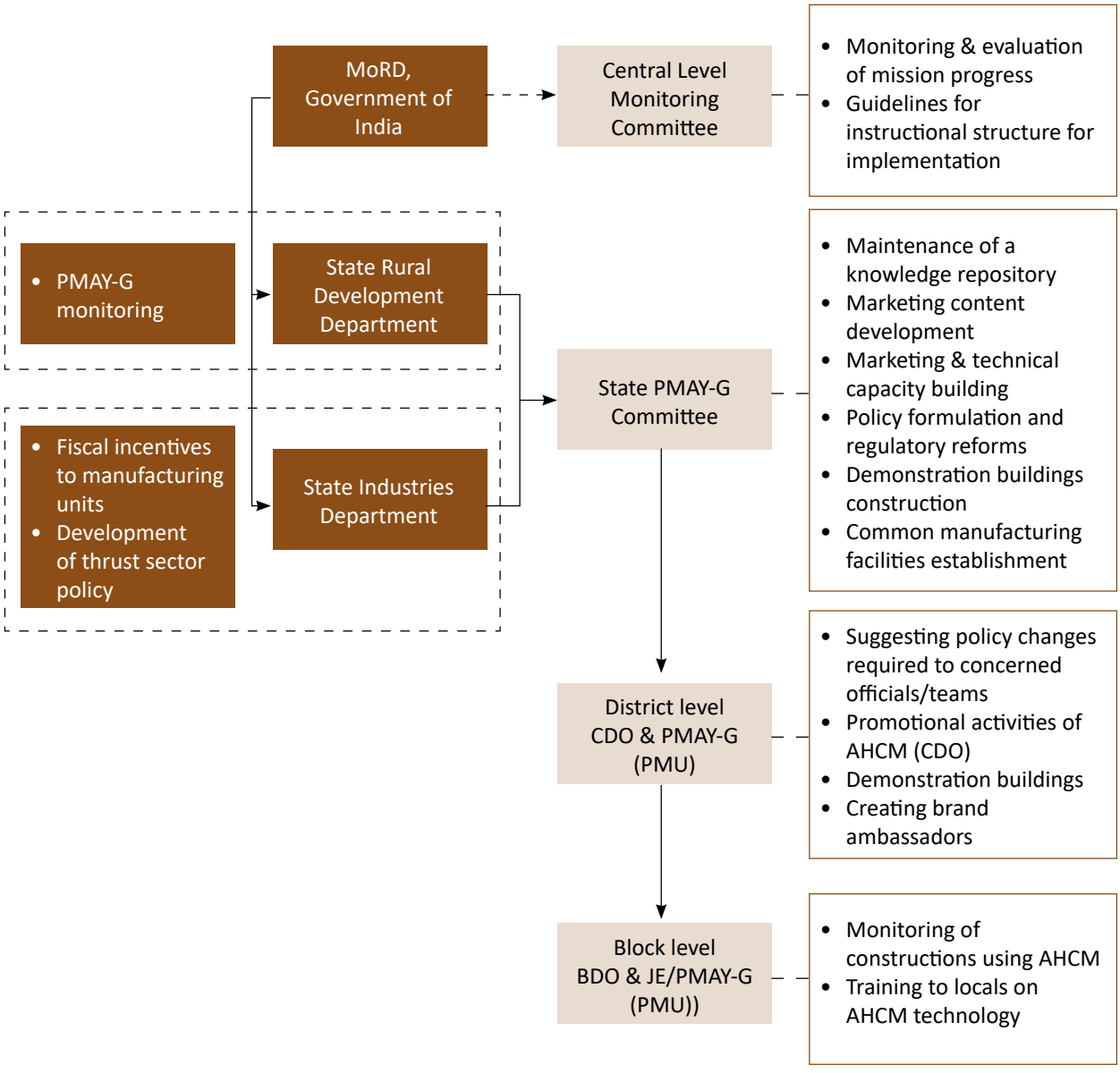
Figure 24: Structure of the PMU-driven model



Option 2: Centre and State Department Competent Authorities Model

Under MoRD, a central committee for the preparation of an evaluation matrix and monitoring of mission progress shall be formed. Rural development departments of respective states would create committees which would coordinate with the states' industries departments in distribution of incentives to manufacturing units apart from implementing initiatives for the promotion of AHCM. Respective officials in the districts and blocks would implement the mission objectives for the promotion of AHCM on the ground. If required, a third party may be engaged by the respective departments to carry out evaluation of mission progress. Figure 25 illustrates the structure.

Figure 25: Structure of the competent authorities-driven model



7.4 Budget Estimate

The following section details out the expenses to be incurred at the central and state levels. However, the allotment of the central and state contributions could follow the PMAY-G programme model of 60:40 contribution of centre and state in plain areas and 70:30 contribution in hilly states, difficult areas and IAP districts. Alternatively, the centre and states may distribute actionable points as may seem appropriate. Table 18 provides a break-up of the central government's estimated expenditure in implementing the suggested recommendations through two suggested implemented structures.

Table 18: Central government's estimated expenditure on implementing Option 1 and Option 2

Budget Estimate	Centre	Assam	Jharkhand	Odisha	Madhya Pradesh	Maharashtra	Uttar Pradesh
Option 1	111.18	226.94	278.85	377.61	373.67	340.83	751.79
Option 2	100.50	217.49	269.40	368.16	364.22	331.38	742.34

The following sections provide the recommendation-wise split up and methodology adopted for estimating the budget.

Table 19: Recommendation-wise explanation of quantity, rate, districts and blocks used in calculations

Head	Individual Components	Explanation for Quantity	Explanation for Rate
Central Expenditure			
Development of strategy roadmap and mission monitoring & evaluation **(Option 1)**	PMU set up cost (furniture, phone, recruitment, space, computers, etc.)	-	5% of PMU operation cost
	Operation cost of PMU - knowledge repository, monitoring & evaluation	Number of years	12 persons for 36 states and union territories at INR 300,000 per month
Monitoring & evaluation **(Option 2)**	Third party monitoring/ progress evaluation	Number of years	10 persons for 5 years at a cost of INR 200,000 per person month
Incremental learning activities	R&D	Number of years	Based on consultation with R&D centre
	Reference materials such as information guides, material handbooks, etc.	Number of materials	Based on market rates
	Workshops with state departments	Number of states*10 persons per state /20 persons per workshop	Based on market rates
Marketing	Promotion through print media, advertisements, hoardings, etc.	Number of shortlisted AHCM	Based on market rates
	Development of marketing collaterals - product profiles in English and in Hindi	Number of shortlisted AHCM	Based on market rates
	Website updating/development and maintenance	Number of years	Based on market rates
	Organize trade fairs, conferences, exhibitions, etc.	Number of states*number of years	Based on market rates
Infrastructure development	Support for reviving closed down building centres[7]	Approx. non-operational building centres	Based on consultation with R&D centre
State Expenditure			
Development of strategy roadmap and mission monitoring & evaluation (**Option 1**)	PMU setup cost (recruitment, space, computers, furniture, telephone, etc.)		5% of PMU operation cost
	Operation cost of PMU: knowledge repository, monitoring and evaluation	Number of years	6 members per state at rate of INR 250,000 per month

Head	Individual Components	Explanation for Quantity	Explanation for Rate
Incremental learning activities	Workshops with state line departments to districts – annually	(Number of districts*4 persons*number of years)/(20 persons per workshop)	Based on market rates
	Workshops by district authorities to block-level officers – half yearly	Number of blocks*3 persons*2 times*number of years/(20 persons per workshop)	Based on market rates
	Partnerships with institutions/ skilling centres	Number of districts	Based on market rates
	Workshop with SHGs, women entrepreneurs, MSME representatives, rural area residents	Number of blocks*4	Based on market rates
Infrastructure development	Establishment of common manufacturing facilities	Total number of districts/3	Based on consultation with R&D centre
	Establishment of new exclusive training institutes	Total number of districts/3	Based on consultation with R&D centre
Marketing	Promotion through print media, advertisements, hoardings, etc.		2% of estimated investment in plant and machinery in state until 2022
	Construction of demonstration buildings	(Total blocks and districts)*2	Estimated sum of PMAY-G building construction and related marketing
	Development of marketing collateral such as product profiles, vendor lists, etc.	Number of products in the state	Based on market rates
	Website updation/development and maintenance	Number of years	Based on market rates
	Organize trade fairs, conferences, exhibitions, etc.	Number of blocks *2 times over 5 year period	Based on market rates
	Organize awards for best practices	(Total number of districts +blocks)*(number of years*2)	Estimated based on stakeholder consultation data from field study
	Brand ambassadors at the Panchayat level	Sum of number of districts+ blocks+ villages	Estimated based on stakeholder consultation data from field study
Fiscal Incentives	Creation of affordable housing material specific policy	-	Based on market rates
	Subsidies to manufacturing units[7]	-	20%*(projected investment in plant and machinery)
	Support to SHG	-	10%*(projected investment in plant and machinery)
	Incentives to early adopters	Number of blocks*1,500 beneficiaries over 4 years in a phasing out manner	Estimated based on stakeholder consultation data from field study

7 In areas where building centres are non-operational due to location, other government buildings which are not used can be made into training centres.

Table 20: Implementation area in the states

State	Assam	Jharkhand	Madhya Pradesh	Maharashtra	Odisha	Uttar Pradesh
No. of districts	27	24	30	50	34	75
No. of blocks	219	260	314	313	351	822

7.4.1 Central Budget

Table 21: Central budget estimate for implementation of mission

Head	Individual Components	Timeline	Quantity	Rate (in INR million)	Total Cost (in INR million)	
					Option 1	Option 2
Development of strategy roadmap and mission monitoring & evaluation (Option 1)	PMU set up cost (recruitment, space, computers, furniture, telephone, etc.)	Short term	-	-	1.08	-
	Operation cost of PMU - knowledge repository, monitoring and evaluation	Short term	5	4.32	21.60	-
Monitoring & evaluation (Option 2)	Third party monitoring/ progress evaluation	Medium term	5	2.40	-	12.00
Incremental learning activities	R&D	Short term	5	50.0	250.0	250.0
	Reference materials such as information guides, material handbooks, etc.	Short term	10	0.1	1.0	1.0
	Workshop with state departments	Short term	3	1.0	3.0	3.0
Marketing	Promotion through print media, advertisements, hoardings, etc.	Medium term	10	10.0	100.0	100.0
	Development of marketing collaterals - product profiles in English and in Hindi	Short term	10	0.3	3.0	3.0
	Website updation/ development and maintenance	Short term	5	0.6	3.0	3.0
	Organize trade fairs, conferences, exhibitions, etc.	Medium term	30	5.0	150.0	150.0
Infrastructure development	Support for reviving closed down building centres[8]	Short term	150	2.5	375.0	375.0
				Total	**1111.8**	**1,005.0**

8 It is assumed that the sector would be considered as a new thrust sector. Hence the total incentives are considered instead of additional incentives over industrial policy.

7.4.2 State-wise Budget

1. Assam

Table 22: Budget estimate for implementation of the mission for Assam

Head	Individual Components	Timeline	Quantity	Rate (in INR Cr.)	Total Cost (in INR Cr.)	
					Option 1	Option 2
Development of strategy roadmap and mission monitoring & evaluation (Option 1)	PMU set up cost (recruitment, space, computers, furniture, telephone, etc.)	Short term	-	-	0.45	-
	Operation cost of PMU - knowledge repository, monitoring & evaluation	Short term	5	2	9.00	-
Incremental learning activities	Workshops with state line departments to districts - annually	Medium term	27	0.05	1.35	1.35
	Workshops by district authorities for block level officers - half yearly	Short term	329	0.02	6.57	6.57
	Partnerships with institutions/ skilling centres	Medium term	27	0.02	0.54	0.54
	Workshop with SHGs, women entrepreneurs, MSME, rural area residents	Medium term	876	0.05	43.80	43.80
Infrastructure development	Establishment of common manufacturing facilities	Medium term	9	0.25	2.25	2.25
	Establishment of new exclusive training institutes	Medium term	9	0.25	2.25	2.25
Marketing	Promotion through print media, advertisements, hoardings, etc.	Short term	-	-	3.13	3.13
	Construction of demonstration buildings	Short term	492	0.025	12.30	12.30
	Development of marketing collaterals - product profiles, vendor lists, etc.	Short term	6	0.03	0.18	0.18
	Website updating/development and maintenance	Short term	5	1.8	9.00	9.00
	Organize trade fairs, conferences, exhibitions, etc.	Medium term	438	0.02	8.76	8.76
	Organize awards for best practices	Medium term	2460	0.0005	1.23	1.23
	Brand ambassadors at the Panchayat level	Long term	26641	0.0005	13.32	13.32

Head	Individual Components	Timeline	Quantity	Rate (in INR Cr.)	Total Cost (in INR Cr.)	
					Option 1	Option 2
Fiscal incentives	Creation of affordable housing material specific policy	Short term	1	0.2	0.20	0.20
	Subsidies to manufacturing units[9]	Long term	-	-	31.28	31.28
	Support to SHGs	Long term	-	-	15.64	15.64
	Incentives to early adopters	Long term	328500	0.0002	65.70	65.70
				Total	226.94	217.49

2. Jharkhand

Table 23: Budget estimate for implementation of the mission for Jharkhand

Head	Individual Components	Timeline	Quantity	Rate (in INR million)	Total Cost (in INR million)	
					Option 1	Option 2
Development of strategy roadmap and mission monitoring & evaluation (Option 1)	PMU set up cost (recruitment, space, computers, furniture, telephone, etc.)	Short term	-	-	4.5	-
	Operation cost of PMU - knowledge repository, monitoring & evaluation	Short term	5	20	90.0	-
Incremental learning activities	Workshops with state line departments to districts - annually	Medium term	260	0.5	130.0	130.0
	Workshops by district authorities for block level officers - half yearly	Short term	390	0.2	78.0	78.0
	Partnerships with institutions/ skilling centres	Medium term	24	0.2	4.8	4.8
	Workshop with SHGs, women entrepreneurs, MSME, rural area residents	Medium term	1040	0.5	520.0	520.0
Infrastructure development	Establishment of common manufacturing facilities	Medium term	8	2.5	20.0	20.0
	Establishment of new exclusive training institutes	Medium term	8	2.5	20.0	20.0

9 In areas where building centres are non-operational due to location, other government buildings which are not used can be made into training centres.

Head	Individual Components	Timeline	Quantity	Rate (in INR million)	Total Cost (in INR million)	
					Option 1	Option 2
Marketing	Promotion through print media, advertisements, hoardings, etc.	Short term	-	-	39.5	39.5
	Construction of demonstration buildings	Short term	520	0.25	130.0	130.0
	Development of marketing collaterals - product profiles, vendor lists, etc.	Short term	4	0.3	1.2	1.2
	Website updating/development and maintenance	Short term	5	18	90.0	90.0
	Organise trade fairs, conferences, exhibitions, etc.	Medium term	520	0.2	104.0	104.0
	Organize awards for best practices	Medium term	2840	0.005	14.2	14.2
	Brand ambassadors at the Panchayat level	Long term	32904	0.005	164.5	164.5
Fiscal incentives	Creation of affordable housing material specific policy	Short term	1	020	2.0	2.0
	Subsidies to manufacturing units[10]	Long term	-	-	395.3	395.3
	Support to SHGs	Long term	-	-	197.6	197.6
	Incentives to early adopters	Long term	390,000	0.002	780.0	780.0
				Total	2788.5	2694.0

3. Odisha

Table 24: Budget estimate for implementation of the mission for Odisha

Head	Individual Components	Timeline	Quantity	Rate (in INR million)	Total Cost (in INR million)	
					Option 1	Option 2
Development of strategy roadmap and mission monitoring & evaluation (Option 1)	PMU set up cost (recruitment, space, computers, furniture, telephone, etc.)	Short term	-	-	4.5	-
	Operation cost of PMU - knowledge repository, monitoring & evaluation	Short term	5	20	90.0	-

10 It is assumed that the sector would be considered as a new thrust sector. Hence the total incentives are considered instead of the additional incentives over industrial policy.

Head	Individual Components	Timeline	Quantity	Rate (in INR million)	Total Cost (in INR million)	
					Option 1	Option 2
Incremental learning activities	Workshops with state line departments to districts - annually	Medium term	314	0.5	157.0	157.0
	Workshops by district authorities for block level officers - half yearly	Short term	471	0.2	94.2	94.2
	Partnerships with institutions/ skilling centres	Medium term	30	0.2	6.0	6.0
	Workshop with SHGs, women entrepreneurs, MSME, rural area residents	Medium term	1256	0.5	628.0	628.0
Infrastructure development	Establishment of common manufacturing facilities	Medium term	10	2.5	25.0	25.0
	Establishment of new exclusive training institutes	Medium term	10	2.5	25.0	25.0
Marketing	Promotion through print media, advertisements, hoardings, etc.	Short term	-	-	72.1	72.1
	Construction of demonstration buildings	Short term	628	0.25	157.0	157.0
	Development of marketing collaterals - product profiles, vendor lists, etc.	Short term	6	0.3	1.8	1.8
	Website updating/ development and maintenance	Short term	5	18	90.0	90.0
	Organise trade fairs, conferences, exhibitions, etc.	Medium term	628	0.2	125.6	125.6
	Organize awards for best practices	Medium term	3440	0.005	17.2	17.2
	Brand ambassadors at the Panchayat level	Long term	51316	0.005	256.6	256.6
Fiscal incentives	Creation of affordable housing material specific policy	Short term	1	20	2.0	2.0
	Subsidies to manufacturing units[11]	Long term	-	-	721.4	721.4
	Support to SHGs	Long term	-	-	360.7	360.7
	Incentives to early adopters	Long term	471,000	0.002	942.0	942.0
				Total	3776.1	3681.6

11 It is assumed that the sector would be considered as a new thrust sector. Hence the total incentives are considered instead of the additional incentives over industrial policy.

4. Madhya Pradesh

Table 25: Budget estimate for implementation of the mission for Madhya Pradesh

Head	Individual Components	Timeline	Quantity	Rate (in INR million)	Total Cost (in INR million)	
					Option 1	Option 2
Development of strategy roadmap and mission monitoring & evaluation (Option 1)	PMU set up cost (recruitment, space, computers, furniture, telephone, etc.)	Short term	-	-	4,5	-
	Operation cost of PMU - knowledge repository, monitoring & evaluation	Short term	5	20	90.0	-
Incremental learning activities	Workshops with state line departments to districts - annually	Medium term	313	0.5	156.5	156.5
	Workshops by district authorities for block level officers - half yearly	Short term	470	0.2	93.9	93.9
	Partnerships with institutions/skilling centres	Medium term	50	0.2	10.0	10.0
	Workshop with SHGs, women entrepreneurs, MSME, rural area residents	Medium term	1,252	0.5	626.0	626.0
Infrastructure development	Establishment of common manufacturing facilities	Medium term	17	2.5	41.7	41.7
	Establishment of new exclusive training institutes	Medium term	17	2.5	41.7	41.7
Marketing	Promotion through print media, advertisements, hoardings, etc.	Short term	-	-	67.5	67.5
	Construction of demonstration buildings	Short term	626	0.25	156.5	156.5
	Development of marketing collaterals - product profiles, vendor lists, etc.	Short term	5	0.3	1.5	1.5
	Website updating/ development and maintenance	Short term	5	18	90.0	90.0
	Organise trade fairs, conferences, exhibitions, etc.	Medium term	626	0.2	125.2	125.2
	Organize awards for best practices	Medium term	3,630	0.005	18.2	18.2
	Brand ambassadors at the Panchayat level	Long term	51,890	0.005	259.5	259.5

Head	Individual Components	Timeline	Quantity	Rate (in INR million)	Total Cost (in INR million)	
					Option 1	Option 2
Fiscal incentives	Creation of affordable housing material specific policy	Short term	1	20	200	200
	Subsidies to manufacturing units[12]	Long term	-	-	675.4	675.4
	Support to SHGs	Long term	-	-	337.7	337.7
	Incentives to early adopters	Long term	469,500	0.002	939.0	939.0
				Total	3,736.7	3,642.2

5. Maharashtra

Table 26: Budget estimate for implementation of the mission for Maharashtra

Head	Individual Components	Timeline	Quantity	Rate (in INR million)	Total Cost (in INR million)	
					Option 1	Option 2
Development of strategy roadmap and mission monitoring & evaluation (Option 1)	PMU set up cost (recruitment, space, computers, furniture, telephone, etc.)	Short term	-	-	4.5	-
	Operation cost of PMU - knowledge repository, monitoring & evaluation	Short term	5	20	90.0	-
Incremental learning activities	Workshops with state line departments to districts - annually	Medium term	351	0.5	175.5	175.5
	Workshops by district authorities for block level officers - half yearly	Short term	527	0.2	105.3	105.3
	Partnerships with institutions/ skilling centres	Medium term	34	0.2	6.8	6.8
	Workshop with SHGs, women entrepreneurs, MSME, rural area residents	Medium term	1,404	0.5	702.0	702.0
Infrastructure development	Establishment of common manufacturing facilities	Medium term	11	2.5	28.3	28.3
	Establishment of new exclusive training institutes	Medium term	11	2.5	28.3	28.3

12 It is assumed that the sector would be considered as a new thrust sector. Hence the total incentives are considered instead of the additional incentives over industrial policy.

Head	Individual Components	Timeline	Quantity	Rate (in INR million)	Total Cost (in INR million)	
					Option 1	Option 2
Marketing	Promotion through print media, advertisements, hoardings, etc.	Short term	-	-	36.2	36.2
	Construction of demonstration buildings	Short term	702	0.25	175.5	175.5
	Development of marketing collaterals - product profiles, vendor lists, etc.	Short term	3	0.3	0.9	0.9
	Website updating/development and maintenance	Short term	5	18	90.0	90.0
	Organise trade fairs, conferences, exhibitions, etc.	Medium term	702	0.2	140.4	140.4
	Organize awards for best practices	Medium term	3,850	0.005	19.3	19.3
	Brand ambassadors at the Panchayat level	Long term	41,592	0.005	208.0	208.0
Fiscal incentives	Creation of affordable housing material specific policy	Short term	1	20	2.0	2.0
	Subsidies to manufacturing units[13]	Long term	-	-	361.6	361.6
	Support to SHGs	Long term	-	-	180.8	180.8
	Incentives to early adopters	Long term	526,500	0.002	1053.0	1053.0
				Total	3,408.3	3,313.8

6. Uttar Pradesh

Table 27: Budget estimate for implementation of the mission for Uttar Pradesh

Head	Individual Components	Timeline	Quantity	Rate (in INR million)	Total Cost (in INR millon)	
					Option 1	Option 2
Development of strategy roadmap and mission monitoring & evaluation (Option 1)	PMU set up cost (recruitment, space, computers, furniture, telephone, etc.)	Short term	-	-	4.5	-
	Operation cost of PMU - knowledge repository, monitoring & evaluation	Short term	5	20	90.0	-

13 It is assumed that the sector would be considered as a new thrust sector. Hence the total incentives are considered instead of additional incentives over the industrial policy.

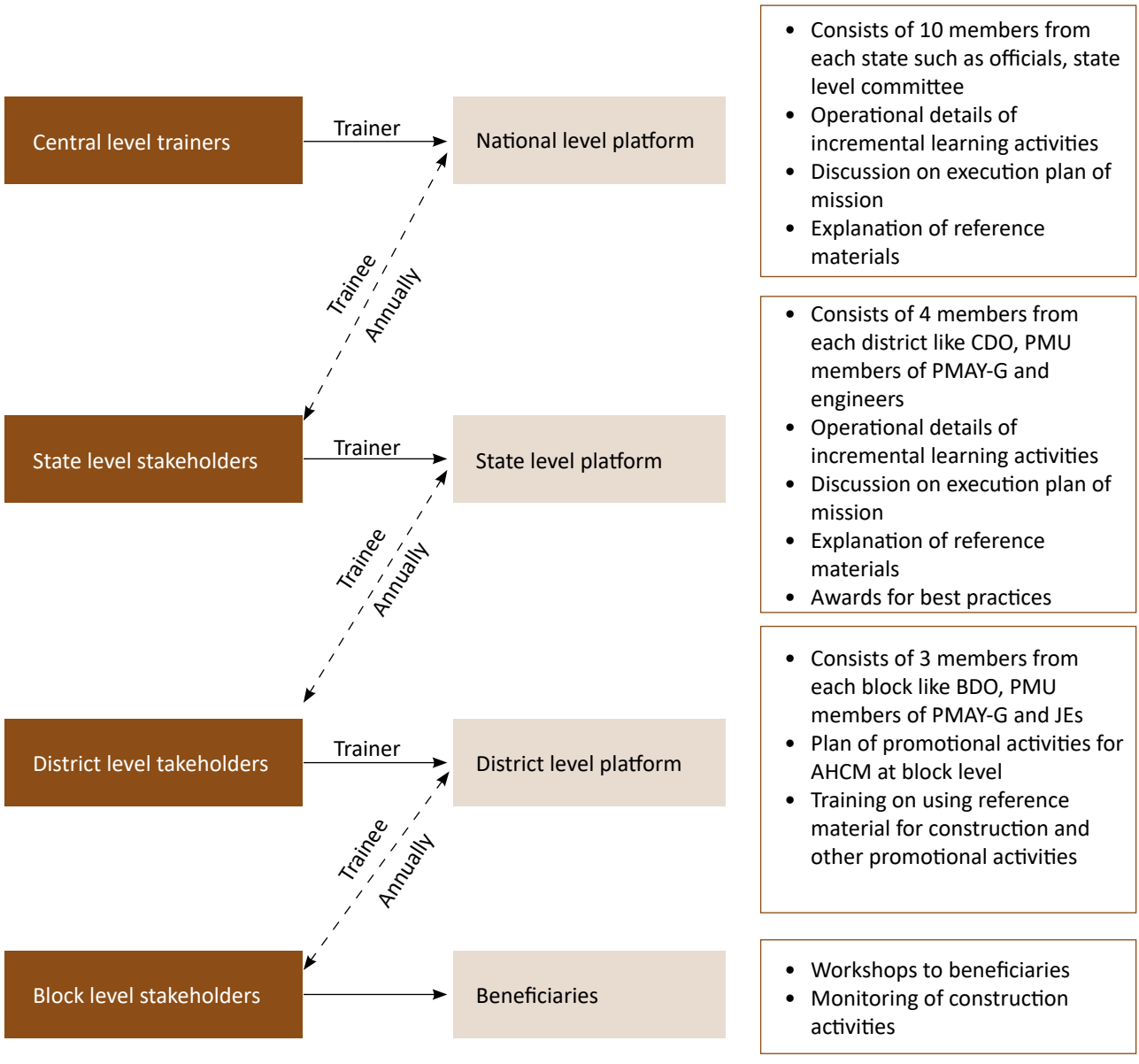
Head	Individual Components	Timeline	Quantity	Rate (in INR million)	Total Cost (in INR millon)	
					Option 1	Option 2
Incremental learning activities	Workshops with state line departments to districts - annually	Medium term	822	0.5	411.0	411.0
	Workshops by district authorities for block level officers - half yearly	Short term	1233	0.2	246.6	246.6
	Partnerships with institutions/ skilling centres	Medium term	75	0.2	15.0	15.0
	Workshop with SHGs, women entrepreneurs, MSME, rural area residents	Medium term	3,288	0.5	1,644.0	1,644,0
Infrastructure development	Establishment of common manufacturing facilities	Medium term	25	2.5	62.5	62.5
	Establishment of new exclusive training institutes	Medium term	25	2.5	62.5	62.5
Marketing	Promotion through print media, advertisements, hoardings, etc.	Short term	-	-	71.5	71.5
	Construction of demonstration buildings	Short term	1,644	0.25	411.0	411.0
	Development of marketing collaterals - product profiles, vendor lists, etc.	Short term	5	0.3	1.5	1.5
	Website updating/development and maintenance	Short term	5	18	90.0	90.0
	Organise trade fairs, conferences, exhibitions, etc.	Medium term	1644	0.2	328.8	328.8
	Organize awards for best practices	Medium term	8970	0.0.005	44.9	44.9
	Brand ambassadors at the Panchayat level	Long term	98838	0.005	494.2	494.2
Fiscal incentives	Creation of affordable housing material specific policy	Short term	1	2	20	20
	Subsidies to manufacturing units[14]	Long term	-	-	714.6	714.6
	Support to SHGs	Long term	-	-	357.3	357.3
	Incentives to early adopters	Long term	1233000	0.002	2466.0	2466.0
				Total	7,517.9	7,423.4

14 It is assumed that the sector would be considered as a new thrust sector. Hence the total incentives are considered instead of the additional incentives over industrial policy.

Incremental Learning Activities

For capacity building activities, the structure shown in Figure 26 is suggested to be implemented where the trainee at one level becomes the trainer at the lower levels. For example, a district level engineer would attend training at a state level platform and train other engineers in blocks of the concerned district at the district level platform. By following this structure, the effective cost of capacity building reduces considerably while promoting constant supervision of implementation of the mission.

Figure 26: Incremental learning activities implementation structure



15 It is assumed that sector would be considered as new thrust sector. Hence total incentives are considered instead of additional incentives over the industrial policy,

Annexures

Annexure 1: List of identified AHCM available in India

Ferro cement door, window frames	Stones (packed with lime or cement)	Precast reinforced concrete l-panel for roofs
Ferro cement roofing channels	Stabilized adobe	Precast doubly curved shell unit for floor/roofs
Ferro cement wall panels	Fal-G stabilized mud blocks	Precast reinforced/ prestressed concrete ribbed/cored slab units for floors/roofs
Treated bamboo elements for beam, column and roofing elements	Fly ash lime bricks	Precast solid cement concrete block
Bamboo mat walling panels	Clay fly ash brick	Precast concrete stone masonry blocks
Bamboo mat corrugated roofing sheets	Flyash/red mud polymer door shutters	Precast concrete ceiling components
Bamboo mat flooring	Pulverized fly ash lime bricks	Micro concrete roofing tiles
Glass fibre reinforced polymer doors and door frames	Fly ash – sand – lime brick	Reinforced cement concrete (RCC)
Bagasse-cement boards and panels	Flyash-lime-gypsum (fal-g) products	Reinforced brick concrete (RBC)
Jute-coir composites	Flyash based light weight aerated concrete walling and roofing blocks	Demolition waste
Poplar wood flush door shutters	Burnt clay flooring tiles	Lato blocks
Rubber wood flush door shutters	Burnt clay flat terracing tiles	Precast stone blocks
Pozzolana	Hollow block tile	Precast concrete blocks
Compressed earth block	Clay tiles	Precast hollow concrete blocks
Stabilized earth blocks	Clay red mud burnt bricks	CGI sheets
Nonerodable mud plaster	Precast channel unit for floors/ roofs	Timber Frames
Hydraform interlocking compressed earth blocks (CEB)	Precast RC planks and joints	
Cement stabilized earth blocks	Precast waffle unit for floors/roofs	

Annexure 2: List of shortlisted AHCM being used in Typology in the targeted states

	Materials	Prototypes*	AS	JH	OD	MP	MH	UP
1	Cement stabilized earth blocks	ASA01, JHA01, ODA01, ODC01, UPA01,UPB01	√	√	√	√	√	√
2	Fly ash – sand – lime brick	ASA01, ASB01, ASC01, JHA01, JHC01, ODA01,UPC01	√	√	√	√	√	√
3	Ferro cement door, window frames	ASD01, ODA01, UPC01	√		√	√	√	√
4	Treated bamboo elements for beam, column and roofing elements	ASB01, JHB01, JHC01, ODC01	√	√	√	√	√	
5	Clay tiles	JHA01, JHB01		√	√	√	√	
6	CGI sheets	ASA01, ASC01, ASD01	√		√	√	√	
7	Micro concrete roofing tiles	ODD01, UPC01			√	√		√
8	Reinforced cement concrete (RCC)	ASA01, ASB01, UPA01	√		√			√
9	Timber Frames	JHC01,ODA01		√	√	√	√	
10	Ferro cement roofing channels	ODA02, UPA01			√			√
11	Ferro cement wall panels	ASD01	√					
12	Bamboo mat walling panels	ASC01, JHA01	√	√				
13	Bamboo mat corrugated roofing sheets	ASC01	√					
14	Bamboo mat flooring	ASB01, ASC01, JHA01	√	√				
15	Compressed earth block	UPB01					√	√
16	Precast channel unit for floors/ roofs	ODB01, UPA01			√			√
17	Stabilized adobe	JHA01		√				
18	Precast hollow concrete blocks	ASC01	√					

Annexure 3: Stakeholders Consulted

Following are the contact details of stakeholder consulted who supported the study

	Name of the stakeholder	Company/organization	Category of stakeholder	Material	Contact number	Email Id	Address
1	Mr. Anjal Goswami	Cane and Bamboo Technology centre	Association	Bamboo products	9864130601	cbtcassam@gmail.com	Burnihat, Assam
2	Dr. B N Divekar	Ferrocement society	Association	Ferro cement products	9921480126	ferrocretedivekar@yahoo.com	Shivajinagar, Pune, Maharashtra
3	Dr Avinash K Dalal	All India MSME association - Maharashtra chapter	Association	NA	9892109000	avinashdalal@hotmail.com	Maharashtra
4	Mr. Udey Dhir	All India MSME association - Jharkhand chapter	Association	NA	9431133385	udeydhir@tribologysolutions.com	Jamshedpur, Jharkhand
5	Mr. Rajeev Agarwal	All India MSME association - Uttar Pradesh chapter	Association	NA	9897345450	rajeev@adee.in	Aligarh, Uttar Pradesh
6	Mr. Anand Bangur	All India MSME association - Madhya Pradesh chapter	Association	NA	9425093070	anand@packingpeople.com	Ujjain, MP
7	Mr. Sanjeev Gadgil	Narmada Jhabua Gramin Bank	Financial Institute	NA	9425911267	njbhoindore@yahoo.com	New Palasia, Indore, Madhya Pradesh
8	Mr. Ananta Prasad Dash	Odisha Gramya Bank	Financial Institute	NA	9777218378	gm.adv@odishabank.in	Bhubneshwar, Odisha

	Name of the stakeholder	Company/organization	Category of stakeholder	Material	Contact number	Email Id	Address
9	Mr. Rajiv Tiberwal	Ranchi Refractory	Implementor	Fly ash bricks	0651-2290628	rare_refr@yahoo.com	Tupudana, Ranchi, Jharkhand
10	Mr. Naresh Jain	Naresh Build & Homes Private Limited	Implementor/ Developer	Fly ash bricks	9893093984	nareshjainbalaji@yahoo.com	Vidisha, Madhya Pradesh
11	Naresh Jain	Naresh Build & Homes Private Limited, Vidisha	Implementor/ Developer	Flyash bricks	9893093984	nareshjainbalaji@yahoo.com	Vidisha, Madhya Pradesh
12	Mr. Satyam Patidar	Prabhakar Constructions	Manufacturer	Fly ash bricks	9826285704	-	Misrod, Madhya Pradesh
13	Mr. Gaurav Mohta	Mohta cement Pvt. Ltd.	Manufacturer	Fly ash bricks	9302110997	mohta2000@yahoo.com	Old Palasia, Indore, Madhya Pradesh
14	Mr. Vikash Khemka	Nano Steel Private Limited	Manufacturer	Bamboo products	9864070234	nanosteel@gmail.com	G.S. Road, Guwahati, Assam
15	Mr. M K Thakur	Baba Ash Bricks	Manufacturer	Fly ash bricks	9471182407	mukeshthakur123@gmail.com	Tatisilwai, Ranchi
16	Mr. Bikram Keshari Pradhan	Sai Flyash Bricks	Manufacturer	Fly ash bricks	9437026258	krishna_ambrutanshu@rediffmail.com	Bhubaneshwar, Odisha
17	Mr. D K Chetia	Maisang Products Pvt Ltd	Manufacturer	Bamboo products	9864059677	dkchetia@yahoo.com	Guwahati, Assam
18	Mr. Rohit Karidhal	V4U infra Solutions	Manufacturer	Fly ash bricks	7703000890	rohit@sunwizeepc.com	Vibhutikhand, Lucknow, Uttar Pradesh

	Name of the stakeholder	Company/organization	Category of stakeholder	Material	Contact number	Email Id	Address
19	Mr. Rahul Pandey	Green Eco bricks	Manufacturer	Fly ash bricks	9628344465	info.greenecoblocks@gmail.com	Sushant Golf City, Lucknow, Uttar Pradesh
20	Mr. Vaibhav Khade	Wonder grass	Manufacturer	Bamboo products	9011019001	contact@wondergrass.in	Peth Amravati Road, Near Nagpur, Maharashtra
21	Mr. Tejeshwar Singh Sirohi	TEJA Manufacturers	Manufacturer	Fly ash bricks	9039773263	-	Vidisha, Madhya Pradesh
22	Mr. Imkong	Nagaland Bamboo Development Agency	Manufacturer	Bamboo products	9856965457	-	Dimapur, Nagaland
23	Mr. Susheel	Shree Lakshmi Cement works	Manufacturer	Ferro cement products	9937746295	sreelaxmicementworks16@gmail.com	Athigad, Odisha
24	Mr. Kumar	NA	Manufacturer	CSEB	9845966984	-	Bangalore, Karnataka
25	Mr. Abhisheak Singh	Eco Sai Bricks Manufacturing Pvt Ltd	Manufacturer	CLC blocks	9308893769		Ranchi, Jharkhand
26	Mr. BN Jha	Innovative Solution	Manufacturer	Fly ash bricks	9771491248		Ranchi, Jharkhand
27	Mr. Rahul Pandey	Green Eco Blocks	Manufacturer	Fly ash bricks	9628344465	info.greenecoblock@gmail.com	Lucknow, Uttar Pradesh
28	Mr. Prakash chandra Awain	Subhadra Concrete bricks	Manufacturer	Precast hollow concrete blocks	9437081338		Bhubaneshwar, Odisha
29	Mr. Binod Swain	M/s B.S. Fal-G Bricks & Allied Products	Manufacturer	Flyash bricks	9437961116	vinodswain@hotmail.com	Bhubaneshwar, Odisha

	Name of the stakeholder	Company/organization	Category of stakeholder	Material	Contact number	Email Id	Address
30	Mr. Subrat Patro	M/s AB Green Bricks	Manufacturer	Flyash bricks	9040672721	subrat151976@gmail.com	Bhubaneshwar, Odisha
31	Mrs. Rashmi Mohanty	Secretary, Unnayan	NGO	NA	9437024198	unnayanorissa@gmail.com	Bhubaneshwar, Odisha
32	Mr. V Giriraj	Additional chief secretary, Finance	Policy Maker	Bamboo products	-	-	Mumbai, Maharashtra
33	Mr. Er Aseem Gupta	Secretary, Department of Rural Development	Policy Maker	NA	9821937549	-	Mumbai, Maharashtra
34	Dr. J. B. Ekka	Commissioner & Secretary, Panchayat Raj & Rural Development Department	Policy Maker	NA	9954095488	pnrddispur@gmail.com	Guwahati, Assam
35	Mr. S. Z. Hazarika	Secretary, Panchayat Raj & Rural Development Department	Policy Maker	NA	9435075007	pnrddispur@gmail.com	Guwahati, Assam
36	Mr. M. G.V. K. Bhanu	Additional Chief Secretary, Panchayat Raj & Rural Development Department	Policy Maker	NA	(0361)2237255	mgvkbhanu@gmail.com	Guwahati, Assam
37	Mr. Radheshyam Julania	Addl.Chief Secretary, Panchayat Raj & Rural Development Department	Policy Maker	NA	0755 2570005, 0755 2551114	-	Bhopal, Madhya Pradesh

	Name of the stakeholder	Company/organization	Category of stakeholder	Material	Contact number	Email Id	Address
38	Mr. N N Sinha	Principal Secretary, Department of Rural Development	Policy Maker	NA	9431170016	nagendra_nath_sinha@rediffmail.com	Ranchi, Jharkhand
39	Mr. Yatndra Prsad	Joint Secretary, Department of Rural Development	Policy Maker	NA	9431371831	yatinjas1990@gmail.com	Ranchi, Jharkhand
40	Mr. V K Bhagawat	Director - PMAY G, Panchayat Raj & Rural Development Department	Policy Maker	NA	9415424754	iayvkb@yahoo.com	Lucknow, Uttar Pradesh
41	Mr. Rishrendra Kumar	CDO - Bara Banki	Policy Maker	NA	9454465309	-	Vikas Bhawan, Barabanki, Jharkhand
42	Ms. Manisha Dubey	Deputy Commissioner, Panchayat Raj & Rural Development Department	Policy Maker	NA	9827271733	-	Bhopal, Madhya Pradesh
43	Ms. Hemanti Varman	IFS,Panchayat Raj & Rural Development Department	Policy Maker	NA	-	-	Bhopal, Madhya Pradesh
44	Mr. NL Belwal	CEO(Chief executive officer), Rural Livelihood Mission	Policy Maker	NA	-	-	Bhopal, Madhya Pradesh
45	Ms. Garima Sundaram	Rural Livelihood Mission	Policy Maker	NA	-	-	Bhopal, Madhya Pradesh

	Name of the stakeholder	Company/organization	Category of stakeholder	Material	Contact number	Email Id	Address
46	Mr. Anil Merabi	DPM, District Panchayati Raj, Vidisha	Policy Maker	NA	8349901296	-	Bhopal, Madhya Pradesh
47	Mr. Satish	MED(Micro Enterprise Development), District Panchayati Raj, Vidisha	Policy Maker	NA	7222992881	-	Bhopal, Madhya Pradesh
48	Mr. Surajit Dutta	FICCI	Policy maker	NA	9435102251	surajit.dutta@ficci.com	Guwahati, Assam
49	Mr. Prafulla Saikia	Managing Director, Assam Small Industries Development Corporation	Policy maker	NA	9435015207	-	Guwahati, Assam
50	Mr. S A Laskar	Panchayat Raj & Rural DevelopmentDepartment	Policy Maker	NA	7086997152	-	Guwahati, Assam
51	Mr. S R Malpani	PMU - RH, Department of Rural Development	Policy Maker	Multiple	7507004444	ssudhir31@reddifmail.com	Mumbai, Maharashtra
52	Mr. Avdesh Sharma	Department of Rural Development	Policy Maker	NA	9430055355	-	Ranchi, Jharkhand
53	Ms. Syamala	PMU, Department of Rural Development	Policy Maker	NA	7281065194	-	Ranchi, Jharkhand
54	Mr. Suvendhu Singhal	PMU, Department of Rural Development	Policy Maker	NA	9570372727	-	Ranchi, Jharkhand
55	Mr. Thakur Gouri Shankar Sharma	BDO Namkum	Policy Maker	NA	0651-2260221	-	Ranchi, Jharkhand

	Name of the stakeholder	Company/organization	Category of stakeholder	Material	Contact number	Email Id	Address
56	Mr. Deepak Kumar Goswami	Bamboo Technology Park	Policy Maker	Bamboo products	9864045430	dk_goswami@rediffmail.com	Guwahati, Assam
57	Mri. Kulamani Mishra	Deputy Secretary, Panchayati Raj Department	Policy Maker	NA	8280405012	dsrhpr@gmail.com	Bhubaneshwar, Odisha
58	Mr. Anjan Jana	CORE(co-operation for Rural Excellence)	R&D	Multiple	7327004931	ashrayorissa@gmail.com	Agrahat, Odisha
59	Dr. Soham Pandya	Centre of science for Villages	R&D	Sundried Mud blocks	9890434003	csvwardha@gmail.com	Dattapur, Wardha, Maharashtra
60	Mr. Kamesh Salem	Bamboo management expert	R&D	Bamboo products	9954170000	kameshsalam@gmail.com	Guwahati, Assam
61	Dr. V Venkatakrishnan	KIIT school of rural Management	R&D	Training	8280716964	venkat@ksrmc.ac.in	Bhubaneshwar, Odisha
62	Mr. Anil Daniel Hans	Sun Tech Laboratory	R&D	Testing Lab	0651-2291540	sun.tech.lab@gmail.com	Tupudana, Ranchi, Jharkhand
63	Dr.S.K.S Rathore	CSIR-Advanced Materials and Processes Research Institute	R&D	Cement free green Concrete	9424477312	sanjai1962@yahoo.com	Ranchi, Jharkhand
64	Dr. Prabir Kumar Das	Studio1860	R&D	Multiple	9811241456	pkpeudas@gmail.com	Noida, Uttar Pradesh
65	Mr. J.K. Prasad	Chief - Building Materials, BMTPC	R&D	Multiple	9871095589	jkprasad@bmtpc.org	India Habitat Center, Delhi
66	Mr. Nilesh Bhosale	Shri Engineering Enterprises	Supplier	Machinery	9822011041	shrivg_nit@yahoo.com	Tathwade, Pune, Maharashtra

	Name of the stakeholder	Company/organization	Category of stakeholder	Material	Contact number	Email Id	Address
67	Mr. Srikant Sutar	Technofast Engineering Equipments	Supplier	Machinery	8048407778	sales@technofastengg.com	Pune, Maharashtra
68	Mr. Sandeep Chaurasya	Gajanand Traders	supplier	Bamboo products	9826161496	gajanand.traders92@yahoo.com	G N T market, Indore, Madhya Pradesh
69	Mr. U K Jena	U K traders	Supplier	Bamboo products	9438185532	-	Bhubaneshwar, Odisha
70	Mr. Tanmay Roy	Ushamaretin	Supplier	Flyash	0651-3051683	tanmay_all@ushamrtin.co.in	Ranchi, Jharkhand
71	Mr.Sanjay Singh	Inland Power	Supplier	Flyash	0651-224 0532	sanjay.singh@inlandpower.in	Ranchi, Jharkhand
72	Supplier	Rahul Saxena	Supplier	Treated Bamboo	9713087294	saksena.rahul@gmail.com	Madhya Pradesh
73	Mr. Mangal Tapoo	NA	Trader	Traditional materials	9835555389	-	Namkum, Jharkhand
74	Mr. Shobhit Yadav	Jaid Shuttring and Timber	Trader	Bamboo products	9838353060	shobitvsingh@gmail.com	Lucknow, Uttar Pradesh
75	Mr. Bipin Bihari Majhi	Nandigosh Concrete	Trader	Ferro cement products	9937251049		Khandagirli, Odisha

Annexure 4: Product-wise Case Studies of Selected States

1. Treated Bamboo: Nagpur, Maharashtra case

Figure 27: Case study of Treated Bamboo unit near Nagpur, Maharashtra

Plant & machinery Cost	Annual Production	Break-Even Point	IRR till 2022	NPV till 2022
INR 10,75,000	4500 poles	3.52 Years	122%	INR 8,46,075

Operation Cost

Raw material	Manufacturing Stage	Marketing	Consumer
Bamboo Cost=INR 6,45,000 pa	**Manufacturing overhead cost** Cost=INR 67,500pa	**Advertisements** Cost=INR 500pa	Wholesaler*** **Transportation** within 100 km Cost = INR 10 per pole
Borax, Boric acid and CNSL Cost=INR 2,36,250pa	**Labour cost** Cost=INR 96,000pa		
Direct Material Cost = INR 8,81,250 pa ***Cost per running foot = INR 13.06***	**Processing cost** Cost = INR 1,63,500 pa ***Cost per running foot = INR 2.42***	**Marketing cost** Cost = INR 500 pa ***Cost/run ft. = INR 0.007***	**Transportation** ***Cost per pole = INR 10***

Assumptions

- 4500 treated poles of 15 feet are sold annually
- Cost of bamboo = INR 10.22 per foot (Since 25% is wasted)
- Cost of borax, borax and CNSL for treatment = INR 3.5/ foot of treated bamboo
- 25% of the poles are removed as wastage before treatment due to lower quality or bent shape

- The basic machinery required for treating the poles like drilling machines, tanks for borane solution are repaired/replaced once in 5 years
- Labor cost of INR 800/ month for 1 person working for treatment
- An overhead cost of INR 1 per runing foot is considered for all the other costs like electricity, maintenance, water etc.

- Oline advertisements on Facebook, Google and own website.etc.
- Cost of transportetion within 100 km is INR 10/pole as per the customer location.

Value per pole
Cost of running foot = INR 15.48
Selling price excluding transport cost = INR 20
(Margin = INR 4.52)
Selling price including transport cost within 100 km = INR 30

***The manufacturer utilizes most of the treated bamboo in making cottages to cater market in Karnataka

2. Treated bamboo – Dimapur, Nagaland case

Figure 28: Case study of Treated Bamboo unit in Dimapur, Nagaland

Plant & Machinery Cost	Annual Production	Break-Even Point	IRR till 2022	NPV till 2022
INR 10,75,000	9000 poles	2.93 Years	1%	INR -5,91,888

Operation Cost

Raw material	Manufacturing Stage	Marketing	Consumer
Bamboo Cost=INR 8,10,000 pa for 9000 poles of 22 ft	**Manufacturing cost** Cost=INR 10,000pa	**Advertisements** Cost=INR 0pa	Wholesaler*** **Transportation within 50 km** As per distance
Copper chrome Borax Cost=INR 2,96,000pa for 2000 liters	**Labour cost** Cost=INR 5,37,600pa		
	Electricity Cost=INR 48,000pa		
	Admin cost Cost=INR 5,000pa		
	Misc cost Cost=INR 5,000pa		
Direct Material Cost = INR 11,06,000 pa ***Cost per running foot = INR 5.59***	**Processing cost** Cost = INR 6,05,600 pa ***Cost per running foot = INR 3.06***	**Marketing cost** Cost = INR 0 pa ***Cost/run ft. = INR 0***	**Transportation** ***Cost per pole = INR 0***

Assumptions

- 9000 treated poles of 22 ft are sold annually
- Cost of bamboo = INR 90/ pole including transportion
- Cost of CCB = INR 37000/250 litres
- 2000 liters of CCB is required for treating 9000 poles
- Water is generally available for free

- The basic machinery required for treating the poles like drilling machines, tanks for borane solution are repaired/replaced once in 5 years
- Labor cost of INR 200/ day for 6 persons working for treatment paid weekly and 8000/ month for 2 supervisors
- Electricity required for operation of plant of INR 4000 per month
- Admin and misc. costs of INR 5,000 and 5,000 respectively

- No marketing cost bom by the unit
- Transportation is taken care by the buyers/customers
- Majorly sold to Bangalore, Odisha for resorts and villas

Value per pole
Cost of running foot = INR 8.64
Selling price excluding
transport cost = INR 10.5 (Margin)=INR 1.86)

***Main buyers for treated bamboo are manufacturers of cottages and villas catering for markets in Karnataka and kerala

3. Fly Ash Bricks – Jaipur, Rajasthan case

Figure 29: Case study for Fly Ash Brick Manufacturing plant in Jaipur, Rajasthan

Plant & Machinery Cost	Annual Production	Break-Even Point	IRR till 2022	NPV till 2022
INR 22,10,000	15,00,000 bricks	3.27 Years	-5%	INR -17,19,359

Operation Cost Across*

	Raw material	Manufacturing Stage	Marketing	Consumer
8 months	**Fly ash**[x] Cost =INR 8,26,200 pa **Stone Dust**[**] Cost =INR 6,94,032 pa **Lime**[xx] Cost=INR 3,86,100 pa	**Maintenance cost** Cost=INR 2,20,000pa **Electricity cost** Cost=INR 2,54,000pa **Admin cost** Cost=INR 5,000pa **Labour cost** Cost=INR10,59,000pa	**Advertisements** Cost=INR 80,000pa	Wholesaler*** **Transportation within 65 km** Cost= INR 1 per brick
12 months		**Land rent** Cost=INR 3,00,000pa **Fuel cost** Cost=INR 800pa		
	Direct Material[##] Cost = INR 19,06,332 pa ***Cost per brick = INR 1.27***	**Processing cost** Cost = INR 18,38,800 pa ***Cost per brick= INR 1.23***	**Marketing cost** Cost = INR 80,000 pa ***Cost per brick = INR 0.05***	**Transportation** ***Cost per pole = INR 1***

Assumptions

- 200000 bricks are produced each month across 8 working months and the following inputs:
  - Fly ash at transportation cost of INR 850/tonne from Bikaner (250 km distance).
  - Lime at INR 2600/ tonne by trader from Jodhpur.
  - Stone dust is purchased at the price of INR 12/Sqft from Delhi.
- The manufacturer pays INR 25,000 rent for the land in use for the producation.
- Also the Manufacturer has sold only 2 lakh bricks since its inception and hasn't been able to sell 13 lakh units of Fly ash bricks which are kept in inventory.

- INR 70,000 is incurred to change the die on production of every 7-8 lakhs bricks.
- INR 100/month oiling cost is incurred for 8 months added in the maintenance cost.
- INR 5000 administration cost in incurred annually mainly for stationaries purchased.
- The plants has 15 labours and 4 office staff. The labour are paid on the basis of bricks produced at 45p/ brick. While salary of 2 office staff is INR 10,000 for 12 months and 2 loading labour is INR 6000/month.
- Three phase electricity supply is required which cost INR 30,000/-month for 8 working months and INR 3500/month for 4 non-working months.

- Marketing is done directly through phone and travelling to builders and developers.
- Currently the products are being purchased by the consumer directly and the manufacturer margin is INR 0.5/ brick.
- Cost of transportation within 65 km is INR 1/brick.

Value per pole
Cost of brick = INR 2.55
Selling price excluding transport cost = INR 3 (Margin=INR 0.45)
Selling price including transport cost within 65 km = INR 4

*The plant operates for 8 months with 4 month seasonal halt due to monsoon
[x]The Cost of Fly Art is 2810 and only transportation cost is applicable
[**]The material cost is calculated from the volume composition of the bricks and different densities of the raw material
[xx]Lime and Stone Dust is bought from the trader, hence cost break up of the product and transportation not know
[##]No wholesaler in this case study

4. Fly Ash Bricks: Bhubaneshwar, Odisha Case

Figure 30: Case study for Fly Ash Brick Manufacturing plant in Bhubaneshwar, Odisha

Plant & Machinery Cost	Annual Production	Break-Even Point	IRR till 2022	NPV till 2022
INR 6,00,00,000	1,87,20,000 bricks	2.32 Years	10%	INR -67,82,884

Operation Cost

Raw material

- **Cement** Cost =INR 2,00,92,146.60 pa
- **Flyash** Cost =INR 1,20,74.400 pa
- **Sand** Cost =INR 1,12,32,000 pa
- **Direct Material** Cost = INR 4,33,98,546.6 pa ***Cost per brick = INR 2.32***

Manufacturing Stage

- **Maintenance cost** Cost=INR 1,00,000pa
- **Labour cost** Cost=INR 42,00,000 pa
- **Electricity cost** Cost=INR 6,00,000pa
- **Rent** Cost=INR 7,00,000pa
- **Misc. cost** Cost=INR 30,000pa
- **Admin cost** Cost=INR 5,000pa
- **Processing cost** Cost = INR 56,35,000 pa ***Cost per brick= INR 0.3***

Marketing

- **Advertisements** Cost=INR 50,000pa
- **Marketing cost** Cost = INR 50,000 pa ***Cost per brick = INR 0.00***

Consumer

Wholesaler***

- **Transportation within 50 km** Cost = INR 0.5 per brick
- **Transportation** ***Cost per brick = INR 0.5***

Assumptions

- Each cement bag produces 191 bricks
- Around 50% flyash is used in the products
- Non trading cement from the companies @ INR 205 per bag is used which reduces the cost of production
- For faster processing at the thernal prower plant, a facilitation fee of INR 300 per truck is paid to the power plant employees

- Fully automated machine and requires less labour
- 5 persons working on machines @10,000 pm and 15 persons in the plant @20,000 pm are emloyed
- Rent of 7,00,000 per annum
- The plant runs over the year for 12 months. Hence the electricity cost is for whole year.
- Admin cost is 5,000 for whole year
- Bribe to the local goons for operating in that area.

- Online advertisements on Justdial, Facebook, Indiamart, Google etc.
- Cost of transportation within 50 km is INR 0.5/brick

Value per pole
Cost of brick = INR 2.62
Selling price excluding transport cost = INR 4 (Margin=INR 1.38)
Selling price including transport cost within 50 km = INR 4.5

*No need of wholesalers as the model have been designed for local small entrepreneurs and women's self-help qroups to cater to the local community

5. Fly ash Bricks – Ranchi, Jharkhand Case:

Figure 31: Case study for Fly Ash Brick Manufacturing plant in Ranchi, Jharkhand

Plant & Machinery Cost	Annual Production	Break-Even Point	IRR till 2022	NPV till 2022
INR 22,15,000	24,00,000 bricks	0.77 Years	19%	INR 8,47,676

Operation Cost

Raw material

- **Fly ash*** Cost =INR 3,40,000 pa
- **Gypsum**** Cost =INR 4,80,000 pa
- **Lime**** Cost =INR 12,00,000 pa
- **Bonding Material**** Cost =INR 1,73,000 pa
- **Crusher dust** Cost =INR 12,00,000 pa
- **Direct Material**** Cost = INR 23,13,000 pa ***Cost per brick = INR 1.45***

Manufacturing Stage

- **Maintenance cost** Cost=INR 2,00,000pa
- **Fuel cost** Cost=INR 24,000 pa
- **Admin cost** Cost=INR 5,000 pa
- **Labour cost** Cost=INR 12,00,000 pa
- **Electricity cost** Cost=INR 1,16,000 pa
- **Misc cost** Cost=INR 30,000pa
- **Processing cost** Cost = INR 15,75,000 pa ***Cost per brick= INR 0.98***

Marketing

- **Banners** Cost= INR 15,000pa
- **Space at Trade Fairs** Cost= INR 10,000pa
- **Marketing cost** Cost = INR 25,000 pa ***Cost per brick = INR 0.02***

Consumer

Wholesaler***

- **Transportation within 100 km** Cost = INR 1 per brick
- **Transportation** ***Cost per brick = INR 1***

Assumptions

- 2,00,000 bricks are produced each month across 8 working months and the following inputs:
  - 425 tonnes of Fly ash at transportation cost of INR 100/tonne from 3 km distance.
  - 20 tonnes of Gypsum at INR 3000/tonne by trader from Cuttack
  - 20 tonnes Lime at INR 7500/tonne by trader from Rajasthan.
  - 0.0625 tonnes Bonding Material is purchased at INR 21,250/month & at INR 375/month cost of transportation from Kolkata. (The matarial is brought twice in a year)

- 10% of machine cost goes into maintenance once in a year, while the cost machine is 20,00,000.
- INR 3000/month fuel cost is incurred for 8 months
- INR 5000 administration cost is incurred annually mainly for stationaries purchased.
- The plants has 12 labours and 3 office staff. Average salary of labour is INR 9,000 for 8 months. While salary of office staff is 12000, 10000 and 6000 as per the position for 12 months.
- Three phase electricity supply is required which cost INR 10,500/month for 8 working months and INR 8000/month for 4 non-working months.

- Marketing is done at a trade fair which is held twice a year. Cost of space is INR 5000 and banners is INR 7500 for participation in the Trade Fair.
- Currently the products are being purchased by the consumer directly and the manufacturer margin is INR 1/ brick.
- Cost of transportation within 100 km is INR 1/brick.

Value per pole
Cost of brick = INR 2.43
Selling price excluding transport cost = INR 3.40
(Margin=INR 0.97)
Selling price including transport cost within 100 km = INR 4.4

The plant operates for 8 months with 4 month seasonal halt due to monsoon
The Cost of Fly Ash is zero and only transportation cost is applicable
Gypsum, Lime and Handling material is bought from the trader, hence cost break up of the product and transportation not known
***No wholesaler in this case study

6. Fly ash Brick: Bhopal, Madhya Pradesh Case

Figure 32: Case study for Fly Ash Brick Manufacturing plant in Bhopal. Madhya Pradesh

Plant & Machinery Cost	Annual Production	Break-Even Point	IRR till 2022	NPV till 2022
INR 40,25,000	24,00,000 bricks	2.59 Years	55%	INR 57,52,889

Operation Cost

Raw material

- **Fly ash*** Cost =INR 16,58,880 pa
- **Gypsum**** Cost =INR 9,72,000 pa
- **Lime**** Cost =INR 16,20,000 pa
- **Aggregate**** Cost =INR 9,15,313 pa

Direct Material**
Cost = INR 51,66,193 pa
Cost per brick = INR 2.15

Manufacturing Stage

- **Maintenance cost** Cost=INR 50,000pa
- **Water cost** Cost=INR 40,000 pa
- **Admin cost** Cost=INR 5,000pa
- **Labour cost** Cost=INR 8,64,000pa
- **Electricity cost** Cost=INR 2,32,000 pa
- **Rent for land** Cost=INR 2,40,000pa

Processing cost
Cost = INR 14,31,000 pa
Cost per brick= INR 0.6

Marketing

Marketing Executive (Including office work+admin) Cost=INR 1,20,000pa

Marketing cost
Cost = INR 1,20,000 pa
Cost per brick = INR 0.05

Consumer

Wholesaler***

Transportation within 30 km
Cost = INR 1 per brick

Transportation
Cost per brick = INR 1

Assumptions

- The composition of the above materials are in 40:10:20:30, respectively.
- 30,00,000 bricks are produced each month across 8 working months and the following inputs.
  - INR 500/tonnes of Fly ash at transportation cost of INR 140/tonne from 10km distance.
  - INR 1300/tonnes Gypsum at INR 1700/ tonne transportation cost from Rajasthan.
  - INR 3300/tonnes Lime at INR 1700/tonne transportation cost from Rajasthan
  - Aggregate is purchased at INR 17 per sq. ft. where (1.7 tonnes = 35.313 sq. ft.)

- 10% of machine cost goes into maintenance once in a year, while the cost machine is 20,00,000.
- INR 5000 administration cost is incurred annually mainly for stationaries purchased.
- The plants has 12 labours and 1 office staff. Average salary of labour is INR 9,000 pm person. While salary of office staff is 10000 which include the administration and office work for 12 months.
- Three phase electricity supply is required which cost INR 25000/month for 8 working months and INR 8000/month for 4 non-working months.
- Water bill expenses of INR 5000/ month for 8 working months

- Marketing executive sells the product to the other consumers/contractors
- Currently the products are being purchased by the consumer directly and the manufacturer margin is INR 1/ brick
- Cost of transportation within 30-50 km is INR 1/brick.

Value per pole
Cost of brick = INR 2.8
Selling price excluding transport cost = INR 4
(Margin=INR 1.2)
Selling price including transport cost within 30-50 km = INR 5

*The Plant operates for 8 moths with 4 month seasonal halt due to monsoon.
xThe material cost is calculated from the volume composition of the brick and different densities of the raw material.
#The Cost of Fly Ash purchased from Mandideep and includes transportation cost
xxxGypsum, Lime is bought from Rajasthan and Aggregate is bought from local market
***No wholesaler in this case study

7. Fly ash bricks: Indore, Madhya Pradesh Case

Figure 33: Case study for Fly Ash Brick Manufacturing plant in Indore, Madhya Pradesh

Plant & Machinery Cost	Annual Production	Break-Even Point	IRR till 2022	NPV till 2022
INR 1,20,00,000	36,00,000 bricks	3.83 Years	6%	INR -21,16,328

Operation Cost

Raw material	Manufacturing Stage	Marketing	Consumer
Flyash Cost =INR 21,38,400 pa	**Maintenance cost** Cost=INR 1,00,000pa	**Advertisements** Cost = INR 7000 pa	Wholesaler***
Cement Cost =INR 93,31,200 pa	**Labour cost** Cost=INR 11,04,000 pa		**Transportation within 50 km** Cost = INR 0.5 per brick
Sand Cost =INR 11,66,400 pa	**Electricity cost** Cost=INR 6,00,000 pa		
	Admin cost Cost=INR 10,000pa		
	Misc. cost Cost=INR 50,000pa		
	Water cost Cost=INR 3,60,000pa		
Direct Material Cost = INR 1,26,36,000 pa ***Cost per brick = INR 3.51***	**Processing cost** Cost = INR 22,24,000 pa ***Cost per brick= INR 0.62***	**Marketing cost** Cost = INR 7000 pa ***Cost per brick = INR 0.00***	**Transportation** ***Cost per brick = INR 0.5***

Assumptions

• Brick composition - 55% flyash, 15% cement, 30% sand • Each bag of cement costs INR 320 • Cost of each ton of fly ash 400 • Capacity of the plant = 25000 bricks per day • Plant is running at lower capacity due to lower demand	• Fully automated machine and requires less labour • 7 persons working on machines @8000 pm and 3 persons in the plant @12,000 pm are employed • Rent of 7,00,000 per annum	• Online advertisements on Justdial • Cost of transportation within 50 km is INR 0.5/brick

Value per pole
Cost of brick = INR 4.13
Selling price excluding transport cost = INR 5
(Margin=INR 0.87)
Selling price including transport cost within 50 km = INR 6

*** No wholesaler in this case study

8. Fly ash bricks: Lucknow, Uttar Pradesh Case.

Figure 34: Case study for Fly Ash Brick Manufacturing plant in Lucknow, Uttar Pradesh

Plant & Machinery Cost	Annual Production	Break-Even Point	IRR till 2022	NPV till 2022
INR 55,00,000	25,00,000 bricks	2 Years	7 %	INR -14,85,736

Operation Cost

Raw material

- **Flyash** Cost =INR 24,75,000 pa
- **Sand** Cost =INR 9,00,000 pa
- **Lime** Cost =INR 41,25,000 pa
- **Gypsum** Cost =INR 20,62,500 pa

Direct Material Cost = INR 95,62,500 pa ***Cost per brick = INR 3.83***

Manufacturing Stage

- **Manufacturing cost** Cost=INR 1,00,000pa
- **Labour cost** Cost=INR 14,24,000 pa
- **Electricity cost** Cost=INR 7,16,000pa
- **Rent for land** Cost=INR 6,00,000pa
- **Water cost** Cost=INR 7,14,000pa
- **Fuel cost** Cost=INR 10,00,000pa
- **Misc. cost** Cost=INR 6,00,00pa
- **Admin cost** Cost=INR 5,000pa

Processing cost Cost = INR 51,59,000 pa ***Cost per brick= INR 2.06***

Marketing

- **Advertisements** Cost = INR 12,000 pa
- **Banners** Cost = INR 10,000 pa

Marketing cost Cost = INR 22,000pa ***Cost per brick = INR 0.01***

Consumer

Wholesaler***

- **Transportation within 50 km** Cost = INR 0.5 per brick

Transportation ***Cost per pole = INR 0.5***

Assumptions

- Composition of brick is 55% flyash, 30% sand, 10% Lime and 5% Gypsum
- Cost of flyash = 600/ tonne
- Cost of Sand = 4000/10 tonne
- Cost of Lime = 5500/ tonne
- Cost of Gypsum = 5500/tonne

- Labour cost of 80,000 per month is paid to the contractor who provides the constant supply of labour for the plant
- Two managers @12000, two supervisors @8000 and two gaurds @6000 are working in the plant
- Plant has both electricity connection and generator due to unreliability of electricity costing 70k/month.
- Water cost is also 70k/month
- Rent goes at 50k per month for whole year.
- Fuel cost 100k/month
- Wastages, damages, major repairs comes under the miscellaneous cost.

- Online advertisements on Justdial, Indiamart
- Cost of transportation within 50 km is INR 0.5/brick

Value per pole
Cost of brick = INR 5.9
Selling price excluding transport cost = INR 7
(Margin=INR 1.1)
Selling price including transport cost within 50 km = INR 7.5

**The Plant operates for 10 months with 2 month halt.
***No Wholesaler in the case study

9 Precast Hollow Block – Khurdha, Odisha Case

Figure 35: Case study for Precast Hollow Block Manufacturing plant in Khurdha, Odisha

Plant & Machinery Cost	Annual Production	Break-Even Point	IRR till 2022	NPV till 2022
INR 18,50,000	3,00,000 blocks	2.73 Years	7 %	INR -4,52,086

Operation Cost

Raw material

Cement
Cost =INR 16,00,000 pa for 5000 bags

River sand
Cost =INR 16,00,000 pa for 4000 mt^3

Coarse aggregates
Cost =INR 28,00,000 pa for 4000 mt^3

Direct Material
Cost = INR 60,00,000 pa
Cost per block = INR 20

Manufacturing Stage

Maintenance cost
Cost=INR 30,000pa

Labour cost
Cost=INR 3,89,000 pa

Electricity cost
Cost=INR 81,000pa

Admin cost
Cost=INR 5,000pa

Misc. cost
Cost=INR 10,000pa

Processing cost
Cost = INR 5,15,000 pa
Cost per block= INR 1.72

Marketing

Advertisements
Cost = INR 7000 pa

Marketing cost
Cost = INR 7000 pa
Cost per brick = INR 0.02

Consumer

Wholesaler***

Transportation within 50 km
Cost = INR 2 per brick

Transportation
Cost per pole = INR 2

Assumptions

- Cost of cement per bag (50kg)= INR 320 Which is Inclusive of INR 20 Per bag transportation cost
- Cost of river sand per m^3 = INR 400
- Cost of Coarse aggregate per m^3 = INR 700
- 3,00,000 blocks are manufactured pa with 1:3:3 volume ratio of materials mentioned in the above order
- 1:3:5 (in the above mantioned order by volume) can also be used to increase the profit margin as it lowers the cost but this lowers the quality of the product.
- Water is sourced from bore well on the site (cost included in one time plant setup

- Annual maintenance cost of approximately 30,000 if machine is used regularly and in the prescribed manner
- Labor cost for permanent labors (3 person* INR 300*20 day* 6 months), temprorary labors (5 person* INR 250* 20 day* 5 months), manager (1 person* INR 12,000* 6 months), supervisor (1 person* INR 8000 per month* 6 months), Security (2 person *6,000 per month *6 months
- Manager, supervisor & guards are shared between hollow block plant and paver block plant. Hence a contribution of 6 months each
- Electricity required for operation of plant of INR 10,500 per month considering 30% of total bill is consumer by this plant (total bill of 30—40 k per month for two plants)

- Online advertisements on Justdial, Facebook, Google
- Cost of transportation within 50 km is INR 2/block

Value per pole
Cost of brick = INR 21.74
Selling price excluding transport cost = INR 24
(Margin=INR 2.26)
Selling price including transport cost within 50 km = INR 26

*** No wholesaler in this case study

10 Precast Hollow Cocrete Block - Khandagiri case

Figure 36: Case study for Precast Hollow Block Manufacturing plant in Khandagiri, Odisha

Plant & Machinery Cost	Annual Production	Break-Even Point	IRR till 2022	NPV till 2022
INR 16,00,000	4,60,800 blocks	2.78 Years	10 %	INR -2,37,939

Operation Cost

Raw material

Cement
Cost =INR 24,80,000 pa for 7750 bags

Crusher dust
Cost =INR 28,00,000 pa for 700 Trucks (1050 MT)

Aggregates
Cost =INR 38,50,000 pa for 700 Trucks (1050 MT)

Direct Material
Cost = INR 91,30,000 pa
Cost per block = INR 19.81

Manufacturing Stage

Maintenance cost
Cost=INR 50,000pa

Labour cost
Cost=INR 4,60,000 pa

Electricity cost
Cost=INR 3,48,000pa

Admin cost
Cost=INR 5,000pa

Misc. cost
Cost=INR 30,000pa

Processing cost
Cost = INR 8,93,000 pa
Cost per block= INR 1.94

Marketing

Advertisements
Cost = INR 0 pa

Marketing cost
Cost = INR 0 pa
Cost per block = INR 0

Consumer

Wholesaler***

Transportation within 50 km
Cost = INR 2 per brick

Transportation
Cost per block = INR 2

Assumptions

- 4,60,000 blocks are manufactured pa
- Cost of cement per bag (50kg) = INR 320 which is inclusive of INR 20 per bag transportation cost
- Cost of crusher dust per truck (Around 1.5 MT) = INR 4000 (purchased from a trader)
- Cost of Stone chips per truck (Around 1.5 MT) = INR 5500 (purchased form a trader)
- 1:3:5 (in the above mantioned order by volume) is being used to increase the profit margin as it lowers the cost but this lowers the quality.
- Water is sourced from bore well on the site (cost included in one time plant setup)

- Annual maintenance cost of approximately 50,000 if machine is used regularly and in the prescribed manner
- Availability of labor is handled by the in charge of the plant who is given INR 1 for each brick
- Electricity required for operation of plant of INR 50,000 per month for 6 months and 8,000 for 6 months
- Admin and misc. costs of INR 5,000 and 30,000 (extortion money) respectively

- No Marketing channel is used.
- Cost of transportation within 50 km is INR 2/block.

Value per block
Cost of brick = INR 21.75
Selling price excluding transport cost = INR 23
(Margin=INR 1.2)
Selling price including transport cost within 50 km = INR 25

*** No wholesaler in this case study

11 Ferro Cement Door frame – Jaipur, Rajasthan case

Figure 37: Case study for Ferro Cement Door & Window Frame manufacturing plant in Jaipur, Rajashthan

Plant & Machinery Cost	Annual Production	Break-Even Point	IRR till 2022	NPV till 2022
INR 10,00,000	1,91,250 ft.	2.18 Years	-2 %	INR -7,49,478

Operation Cost

Raw material	Manufacturing Stage	Wholesaler	Consumer
Cement Cost=INR 17,21,250pa	**Direct labour cost** Cost=INR 4,86,000pa	**For wholesaler** Price = INR 28-30/ft. (5-6% margin)	**For Customer** Price = INR 40-45/ft. (30-35% margin)
Chicken Mesh Cost=INR 80-82/kg	**Indirect labour cost** Cost=INR 2,88,000 pa	**Transportation for 50 km** Cost = INR 1 per piece	**Transportation within 50 km** Cost = INR 1 per piece
Reinforcement bars Cost=1068896 pa	**Electricity cost** Cost=INR 1,44,000 pa		
Sand Cost=INR 3,22,734 pa	**Water cost** Cost=INR 39,804 pa		
Grit Cost=INR 3,22,734pa	**Maintenance cost** Cost=INR 3,59,015 pa		
Chemicals Cost=INR 1,43,438pa	**Misc. cost** Cost=INR 1,79,508 pa		
Direct Material Cost = INR 35,90,156 pa ***Cost per door = INR 18.8 per ft.*****	**Processing cost** Cost = INR 14,90,358 pa ***Cost per door = INR 7.8 per ft.*****	**Wholesaler price** ***Price per door = INR 28-30/ ft.*****	**Consumer Price Price per door = INR 40-45/ ft.**

Assumptions

- Composition of the Grit, cement and sand is in the ratio of 1:1:1 which is for the M 30 strength.
  - Cost of cement per bag (50kg) = INR 300
  - Cost of sand per Kg = INR 1.125
  - Cost of Grit per Kg = INR 1.125
  - Cost of Chicken Mesh = INR 80/Kg
  - Cost of Steel bar (8mm) = 47.5/Kg
- All the above cost are based on assumption that 50 units of door produced daily with 3 side perimeter of 17 ft. and 4x3 sq. inch thickness.
- The plant runs for 9 months in an year, with 3 months seasonal halt.

- Direct labour involves 6 labour directly working to produce the doors at 8-10k/Month.
- Indirect labours involves 2 managers at 12k/ month.
- Electricity cost is 15k/ month in the running months and 3k/month in the seasonal halts.
- Water is purchased at the rate of INR 250/ tank of 4000 liters.
- Maintenance cost is the cost to repair slabs and safeguarding the plant at 10% of the material used.
- Miscellaneous cost is kept at 5% of material cost for damage of material, damaged products and material the fts.

- No Marketing cost is incurring, since the firm is already established.
- For wholesalers, the manufacturer only get around 5-6% profit margin after taxes and negotiations.
- To consumers, the whoesaler sells at 30-35% profit margin.

Value of door per ft

Cost of a door = 26.6/ ft. of 4*3 sq inch thickness

Selling price to wholesaler = INR 28-30/ft. of 4*3 sq inch thickness

Selling price to customer = INR 40-45/ft. of 4*3 sq inch thickness

** of 4*3 sq inch thickness

12 Ferro Cement Door & Window Frame – Athigad, Odisha case

Figure 38: Case study for Ferro Cement Door & Window Frame manufacturing plant in Athigad, Odisha

Plant & Machinery Cost	Annual Production	Break-Even Point	IRR till 2022	NPV till 2022
INR 5,00,000	28,800 ft.	1.68 Years	12 %	INR -23,548

Operation Cost

Raw material	Manufacturing Stage	Wholesaler	Consumer
Cement Cost=INR 2,56,000 pa	**Land Rent** Cost=INR 30,000 pa	**For wholesaler** Price = INR 61.1/ft. (24% margin)	**For Customer** Price = INR 64-66/ft. (30% margin)
Sand Cost=INR 1,26,000 pa	**Labour cost** Cost=INR 4,08,000 pa		
Stone chips Cost= INR 1,54,000 pa	**Electricity cost** Cost=INR 7,200 pa		
GI Mesh Cost=INR 4,80,000 pa	**Admin cost** Cost=INR 2,000 pa		
GI grill Cost=INR 3,20,000 pa			
Direct Material Cost = INR 13,36,000 pa ***Cost per door & window = INR 35.28, 57.5***	**Processing cost** Cost = INR 4,47,200 pa ***Cost per foot of door & window = INR 15.5***	**Wholesaler price** ***Price per ft. = INR.61.1***	**Consumer Price** ***Price per ft. = INR.64-66***

Assumptions

- 800 doors and window frames are sold annually.
- Cost of the window is due to the additional grill provided
- 1:5:5 of cement, sand and stone chips are used
- Cost per frame
  - » Cement —INR 200
  - » Sand —INR 96.25
  - » Stone chips—INR 96.25
  - » GI Mesh— INR 300
  - » GI grill (for window) —INR 400

- Land is rented at 2500 per month.
- Electricity cost of 600 per month as it is not industrial electricity.
- Labor of 6 people at 8,000 per month and 2 managers at 10,000 per month.
- Administrative cost comes at INR 2000 per annum.

- No advertisements or marketing
- Cost of transportation within not known as it is taken care by the buyers

Value per block
Cost of Door and window frame per foot = INR 50.81 & 73
Price without transport cost = INR 61.1, 83.3 (Margin = 9.8 & 9.7)
Price including transport cost = As per the distance

Annexure 5: Product-wise Cash flow sheet of models

1. Treated bamboo

Material	**Treated Bamboo**
Cost Price	10.4
Selling Price	11.5
Selling Price with Transportation (Within 100km)	12.5

Assumptions / Constants	Value
Number of working months	4
No of batches of bamboo treated per month	6
Number of Bamboo treated per batch	100
Length of each bamboo (in ft)	17
Cost of each bamboo pole (in INR)	90
Borax required per each batch (in kg)	3
Cost of borax per kg (in INR)	65
Boric acid required per each batch (in kg)	2
Cost of boric acid per kg (in INR)	70
Quantity of CNSL required(in liters)	204
Cost of CNSL per liter (in INR)	23

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Sales (Annually)	**RS**	**469200**	**469200**	
Total No. of Units	Running feet	40800	40800	
Selling Price per running foot	RS	11.5	11.5	
Other Sources of Revenue If Any	RS	0	0	
Total Material Cost incurred (Annually)	**RS**	**232686**	**232686**	

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Total Processing Cost incurred (Annually)	RS	189800	189800	
Total Cost incurred(Annually)	**RS**	**422486**	**422486**	
Material cost per ft	Rs	5.7	5.7	Difference due to average cost
Processing cost per ft	Rs	4.7	4.7	
Total product cost per ft	Rs	10.4	10.4	Difference due to average cost
Input Stage				
Product Related				
Raw Material 1 (Bamboo)			216000	
Cost of Material	RS	216000		
% Used in the Whole product	%			
Transportation cost	RS	0		Locally produced bamboo is used. Hence, the cost is zero
Distance travelled / Source	KM	<10		
Raw Material 2 (borax)			5616	
Cost of Material	RS	4680		Cost of borax per kg INR 65/kg
% Used in the Whole product	%			
Transportation cost	RS	936		transportation cost = 20% of material cost
Distance travelled / Source	KM	Trader from local market		
Raw Material 3 (boric acid)			4032	
Cost of Material	RS	3360		Rs. 70/kg
% Used in the Whole product	%			
Transportation cost	RS	672		transportation cost = 20% of material cost
Distance travelled / Source	KM			
Raw Material 4 (CNSL)			7038	

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Cost of Material	RS	4692		1 litre@ INR 23 can coat 200 ft of bamboo
% Used in the Whole product	%			
Transportation cost	RS	2346		transportation cost = 50% of material cost R: due to larger volumes to be puchased
Distance travelled / Source	KM			
Material Cost	**RS**		**232686**	
Processing Stage				
Electricity cost	RS	0		
Water cost	RS	0		
Fuel cost of Machinery	RS	0		
Operational/ Maintenance cost	RS	0		
Packaging cost	RS	0		
Any other cost related to manufacturing	RS	0		
Manufacturing Overhead cost	**RS**		**40800**	**approx 1 rupee for all overhead cost including rent of the land, admin cost, marketing etc**
Related to Manufacturing		72000		6 labour @INR200 per day for 15 days a month for the 4 working months
Not related to Manufacturing		72000		1 plant manager and sales manager @ INR 6000 per month throughout the year
Others (Please mention what do you mean by others)		0		
Labour cost	**RS**		**144000**	

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Product delivery cost with distance	RS	Rs10/pole		If the customer wants it delivered to his location.
Distance travelled	km	<100km		
R&D	RS	0		
Insurance	RS	0		
Administrative cost	RS	0		
Taxes 1 (%)	%	0		
Taxes 2 (%)	%	0		
Non-Manufacturing Overhead Cost	**RS**	**0**	**0**	
Number of Years(N)	NUMBER	5 years		
Building and Plant	RS	Market Value		
Machineries	RS	50% of Market Value		
Scrap Value of Following after N years(>5)	**RS**	**0**	**0**	
Miscellaneous cost	**RS**	**5000**	**5000**	
Marketing Stage				
Marketing cost(If any)	RS	400	400	
Storage Warehousing				
Cost of Storage Space		0		
Special Requirements for Storing Raw Material 1		Normal racks		
Special Requirements for Storing Raw Material 2		Bags		
Special Requirements for Processed Product		Normal racks		
Inventory Cost	**RS**		**0**	
Plant and Machinery				

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Cost of Land	RS	0		Land of govt or community is used for this purpose on rental or lease basis
Plant and Machinery	RS	0		
Equipment cost like Electric wiring, Piping or other supplies.	RS	20000		Cost of wiring and other supplies at the workshop
Cost of Approvals	RS	0		
Other Setup Cost (Please mention what do you mean by others)	RS	0		
Share of Loan	%	0		No loan Taken
Interest Rate of the Loan	%	0		
Fixed one time cost of the Manufacturing Unit	**RS**	**20000**	**20000**	
Break-Even Point	**Years**	**0.43**		

Financial Feasibility	● Treated Bamboo	
Equity	50%	
Debt	50%	
Cost Of Debt	10%	
Cost Of Equity	15%	
WACC	11.50%	
Estimated sales (in quantity)	40,800	units/Year
Projected Price per unit	11.50 INR	
Investment in Machines and Plant	20,000	INR
Estimated Life of Machines (in years)	6	Year
Cost of machine	5,000	
Resale Value of Machine	2,500	INR
Depreciation of machine - straight line method	417	INR/year
Opportunity Cost of the Invested amount	1,410	INR/year
Account receivable	14	Days
Processing time	21	Days
Inventory time	7	Days
Account Payable	30	Days
Raw Material (per unit)	5.70	INR/unit
Total cost per unit	10.36	
Labor Cost per year	144,000	INR/year
Operating Cost per year	40,800	INR/year
Administrative & Selling Expenses	5,000	INR/Year
Marketing Expense	2000	INR/Year
Number of working months	4 Months	
Working Capital Required	156,557 INR/45	day cycle
Tax Rate	20%	INR/Rate
Market growth rate	3%	
Inflation rate	5%	
Setup cost	174557.25	INR

Quantity of AHCM sold		40,800	42,024	43,285	44,583	45,921	47,298
Year	2016	2017	2018	2019	2020	2021	2022
Total Investment	-20,000						
Opportunity Cost of Invested Amount for 6 years	-8,460						
Working Capital	-156,557						
Sales Revenue		469,200	483,276	497,774	512,708	528,089	543,931
Raw Materials		-232,686	-239,667	-259,199	-254,262	-261,890	-269,747
Labour Cost		-144,000	-151,200	-158,760	-166,698	-175,033	-183,785
Operating Cost		-40,800	-42,840	-44,982	-47,231	-49,593	-52,072
Gross Profit		51,714	49,569	34,833	44,516	41,573	38,328
Administrative & Selling Expenses		-5,000	-5,250	-5,513	-5,788	-6,078	-6,381
Marketing Expense		-2,000	-2,100	-2,205	-2,315	-2,431	-2,553
EBITDA		44,714	42,219	27,115	36,413	33,064	29,394
Interest payment		-2,296	-2,296	-2,296	-2,296	-2,296	-2,296
Depreciation		-417	-417	-417	-417	-417	-417
EBT		42,001	39,507	24,403	33,700	30,352	26,681
Taxes		-8,400	-7,901	-4,881	-6,740	-6,070	-5,336
Net Income		33,601	31,605	19,522	26,960	24,281	21,345
Add back depreciation		417	417	417	417	417	417
Working Capital Redeemed							156,557
After tax Salvage Value of Machine							2,000
Total cash flow	-185,017	34,018	32,022	19,939	27,377	24,698	180,319

NPV	11,517.63	INR
IRR	13%	

2. Bamboo mat wall and floor boards

Assam Case - Bamboo Mat Flooring and Wall Panels	
Material	Bamboo mat
State	Assam
Name of the Stakeholder:	Vikas Khemka
Contact Details :	Nano Steel Pvt. Ltd., Guwahati, Assam
Cost Price (in INR)	82.63
Selling Price (in INR)	98.00
Selling Price with Transportation(Within 100km) (in INR)	99.00

Assumptions / Constants	Value
No of working months in an year	12.00
No of working days in an year	300.00
Area of board (in Sq ft)	32.00
Plant Board capacity (per day)	80.00
Cost of bamboo mat (per Sq Ft) (two kinds of boards used per 8ftx4ft board, 2 face boards- INR 135/board and 6 core boards of INR 125/board each)	31.88
No of layers of board / mats used (2 face boards and 6 core boards)	8.00
Amt of resin required for each layer of board (in Kg)	1.00
Cost of resin (per kg) in INR	75.00
Cost of labour for manufacturing boards (per Sq ft) in INR	14.00
Variable cost (as a % of raw material and labour cost)	15%
Administrative cost (as a % of raw material and labour cost)	5%

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Sales (Annually)	**RS**	**75,264,000.00**	**75,264,000.00**	
Total No. of Units	sq ft	768,000.00	768,000.00	Max plant capacity: 200 boards of 8ftx4ft/day Currently running @40% capacity for 300 days an year (12 mm thickness boards)
Selling Price per Unit	RS	98.00	98.00	
Other Sources of Revenue If Any	RS	-	-	
Total Material Cost incurred(Annually)	**RS**	**38,880,000.00**	**38,880,000.00**	
Total Processing Cost incurred(Annually)	**RS**	**24,578,400.00**	**24,578,400.00**	
Total Marketing Cost incurred(Annually)	**INR**	**-**	**-**	
Total Cost incurred(Annually)	**RS**	**63,458,400.00**	**63,458,400.00**	
Material cost per Unit	**Rs**	**50.63**	**50.63**	
Processing cost per Unit	**Rs**	**32.00**	**32.00**	
Marketing cost per Unit	**INR**	**-**	**-**	
Total product cost per Unit	**Rs**	**82.63**	**82.63**	
Input Stage				
Product Related				
Raw Material 1 (Bamboo mat)			24,480,000.00	
Cost of Material	RS	24,480,000.00		two kinds of boards used per 8ftx4ft board, 2 face boards- INR 135/board and 6 core boards of INR 125/board each
% Used in the Whole product	%			
Transportation cost	RS	-		Included in the cost of the material. Delivered by seller
Distance travelled / Source	KM			

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Raw Material 1 (Phenol formaldehyde)			14,400,000.00	
Cost of Material	RS	14,400,000.00		1kg of resin is required for each layer of board. Hence 8 kgs of resin @INR 75/kg
% Used in the Whole product	%			
Transportation cost	RS	-		Included in the cost of the material. Delivered by seller
Distance travelled / Source	KM			Local trader
Material Cost	**RS**		**38,880,000.00**	
Processing Stage				
Variable operational cost		7,444,800.00		Variable cost @15% of the raw materials and labour cost includes water, electricity etc
Fixed operational cost		3,600,000.00		Fixed cost every month irrespective of production includes rent, interest etc
Electricity cost	RS	-		Included in Variable cost
Rent for land	Rs	-		Included in Fixed operational cost
Water cost	RS	-		Included in Variable cost
Fuel cost of Machinery	RS	-		
Operational/ Maintenance cost	RS	-		
Packaging cost	RS	-		
Any other cost related to manufacturing	RS	-		
Manufacturing Overhead cost	**RS**		**11,044,800.00**	

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Related to Manufacturing		10,752,000.00		14rs/sq ft labour cost for manufacturing the boards
Not related to Manufacturing		-		
Others (Please mention what do you mean by others)		-		
Labour cost	**RS**	**10,752,000.00**	**10,752,000.00**	
Product delivery cost with distance	RS	Rs2/brick		
Distance travelled	km	<50km		
R&D	RS	-		
Insurance	RS	-		
Administrative cost	RS	2,481,600.00		Administrative cost @5% of the raw materials and labour cost
Taxes 1 (%)	%	5.00		
Taxes 2 (%)	%	-		
Non-Manufacturing Overhead Cost	**RS**		**2,481,600.00**	
Number of Years(N)	NUMBER	5 years		
Building and Plant	RS	Market Value		
Machineries	RS	50% of Market Value		
Scrap Value of Following after N years(>5)	**RS**		**-**	
Miscellaneous cost	**RS**	**300,000.00**	**300,000.00**	
Marketing Stage				
Marketing cost(If any)	RS	-	-	
Storage Warehousing				
Cost of Storage Space		-		Included in the fixed cost of the manufacturing
Special Requirements for Storing Raw Material 1	store room for cement storage	-		Included in the fixed cost of the manufacturing

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Special Requirements for Storing Raw Material 2				
Special Requirements for Storing Raw Material 3				
Special Requirements for Processed Product				
Inventory Cost	RS		-	
FIXED COST				
Cost of Land	RS	75,000,000.00		
Plant and Machinery	RS	10,000,000.00		includes all the components
Equipment cost like Electric wiring, Piping or other supplies.	RS	-		
Cost of Approvals	RS	-		
Other Setup Cost (Please mention what do you mean by others)	RS	15,000,000.00		
Share of Loan	%	-		Not shared
Interest Rate of the Loan	%	-		
Fixed one time cost of the Manufacturing Unit	RS		##############	
Break-Even Point	Years	8.47		

● **Bamboo Mat**

Financial Feasibility		
Equity	50%	
Debt	50%	
Cost Of Debt	10%	
Cost Of Equity	15%	
WACC	11.50%	
Estimated sales (in quantity)	768,000	units/Year
Projected Price per unit	98.00	INR
Investment in Machines and Plant	25,000,000	INR
Estimated Life of Machines (in years)	6	Year
Cost of machine	10,000,000	
Resale Value of Machine	5,000,000	INR
Depreciation of machine - straight line method	833,333	INR/year
Opportunity Cost of the Invested amount	1,762,500	INR/year
Account receivable	14	Days
Processing time	21	Days
Inventory time	7	Days
Account Payable	30	Days
Raw Material (per unit)	50.63	INR/unit
Total cost per unit	82.63	
Labor Cost per year	10,752,000	INR/year
Operating Cost per year	11,044,800	INR/year
Administrative & Selling Expenses	2,781,600	INR/Year
Marketing Expense	500000	INR/Year
Number of working months	12	Months
Working Capital Required	7,584,600	INR/45 day cycle
Tax Rate	20%	INR/Rate
Market growth rate	3%	
Inflation rate	5%	
Setup cost	32084600	

Quantity of AHCM sold		768,000	791,040	814,771	839,214	864,391	890,322
Year	2016	2017	2018	2019	2020	2021	2022
Total Investment	-25,000,000						
Opportunity Cost of Invested Amount for 6 years	-10,575,000						
Working Capital	-7,584,600						
Sales Revenue		75,264,000	77,521,920	79,847,578	82,243,005	84,710,295	87,251,604
Raw Materials		-38,880,000	-40,046,400	-43,310,182	-42,485,226	-43,759,783	-45,072,576
Labour Cost		-10,752,000	-11,289,600	-11,854,080	-12,446,784	-13,069,123	-13,722,579
Operating Cost		-11,044,800	-11,597,040	-12,176,892	-12,785,737	-13,425,023	-14,096,275
Gross Profit		14,587,200	14,588,880	12,506,424	14,525,259	14,456,366	14,360,174
Administrative & Selling Expenses		-2,781,600	-2,920,680	-3,066,714	-3,220,050	-3,381,052	-3,550,105
Marketing Expense		-500,000	-525,000	-551,250	-578,813	-607,753	-638,141
EBITDA		11,305,600	11,143,200	8,888,460	10,726,396	10,467,561	10,171,928
Interest payment		-2,870,092	-2,870,092	-2,870,092	-2,870,092	-2,870,092	-2,870,092
Depreciation		-833,333	-833,333	-833,333	-833,333	-833,333	-833,333
EBT		7,602,174	7,439,774	5,185,034	7,022,971	6,764,135	6,468,503
Taxes		-1,520,435	-1,487,955	-1,037,007	-1,404,594	-1,352,827	-1,293,701
Net Income		6,081,740	5,951,820	4,148,028	5,618,377	5,411,308	5,174,802
Add back depreciation		833,333	833,333	833,333	833,333	833,333	833,333
Working Capital Redeemed							7,584,600
After tax Salvage Value of Machine							4,000,000
Total cash flow	-43,159,600	6,915,073	6,785,153	4,981,361	6,451,710	6,244,641	17,592,736

NPV	-10,953,184.78	INR
IRR	3%	

3. Fly ash brick

Model Case: Fly ash bricks	
Material	Flyash Bricks
Cost Price (in INR)	4.48
Selling Price (in INR)	5.50
Selling Price with Transportation(Within 100km) (in INR)	6.50

Assumptions / Constants	Value
No of working months	8.00
No of seasonal months	4.00
Number of working days	24.00
Daily production capacity	2,500.00
Mass of each brick (in Kg)	3.00
% of fly ash used in each brick	55%
Annual fly ash requirement (in tonne)	792.00
Cost of fly ash per tonne (in INR)	400.00
% of sand used in each brick	35%
Annual sand requirement (in tonne)	504.00
Cost of sand per tonne (in INR)	400.00
% of Gypsum used in each brick	5%
Annual Gypsum requirement (in tonne)	72.00
Cost of Gypsum per tonne (in INR)	5,500.00
% of lime used in each brick	5%
Annual lime requirement (in tonne)	72.00
Cost of lime per tonne (in INR)	6,000.00
Monthly wage for direct labour (In INR)	48,000.00
Monthly salary for indirect labour (In INR)	16,000.00

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Sales(Annually)	**RS**	**2,640,000.00**	**2,640,000.00**	
Total No. of Units	NUMBER	480,000.00	480,000.00	
Selling Price per Unit	RS	5.50	5.50	
Other Sources of Revenue If Any	RS	-	-	
Total Material Cost incurred (Annually)	**RS**	**1,346,400.00**	**1,346,400.00**	
Total Processing Cost incurred (Annually)	**RS**	**806,000.00**	**806,000.00**	
Total Marketing Cost incurred (Annually)	**RS**	**-**	**-**	
Total Cost incurred (Annually)	**RS**	**2,152,400.00**	**2,152,400.00**	
Material cost per Unit	**Rs**	**2.81**	**2.81**	
Processing cost per Unit	**Rs**	**1.68**	**1.68**	
Total product cost per Unit	**Rs**	**4.48**	**4.48**	
Input Stage				
Product Related				
Raw Material 1 (Flyash)			316,800.00	
Cost of Material	RS	316,800.00		INR 400 for tonne of flyash
% Used in the Whole product	%	55%		
Transportation cost	RS			Transportation cost included in the cost of raw material
Distance travelled / Source	KM	150.00		
Raw Material 2 (sand)			201,600.00	
Cost of Material	RS	201,600.00		INR 4000 per truck of sand, including transportation, royalty
% Used in the Whole product	%	35%		
Transportation cost	RS			Transportation cost included in the cost of raw material

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Distance travelled / Source	KM	100.00		
Raw Material 3 (Gypsum)			396,000.00	
Cost of Material	RS	396,000.00		INR 5500 per tonne of Lime including transportation
% Used in the Whole product	%	5%		
Transportation cost	RS			Transportation cost included in the cost of raw material
Distance travelled / Source	KM	1,200.00		
Raw Material 4 (Lime)			432,000.00	
Cost of Material	RS	432,000.00		INR 6000 per tonne of Gypsum including transportation
% Used in the Whole product	%	5%		
Transportation cost	RS	-		Transportation cost included in the cost of raw material
Distance travelled / Source	KM	900.00		
Material Cost	RS		1,346,400.00	
Processing Stage				
Electricity cost	RS	96,000.00		Electricity bill of 8000 per month for all 12 months
Rent for land	Rs	30,000.00		Monthly rent of INR 2500 for the land
Water cost	RS	-		
Fuel cost of Machinery	RS			
Operational/ Maintenance cost	RS	49,000.00		Maintenance cost of 10% of the machine cost
Packaging cost	RS	-		
Any other cost related to manufacturing	RS	-		

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Manufacturing Overhead cost	RS		175,000.00	
Related to Manufacturing		384,000.00		8 labourers @INR 6000 for the eight working months
Not related to Manufacturing		192,000.00		1 manager and 1 supervisor @INR 8000 per month
Others (Please mention what do you mean by others)		-		
Labour cost	RS		576,000.00	
Non-Manufacturing Overhead Cost	RS		5,000.00	
Scrap Value of Following after N years (>5)	RS	-	-	
Miscellaneous cost	RS	50,000.00	50,000.00	Wastages, damages, major repairs and other expenses
Marketing stage				
Marketing cost (If any)	RS	-	-	INR 7000 for Justdial INR 5000 for Indiamart INR 10000 other expenses
Storage Warehousing				
Inventory Cost	RS		-	
FIXED COST				
Cost of Land	RS	-		Rented land
Plant and Machinery	RS	490,000.00		Includes machinery(automatic) , transport, setup, training
Equipment cost like Electric wiring, Piping or other supplies.	RS	98,000.00		20% of the machinery cost
Cost of Approvals	RS			

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Other Setup Cost (Please mention what do you mean by others)	RS	755,000.00		INR 55000 - Trolleys, extra moulds etc. INR 7 lakhs for transformer
Share of Loan	%	50%		
Interest Rate of the Loan	%	10%		
Fixed one time cost of the Manufacturing Unit	RS		1,343,000.00	
Break-Even Point	Years	2.8		

Financial Feasibility	• Fly ash bricks	
Equity	50%	
Debt	50%	
Cost Of Debt	10%	
Cost Of Equity	15%	
WACC	11.50%	
Estimated sales (in quantity)	480,000	units/Year
Projected Price per unit	5.50	INR
Investment in Machines and Plant	1,343,000	INR
Estimated Life of Machines (in years)	6	Year
Cost of machine	1,245,000	
Resale Value of Machine	622,500	INR
Depreciation of machine - straight line method	103,750	INR/year
Opportunity Cost of the Invested amount	94,682	INR/year
Account receivable	14	Days
Processing time	21	Days
Inventory time	7	Days
Account Payable	30	Days
Raw Material (per unit)	2.81	INR/unit
Total cost per unit	4.48	
Labor Cost per year	576,000	INR/year
Operating Cost per year	175,000	INR/year
Administrative & Selling Expenses	55,000	INR/Year
Marketing Expense	26,860	INR/Year
Number of working months	8	Months
Working Capital Required	393,263	INR/45 day cycle
Tax Rate	20%	INR/Rate
Market growth rate	3%	
Inflation rate	5%	
Setup cost	1709402.5	INR

Quantity of AHCM sold		480,000	494,400	509,232	524,509	540,244	556,452
Year	2016	2017	2018	2019	2020	2021	2022
Total Investment	-1,343,000						
Opportunity Cost of Invested Amount for 6 years	-568,089						
Working Capital	-393,263						
Sales Revenue		2,640,000	2,719,200	2,800,776	2,884,799	2,971,343	3,060,484
Raw Materials		-1,346,400	-1,386,792	-1,499,816	-1,471,248	-1,515,385	-1,560,847
Labour Cost		-576,000	-604,800	-635,040	-666,792	-700,132	-735,138
Operating Cost		-175,000	-183,750	-192,938	-202,584	-212,714	-223,349
Gross Profit		542,600	543,858	472,983	544,175	543,113	541,149
Administrative & Selling Expenses		-55,000	-57,750	-60,638	-63,669	-66,853	-70,195
Marketing Expense		-26,860	-28,203	-29,613	-31,094	-32,648	-34,281
EBITDA		460,740	457,905	382,732	449,412	443,612	436,673
Interest payment		-154,181	-154,181	-154,181	-154,181	-154,181	-154,181
Depreciation		-103,750	-103,750	-103,750	-103,750	-103,750	-103,750
EBT		202,809	199,974	124,801	191,481	185,680	178,742
Taxes		-40,562	-39,995	-24,960	-38,296	-37,136	-35,748
Net Income		162,247	159,979	99,841	153,185	148,544	142,993
Add back depreciation		103,750	103,750	103,750	103,750	103,750	103,750
Working Capital Redeemed							393,263
After tax Salvage Value of Machine							498,000
Total cash flow	-2,304,352	265,997	263,729	203,591	256,935	252,294	1,138,006

NPV	-801,917.03	INR
IRR	1%	

4. Precast Hollow Concrete Block - Manual mixer method

Model case 1: Precast Hollow cement blocks	
Material	Precast hollow Bricks
Cost Price	32.8
Selling Price	38
Selling Price with Transportation (Within 50km)	40

Assumptions / Constants	Value
Number f working months	8.00
Number of working days	24.00
Daily production	80.00
Volume of each block	0.02
Ratio of cement in the block (by volume)	0.08
Bulk density of cement (kg/cum)	1,250.00
Quantity of cement required (in 50 kg bags)	472.62
Cost of each cement bag (in INR)	360.00
Ratio of sand in the block (by volume)	0.46
Quantity of sand required (in cum)	113.43
Cost of sand per cum (in INR)	400.00
Ratio of aggregate in the block (by volume)	0.46
Quantity of aggregate required (in cum)	113.43
Cost of aggregate per cum (in INR)	400.00

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Sales(Annually)	**RS**	**583680**	**583680**	
Total No. of Units	NUMBER	15360	15360	80 per bricks per day when it's fully operational
Selling Price per Unit	RS	38	38	10 % profit margin, price varies with the quality and number of the order
Other Sources of Revenue If Any	RS	0	0	
Total Material Cost incurred(Annually)	**RS**	**260883.6923**	**260884**	
Total Processing Cost incurred(Annually)	**RS**	**256600**	**256600**	
Total Marketing cost(Annually)	**Rs**		**0**	
Total Cost incurred(Annually)	**RS**	**517483.6923**	**517483.6923**	
Material cost per Unit	**Rs**	**17.0**	**17.0**	
Processing cost per Unit	**Rs**	**16.7**	**16.7**	
Marketing cost per Unit	**Rs**	**0.0**	**0.0**	
Total product cost per Unit	**Rs**	**33.7**	**33.7**	
Input Stage				
Product Related				
Raw Material 1 (Cement)			170141.54	
Cost of Material	RS	170141.54		INR 400 /bag includes cost of material and transportation
% Used in the Whole product	%			1/13 by volume
Transportation cost	RS	0		Transportation cost included in the cost of material
Distance travelled / Source	KM			
Raw Material 2 (river sand)			45371.08	

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Cost of Material	RS	45371.08		INR 400/m^3 including royalty, transport, labour for loading and unloading
% Used in the Whole product	%			6/13 by volume
Transportation cost	RS	0		Transportation cost included in the cost of material
Distance travelled / Source	KM			
Raw Material[3] (6 mm aggregate)			45371.08	
Cost of Material	RS	45371.08		INR 400/m^3 including the cost of the bricks, transporation and labour
% Used in the Whole product	%			6/13 by volume
Transportation cost	RS	0		Transportation cost included in the cost of material
Distance travelled / Source	KM			
Material Cost	**RS**		**260883.69**	
Processing Stage				
Electricity cost	RS	1600		Electricity cost of INR 200 per month for 8 working months
Water cost	RS	0		
Fuel cost of Machinery	RS	0		
Operational/ Maintenance cost	RS	5000		
Packaging cost	RS	0		
Any other cost related to manufacturing	RS	0		
Manufacturing Overhead cost	**RS**	**6600**	**6600**	
Related to Manufacturing		168000		

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Not related to Manufacturing		72000		1 supervisor/ manager for 12 months @INR 600 per month
Others (Please mention what do you mean by others)		0		
Labour cost	**RS**	**240000**	**240000**	
Product delivery cost with distance	RS	Rs2/brick		If the customer wants it delivered to his location, including labour for loading and unloading
Distance travelled	km	<100km		
R&D	RS	0		
Insurance	RS	0		
Administrative cost	RS	5000		mainly consist of stationary cost.
Taxes 1 (%)	%	0		
Taxes 2 (%)	%	0		
Non-Manufacturing Overhead Cost	**RS**	**5000**	**5000**	
Number of Years(N)	NUMBER	5 years		
Building and Plant	RS	Market Value		
Machineries	RS	50% of Market Value		
Scrap Value of Following after N years(>5)	**RS**		**0**	
Miscellaneous cost	**RS**	**5000**	**5000**	
Marketing Stage				
Marketing cost(If any)	**RS**	**0**	**0**	
Storage Warehousing				
Cost of Storage Space		0		Included in the fixed cost of the manufacturing

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Special Requirements for Storing Raw Material 1	store room for cement storage	0		Included in the fixed cost of the manufacturing
Special Requirements for Storing Raw Material 2				
Special Requirements for Storing Raw Material 3				
Special Requirements for Processed Product				
Inventory Cost	RS		0	
FIXED COST				
Cost of Land	RS	0		Own land
Plant and Machinery	RS	23000		Only machinery including installation and transport
Equipment cost like Electric wiring, Piping or other supplies.	RS	0		Includes transformer(shared), borewell (shared), platform for keeping the bricks (capacity = 2 days of max production), vibrator machine and shed for covering the bricks and approvals
Cost of Approvals	RS	0		
Other Setup Cost (Please mention what do you mean by others)	RS	50000		
Share of Loan	%	0		No loan Taken
Interest Rate of the Loan	%	0		
Fixed one time cost of the Manufacturing Unit	RS	73000	73000	
Break-Even Point	Years	1.10		

Financial Feasibility	● Hollow concrete block - Manual mixer
Equity	50%
Debt	50%
Cost Of Debt	10%
Cost Of Equity	15%
WACC	11.50%
Estimated sales (in quantity)	15,360 units/Year
Projected Price per unit	38.00 INR
Investment in Machines and Plant	73,000 INR
Estimated Life of Machines (in years)	6 Year
Cost of machine	23,000
Resale Value of Machine	11,500 INR
Depreciation of machine - straight line method	1,917 INR/year
Opportunity Cost of the Invested amount	5,147 INR/year
Account receivable	14 Days
Processing time	21 Days
Inventory time	7 Days
Account Payable	30 Days
Raw Material (per unit)	16.98 INR/unit
Total cost per unit	33.69
Labor Cost per year	240,000 INR/year
Operating Cost per year	6,600 INR/year
Administrative & Selling Expenses	10,000 INR/Year
Marketing Expense	2000 INR/Year
Number of working months	8 Months
Working Capital Required	95,153 INR/45 day cycle
Tax Rate	20% INR/Rate
Market growth rate	3%
Inflation rate	5%
Setup cost	166153.1923 INR

Quantity of AHCM sold		15,360	15,821	16,295	16,784	17,288	17,806
Year	2016	2017	2018	2019	2020	2021	2022
Total Investment	-73,000						
Opportunity Cost of Invested Amount for 6 years	-30,879						
Working Capital	-95,153						
Sales Revenue		583,680	601,190	619,226	637,803	656,937	676,645
Raw Materials		-260,884	-268,710	-290,610	-285,075	-293,627	-302,436
Labour Cost		-240,000	-252,000	-264,600	-277,830	-291,722	-306,308
Operating Cost		-6,600	-6,930	-7,277	-7,640	-8,022	-8,423
Gross Profit		76,196	73,550	56,740	67,258	63,566	59,478
Administrative & Selling Expenses		-10,000	-10,500	-11,025	-11,576	-12,155	-12,763
Marketing Expense		-2,000	-2,100	-2,205	-2,315	-2,431	-2,553
EBITDA		64,196	60,950	43,510	53,366	48,980	44,163
Interest payment		-8,381	-8,381	-8,381	-8,381	-8,381	-8,381
Depreciation		-1,917	-1,917	-1,917	-1,917	-1,917	-1,917
EBT		53,899	50,653	33,212	43,069	38,683	33,866
Taxes		-10,780	-10,131	-6,642	-8,614	-7,737	-6,773
Net Income		43,119	40,522	26,570	34,455	30,946	27,093
Add back depreciation		1,917	1,917	1,917	1,917	1,917	1,917
Working Capital Redeemed							95,153
After tax Salvage Value of Machine							9,200
Total cash flow	-199,032	45,036	42,439	28,486	36,372	32,863	133,362

NPV	8,050.50	INR
IRR	13%	

5. Precast Hollow Concrete block - Electric Mixer Model

Model case 2: Precast Hollow cement blocks	
Material	Precast hollow Bricks
Cost Price	29.2
Selling Price	33.5
Selling Price with Transportation(Within 50km)	35.5

Number of working months	8.00
Number of working days	24.00
Daily production	120.00
Volume of each block	0.02
Ratio of cement in the block (by volume)	0.08
Bulk density of cement (kg/cum)	1,250.00
Quantity of cement required (in 50 kg bags)	708.92
Cost of each cement bag (in INR)	360.00
Ratio of sand in the block (by volume)	0.46
Quantity of sand required (in cum)	170.14
Cost of sand per cum (in INR)	400.00
Ratio of aggregate in the block (by volume)	0.46
Quantity of aggregate required (in cum)	170.14
Cost of aggregate per cum (in INR)	400.00
Number of units of electricity required for all bricks	13,824.00
Cost of each unit of electricity	5.00

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Sales(Annually)	**RS**	**771840**	**771840**	
Total No. of Units	NUMBER	23040	23040	2500 per bricks per day when it's fully operational
Selling Price per Unit	RS	33.5	33.5	10 % profit margin, price varies with the quality and number of the order
Other Sources of Revenue If Any	RS	0	0	
Total Material Cost incurred(Annually)	**RS**	**391326**	**391326**	
Total Processing Cost incurred(Annually)	**RS**	**281120**	**281120**	
Total Marketing cost(Annually)	**Rs**	**0**	**0**	
Total Cost incurred(Annually)	**RS**	**672446**	**672446**	
Material cost per Unit	**Rs**	**17.0**	**17.0**	**False due to differences in decimal.**
Processing cost per Unit	**Rs**	**12.2**	**12.2**	
Marketing cost per Unit	**Rs**	**0.0**	**0.0**	
Total product cost per Unit	**Rs**	**29.2**	**29.2**	**False due to differences in decimal.**
Input Stage				
Product Related				
Raw Material 1 (Cement)			255212.31	
Cost of Material	RS	255212.31		
% Used in the Whole product	%			1/7 by volume
Transportation cost	RS	0		
Distance travelled / Source	KM			
Raw Material 2 (river sand)			68056.62	
Cost of Material	RS	68056.62		

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
% Used in the Whole product	%			3/7 by volume
Transportation cost	RS	0		
Distance travelled / Source	KM			
Raw Material 3 (6 mm aggregate)			68056.62	
Cost of Material	RS	68056.62		
% Used in the Whole product	%			3/7 by volume
Transportation cost	RS	0		
Distance travelled / Source	KM			
Material Cost	**RS**		**391325.54**	
Processing Stage				
Electricity cost	RS	69120		
Water cost	RS	0		
Fuel cost of Machinery	RS	0		
Operational/ Maintenance cost	RS	10000		
Packaging cost	RS	0		
Any other cost related to manufacturing	RS	0		
Manufacturing Overhead cost	**RS**	**79120**	**79120**	
Related to Manufacturing		120000		
Not related to Manufacturing		72000		
Others (Please mention what do you mean by others)		0		
Labour cost	**RS**	**192000**	**192000**	
Product delivery cost with distance	RS	Rs2/brick		If the customer wants it delivered to his location, including labour for loading and unloading

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Distance travelled	km	<100km		
R&D	RS	0		
Insurance	RS	0		
Administrative cost	RS	5000		mainly consist of stationary cost.
Taxes 1 (%)	%	0		
Taxes 2 (%)	%	0		
Non-Manufacturing Overhead Cost	**RS**	**5000**	**5000**	
Number of Years(N)	NUMBER	5 years		
Building and Plant	RS	Market Value		
Machineries	RS	50% of Market Value		
Scrap Value of Following after N years(>5)	**RS**		**0**	
Miscellaneous cost	**RS**	**5000**	**5000**	
Marketing Stage				
Marketing cost(If any)	**RS**	**0**	**0**	
Storage Warehousing				
Cost of Storage Space		0		
Special Requirements for Storing Raw Material 1	store room for cement storage	0		
Special Requirements for Storing Raw Material 2				
Special Requirements for Storing Raw Material 3				
Special Requirements for Processed Product				
Inventory Cost	RS		0	
FIXED COST				
Cost of Land	RS	0		Own land

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Plant and Machinery	RS	55000		Only machinery including installation and transport
Equipment cost like Electric wiring, Piping or other supplies.	RS	10000		Includes transformer(shared), borewell (shared), platform for keeping the bricks (capacity = 2 days of max production), vibrator machine and shed for covering the bricks and approvals
Cost of Approvals	RS	0		
Other Setup Cost (Please mention what do you mean by others)	RS	50000		
Share of Loan	%	50%		No loan Taken
Interest Rate of the Loan	%	10%		
Fixed one time cost of the Manufacturing Unit	RS	115000	115000	
Break-Even Point	Years	1.16		

Financial Feasibility	● Hollow concrete block - Electric mixer	
Equity	50%	
Debt	50%	
Cost Of Debt	10%	
Cost Of Equity	15%	
WACC	11.50%	
Estimated sales (in quantity)	23,040	units/Year
Projected Price per unit	33.50	INR
Investment in Machines and Plant	115,000	INR
Estimated Life of Machines (in years)	6	Year
Cost of machine	55,000	
Resale Value of Machine	27,500	INR
Depreciation of machine - straight line method	4,583	INR/year
Opportunity Cost of the Invested amount	8,108	INR/year
Account receivable	14	Days
Processing time	21	Days
Inventory time	7	Days
Account Payable	30	Days
Raw Material (per unit)	16.98	INR/unit
Total cost per unit	29.19	
Labor Cost per year	192,000	INR/year
Operating Cost per year	79,120	INR/year
Administrative & Selling Expenses	10,000	INR/Year
Marketing Expense	2300	INR/Year
Number of working months	8	Months
Working Capital Required	124,209 INR/45	day cycle
Tax Rate	20%	INR/Rate
Market growth rate	3%	
Inflation rate	5%	
Setup cost	236908.5385	INR

Quantity of AHCM sold		*23,040*	*23,731*	*24,443*	*25,176*	*25,932*	*26,710*
Year	2016	2017	2018	2019	2020	2021	2022
Total Investment	-115,000						
Opportunity Cost of Invested Amount for 6 years	-48,645						
Working Capital	-124,209						
Sales Revenue		771,840	794,995	818,845	843,410	868,713	894,774
Raw Materials		-391,326	-403,065	-435,915	-427,612	-440,440	-453,654
Labour Cost		-192,000	-201,600	-211,680	-222,264	-233,377	-245,046
Operating Cost		-79,120	-83,076	-87,230	-91,591	-96,171	-100,979
Gross Profit		*109,394*	*107,254*	*84,020*	*101,943*	*98,724*	*95,095*
Administrative & Selling Expenses		-10,000	-10,500	-11,025	-11,576	-12,155	-12,763
Marketing Expense		-2,300	-2,415	-2,536	-2,663	-2,796	-2,935
EBITDA		*97,094*	*94,339*	*70,459*	*87,704*	*83,774*	*79,397*
Interest payment		-13,202	-13,202	-13,202	-13,202	-13,202	-13,202
Depreciation		-4,583	-4,583	-4,583	-4,583	-4,583	-4,583
EBT		79,309	76,553	52,674	69,919	65,988	61,611
Taxes		-15,862	-15,311	-10,535	-13,984	-13,198	-12,322
Net Income		*63,447*	*61,243*	*42,139*	*55,935*	*52,790*	*49,289*
Add back depreciation		4,583	4,583	4,583	4,583	4,583	4,583
Working Capital Redeemed							124,209
After tax Salvage Value of Machine							22,000
Total cash flow	*-287,854*	*68,030*	*65,826*	*46,722*	*60,518*	*57,374*	*200,081*

NPV	***36,385.22***	*INR*
IRR	***15%***	

6. Compressed stabilized earth blocks – Model case

Model Case - Compressed Stabalized Earth Blocks	
Material	CSEB
Cost Price (in INR)	17.67
Selling Price (in INR)	21.00
Selling Price with Transportation(Within 100km) (in INR)	22.00

Assumptions / Constants	Value
No of working months	8.00
No of working days in a month	21.00
Current production of the plant (blocks/day)	500.00
Quantity of cement bag required for 1000 blocks (in 50 kg bags)	12.00
Cost per each 50 kg cement bag (in INR)	360.00
Quantity of soil required for 1000 blocks (in cum)	12.00
Cost of soil per cum (in INR)	300.00
Quantity of sand/crusher dust required for 1000 blocks (in cum)	1.20
Cost of sand/ dust per cum (in INR)	400.00
Quantity of Lime required for 1000 blocks (in kg)	12.00
Cost of lime per kg (in INR)	12.00
Quantity of water required for 1000 bricks (in liters)	1,800.00
Cost of water per liter (in INR)	1.00
Daily wage for direct labour (In INR)	3,000.00
Monthly salary for indirect labour (In INR)	8,000.00

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Sales(Annually)	**RS**	**1,764,000.00**	**1,764,000.00**	**Assuming 8 months of working duration**
Total No. of Units	NUMBER	84,000.00	84,000.00	500 blocks per day (capacity 1000 blocks)
Selling Price per Unit	RS	21.00	21.00	
Other Sources of Revenue If Any	RS	-	-	
Total Material Cost incurred(Annually)	**RS**	**756,000.00**	**717,696.00**	
Total Processing Cost incurred(Annually)	**RS**	**756,000.00**	**766,200.00**	
Total Marketing Cost incurred(Annually)	**INR**	**-**	**-**	
Total Cost incurred(Annually)	**RS**	**1,512,000.00**	**1,483,896.00**	
Material cost per Unit	**Rs**	**9.00**	**8.54**	**Difference in decimal**
Processing cost per Unit	**Rs**	**9.00**	**9.12**	**Approx reporting**
Marketing cost per Unit	**INR**	**-**	**-**	
Total product cost per Unit	**Rs**	**18.00**	**17.67**	
Input Stage				
Product Related				
Raw Material 1 (Cement)			**362,880.00**	
Cost of Material	RS	362,880.00		320 per bag
% Used in the Whole product	%			
Transportation cost	RS	-		Transportation cost included in the cost of raw material
Distance travelled / Source	KM			
Raw Material 2 (Soil)			**302,400.00**	
Cost of Material	RS	302,400.00		300 rs/m3 of soil
% Used in the Whole product	%			

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Transportation cost	RS	-		Transportation cost included in the cost of raw material
Distance travelled / Source	KM	<10 km		
Raw Material 3 (Sand/Dust)			**40,320.00**	
Cost of Material	RS	40,320.00		400/m^3 of sand
% Used in the Whole product	%			
Transportation cost	RS	-		Transportation cost included in the cost of raw material
Distance travelled / Source	KM	<10 km		
Raw Material 4 (lime)			12,096.00	
Cost of Material	RS	12,096.00		INR 12 per kg of Lime
% Used in the Whole product	%			
Transportation cost	RS	-		Transportation cost included in the cost of raw material
Distance travelled / Source	KM	<10 km		
Material Cost	**RS**		**717,696.00**	
Processing Stage				
Electricity cost	RS	-		
Rent for land	Rs	-		
Water cost	RS	151,200.00		1800 litres of water for 1000 bricks @1 per litre
Fuel cost of Machinery	RS	-		
Operational/ Maintenance cost	RS	-		
Packaging cost	RS	-		
Any other cost related to manufacturing	RS	-		

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Manufacturing Overhead cost	**RS**		**151,200.00**	
Related to Manufacturing		504,000.00		9 labourers working with soil @200 perday, 4 labourers working on machine @300 per day
Not related to Manufacturing		96,000.00		1 incharge @8000 per month
Others (Please mention what do you mean by others)		-		
Labour cost	**RS**	**600,000.00**	**600,000.00**	
Product delivery cost with distance	RS	Rs/brick		
Distance travelled	km	<50km		
R&D	RS	-		
Insurance	RS	-		
Administrative cost	RS	5,000.00		mainly consist of stationary cost.
Taxes 1 (%)	%	5.00		
Taxes 2 (%)	%	-		
Non-Manufacturing Overhead Cost	**RS**		**5,000.00**	
Scrap Value of Following after N years(>5)	**RS**		**0**	
Miscellaneous cost	**RS**	**10,000.00**	**10,000.00**	**Bribe to the local goons for operating in that area**
Marketing Stage				
Marketing cost (If any)	RS	-	-	
Storage Warehousing				
Inventory Cost	**RS**		**-**	
FIXED COST				
Cost of Land	RS	-		

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Plant and Machinery	RS	170,000.00		1.2 lakhs for pressing machine, 50k for water pump
Equipment cost like Electric wiring, Piping or other supplies.	RS	50,000.00		50,000 for shed, storage etc
Cost of Approvals	RS	-		
Other Setup Cost (Please mention what do you mean by others)	RS	60,000.00		
Share of Loan	%			No loan Taken
Interest Rate of the Loan	%	-		
Fixed one time cost of the Manufacturing Unit	**RS**		**280,000.00**	
Break even point	Years	1.00		

Financial Feasibility		● CSEB
Equity	50%	
Debt	50%	
Cost Of Debt	10%	
Cost Of Equity	15%	
WACC	11.50%	
Estimated sales (in quantity)	84,000	units/Year
Projected Price per unit	21.00	INR
Investment in Machines and Plant	280,000	INR
Estimated Life of Machines (in years)	6	Year
Cost of machine	280,000	
Resale Value of Machine	140,000	INR
Depreciation of machine - straight line method	23,333	INR/year
Opportunity Cost of the Invested amount	19,740	INR/year
Account receivable	14	Days
Processing time	21	Days
Inventory time	7	Days
Account Payable	30	Days
Raw Material (per unit)	9.00	INR/unit
Total cost per unit	18.00	
Labor Cost per year	600,000	INR/year
Operating Cost per year	151,200	INR/year
Administrative & Selling Expenses	15,000	INR/Year
Marketing Expense	5600	INR/Year
Number of working months	8	Months
Working Capital Required	282,600	INR/45 day cycle
Tax Rate	20%	INR/Rate
Market growth rate	3%	
Inflation rate	5%	
Setup cost	557000	INR

Quantity of AHCM sold		*84,000*	*86,520*	*89,116*	*91,789*	*94,543*	*97,379*
Year	2016	2017	2018	2019	2020	2021	2022
Total Investment	-280,000						
Opportunity Cost of Invested Amount for 6 years	-118,440						
Working Capital	-282,600						
Sales Revenue		1,764,000	1,816,920	1,871,428	1,927,570	1,985,398	2,044,959
Raw Materials		-756,000	-778,680	-842,142	-826,102	-850,885	-876,411
Labour Cost		-600,000	-630,000	-661,500	-694,575	-729,304	-765,769
Operating Cost		-151,200	-158,760	-166,698	-175,033	-183,785	-192,974
Gross Profit		*256,800*	*249,480*	*201,087*	*231,861*	*221,425*	*209,806*
Administrative & Selling Expenses		-15,000	-15,750	-16,538	-17,364	-18,233	-19,144
Marketing Expense		-5,600	-5,880	-6,174	-6,483	-6,807	-7,147
EBITDA		*236,200*	*227,850*	*178,376*	*208,014*	*196,385*	*183,514*
Interest payment		-32,145	-32,145	-32,145	-32,145	-32,145	-32,145
Depreciation		-23,333	-23,333	-23,333	-23,333	-23,333	-23,333
EBT		*180,722*	*172,372*	*122,897*	*152,535*	*140,907*	*128,036*
Taxes		-36,144	-34,474	-24,579	-30,507	-28,181	-25,607
Net Income		*144,577*	*137,897*	*98,318*	*122,028*	*112,725*	*102,429*
Add back depreciation		23,333	23,333	23,333	23,333	23,333	23,333
Working Capital Redeemed							282,600
After tax Salvage Value of Machine							112,000
Total cash flow	*-681,040*	*167,911*	*161,231*	*121,651*	*145,362*	*136,059*	*520,362*

NPV	130,801.95	INR
IRR	17%	

7. Micro concrete roofing tiles – Model case

Material	MCR tiles
Cost Price (in INR)	9.67
Selling Price (in INR)	12.50
Selling Price with Transportation(Within 100km) (in INR)	13.50

Assumptions / Constants	Value
No of working months	12.00
Production per month	5,000.00
Total cement required monthly (in 50 kg bags)	53.00
Cost of cement per 50 kg pag (in INR)	360.00
Quantity of sand required per month (in Tonnes)	3.00
Cost of sand per tonne(in INR)	400.00
Quantity of stone chips required per month (in Tonnes)	6.00
Cost of stone chips per tonne(in INR)	400.00
Electricity cost per month (in INR)	2,500.00
Land rent per month (in INR)	1,500.00
Monthly wage for direct labour (In INR)	20,000.00
No of working months	12.00
Production per month	5,000.00
Total cement required monthly (in 50 kg bags)	53.00

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Sales(Annually)	RS	750,000.00	750,000.00	
Total No. of Units	NUMBER	60,000.00	60,000.00	5000 tiles every month
Selling Price per Unit	RS	12.50	12.50	
Other Sources of Revenue If Any	RS	-	-	
Total Material Cost incurred(Annually)	**RS**	**272,160.00**	**272,160.00**	
Total Processing Cost incurred(Annually)	**RS**	**308,000.00**	**308,000.00**	
Total Marketing Cost incurred(Annually)	**INR**	**-**	**-**	
Total Cost incurred(Annually)	**RS**	**580,160.00**	**580,160.00**	
Material cost per Unit	**Rs**	**4.54**	**4.54**	**Difference in decimal**
Processing cost per Unit	**Rs**	**5.13**	**5.13**	**Approx reporting**
Marketing cost per Unit	**INR**	**-**	**-**	
Total product cost per Unit	**Rs**	**9.67**	**9.67**	
Input Stage				
Product Related				
Raw Material 1 (Cement)			228,960.00	
Cost of Material	RS	228,960.00		320 per bag
% Used in the Whole product	%			53 bags per month for 5000 tiles
Transportation cost	RS	-		
Distance travelled / Source	KM			
Raw Material 2 (Sand)			14,400.00	9
Cost of Material	RS	14,400.00		4000 per trip
% Used in the Whole product	%			3 tonnes per month for 5000 tiles
Transportation cost	RS	-		
Distance travelled / Source	KM	<10 km		

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Raw Material 3 (stone chips)			28,800.00	
Cost of Material	RS	28,800.00		4000 per trip
% Used in the Whole product	%			6 tonnes per month for 5000 tiles
Transportation cost	RS	-		
Distance travelled / Source	KM	<10 km		
Material Cost	**RS**		**272,160.00**	
Processing Stage				
Electricity cost	RS	30,000.00		
Rent for land	Rs	18,000.00		
Water cost	RS	-		
Fuel cost of Machinery	RS	-		
Operational/ Maintenance cost	RS	5,000.00		
Packaging cost	RS	-		
Any other cost related to manufacturing	RS	-		
Manufacturing Overhead cost	**RS**		**53,000.00**	
Related to Manufacturing		240,000.00		1 skilled labour @ 8000/month, 2 unskilled labour @6000/month
Not related to Manufacturing		-		
Others (Please mention what do you mean by others)		-		
Labour cost	**RS**	**240,000.00**	**240,000.00**	
Product delivery cost with distance	RS	Rs/brick		
Distance travelled	km	<50km		
R&D	RS	-		
Insurance	RS	-		

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Administrative cost	RS	5,000.00		mainly consist of stationary cost.
Taxes 1 (%)	%	5.00		
Taxes 2 (%)	%	-		
Non-Manufacturing Overhead Cost	**RS**		**5,000.00**	
Scrap Value of Following after N years(>5)	**RS**		**-**	
Miscellaneous cost	**RS**	**10,000.00**	**10,000.00**	
Marketing Stage				
Marketing cost(If any)	RS	-	-	
Storage Warehousing				
Inventory Cost	**RS**		**-**	
FIXED COST				
Cost of Land	RS	-		
Plant and Machinery	RS	107,000.00		Includes machinery, transport, setup, training
Equipment cost like Electric wiring, Piping or other supplies.	RS	125,000.00		Moulds
Cost of Approvals	RS	-		
Other Setup Cost (Please mention what do you mean by others)	RS	25,000.00		Curing tank, shed
Share of Loan	%			No loan Taken
Interest Rate of the Loan	%	-		
Fixed one time cost of the Manufacturing Unit	RS		257,000.00	
Break-Even Point	Years	1.51		

Financial Feasibility		• MCR tiles
Equity	50%	
Debt	50%	
Cost Of Debt	10%	
Cost Of Equity	15%	
WACC	11.50%	
Estimated sales (in quantity)	60,000	units/Year
Projected Price per unit	12.50	INR
Investment in Machines and Plant	232,000	INR
Estimated Life of Machines (in years)	6	Year
Cost of machine	232,000	
Resale Value of Machine	116,000	INR
Depreciation of machine - straight line method	19,333	INR/year
Opportunity Cost of the Invested amount	16,356	INR/year
Account receivable	14	Days
Processing time	21	Days
Inventory time	7	Days
Account Payable	30	Days
Raw Material (per unit)	4.54	INR/unit
Total cost per unit	9.67	
Labor Cost per year	240,000	INR/year
Operating Cost per year	53,000	INR/year
Administrative & Selling Expenses	35,000	INR/Year
Marketing Expense	4640	INR/Year
Number of working months	12	Months
Working Capital Required	70,645	INR/45 day cycle
Tax Rate	20%	INR/Rate
Market growth rate	3%	
Inflation rate	5%	
Setup cost	298005	INR

Quantity of AHCM sold		*60,000*	*61,800*	*63,654*	*65,564*	*67,531*	*69,556*
Year	***2016***	***2017***	***2018***	***2019***	***2020***	***2021***	***2022***
Total Investment	*-232,000*						
Opportunity Cost of Invested Amount for 6 years	*-98,136*						
Working Capital	*-70,645*						
Sales Revenue		*750,000*	*772,500*	*795,675*	*819,545*	*844,132*	*869,456*
Raw Materials		*-272,160*	*-280,325*	*-303,171*	*-297,397*	*-306,318*	*-315,508*
Labour Cost		*-240,000*	*-252,000*	*-264,600*	*-277,830*	*-291,722*	*-306,308*
Operating Cost		*-53,000*	*-55,650*	*-58,433*	*-61,354*	*-64,422*	*-67,643*
Gross Profit		*184,840*	*184,525*	*169,471*	*182,965*	*181,670*	*179,997*
Administrative & Selling Expenses		*-35,000*	*-36,750*	*-38,588*	*-40,517*	*-42,543*	*-44,670*
Marketing Expense		*-4,640*	*-4,872*	*-5,116*	*-5,371*	*-5,640*	*-5,922*
EBITDA		*145,200*	*142,903*	*125,768*	*137,076*	*133,487*	*129,405*
Interest payment		*-26,634*	*-26,634*	*-26,634*	*-26,634*	*-26,634*	*-26,634*
Depreciation		*-19,333*	*-19,333*	*-19,333*	*-19,333*	*-19,333*	*-19,333*
EBT		*99,232*	*96,935*	*79,800*	*91,109*	*87,519*	*83,437*
Taxes		*-19,846*	*-19,387*	*-15,960*	*-18,222*	*-17,504*	*-16,687*
Net Income		*79,386*	*77,548*	*63,840*	*72,887*	*70,015*	*66,750*
Add back depreciation		*19,333*	*19,333*	*19,333*	*19,333*	*19,333*	*19,333*
Working Capital Redeemed							*70,645*
After tax Salvage Value of Machine							*92,800*
Total cash flow	*-400,781*	*98,719*	*96,882*	*83,174*	*92,220*	*89,349*	*249,528*
NPV		***67,055.71***	*INR*				
IRR		***16%***					

8. Ferro Cement Door &Window Frame – Model case

Model Case - Ferro cement Door and Window Frame		
Material	Ferro cement door frame	
Cost Price per ft.	₹	48.48
Selling Price per ft.	₹	1.57
Selling Price per ft. with Transportation(Within 50km)	₹	62.57

Assumptions / Constants	Value
Number of working months	8.00
Number of working days per month	24
Number of frames in a month	50.00
Annual Door production capacity	400.00
Annual Window Production capacity	400.00
Weight of each frame (in Kg)	76.50
% of cement in the frame	0.33
Total annual cement required (in 50 kg bags)	407.96
Cost of each cement bag	360.00
% composition of grit in the frame	0.33
Total annual grit required (in tonnes)	20.40
Cost of grit per tonne (in INR)	400.00
% composition of sand in the frame	0.33
Total annual sand required (in tonnes)	20.40
Cost of sand per tonne (in INR)	400.00
Steel required per door frame (in kg)	2.00
Steel required per window frame (in kg)	8.00
Total annual steel requirement (in kg)	4,000.00
Cost of steel per kg (in INR)	47.00

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Sales(Annually)	**RS**	**5546250**	**837313.601**	
Total No. of Units	feet	13600	13600	This 17ft is straightened length of a door(7x3)
Selling Price per Unit	RS	61.6	61.6	
Other Sources of Revenue If Any	RS		0	
Total Material Cost incurred(Annually)	**RS**	**They bring material as per demand**	**355184**	**Larger the production, greater the material requirement.**
Total Processing Cost incurred(Annually)	**RS**	**This depends on material purchased**	**304118**	**More the material, more the processing.**
Total Marketing Cost(Annually)	**RS**		**0**	
Total Cost incurred(Annually)	**RS**		**659302**	
Material cost per Unit	**Rs**	**26.1**	**26.1**	**False due to differences in decimal.**
Processing cost per Unit	**Rs**	**22.4**	**22.4**	
Marketing cost per Unit	**Rs**	**0.0**	**0.0**	
Total product cost per Unit	**Rs**	**48.5**	**48.5**	**False due to differences in decimal.**
Input Stage				
Product Related				
Raw Material 1 (Cement)			146865	
Cost of Material	RS	146865		
% Used in the Whole product	%	33%		
Transportation cost	RS			
Distance travelled / Source	KM			
Raw Material 2 (Grit)			8159	
Cost of Material	RS	8159		
% Used in the Whole product	%	33%		

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Transportation cost	RS			
Distance travelled / Source	KM			
Raw Material 3 (Sand)			8159	
Cost of Material	RS	8159		
% Used in the Whole product	%	33%		
Transportation cost	RS			
Distance travelled / Source	KM			
Raw Material 4 (Steel)			192000	
Cost of Material	RS	188000		45-50/Kg
% Used in the Whole product	%			2kg of steel is required per door frame and 8 kg of steel for window frame
Transportation cost	RS	4000		1Rs/kg
Distance travelled / Source	KM			
Others (Please mention what do you mean by others)	RS		0	
Material Cost	**RS**		**355184**	**Composition of the cement, grit and sand is in the ratio of 1:1:1, which is for the M30 strength.**
Processing Stage				
Electricity cost	RS	36000		
Water cost	RS	0		
Fuel cost of Machinery	RS			
Operational/ Maintenance cost	RS	35518		Maintenance cost is the cost to repair slabs and safeguarding the plant at 10% of the material used.
Packaging cost	RS			

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Any other cost related to manufacturing	RS			
Manufacturing Overhead cost	**RS**		**71518**	
Related to Manufacturing		153600		
Not related to Manufacturing		72000		
Others (Please mention what do you mean by others)				
Labour cost	**RS**	**225600**	**225600**	
Product delivery cost with distance	RS	NA		5-10%; mostly Rs 1 which includes transportation and handling.
Distance travelled	km	NA		
R&D	RS	NA		
Insurance	RS	NA		No insurance
Administrative cost	RS	Not known	2000	
Taxes 1 (%)	%	Not known		
Taxes 2 (%)	%	Not known		
Non-Manufacturing Overhead Cost	**RS**		**2000**	
Number of Years(N)	NUMBER			
Building and Plant	RS	Market Value		
Machineries	RS	No Machineries, just die		
Scrap Value of Following after N years(>5)	**RS**		**0**	
Miscellaneous cost	**RS**	**5000**	**5000**	
Marketing Stage				
Marketing cost(If any)	**RS**			
Storage Warehousing				
Cost of Storage Space		Not Known		

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Special Requirements for Storing Raw Material 1		Not Known		
Special Requirements for Storing Raw Material 2		Not Known		
Special Requirements for Processed Product		Not Known		
Inventory Cost	**RS**		**0**	
FIXED COST				
Cost of Land	RS	NA		
Plant and Machinery	RS	100000		
Equipment cost like Electric wiring, Piping or other supplies.	RS	100000		
Cost of Approvals	RS	NA		
Other Setup Cost (Please mention what do you mean by others)	RS	50000		All cost included in this
Share of Loan	%	NA		
Interest Rate of the Loan	%	NA		
Fixed one time cost of the Manufacturing Unit	**RS**	**250000**	**250000**	
Break-Even Point	**Years**	**1.40**		

Financial Feasibility	• Ferro cement Door & Window frames
Equity	50%
Debt	50%
Cost Of Debt	10%
Cost Of Equity	15%
WACC	11.50%
Estimated sales (in quantity)	13,600 units/Year
Projected Price per unit	61.57 INR
Investment in Machines and Plant	250,000 INR
Estimated Life of Machines (in years)	6 Year
Cost of machine	100,000
Resale Value of Machine	50,000 INR
Depreciation of machine - straight line method	8,333 INR/year
Opportunity Cost of the Invested amount	17,625 INR/year
Account receivable	14 Days
Processing time	21 Days
Inventory time	7 Days
Account Payable	30 Days
Raw Material (per unit)	26.12 INR/unit
Total cost per unit	48.48
Labor Cost per year	225,600 INR/year
Operating Cost per year	71,518 INR/year
Administrative & Selling Expenses	5,000 INR/Year
Marketing Expense	5000 INR/Year
Number of working months	8 Months
Working Capital Required	122,307 INR/45 day cycle
Tax Rate	20% INR/Rate
Market growth rate	3%
Inflation rate	5%
Setup cost	367306.634 INR

Quantity of AHCM sold		13,600	14,008	14,428	14,861	15,307	15,766
Year	2016	2017	2018	2019	2020	2021	2022
Total Investment	-250,000						
Opportunity Cost of Invested Amount for 6 years	-105,750						
Working Capital	-122,307						
Sales Revenue		837,314	862,433	888,306	914,955	942,404	970,676
Raw Materials		-355,184	-365,839	-395,655	-388,119	-399,762	-411,755
Labour Cost		-225,600	-236,880	-248,724	-261,160	-274,218	-287,929
Operating Cost		-71,518	-75,094	-78,849	-82,791	-86,931	-91,278
Gross Profit		185,012	184,620	165,078	182,885	181,492	179,714
Administrative & Selling Expenses		-5,000	-5,250	-5,513	-5,788	-6,078	-6,381
Marketing Expense		-5,000	-5,250	-5,513	-5,788	-6,078	-6,381
EBITDA		175,012	174,120	154,053	171,308	169,337	166,951
Interest payment		-28,701	-28,701	-28,701	-28,701	-28,701	-28,701
Depreciation		-8,333	-8,333	-8,333	-8,333	-8,333	-8,333
EBT		137,977	137,085	117,019	134,274	132,303	129,917
Taxes		-27,595	-27,417	-23,404	-26,855	-26,461	-25,983
Net Income		110,382	109,668	93,615	107,419	105,842	103,934
Add back depreciation		8,333	8,333	8,333	8,333	8,333	8,333
Working Capital Redeemed							122,307
After tax Salvage Value of Machine							40,000
Total cash flow	-478,057	118,715	118,002	101,948	115,753	114,176	274,574

NPV	80,911.31	INR
IRR	17%	

9. Ferro cement roofing channel

Model Case: Ferro cement Roofing Channel	
Material	Ferro cement roofing channels
State	Jharkhand
Name of the Stakeholder:	
Contact Details :	
Cost Price (in INR)	2,546.37
Selling Price (in INR)	2,800.00

Assumptions / Constants	Value
Total number of working months	8.00
Monthly production capacity	125.00
Cement required for each channel (in Kgs)	68.15
Total cement bags required annually (in 50 kg bags)	1,363.00
Cost of cement per 50 kg pag (in INR)	360.00
Volume of sand required for each channel (in cum)	0.16
Density of sand (in kg/cum)	1,520.00
Total sand required annually (in tonnes)	243.20
Cost of sand per tonne (in INR)	500.00
Steel required for each channel (in Kg)	8.52
Total steel requirement	8,520.00
Cost of steel per kg (in INR)	60.00
Chicken mesh required for each channel (in sqm)	9.20
Cost of chicken mesh per sqm (in INR)	60.00
welded mesh required for each channel (in sqm)	1.23
Cost of welded mesh per sqm (in INR)	89.00
Binding wire required for each channel (in Kg)	0.46
Cost of binding wire per kg (in INR)	58.00
Maintenance Cost (as a % of labour and material cost)	15%
Monthly wage for direct labour (In INR)	46,000.00
Monthly salary for indirect labour (In INR)	10,000.00
Total number of working months	8.00

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Sales(Annually)	RS	2,800,000.00	2,800,000.00	
Total No. of Units	NUMBER	1,000.00	1,000.00	
Selling Price per Unit	RS	2,800.00	2,800.00	
Other Sources of Revenue If Any	RS	-	-	
Total Material Cost incurred(Annually)	**RS**	**1,811,630.00**	**1,811,630.00**	
Total Processing Cost incurred(Annually)	**RS**	**734,744.50**	**734,744.50**	
Total Marketing Cost incurred(Annually)	**RS**	**-**	**-**	
Total Cost incurred(Annually)	**RS**	**2,546,374.50**	**2,546,374.50**	
Material cost per Unit	**Rs**	**1,811.63**	**1,811.63**	**Difference in decimal**
Processing cost per Unit	**Rs**	**734.74**	**734.74**	**Approx reporting**
Marketing cost per Unit	**Rs**	**-**	**-**	
Total product cost per Unit	**Rs**	**2,546.37**	**2,546.37**	
Input Stage				
Product Related				
Raw Material 1 (cement)			490,680.00	
Cost of Material	RS	490,680.00		
% Used in the Whole product	%			
Transportation cost	RS	-		Transportation cost included in the cost of raw material
Distance travelled / Source	KM			Local market
Raw Material 2 (sand)			121,600.00	
Cost of Material	RS	121,600.00		INR 5000 per 10 tonne of sand, including transportation, royalty
% Used in the Whole product	%			

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Transportation cost	RS			Transportation cost included in the cost of raw material
Distance travelled / Source	KM	50.00		
Raw Material 3 (steel)			511,200.00	
Cost of Material	RS	511,200.00		INR 60/kg of steel
% Used in the Whole product	%			
Transportation cost	RS			Transportation cost included in the cost of raw material
Distance travelled / Source	KM	<50km		
Raw Material 4 (Chicken mesh)			552,000.00	
Cost of Material	RS	552,000.00		INR 60/kg
% Used in the Whole product	%			
Transportation cost	RS	0		Transportation cost included in the cost of raw material
Distance travelled / Source	KM	<50 km		
Raw Material 5 (welded mesh)			109,470.00	
Cost of Material	RS	109,470.00		INR 89/kg of welded mesh
% Used in the Whole product	%			
Transportation cost	RS	-		Transportation cost included in the cost of raw material
Distance travelled / Source	KM	<50km		
Raw Material 6 (Binding wire)			26,680.00	460
Cost of Material	RS	26,680.00		One kg = INR 58 including transportation
% Used in the Whole product	%			

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Transportation cost	RS	-		Transportation cost included in the cost of raw material
Distance travelled / Source	KM	<50km		
Material Cost	**RS**		**1,811,630.00**	
Processing Stage				
Electricity cost	RS			
Rent for land	Rs			
Water cost	RS			
Fuel cost of Machinery	RS			
Operational/ Maintenance cost	RS	271,744.50		Includes all the machinery maintenance, electricity and water bills
Packaging cost	RS	-		
Any other cost related to manufacturing	RS	-		
Manufacturing Overhead cost	**RS**		**271,744.50**	
Related to Manufacturing		368,000.00		2 skilled workers @8000/month, 5 unskilled labour @6000/month
Not related to Manufacturing		80,000.00		1 supervisor @10000/month
Others (Please mention what do you mean by others)		-		
Labour cost	**RS**		**448,000.00**	
Product delivery cost with distance	RS			
Distance travelled	km	<50km		
R&D	RS	-		
Insurance	RS	-		

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Administrative cost	RS	5,000.00		mainly consist of stationary cost.
Taxes 1 (%)	%	5.00		
Taxes 2 (%)	%	-		
Non-Manufacturing Overhead Cost	**RS**		**5,000.00**	
Number of Years(N)	NUMBER	5 years		
Building and Plant	RS	Market Value		
Machineries	RS	50% of Market Value		
Scrap Value of Following after N years(>5)	**RS**		**0**	
Miscellaneous cost	**RS**	**10,000.00**	**10,000.00**	
Marketing Stage				
Marketing cost(If any)	**RS**	**0**	**0**	
Storage Warehousing				
Cost of Storage Space		0		Included in the fixed cost of the manufacturing
Special Requirements for Storing Raw Material 1	store room for cement storage	0		Included in the fixed cost of the manufacturing
Special Requirements for Storing Raw Material 2				
Special Requirements for Storing Raw Material 3				
Special Requirements for Processed Product				
Inventory Cost	RS		0	
FIXED COST				
Cost of Land	RS	0		Govt land
Plant and Machinery	RS	150,000.00		Includes machinery and it's transportation

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Equipment cost like Electric wiring, Piping or other supplies.	RS	100,000.00		Includes the moulds, setup cost etc.
Cost of Approvals	RS	0		
Other Setup Cost (Please mention what do you mean by others)	RS	0		
Share of Loan	%	0		
Interest Rate of the Loan	%	0		
Fixed one time cost of the Manufacturing Unit	RS		250,000.00	
Break-Even Point	Years	0.99		

Financial Feasibility	• Ferro cement Roofing Channel	
Equity	50%	
Debt	50%	
Cost Of Debt	10%	
Cost Of Equity	15%	
WACC	11.50%	
Estimated sales (in quantity)	1,000	units/Year
Projected Price per unit	2,800.00	INR
Investment in Machines and Plant	250,000	INR
Estimated Life of Machines (in years)	6	Year
Cost of machine	150,000	
Resale Value of Machine	75,000	INR
Depreciation of machine - straight line method	12,500	INR/year
Opportunity Cost of the Invested amount	17,625	INR/year
Account receivable	14	Days
Processing time	21	Days
Inventory time	7	Days
Account Payable	30	Days
Raw Material (per unit)	1,811.63	INR/unit
Total cost per unit	2,546.37	
Labor Cost per year	448,000	INR/year
Operating Cost per year	271,745	INR/year
Administrative & Selling Expenses	15,000	INR/Year
Marketing Expense	5000	INR/Year
Number of working months	8	Months
Working Capital Required	474,633	INR/45 day cycle
Tax Rate	20%	INR/Rate
Market growth rate	3%	
Inflation rate	5%	
Setup cost	719632.7188	INR

Quantity of AHCM sold		1,000	1,030	1,061	1,093	1,126	1,159
Year	2016	2017	2018	2019	2020	2021	2022
Total Investment	-250,000						
Opportunity Cost of Invested Amount for 6 years	-105,750						
Working Capital	-474,633						
Sales Revenue		2,800,000	2,884,000	2,970,520	3,059,636	3,151,425	3,245,967
Raw Materials		-1,811,630	-1,865,979	-2,018,056	-1,979,617	-2,039,006	-2,100,176
Labour Cost		-448,000	-470,400	-493,920	-518,616	-544,547	-571,774
Operating Cost		-271,745	-285,332	-299,598	-314,578	-330,307	-346,822
Gross Profit		268,626	262,289	158,946	246,824	237,565	227,195
Administrative & Selling Expenses		-15,000	-15,750	-16,538	-17,364	-18,233	-19,144
Marketing Expense		-5,000	-5,250	-5,513	-5,788	-6,078	-6,381
EBITDA		248,626	241,289	136,896	223,672	213,255	201,669
Interest payment		-28,701	-28,701	-28,701	-28,701	-28,701	-28,701
Depreciation		-12,500	-12,500	-12,500	-12,500	-12,500	-12,500
EBT		207,425	200,088	95,695	182,471	172,054	160,469
Taxes		-41,485	-40,018	-19,139	-36,494	-34,411	-32,094
Net Income		165,940	160,071	76,556	145,977	137,643	128,375
Add back depreciation		12,500	12,500	12,500	12,500	12,500	12,500
Working Capital Redeemed							474,633
After tax Salvage Value of Machine							60,000
Total cash flow	-830,383	178,440	172,571	89,056	158,477	150,143	675,508
NPV		73,907.86	INR				
IRR		14%					

10. CGI sheets – Model case

Model Case: CGI sheets	
Material	CGI Sheet
Cost Price per Mtr. (in INR)	266.96
Selling Price per Mtr. (in INR)	290.00

Assumptions / Constants	Value
No of working months in an year	12.00
No of working days in a month	25.00
GI coil processed each month in metres (1 Mtr = 4.5 Kg)	111,111.11
Profit Margin (in INR)	25.00
Cost of steel per month per tonne	59,000.00
Requirement of steel per month (in tonnes)	500.00
Electricity cost per unit (in INR)	5.50
Water and compressed air charges (in INR)	1,375.00
Wages of skilled labour	12,000.00
Wages of unskilled labour	8,000.00

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Sales(Annually)	**INR**	**386,666,666.67**	**386,666,666.67**	**12 working months**
Total No. of Units	Mtr	1,333,333.33	1,333,333.33	500 tonnes of GI coil processed each month (1 Mtr = 4.5 Kg)
Selling Price per Unit	INR	290.00	290.00	INR 25 profit margin.
Other Sources of Revenue If Any	INR	-	-	
Total Material Cost incurred(Annually)	**INR**	**330,000,000.00**	**354,000,000.00**	
Total Processing Cost incurred(Annually)	**INR**	**1,946,000.00**	**1,941,000.00**	
Total Marketing Cost incurred(Annually)	**INR**	**5,000.00**	**5,000.00**	
Total Cost incurred(Annually)	**INR**	**331,951,000.00**	**355,941,000.00**	
Material cost per Unit	**INR**	**NA**	**265.50**	**False due to differences in decimal.**
Processing cost per Unit	**INR**	**NA**	**1.46**	
Marketing cost per Unit	**INR**	**NA**	**0.00**	**Negligible**
Total product cost per Unit	**INR**	**250.00**	**266.96**	**False due to differences in decimal.**
Input Stage				
Product Related				
Raw Material 1 (GI Coil)			**354,000,000.00**	
Cost of Material	INR	354,000,000.00		Cost of 500 tonnes of steel each month at INR 59000 per tonne
% Used in the Whole product	%			
Transportation cost	INR			Transportation cost included in the cost of raw material
Distance travelled / Source	KM			
Other(Please mention what do you mean by other)	INR			

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Material Cost	**INR**		**354,000,000.00**	
Processing Stage				
Electricity cost	INR	247,500.00		150 units of power consumed each day at INR 5.5 per unit.
Water cost	INR	16,500.00		Water and compressed air charges.
Fuel cost of Machinery	INR			
Operational/ Maintenance cost	INR	10,000.00		
Packaging cost	INR			
Any other cost related to manufacturing	INR			
Manufacturing Overhead cost	**INR**		**274,000.00**	
Related to Manufacturing	INR	480,000.00		2 skilled labour and 2 unskilled labour
Not related to Manufacturing	INR	1,140,000.00		Different salaries as per the position of the person
Other(Please mention what do you mean by other)	INR			
Labour cost	**INR**		**1,620,000.00**	
Product delivery cost with distance	INR			
Distance travelled	km			
R&D	INR			
Insurance	INR	7,500.00		
Administrative cost	INR	37,000.00		This includes postage, telephone charges, stationary charges, travelling expense etc.
Taxes 1 (%)	%			
Taxes 2 (%)	%			
Non-Manufacturing Overhead Cost	**INR**		**44,500.00**	

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Number of Year(N)	NUMBER			
Building and Plant	INR			
Machineries	INR			
Scrap Value of Following after N year(>5)	INR		-	
Miscellaneous cost	INR	2,500.00	2,500.00	
Marketing Stage				
Marketing cost(If any)	INR	5,000.00	5,000.00	Publicity charges through posters and newspaper ads.
Storage Warehousing				
Cost of Storage Space				
Special Requirements for Storing Raw Material 1				
Special Requirements for Storing Raw Material 2				
Special Requirements for Storing Raw Material 3				
Special Requirements for Processed Product				
Inventory Cost	**INR**		-	
FIXED COST				
Cost of Land	INR	7,000,000.00		Land of 2000 Sq.m at the rate of INR 3500/ Sq. m
Plant and Machinery	INR	3,800,000.00		This is the cost of an Automatic roll forming line including all the taxes and installation charges.
Equipment cost like Electric wiring, Piping or other supplies.	INR	200,000.00		This is the cost of office setup, electrical fittings, furnitures etc.
Cost of Approvals	INR			

Parameters	Unit	Cost		
		Told by Manufacturer (To be filled Interviewer)	Calculated (Autofill)	Remarks
Other Setup Cost (Please mention what do you mean by other)	INR	4,585,000.00		This includes the cost the factor shed, Labour quarter, boundary wall construction, office building etc.
Share of Loan	%			
Interest Rate of the Loan	%			
Fixed one time cost of the Manufacturing Unit	INR		15,585,000.00	
Break-Even Point	Years	0.51		

Financial Feasibility		● CGI Sheet
Equity	50%	
Debt	50%	
Cost Of Debt	10%	
Cost Of Equity	15%	
WACC	11.50%	
Estimated sales (in quantity)	1,333,333	units/Year
Projected Price per unit	290.00	INR
Investment in Machines and Plant	8,585,000	INR
Estimated Life of Machines (in years)	6	Year
Cost of machine	3,800,000	
Resale Value of Machine	1,900,000	INR
Depreciation of machine - straight line method	316,667	INR/year
Opportunity Cost of the Invested amount	605,243	INR/year
Account receivable	14	Days
Processing time	21	Days
Inventory time	7	Days
Account Payable	30	Days
Raw Material (per unit)	265.50	INR/unit
Total cost per unit	266.96	
Labor Cost per year	1,620,000	INR/year
Operating Cost per year	274,000	INR/year
Administrative & Selling Expenses	47,000	INR/Year
Marketing Expense	171700	INR/Year
Number of working months	12	Months
Working Capital Required	44,486,750	INR/45 day cycle
Tax Rate	20%	INR/Rate
Market growth rate	3%	
Inflation rate	5%	
Setup cost	52,900,050	INR

Quantity of AHCM sold		1,333,333	1,373,333	1,414,533	1,456,969	1,500,678	1,545,699
Year	2016	2017	2018	2019	2020	2021	2022
Total Investment	-8,585,000						
Opportunity Cost of Invested Amount for 6 years	-3,631,455						
Working Capital	-44,486,750						
Sales Revenue		386,666,667	398,266,667	410,214,667	422,521,107	435,196,740	448,252,642
Raw Materials		-354,000,000	-364,620,000	-394,336,530	-386,825,358	-398,430,119	-410,383,022
Labour Cost		-1,620,000	-1,701,000	-1,786,050	-1,875,353	-1,969,120	-2,067,576
Operating Cost		-274,000	-287,700	-302,085	-317,189	-333,049	-349,701
Gross Profit		30,772,667	31,657,967	13,790,002	33,503,207	34,464,452	35,452,342
Administrative & Selling Expenses		-47,000	-49,350	-51,818	-54,408	-57,129	-59,985
Marketing Expense		-171,700	-180,285	-189,299	-198,764	-208,702	-219,138
EBITDA		30,553,967	31,428,332	13,548,885	33,250,034	34,198,621	35,173,220
Interest payment		-985,590	-985,590	-985,590	-985,590	-985,590	-985,590
Depreciation		-316,667	-316,667	-316,667	-316,667	-316,667	-316,667
EBT		29,251,710	30,126,075	12,246,629	31,947,778	32,896,365	33,870,963
Taxes		-5,850,342	-6,025,215	-2,449,326	-6,389,556	-6,579,273	-6,774,193
Net Income		23,401,368	24,100,860	9,797,303	25,558,222	26,317,092	27,096,771
Add back depreciation		316,667	316,667	316,667	316,667	316,667	316,667
Working Capital Redeemed							44,486,750
After tax Salvage Value of Machine							1,520,000
Total cash flow	-56,703,205	23,718,035	24,417,527	10,113,970	25,874,889	26,633,758	73,420,187

NPV	***61,909,828.31***	*INR*
IRR	***38%***	

Annexure 6: Photos from site visits

Figure 1: Bamboo grown in backyard in Assam

Figure 39: Bamboo mats sold in local market near Daarang

Figure 40: Bamboo mat doors sold in market near Daarang, Assam

Figure 41 PMAY-G House in final stages in Rani block, Assam

Figure 42: PMAY-G house under construction in Rani, Assam

Figure 43: Bamboo house constructed as a part of demonstration by CBTC in Assam - 1

Figure 44 Bamboo house constructed as a part of demonstration by CBTC in Assam - 2

Figure 45 Bamboo house constructed as a part of demonstration by CBTC in Assam - 3

Figure 46 Hostel constructed with Bamboo for 20 people at CBTC in Assam

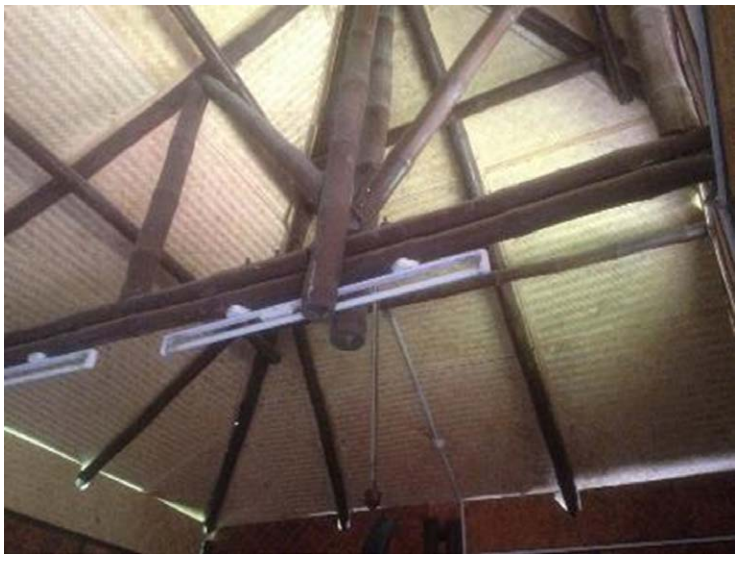


Figure 47 Treated Bamboo roof under structure

Figure 48 Batching and mixing of materials in Fly Ash Brick Manufacturing plant in Misrod, Madhya Pradesh

Figure 49 Bamboo house constructed at treatment unit near Nagpur

Figure 50 Machinery for bamboo treatment at Dimapur plant by Nagaland Bamboo Development Agency

Figure 51: Fly Ash bricks staked after curing for sale near Lucknow, Uttar Pradesh

Figure 52: Semi-automatic machine with hydraulic press for Fly Ash Brick making

Figure 536 PMAY-G house under construction

Figure 547 PMAY-G house under construction, awaiting second payment

Figure 1855 PMAY-G house under construction after second payment

Figure 1956 Stacking of Fly ash bricks for curing after removing from compression machine

Figure 2057 Precast channels and concrete rings for water tanks in Odisha

Figure 58 Toiler made out of Treated Bamboo at Treatment unit near Nagpur

Figure 59: Pan mixer under construction which is used for bricks and block manufacturing

Figure 60 Ferro Cement Window frame in Odisha

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