PROJECT PROPOSAL

Utilization of Cotton-By Produce for Value-added Products

CFC/ICAC 20

Document of

COMMON FUND FOR COMMODITIES

UTILIZATION OF COTTON PLANT BY-PRODUCE FOR VALUE-ADDED PRODUCTS
(CFC/ICAC/20)

(to be financed under the Second Account)

Appraisal Report

Date: 25 May 2004

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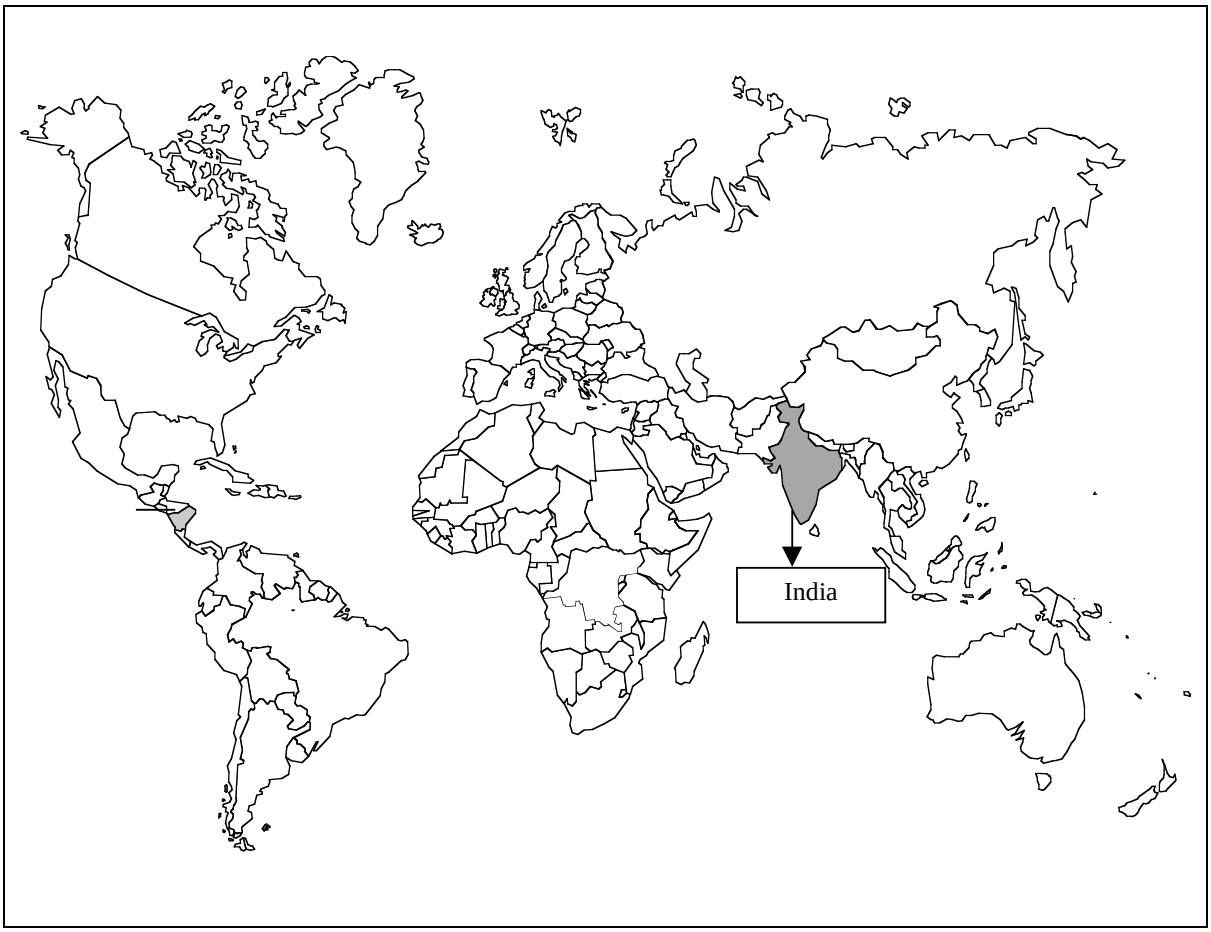
Map

Utilization of Cotton Plant By-Produce for Value-Added Products

India: location of the project



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Abbreviations

1m/m	=	1 man month
Y1	=	1st Year
Y2	=	2nd Year
Y3	=	3rd Year
Y4	=	4th Year
NGO	=	Non-Governmental Organisation
PI	=	Principal Investigator
PPM	=	Pilot Plant Manager
PS	=	Principal Scientist
RA	=	Research Associate
S	=	Scientist
S (Sr. Scale)	=	Scientist (Senior Scale)
SAU	=	State Agricultural University
T	=	Technician
USD	=	US dollar
UW	=	Unskilled Workers

UTILIZATION OF COTTON PLANT BY-PRODUCE FOR VALUE-ADDED PRODUCTS

(CFC/ICAC/20)

Project Summary

1.	**Project title:**	Utilization of Cotton Plant By-produce for Value-added Products
2.	**Duration:**	Four years
3.	**Location:**	India
4.	**Nature of the project:**	Operational research and development for the establishment of optimum parameters for a commercially feasible production process for preparation of particle boards using cotton stalks.
5.	**Brief description:**	This project aims at value addition for cotton farming by demonstrating the utility of cotton stalk residues in commercial particle board and fibre board production. Utilisation of this renewable lignocellulosic material in particle board or binderless board industries as an alternative to forest based wood will also be a significant contribution to arrest deforestation in India, which is posing a considerable environmental threat. The project aims to evaluate the organisation of collection, storage and pre-processing of cotton stalk for industrial use as well as to demonstrate the techno-economic feasibility to board manufacturers and investors. If successfully implemented, the sale of cotton stalks is estimated to increase the income of small farmers by around 5% and create industries and jobs in the rural areas of India and other cotton growing countries.
6.	**Estimated total cost:**	USD 2,190,486
7.	**Financing sought from the Fund:**	USD 918,886
8.	**Mode of financing:**	Grant
9.	**Counterpart Contributions:**	USD 1,271,600
10.	**Project Executing Agency:**	Central Institute for Research on Cotton Technology (CIRCOT) – Mumbai, India

11.	**Facilitating Agencies:**	East India Cotton Association – Mumbai M/s Jolly Board, India Ltd – Mumbai M/s Ecoboard Industries Ltd – Pune
12.	**Supervisory Body:**	International Cotton Advisory Committee (ICAC)

Previous Assistance to the ICB

Title of Project:	Study of Cotton Production Prospects for the Nineties (CFC/ICAC/03)
Amount of Assistance:	USD 529,619 (Grant)
Board Approval Date:	13 October 1992
	Completed
Title of Project:	Integrated Pest Management for Non-sticky Cotton (CFC/ICAC/03)
Amount of Assistance:	USD 3,096,194 (Grant)
Board Approval Date:	29 March 1994
	Completed
Title of Project:	Integrated Pest Management of the Cotton Boll Weevil in Argentina, Brazil and Paraguay (CFC/ICAC/04)
Amount of Assistance:	USD 2,103,305
Board Approval Date:	7 September 1994
	Completed
Title of Project:	Genome Characterization of Whitefly-Transmitted Geminiviruses of Cotton and Development of Virus-resistant Plants through Genetic Engineering and Conventional Breeding (CFC/ICAC/07)
Amount of Assistance:	USD 1,790,123 (Grant)
Board Approval Date:	3 April 1995
	Completed
Title of Project:	Improvement of the Marketability of the Cotton Produced in Zones Affected by Stickiness (CFC/ICAC/11)
Amount of Assistance:	USD 1,187,570 (Grant)
Board Approval Date:	22 October 1996
	Completed
Title of Project:	Improvement of Cotton Marketing and Trade System in Eastern and Southern Africa (CFC/ICAC/12)
Amount of assistance:	USD 3,609,585 (Grant)
	USD 5,717,250 (Loan)
Board Approval Date:	15 July 1997
Date of Effectiveness:	1 May 2000
Closing Date:	30 September 2004
Title of Project:	Sustainable Control of the Cotton Bollworm *Helicoverpa armigera* in Small-scale Cotton Production Systems (CFC/ICAC/14)
Amount of Assistance:	USD 2,258,503 (Grant)
Board Approval Date:	11 October 1999

Date of Effectiveness:	October 2000
Closing Date:	30 September 2004
Title of Project:	Resistance Management of the Cotton Bollworm *Helicoverpa armigera* to Pyrethroids in West Africa (CFC/ICAC/16FT)
Amount of assistance:	USD 30,000 (Grant)
	Completed
Title of Project:	Pilot Project on Price Risk Management for Cotton Farmers (CFC/ICAC/17)
Amount of Assistance:	USD 1,517,751
Board Approval Date:	23 April 2001
Date of effectiveness:	tbd
Title of Project:	Price Risk Management – Consultancy Study (CFC/ICAC/19FT)
Amount of Assistance:	USD 55,000
	Completed
Title of Project:	Cotton Plant Diseases (CFC/ICAC/21FT)
Amount of Assistance:	USD 57,500
	Completed
Title of Project:	Cotton Facts (CFC/ICAC/23FT)
Amount of assistance:	USD 20,000 (Grant)
Closing date:	Completed
Title of Project:	Sustainability of Cotton Production in West Africa (CFC/ICAC/25FT)
Amount of Assistance:	USD 75,000
Closing Date:	Completed
Title of Project:	Cotton Stalks – Study (CFC/ICAC/27FT)
Amount of assistance:	USD 120,000 (Grant)
	Completed

PART I. INTRODUCTION

A. Project Background

1. In India about 26 million tonnes of cotton stalks are generated every year. Most of the stalks produced are treated as waste and to some extent are being used as fuel by the rural population, while the bulk of the stalk is burnt off in the fields after harvest of the cotton crop.

2. As the income from cotton farming in India and other Afro-Asian countries has become very low and often insufficiently remunerative, other ways of fetching adequate returns to farmers are to be explored. In this connection, judicious utilisation of cotton by-produce for value-added products could play a greater role in generating additional income to the farming community.

3. Cotton stalk is rich in cellulose and of comparable composition and fibre structure to many hard wood species (about 79% holocellulose and 27% lignin). For enhanced income to the farmer and better utilisation of cotton stalks the Central Institute for Research on Cotton Technology (CIRCOT) has been carrying out extensive research work and has developed laboratory scale processes to prepare particle boards and binderless boards. These technologies need refinement on an experimental plant, and scale-up in an established board manufacturing industry to work out the techno-economic feasibility for commercial exploitation.

4. In order to assess the technical and economic aspects of cotton stalk valorization, a number of research and development objectives have been defined. A detailed analysis is required of the logistic supply chain, of primary production and pre-processing of cotton stalks to guarantee end users whole year round optimal quality raw material supplies at economically attractive costs. Best practice of pre-processing is to be investigated. In addition, the technology of board production based on cotton stalks needs refinement for high quality board production and adaptation of the technology by the industry. Therefore an experimental plant will be installed for undertaking scale-up trials as well as for refinement of the technologies developed for the production of particle board and binderless board. This plant will also serve as demonstration unit for convincing prospective entrepreneurs for setting up industries. Detailed techno- and economic data evaluation will be performed in the proposed experimental plant for cotton-based board production as well as in commercial production plants**.** The Project aims at utilisation of cotton stalks for the production of value-added products like particle boards and binderless boards.

5. Earlier versions of the project proposal have been reviewed by the Consultative Committee and recommendations had been made for adjustment and improvement. The Committee in its most recent (32nd) meeting noted that "*the reservations it had expressed at the 31st Meeting, particularly the assembly and marketing of cotton stalks and relating the marketing of the output of the manufactured boards; fine-tuning of the budget, activities and equipment specification; private sector involvement; and intellectual property rights (IPRs) were satisfactorily addressed. Although it had some reservations on the coverage and quality of the consultant report on the availability of cotton stalks, it noted the positive responses of the private sector during the study and a related workshop. The Committee felt that the budget needed further scrutiny particularly those items relating to the use of certain inputs in the various*

components, dissemination, the international workshop, vehicles, machinery and equipment, material and supplies, personnel, travel and operational costs. In view of the thorough examination of the project by the Committee at the current and several prior meetings and the technical work that had gone into it, the Committee concluded that the project was now ready to be recommended for approval by the Executive Board".

B. Structural Conditions in the cotton markets and ICAC's views on the project

4. Production of cotton for the season 2002/03 is expected to reach 19,1 million tons, which is 2,4 million tons below the season before that. Consumption for 2002/03 is estimated at 20,8 million tons, resulting in a net decrease of world stocks. Current cotton prices for the season are expected to remain at around 57ct/lb, which is higher than last year. Increased production expected for the coming season will most likely prevent further price increases. Although the cotton price is currently higher than in the two years before, the level is still far below the long-term (30yr) average of 70 ct/lb.

5. Cotton share in textile fibre consumption has for the first time since 1990 increased (to around 40%) after declining from 50% in the mid 1980s. While it does appear that the competitive position of cotton *vs* synthetics is thus not deteriorating, there remains a continuous pressure on prices, in particular in the earlier stages of the supply chain. Prices of cotton are furthermore "capped" as a result of the tendency of increased production in the light of (possibly) higher cotton prices. This, coupled with the (relatively autonomous) increase of input prices (seeds, fertilizers, pesticides, water, etc), leads to a still troublesome overall picture for the cotton producer, in particular the smaller producers who have limited or no options to reduce costs of production or to increase the efficiency of their production.

6. Cotton remains to be grown for its seed cotton/lint, although it is now considered that the cotton plant as such has more valuable components than its seed cotton alone. It is now considered that cotton stalks, which are mostly left in the field after harvesting the cotton bolls, could be a remunerative source of income. Furthermore, entomologists have concluded that the cotton stalks, with immature and unpicked bolls on them after picking, are a major source of pest carryover from one year to the other if left in the field. Unopened or badly opened bolls left on the plant in the field hibernate bollworms and serve as a reservoir for over wintering.

7. The current recommendation from researchers is to remove cotton stalks from the field. In countries where cotton production operations are mechanised, cotton stalks are slashed back into the soil. In other countries, particularly in small-scale farming systems, cotton stalks are cut manually and used as a fuel. The current project is expected to contribute to avoiding insect problems and also bring additional income to cotton growers.

PART II. PROJECT DESCRIPTION

A. Project Rationale and Objective

8. The average yield of cotton production in India is around 1000 kg of seed cotton per hectare, which results in slightly over 300 kg of cotton lint/ha. This is far below the world average of 630 kg lint/ha. While efforts are being undertaken to increase productivity and to lower production costs wherever feasible, no major drastic improvements may be expected in the

short term. In order to enable the cotton producer to increase his/her income from the field, initial efforts have been undertaken to add value to by-products which thus far were considered to be without economic value. Based upon initial laboratory and limited factory trials it appears that cotton stalks can be used commercially for hard board (binderless board) and particle board production. Estimates indicate that in this manner an additional income of some five percent or more could be realised for the cotton farmer. In addition, use of cotton stalks as base material for particle board production would have a positive environmental impact, as it would reduce the need for wood for this type of industrial purposes, thereby contributing to the slowing down of deforestation processes.

9. The proposed pilot production unit will have an estimated production capacity of 1 ton/day, which is expected to be the minimum size/capacity to demonstrate (on reduced scale) the actual production process. Most board manufacturing units in India have a production capacity of 30 – 60 tons/day. Preliminary assessments undertaken in a cotton stalks availability study indicated that on an average a cotton stalk production of around 3 tons/ha can be expected, which, allowing for losses during pre-cleaning, chopping and transportation would still amount to 1.0 – 1.5 tons of stalks/ha. A production unit of 30 tons/day would thus require a "catchment" area of around 9,000 ha (meaning an area with a radius of some 10 km around the factory). Larger production units require larger catchment areas and thus possibly more elaborated supply arrangements. With Indian cotton production covering some 8.5 million hectares, the availability of cotton stalks as such is not a problem. What does require to be looked into, is the economics of availability and supply for individual board making factories, taking into account their location and the "density" of cotton production in their direct environment. These are issues that will need specific analysis in the project.

10. The overall objective of the project is to demonstrate, at a pilot level, the technical and commercial feasibility of using cotton stalks as a base material for board production, addressing issues like collection of base material, (pre-)cleaning, processing and market survey of the boards. The logical framework of the project is given in Annex I. The technical concepts underlying the proposed design of the pilot plant and envisaged process parameters are given in Annex II. A provisional design of the lay-out of the pilot plant has been made and is included in the Annex III. Supporting equipment for the cleaning of the cotton stalk chips is identified and listed in the same Annex III. Provisional drawings are also included. The project implementation schedule is given in Annex IV, while the projection for a 30 TPD plant is given in Annex V. The terms of reference for the proposed pilot plant manager are given in Annex VI.

11. The following substantive components have been identified to be required for such a demonstration project:

- Component 1: Analysis and optimization trials of required logistical (including organizational) arrangements for collection and transportation of cotton stalks from the field to the production units, including possible setting-up of pre-processing units at the field level;
- Component 2: Trials for minimum and optimum levels of cleaning and pre-processing of cotton stalks into chips suitable for processing, at field level and at factory site;
- Component 3: Pilot production of cotton stalks-based particle board;
- Component 4: Utilization of cotton stalks for the production of binderless fibre boards;
- Component 5: Evaluation of technical/financial feasibility of the proposed processes;

- Component 6: Dissemination of project results at national and international level.

B. Description of Project Components

12. In order to ultimately assess the feasibility of the production system, the following components have been identified, each covering a specific segment of the overall process that must be analysed. It starts with a detailed analysis of the optimum logistics for the supply chain of primary production and pre-processing of cotton stalks to guarantee end-users optimal quality raw material supplies at economically attractive costs. Best practice of pre-processing is to be investigated, as well as the technology of board production which may need refinement for high quality board production and adaptation of the technology by the industry. Therefore an experimental plant will be installed for undertaking trials in an environment which reflects real factory conditions. It will serve as demonstration unit for convincing prospective entrepreneurs for setting up similar industries. Detailed technical- and socio-economic data evaluation will be undertaken in the proposed experimental plant for cotton-based board production as well as in commercial production plants.

13. The following components (clusters of activities) have been identified:

Component 1: Analysis and optimization trials of required logistical (including organizational) arrangements for collection and transportation of cotton stalks from the field to the production units, including possible setting-up of pre-processing units at the field level;

Cotton is a seasonal crop wherein the cultivation starts from June and picking is carried out from November to February. Once the picking is complete, cotton stalks are available from March to May and require storage for guaranteed supplies to board manufacturers for whole year production.

Cotton stalks are bushy in nature and have very low bulk density (about 0.14 kg/m^3). They pose technical problems in collection, resulting in high cost of transportation. Further, on storage in stick form cotton stalks may get degraded due to attack of insect pests. Therefore, a systematic study is needed to evolve logistics for proper collection, transportation and storage of cotton stalks. The possibilities for setting up local chipping centers also need investigation.

Presently, there is no organised sector for collection and transportation of quality cotton stalks to industries in a sustainable manner. The success of cotton stalks as an industrial raw material depends on establishment of sustainable supply chain of cotton stalks to the industry. Therefore proper methodology has to be developed for collecting and pre- processing cotton stalks and transportation either to centralised chipping centre or directly to the industry. Various quality parameters and yield levels will be monitored leading to the establishment of a suitable chipping centre.

Output: An optimized system of stalk collection and possibly pre-processing at the field level, including recommended institutional arrangements for collection and transportation of cotton stalks (in various forms) to the production unit.

Activities: In the first year of the project, various activities under Component 1 will be carried out in and around Nagpur by setting up the following three different

arrangements for collection of cotton stalks covering a distance of about 15-20 km. The same arrangement will be extended in the second year covering a wider area of about 100 km. Before undertaking the above work, awareness meetings will be arranged with the farmers in the Nagpur region.
To know the availability of cotton stalks in other regions of the country questionnaires will be sent simultaneously to farmers in North, South and Central Zones and data will be collected, compiled and availability of stalks will be established.

a) Transportation of cotton stalks directly from the field to factory for chipping in the factory.
b) Chipping of cotton stalks by farmers and transportation to the factory.
c) Collection and transportation of cotton stalks by farmers from the field to chipping centres, chipping and subsequent transportation to the factory.

All the above three models will be experimented in at least two different places in the Nagpur zone.

Data will be collected and maintained for cost/efficiency determination and the quality of the chips will be evaluated. Trials will also include analysis and impact of time on deterioration in the quality of the stalk or chips on storage.

Activity 1 – Establishment of Cotton Stalk Availability
- 1.1: Survey on the availability of stalks with farmers in North, South and Central zones with the help of SAU's and NGO's.
- 1.2: Data compilation and establishment of availability

Activity 2 – Methodology for Collection and Handling of Cotton Stalks
- 2.1 : Identification of two suitable locations for undertaking the trials
- 2.2: Identification of suitable method of harvesting of cotton stalks.
- 2.3: Identification of suitable method of collection and transportation of cotton stalks to a suitable collection centre in the field

Activity 3 – Methodology of Chipping of Cotton Stalks
- 3.1: Identification of a suitable chipping device for cotton stalks.
- 3.2: Determination of chip quality and yield.
- 3.3: Establishment of an identified chipper in the farmers field and at the decentralised chipping centre.
- 3.4: Trials with chipper at the farmer's fields and decentralised chipping centre

Activity 4 – Logistics for Economic Collection of Cotton Stalks
- 4.1: Investigation of direct transportation of stalks from farm to factory as such and after compaction using compacting machine developeed by CIRCOT
- 4.2: Investigation of chipping cotton stalk in farmers field and transporting chips from farmers field to factory
- 4.3: Investigation of transporting cotton stalk from farm to decentralized chipping center and then to factory

4.4: Storage trials in different forms of stacking, in stick (baled and as such) as well as in chip form.

4.5: Studies on the effect of storage on quality

Activity.5 – Establishment of Most Suitable Practice for Collection and Transportation of Cotton Stalks

5.1: Collection and compilation of technical and economical data, establishment of most effective supply mechanism.

Activity 6 - Verification of the workability of the established model of collection and transportation of stalks to a larger area

6.1 Identification of suitable farm in the radius of 50 km and 100 km area

6.2 Experimentation of the identified model for collection of cotton stalks

6.3 Collection of data on establishment of most effective mechanisms

Description : Principal Investigator (P. I.), Dr. R. H. Balasubramanya will coordinate the work on the availability of cotton stalk in Nagpur and other cotton growing zones. Mr. P. G. Patil will supervise the activities in this region. Three research associates will assist the scientist in all activities (one man month per region). The survey for establishing availability of cotton stalks in other zones of the country will be carried out with the help of SAU's/NGO's on contractual basis. Principal investigator, Dr. R. H. Balasubramanya will coordinate all the activities, namely, collection, handling and chipping with the help of one principal scientist and one research associate. Principal scientists, Dr. A. J. Shaikh, Mr. R. M. Gurjar and the pilot plant manager will identify suitable farms/plots to undertake the experimental work. In addition to the four technicians employed in the project, required men and material will be hired. They will be trained to carryout the trials on collection, handling, chipping, transportation and storage of cotton stalks. The research associate will take part in the activities and collect the relevant data.

Input:	CIRCOT	US$ 13,300
	CFC	US$ 37,800

Component 2: Trials for minimum and optimum levels of cleaning and pre-processing of cotton stalks into chips suitable for processing, at field level and at factory site;

Dry cotton stalks contain a considerable quantity of undesirable materials for board production in the form of boll rinds, dried leaf bits, cotton lint, dust, etc. In addition, it has about 25% to 30% of bark, which is slightly darker in colour. The bark consists of significant amounts of cellulose and lignin and is quite fibrous in nature. The attachment of bark with the stem and branches is very strong and it is rather difficult to separate the bark from the stem. However, a good percentage of bark gets separated during chipping and rechipping operations. All these impurities pose lot of problems in processing the raw material and affect the quality of the finished product. Boll rinds are non-fibrous in nature and generate shives and fines. Bark also creates problems in pulping operation and leaves dark spots on the panel. Cotton lint and bark can also block or choke the screens. Hence, proper methodologies will have to be developed to remove these undesirable materials from the stalk so that a clean uniformly chipped cotton stalk acceptable to industry is made available. Further, as a protection measure, cotton crop is sprayed with large quantities of pesticides and chemicals, and residues of these pesticides and chemicals may be present on the cotton stalks, that may cause health hazards to the workers and appear in the

effluents and finished products. Therefore, it is essential that stalks are evaluated for the presence of pesticide residues and remedial measures to this effect are devised. The aim of this component is to develop proper cleaning and screening mechanisms to remove the undesirable/ harmful components from the stalks so that a fairly clean ready-to-use raw material is made available to the industry.

The above objectives will be achieved by installing a large-scale pilot chip making-cum-cleaning system (Annex III) located at the production unit for assessing the impact of different sized chips, their level of cleanliness for making boards. The results gathered from the chips obtained from the two systems under component 1 which do not undergo preprocessing will be compared with the chips obtained from the cleaning system. The wastes generated during cleaning of chips will be employed for briquetting for use as fuel. The stalks and chips (cleaned and uncleaned) will be analysed for the presence of pesticide residues at CIRCOT, Mumbai.

Output: Information on the various levels of chip size, required extents of cleanliness of the chips and their impact on the quality of the boards produced. Information will also be collected about possible use of waste generated and the level of insecticide/pesticide residues on the cotton stalks, as well as after their use in board production.

Activity 1: Installation of prototype chip cleaning machine
- 1.1: Tender douments for chip cleaning machine, briquetting machine and bomb calorimeter
- 1.2: Finalisation of tenders and placement of order
- 1.3: Installation and commissioning of chip cleaning system

Activity 2: Evaluation of performance of chip cleaning system
- 2.1: Optimisation of various parameters of chip cleaning system for obtaining quality chips with satisfactory yield
- 2.2: Evaluation of quality of chips obtained from different systems under component1 *vis* a *vis* chips obtained from chip cleaning system and their influence on preparartion of particle boards
- 2.3 Evaluation of cost of cleaned chip prepararion by different modes of chipping

Activity 3: Evaluation of particle boards relating to chip quality
- 3.1: Rechipping trials of the chips obtained from different modes
- 3.2: Cost estmation of rechipped material
- 3.3: Preparartion of boards from rechipped material obtained from different modes of chipping
- 3.4: Evaluation of boards

Activity 4: Utilisation of wastes obtained during chip cleaning
- 4.1: Collection of data on generation of wastes at different stages of chip cleaning
- 4.2: Physical, chemical and thermal characterisation of wastes
- 4.3: Briquetting trials and evaluation of calorific value
- 4.4: Economics of briquette making

Activity 5: Pesticide residue analysis on cotton stalks and chips obtained from different modes

5.1: Development of methodologies for extarction, estimation of the extract and estimation of pesticide residues

5.2: Estimation of pesticide residues in cotton stalks and in chipped material obtained before and after cleaning

5.3: Establishment of health and environmentally safe chip processing practice

Description : Dr. R. H Balsubramanya will coordinate the work of tendering and procuremnt of chip cleaning system and other equipment under this component. Dr. K. M. Paralikar will coordinate the work of installation and commissioning of machinery at GTC, Nagpur with the assistance of pilot plant manager and Mr. S. K. Shukla, Scientist. Trials and data collection on the chip cleaning system and particle board preparation will be carried out by Mr. R. M Gurjar, Prinicpal Scientist with the help of pilot plant manager, one research associate and two technicians. Mr. S. K. Shukla scientist will undertake the work on briquetting. Dr. P. V. Varadarajan will undertake the work of pesticide residue analysis at CIRCOT,Mumbai with the help of one research associate and two technicians. The help of unskilled workers will be utilised for the collection of wastes at different places of operation.

Input:	CIRCOT	US$ 21,500
	CFC	US$ 148,138

Component 3: Pilot plant production of cotton stalks-based particle board;

Laboratory scale studies conducted by CIRCOT have shown that good quality particle boards can be prepared from cotton stalks. However this technology needs refinement with respect to processing parameters, different surface finishing in an experimental plant to work out the techno-economic feasibility of the process. It is proposed to set up an experimental plant for the manufacture of particle boards of size 4'x3' with thermic fluid heated hydraulic press. In Annex II a diagram is given for a prototype particle board plant. In the experimental plant the effects of different processing conditions on the quality parameters of cotton stalk particle boards will be assessed. The production process will be standardized for optimal operational efficiency, with respect to energy consumption and productivity. Industrial trials will be performed to verify and confirm the processing parameters obtained in the experimental board production plant. Data on technical and economic aspects will be collected. Comparison of properties of boards from pilot plant with those of commercial products on the market will be used to assess the competitiveness of the cotton stalk particle boards.

Output: A fully operational pilot production unit of small size, capable of producing particle board under technically identical conditions as commercially operated plants.

Activity 1 – Establishment of an Experimental Demonstration Plant facility for particle board production

1.1: Construction of a building for experimental plant and raw material storage

1.2: Procurement and installation of small scale production equipment

1.3: Commissioning of particle board plant

Activity 2 – Particle Board Production Method

2.1: Determination of processing conditions (temperature, pressure, time and resin content) and synchronisation of different parts of the system.

2.2: Effect of different processing conditions on quality parameters of cotton stalk particle boards

2.3: Identification of different processing conditions for different end-uses (panelling, table tops, false ceiling, partitioning etc.)

2.4: Production and evaluation of boards with different surface finishes (veneer, bamboo mat, prelamination etc.)

2.5: Production and evaluation of boards with different binders (urea formaldehyde, cardanol based adhesives etc.)

2.6: Effect of different chemical additives (fire retardants, water repellent, termite protection) on process conditions and board quality

2.7: Production and evaluation of boards of blended agro residues (bagasse, wood chips, soya stalks, safflower stalks, etc.) with cotton stalks

Activity 3 – Up-scaling and Commercial Trials

3.1: Performance of full capacity running trials on experimental particle board production line.

3.2: Estimation of production costs in relation to energy inputs, production efficiency (cycle time) and board quality on experimental line.

3.3: Confirmation of experimental processing conditions by conducting full-scale commercial trials with M/s Eco-board, Pune.

3.4: Data collection and quality evaluation including evaluation of pesticide residues in commercial scale production trials; comparison with competing commercial products (wood based and bagasse based products) on price performance.

Description : Dr. R. H. Balasubramanya, Principal Scientist will coordinate the work of particle board preparation at G. T. C., Nagpur. Dr. K. M. Paralikar, Principal Scientist will supervise the work of construction of shed with all infrastructre facility, installation and commissioning of particle board plant at GTC, Nagpur with the help of Mr. P. G. Patil, Scientist Sr. Scale, Mr. V. G. Aurde, Scientist, Mr. S. K. Shukla, Scientist, pilot plant manager, three research associates, two technicians and four unskilled workers. Dr. A. J. Shaikh and Mr. R. M. Gurjar, Principal Scientists will supervise the work of particle board preparation with the help of Mr. P. G. Patil, Pilot plant manager, two research associates, two technicians and four unskilled workers. The help of consultant will be sought during particle board production for trouble free running. After standardisation of processing conditions in the pilot plant, commercial trials will be undertaken in M/s Ecoboard Ltd. at Velapur, Dr. R. H. Balasubramanya, Dr. K. M. Paralikar, Dr. A. J. Shaikh, Mr. R. M. Gurjar and Dr. P. V. Varadarajan along with pilot plant manager will coordinate the work pertaining to large scale commercial trials.

Input:	CIRCOT	US$ 1,074,600
	CFC	US$ 323,072

Component 4: Utilisation of cotton stalks for the production of binderless fibre boards (Activities of this component will be carried out using laboratory facilities available at CIRCOT, Mumbai)

CIRCOT has developed a process on laboratory scale to prepare binderless fibre boards from cotton stalks. The process involves chipping of stalks, conversion of chips into thermo-mechanical pulp, preparation of fibre mat and subsequent pressing in a hydraulic press using a 3-step pressure cycle. The boards prepared without additional (chemical) binder possess good mechanical properties conforming to specifications laid down by the Bureau of Indian Standards. This process has to be further fine-tuned to make the technology more cost effective. It is therefore proposed to undertake further trials in the laboratory and then evaluate the techno-economic feasibility of the process by undertaking commercial trials in an existing hard board plant.

Output: Established optimum parameters of thermo-mechanical pulp from cotton stalks and processing parameters for binderless board production, based on laboratory trials and subsequent factory scale trials at the premises of a facilitating commercial operator.

Activity 1: Establishment of Processing Parameters for Binderless Board Production From Cotton Stalks at Laboratory Scale

- 1.1: Production of thermo-mechanical pulp from cotton stalks of various grades by using different chip size, temperature and pressure conditions
- 1.2: Evaluation of pulp quality like yield, freeness, drainage time, etc.
- 1.3: Establishment of processing parameters (temperature, pressure and time) for binderless board production from cotton stalks and evaluation of the quality of boards.

Activity 2: Up-scaling and Commercial Trials

- 2.1: Estimation of production costs in relation to energy inputs, production efficiency (cycle time) and board quality on experimental scale.
- 2.2: Confirmation of experimental processing conditions by conducting full-scale commercial trials with M/s Jollyboard Ltd..
- 2.3: Data collection and quality evaluation of commercial scale production trials; comparison with competing commercial products (wood based products) on price performance.
- 2.4: Evaluation of boards and effluents for pesticide residues.
- 2.4: Evaluation of effluents for COD, BOD, suspended solid content and effluent treatment systems.

Description : Dr. A. J. Shaikh will supervise the work of binderless board preparation at the laboratory scale at CIRCOT, Mumbai with the help of Mr. R. M. Gurjar, Dr. P. V. Varadarajan, one research associate and one technician. Dr. R. H. Balasubrmanya will coordinate the work of commercial trials in a private mill with the help of Dr. A. J. Shaikh, Mr. R. M. Gurjar, Dr. P. V. Varadarajan, one research associate and three technicians.

Input:		
	CIRCOT	US$ 110,600
	CFC	US$ 66,904

Component 5: Evaluation of technical/financial feasibility of the proposed processes;

A detailed study will be carried out on the supply chain of cotton stalks, collection logistics, costs of operations, cleaning and chipping of cotton stalks. Data collected in this study will provide information about the availability of cotton stalks per hectare; logistics for collection, transportation and storage of cotton stalks; cost of raw material and extent of additional income for the farmers. The most efficient methodology for cleaning and chipping of cotton stalks will be selected in relation to costs specification for different scenarios for transportation and storage.

Detailed analysis of these data will be carried out and technical and economical viability of cotton stalk as raw material for industrial application will be established. Estimates for a projected scale of a production plant - say of 30 tonnes / day -will be established in relation to the best practice of raw materials supply and raw material demands of a board production plant.
The technologies developed at laboratory scale will be refined and optimized by carrying out modifications on the experimental plant and the processing parameters will be standardised accordingly. Full capacity trials for long duration will be performed on the experimental plant and scaled up in commercial particle board and hard board industries, applying the standardised conditions. Data on production and economic aspects will be collected for a comprehensive techno-economic analysis that would establish the financial and economic viability of the process under Indian conditions as a practical case study. Such a model would be made available for adaptation by other cotton growing countries in the Afro-Asian region. The risk factors will also be clearly mentioned. The techno-economic feasibility analysis of the first two components i.e. availability, logistics for collection, transportation, storage, cleaning and chipping of cotton stalks will be completed in the first and/or second year of the project, while the feasibility of the processes developed will be evaluated in the 3rd and 4th year of the project.
Selling various products produced during the trials with the help of the East India Cotton Association (EICA) will help in assessment of the market reaction. Particle boards prepared from cotton stalks with different surface finishes and binderless boards will also be displayed at various outlets of the EICA for giving wide publicity and to get consumer reaction.

Output: Full analysis of all relevant parameters covering the process of input collection, processing and board production as well as an assessment of the market potential of cotton stalk boards. The analysis will cover not only the technical parameters but also organizational (stalk collection) as well as cost considerations. The analysis should enable interested entrepreneurs to fully understand the expected advantages and possible disadvantages of using cotton stalks as a base material for hard or particle board production.

Activity 1: Data on Techno-Economic Aspects of Cotton Stalk Feasibility

1.1 : Development of a comprehensive data collection protocol for each of the key component (1-4)

1.2 : Compilation of technical and economic data from compoent 1 employing an optimised method of collection and chipping of cotton stalks

1.3 : Compilation of technical data from component 2 from cotton stalks chip cleaning system to arrive at the ultimate cost of ready to use cleaned chips

1.4: Compilation of technical and economic data from components 1-3 to determine the cost of production and to assess competitiveness of cotton stalks with

agrobased residues as raw material for particle board production on commercial scale

1.5: Compilation of technical and economic data from components 1,2, 4 to determine the cost of production and to assess competitiveness of cotton stalks as raw material for binderless board production on commercial scale

1.6: Assessment of scale of production, investment costs and returns

Activity 2: Marketing Information on Acceptability of Cotton Stalk Based Board Products

2.1: Assessment of market reaction of cotton stalk based boards with the help of EICA involved in the project.

2.2: Incorporation of feedback data into the process design.

Description : The help of outside experts(Agri. Economist, statistician and Agri. Engineers) will be sought for the preparation of a comprehensive data collection protocol and techno economic feasibility for all the key components (1-4). Dr. R. H. Balasubramanya will coordinate the work of preparation of techno economic feasibility report with the help of Dr. P. V. Varadarajan, Mr. R. M. Gurjar and one research associate.

Input:	CIRCOT	US$ 21,000
	CFC	US$ 2,940

Component 6: Dissemination of project results at national and international level;

In order to ensure the commercial adaptation of the technologies developed under the programme and market acceptability of the products prepared, it is proposed to establish strong and effective linkages with private industry, viz., The East India Cotton Association (EICA), Mumbai right from the initial stages of the project. The cotton farming community will be engaged through workshops and involvement of NGOs for promotional activities in rural areas. Promotional brochures, scientific papers and popular articles will be used as media to create awareness among relevant entrepreneurs and consumers. A techno-economic and socio-economic report will be published on the project findings. By conducting industrial scale trials, technology transfer to industries will be achieved. An international workshop of two days duration will be organized at Nagpur in which cotton growing member countries of the CFC will be invited to participate.

Output: Information on the data obtained and results achieved by the project documented and shared with relevant groups from the private sector, be it farmers(-groups), entrepreneurs, researchers, investors etc, in India and abroad (in particular in African and Asian cotton producing countries).

Activity 1: Encouraging farmers for Participation and Cooperation of Primary Production Chain to Supply Cotton Stalks for Board Production

1.1: Organization of one workshop and atleast two awareness meets on potential of cotton stalks as industrial raw material for board production in major cotton growing areas (Workshop at Nagpur and awareness meets in North and Central India).

1.2: Involvement of NGOs for promotion of cotton stalk for industrial applications (Appropriate Rural Technology for India (Pune) and Bharatiya Agro Industries Foundation, Pune)

Activity 2: Convincing the participants and private sector investors for commercialisaion of cotton stalks board prodution

2.1 : Organization of workshops and seminars for industrial parties at national level and demonstration of the plant.

2.2 : Publication of promotional brochures, scientific papers, and popular articles in English and partial translation in Hindi to create awareness.

2.3 : Presentation of project results at national and international seminars, dissemination at national level through EICA network and at international level through ICAC and CFC channels

Activity 3: Publication of Comprehensive Handbook in English and partial translation in Hindi

3.1: Reporting of project findings in English and Hindi, highlighting the techno-economic feasibility and socio-economic aspects of cotton stalk as raw material for board production

Activity 4 : Transfer of Technology

4.1: Undertaking production trials in industries and preparing techno-economic feasibility study with the help of Eco-board and Jollyboard.

4.2: To assess the market acceptability of the products (particle boards of 12 mm & 18 mm thickness with different surface finishes and binderless boards through the help of marketing channels of EICA)

4.3: To disseminate and popularise the technologies developed at national level through EICA and M/s Eco-boards and at International level through ICAC and CFC

4.4: Identification of prospective entrepreneurs by EICA

Activity 5: International Workshop

5.1: Production of an information brochure for the workshop in English.

5.2: Invitation to participants from CFC member countries growing cotton, and national representatives.

5.2: Organization of international workshop for presentation of project achievements.

5.3: Demonstration of technologies developed at the experimental plant to participants.

Description : Dr. R. H. Balasubramanya and Dr. K. M. Paralikar will coordinate the work of dissemination of project results. Dr. K. M. Paralikar in coordination with EICA with their established marketing network will organise awarness meets in the first year for establishing the potential of cotton stalks for board making, special workshops for NGO's and entrepreurs for assessmnet of consumer reaction for particle boards and binderless boards, popularisation of technologies, identifiaction of prospective entrepreneurs and coordinating commerical trials on the preparation of binderless boards. M/s Ecoboard Ltd. will help in the promotion of cotton stalk as raw material for particle board preparation. Director, CIRCOT (PEA) will organise the

International Workshop. Dr. R. H. Balasubramanya will convene the workshop with the help of Dr. K. M. Paralikar as co-convener.

Input:	CIRCOT	US$ 14,000
	CFC	US$ 141,435

Component 7: Project management, monitoring, supervision and evaluation

The Project Executing Agency (PEA) will be CIRCOT (ICAR), Mumbai, India, which will be the responsible Institute for overall implementation of the scheme including day to day management. CIRCOT will coordinate the activities to be undertaken at various institutions in India and will ensure that they are planned and implemented in a manner contributing effectively and efficiently to the achievements of the envisaged objectives of the scheme. The PEA will prepare annual work programme, budget, half yearly progress reports and annual progress reports and administer the finances of the project. An advisory committee specially constituted to assess the progress of the project would perform the job of monitoring by participation in an evaluation meeting once in six months during the execution of the programme. A technical evaluation of the progress of the scheme is proposed at the completion of the second year of the project and will be organised in consultation with the funding and supervisory body and a final Report on completion of the project will be prepared and submitted to the funding agency in the fourth year. The final evaluation and assessment would be conducted by an expert team appointed by the funding agency at the successful completion of the whole programme.

The Project Executing Agency (PEA) CIRCOT, Mumbai, India will co-ordinate the project activities. PEA will organise meetings once in six months with the Advisory panel approved by CFC, Mid term review with the experts appointed by CFC in the second year and final evaluation after the completion of the project with the members nominated by CFC. PEA will submit progress reports every six months to CFC with financial statements. The progress made in the project will also be discussed in the Institutes Staff Research Council (SRC) and Research Advisory Committee (RAC) meetings and suggestions will be considered for improvement and implementation of the objectives envisaged in the project.

Output: An efficiently managed and implemented project, completed as planned within the set time frame and budget.

Activity 1: Project Monitoring

- 1.1: Constitution of advisory board, consisting of 10 members, 5 external Scientists and 5 from private industry, under chairmanship of Director CIRCOT.
- 1.2: Half yearly meeting of advisory board to evaluate the progress of work and planning.
- 1.3: Preparation of annual work programmes, budget and progress reports
- 1.4: Midterm evaluation after second year by external experts assigned by CFC and ICAC officials.
- 1.5: Preparation of final project report
- 1.6: Final project evaluation at the end of the project by external experts assigned by CFC and ICAC officials.

Activity 2: Coordination of the Project Activities by the PEA

2.1: Preparation of management reports, financial statements duly audited, and coordination of project activities. Overall implementation of day-to-day activities.

2.2: Evaluation of progress of the project in regular Staff Research Council and Research Advisory Committee of CIRCOT.

Description : Consitution of advisory board will be a done by PEA, Director, CIRCOT, Mumbai. Prinicpal Investigator, Dr. R. H. Balasubramanya will prepare detailed Annual Work programme and budget and regular substantive progress reprts with the help of two principal scientists, Dr. P. V. Varadarajan and Dr. A. J. Shaikh for onward transmission of CFC/ICAC. The PEA will arrange half yearly, yearly, mid term and final project evaluation meetings. The PEA with the help of principal investigator will prepare financial management reports as per the pertinent guidelines of the fund.

Input:	CIRCOT	US$ 16,600
	CFC	US$ 198,597

C. Benefits and Beneficiaries

14. The main benefits of a successfully implemented project, when taken-up by the private sector, will be the additional income that cotton farmers will secure through the sale of their cotton stalks which are currently perceived to have no monetary value. This additional income could amount to some US$ 15–20/ha, which in the case of small farmers represents an increase of more than five percent of their monetary income from cotton production alone.

15. Additional benefits can be found in the expected reduced use of wood as a basis for particle/hard board production, which has strong environmental benefits, and in the possibility to create new rural based small board manufacturing units which (with their raw material collection/supply systems) may require at least some 100 – 150 workers per unit producing 30 tons per day.

16. Main beneficiaries will thus be the cotton farmers who will generate additional income from the sale of cotton stalks. At a later stage, after commercial uptake of project results and establishment of rural board manufacturing units the project may have a positive impact on reducing rural unemployment.

D. Project Costs and Financing

17. The project costs have been estimated at US$ 2,190,486 over four years. The summary cost, component wise, is given below in Table 1. The summary project cost, allocated by project year, is given in Table 2. Detailed cost tables are given in Annex VII – Financial Tables. The use of the funds earmarked for expenditures per category by project component will be in accordance with the relevant procedures of the Fund. The project will be financed by a grant contribution of US$ 918,886 (42% of the total project costs) from the Fund, while the counterpart contributions are estimated at US$ 1,271,600.

Table 1 : Summary Project Cost by Component (in US$)

Component	CFC	CIRCOT	Total Base cost
1. Analysis and optimisation trials of required logistical (including organisational) arrangements for collection and transportation of cotton stalks from the field to the production units, including possible setting-up of pre-processing units at the field level;	36,000	13,300	49,300
2. Trials for minimum and optimum levels of cleaning and pre-processing of cotton stalks into chips suitable for processing, at field level and at factory site;	137,580	21,500	159,080
3. Pilot production of cotton stalks-based particle board production	297,110	1,074,600	1,371,710
4. Utilisation of Cotton stalks for production of the binderless fibre boards	63,170	110,600	173,770
5. Evaluation of technical/financial feasibility of the proposed processes;	2,800	21,000	23,800
6. Dissemination of project results at national and international level;	134,700	14,000	148,700
7. Project management, monitoring, supervision and evaluation	189,140	16,600	205,740
Sub Total	**860,500**	**1,271,600**	**2,132,100**
Contingency	**58,386**	**0**	**58,386**
Total	**918,886**	**1,271,600**	**2,190,486**

* With contingency

Table 2 : Summary Project Cost by Component by Year

Component Inputs	Estimated Costs				Total		
	PY1	PY2	PY3	PY4	Base Cost	Contingency	Total Cost
1. Analysis and optimization trials of required llogistical (including organisational) arrangements for collection and transportation of cotton stalks from the field to the production units, including possible setting-up of pre-processing units at the field level;	26,850	20,850	750	850	49,300	1,800	51,100
2. Trials for minimum and optimum levels of cleaning and pre-processing of cotton stalks into chips suitable for processing, at field level and at factory site;	90,010	36,320	26,020	6,730	1,59,080	10,558	169,638
3. Pilot production of cotton stalks-based particle board production;	1,258,540	26,190	43,690	43,290	1,371,710	25,962	1,397,672
4. Utilisation of cotton stalks for the production of binderless fibre boards;	127,675	9,400	21,385	15,310	173,770	3,734	177,504
5. Evaluation of technical/financial feasibility of the proposed processes;	2,100	2,200	9,700	9,800	23,800	140	23,940
6. Dissemination of project results at national and international level.	3,400	8,900	16,200	120,200	148,700	6,735	155,435
7. Project management, monitoring, supervision and evaluation	27,260	66,410	38,010	74,060	205,740	9,457	215,197
Sub Total	1,535,835	170,270	155,755	270,240	2,132,100	58,386	2,190,486
Contingency					58,386		
Total					2,190,486		

E. Procurement, Disbursement, Accounts and Audit

18. **Procurement** will be in accordance with the Fund's Rules and Regulations for the Procurement of Goods and Services of the Second Account for all items financed by the Fund and the applicable rules as described in the Fund's Financial Procedures Manual. Project expenditures shall only be incurred for procurement of goods and services from Member States of the Common Fund. The list of Member States is given in Annex VIII. According to the Article 48 of the Agreement Establishing the Common Fund for Commodities, the Common Fund enjoys exemption from all direct taxes and from customs duties. Contracts for machines and equipment with a contract price of or exceeding US$ 100,000 shall be subject to International Competitive Bidding (ICB). Contracts for supply of goods and services with a price equal to or exceeding the equivalent of US$ 50,000, but less than the equivalent of US$ 100,000 shall be awarded following limited competitive bidding procedures. For procurement of items/contracts with a value of between US$ 5,000 and US$ 50,000 at least three quotations should be obtained of which at least two should be from reputable international suppliers. Consultants will be engaged following acceptable international procedures.

19. **Taxes :** Any equipment/machinery/spare parts/any sundry purchases either procured locally or imported attract the following taxes besides the basic unit cost and the cost of equipment shown in the budgetary statements include all the taxes shown below :

Imported	**Local**
Import duty (CIRCOT exempted)	Central Sales Tax
Octroi	State Govt. Sales Tax
Forwarding and clearing charges	Octroi
Bank charges	Packing and forwarding charges
Insurance charges	Insurance

CIRCOT will pay all types of taxes, octroi, insurance during transit and insurance premium every year after the installation of all machinery. Provision has been made at appropriate places in the budget.

20. **Disbursement** against the purchase of items with a value of US$ 500 or more will be fully documented. Other expenditure will be disbursed against certified Statements of Expenditure (SOE). Documentation under SOE need not be forwarded to the Fund but will be retained in a central location by the PEA and the participating institutions for review during monitoring and supervision missions and for authentication by the auditors. Since the PEA and the collaborating institutions will not be in a position to pre-finance expenditures eligible for Fund financing, a project Account will be opened by the PEA in a bank satisfactory to the Fund, and in a convertible currency. However, the CFC will have to remit the amount to ICAR, New Delhi in favour of secretary ICAR. Later after the amount has been credited in ICAR's account they will transfer the funds to the project account of CIRCOT, Mumbai. The PEA shall open a separate bank account in state Bank of India, Dadar Commercial Branch, Dadar, Mumbai and

shall be operated by the signatories of CIRCOT. All the financial statements regarding the project shall be submitted to the CFC directly by CIRCOT. The Fund will make an initial deposit of US $ 150,000 after the conditions of disbursement have been met (such to be determined by the Fund's Managing Director). The Project Account will be replenished in accordance with the Fund's procedures for operating a Project Account. Based on agreed work programme and allocation of responsibilities, the PEA shall provide funds from the Project Account to service providing institutions for the implementation of that part of the programme from the operational expenses allotted to PEA. The Supervisory Body will ensure, prior to the first disbursement from the Grant Account that the contributions from the counterparts are confirmed in the quantify foreseen under the project.

21. **Accounts and Audit:** The PEA will maintain independent and appropriate financial records and statement, including those for the Project Account. These will be audited annually by independent auditors acceptable to the Fund. The audited accounts and the auditors report, including separate opinions on the Statements of Expenditure and on the utilisation of the funds in the Project Account, will be submitted within three months after the end of the project's fiscal year.

F. Organization and Management

22. The Central Institute for Research on Cotton Technology (CIRCOT) based in Mumbai, India, will be the Project Executing Agency (PEA) for the project. CIRCOT has the required organisational, managerial and the general technical capacity to take up the role of PEA. The Director of CIRCOT will be the person overall responsible for the project. He will set up adequate advisory and operational structures (within CIRCOT as well as incorporating the various external parties/stakeholders of the project) as required for the adequate implementation of the project.

23. CIRCOT is an Institute under the administrative control of the Indian Council of Agricultural Research (ICAR), New Delhi based at Mumbai. It includes a Ginning Training Centre at Nagpur and has six regional stations in major cotton growing areas of the country and has the major mandate of increasing the productivity and quality of Indian cottons. One of the facilitators who are private parties involved will be the East India Cotton Association. EICA is a broad-based organisation having membership strength of 400 spanning across the country. It is an apex body connected with the conduct and regulation of cotton trading in India. It has developed required infrastructure comprising state of the art cotton testing laboratory and competent survey system for quality evaluation of Indian Cotton. EICA will assist in the present project in product development, popularising the technologies developed, in sale of the products, in getting the market/consumer reaction and in promotion and commercialisation of the technologies developed among promising industrial and enterprising non-governmental organisations.

24. M/s Jolly Boards, India Ltd. Mumbai, the other facilitator identified for execution of the project will provide facilities for undertaking commercial scale trials for the production of binderless boards and M/s Ecoboard Industries Ltd, Pune will help in undertaking commercial trials on the preparation of particle boards from cotton plant stalks.

25. The help sought from the three private sector parties will be ensured through formal arrangements between CIRCOT and the three parties, outlining the work to be undertaken and duly recognising the public nature of the work within the framework of the project. [*]

26. CIRCOT will be the responsible party to ensure optimum involvement of EICA, Jolly Boards and Ecoboard, based on agreed on work programmes as included in the Annual Work Programmes and Budgets to be prepared by CIRCOT.

G. Reporting, Monitoring, Supervision and Evaluation

27. The PEA will constitute an advisory committee under the chairmanship of Director CIRCOT consisting of 10 members, 5 members will be scientists representing various research & development institutes including ICAR officials and 5 members will be representing private industry, trade etc. for monitoring the progress of the project. This Project Coordination Committee (PCC) will meet twice per year or more frequently as deemed appropriate by its chairman. Meetings of the PCC can be attended by staff of the Fund and the ICAC as deemed relevant. The PEA through its Director remains, however, responsible for the implementation of the project.

28. As the Project Executing Agency, CIRCOT will prepare and submit to the Fund and the Supervisory Body an integrated annual work plan and budget *cum* implementation schedule, linking all the activities envisaged to be undertaken under each component in a logical timeframe. The work plan will include incorporation of measurable milestones which will enable adequate monitoring of the progress of the project. The first years work plan and budget will be prepared on the basis of the final version of the Appraisal Report. This work plan and budget will need to be endorsed by the International Cotton Advisory Committee (ICAC) and the Fund prior to the start of the project.

29. The PEA will submit to the Fund and Supervisory Body six-monthly progress statements and annual monitoring reports which will analyse the progress made by the project against the targets set in the annual work programmes and as reflected in the project's final appraisal report. Variances will be accounted for and remedial action will be proposed if required. A substantive project progress report will be prepared annually by the PEA, which will be submitted to the Fund and the Supervisory Body (the International Cotton Advisory Committee, ICAC) after reviewing draft by the Project Co-ordinating Committee, at its annual meeting. The PEA shall also prepare the standard financial reports as per the Fund's pertinent rules and regulations.

30. In the monitoring of the project by CFC and the Supervisory Body two independent evaluations of technical achievements and the organisation and management of the project are scheduled to be undertaken. The mid-term evaluation is scheduled at the end of the second year of the project while the final assessment is expected in the last year of the project, before the final workshop. The PEA shall organise and assist in the implementation of this evaluation. The PEA will be responsible for preparing and submitting the Project Completion Report. This report will highlight the project achievements, constraints and experiences gained in the design and

[*] * A model format for documentation of such relationships, recommended by the Fund, is contained in the Fund's prevailing Project Manual and on the website, http://www.common-fund.org

implementation of the project. This report will include a summary assessment of the financial benefits resulting from the project achievements as well as guidelines to implement the recommendations of the project in other countries. The report, along with the final project accounts and audit, will be submitted to the Supervisory Body and the Fund.

31. The Supervisory Body will be required to comment on the progress reports submitted by the PEA. It will prepare an annual supervision report and submit the same to the Fund with a copy to the PEA and perform its duties as required by the Project Agreement which will be drawn up between the Fund, CIRCOT and the ICAC, and signed before the start of the project.

H. Risks

32. The project is an applied research and development project aiming to establish the technical and commercial feasibility of a process which is known to be providing good results at laboratory scale and limited larger scale trials. A critical element in the whole process is in particular the pre-process activity of stalks collection and transportation. This has been reviewed by an external consultant whose findings have been incorporated in the design of the project. Likewise, also the potential (Indian) market for cotton-based boards has been assessed by a marketing consultant. The positive, competitive prospects for cotton-based boards which emerged from the study, are considered to be an adequate basis for the implementation of this pilot project.

33. Apart from unforeseen external events which are beyond the control of the project parties (e.g. change of government regulations regarding imports of (cheap) board products, or unexpected new, competitive uses for cotton stalks), it is assumed that there are no direct risks affecting the implementation of the project.

ANNEX I

PROJECT LOGICAL FRAMEWORK

Narrative Summary	Verifiable Indicators	Means of verification	Assumptions
Goal: To improve the profitability of cotton production by making productive use of cotton by-produce.	Increased income for participating cotton producers in the range of US$ 10 – 15/ha.	Sales and processing records Project reports	- Continued demand for non-wood particle boards - Continued interest from the farmer community to deliver cotton stalks at currently accepted prices; - No unfair competition from board producers abroad.
Project Purpose: To demonstrate the technical and economic feasibility of a commercial use of cotton stalks as a basis for industrial hard board and particle board production.	Collection mechanisms in place and operational, securing a sustainable inflow of cotton stalks into the pilot plant and participating commercial units. Operational pilot plant capable of demonstrating all aspects of cotton-based board production supported by factory-scale trials.	Physical operation of the pilot facility. Technical records and reports Monitoring and Evaluation Reports. Mid-term and Terminal Evaluation reports.	- Availability of cotton stalks in suitable quantities and qualities at a price acceptable for the pilot facility operate; - Counterpart funding available
Output: Effective collection arrangements for cotton stalks; Effective methods of pre-processing stalks into adequate base material for board production; Extensive experimental and larger scale production of hard and particle board in the pilot facility and commercial production facilities; Detailed analysis of technical and economic/financial parameters determining the overall feasibility of the proposed process; Dissemination of project results at national and international level.	Establishment of most suitable operational practices, ensuring adequate material supply, Development of cleaning/pre-processing equipment and processes to ensure the required quality of the base material. Operational board production facility, capable of making system adjustments to allow determination of the optimum process parameters; Undertaking of detailed feasibility assessments using methodologies acceptable to the private sector parties involved in the project; Holding of national and international workshop(s) and other presentations about the activities and findings of the project.	Ad-hoc activity reports; Regular project progress reports; Physical establishment and operation of the pilot production unit; Reports on supervision activities by the Supervisory Body; Reports from external evaluators. Review of progress made in regular project meetings, involving implementers, financiers and other parties involved.	- Timely and efficient mobilization of required resources and inputs - Continued support from all key project parties; - Activities are being undertaken with the required professionalism and technical capability. - Market situation does not develop adversely making board production no longer economically feasible.

Narrative Summary	Verifiable Indicators	Means of verification	Assumptions
Inputs/Activities and type of resources Institutional and physical logistics for collection of cotton stalks; Establishment of quality chips for cotton stalks Installation and running of a pilot board production facility; Research support from research institutes and private sector; Training to interested entrepreneurs and other personnel.	Level of effort/expenditure for each component Component 1: Collection and transportation trials US$ 51,100.; Component 2: Cleaning and pre-processing US$ 169,638; Component. 3: Pilot production of article board US$ 1,397,672.; Component. 4: Trials for binderless fibre boards US$ 177,504.; Component.5: Technical-economic feasibility US$ 23,940. ; Component. 6: Dissemination US$ 155,435 US$; Component 7: Project management, monitoring, supervision ands evaluation US$ 215,197.	Actual availability of inputs in quantity and quality required; Progress and evaluation reports.	Funding available in timely manner from all sources. Buildings and other physical inputs (including equipment and machinery required), can be sourced and mobillized in the time and at the cost foreseen. Project management and operational technical activities undertaken as scheduled.

Annex II

TECHNICAL CONCEPTS

Utilization of Cotton Stalks

Cotton is one of the most important commercial cash crops of India. The cultivated cotton species viz, *G. arboreum, G. herbaceum, G. hirsutum* and *G. barbadense* and hybrids are grown on a commercial scale. The current total area under cotton cultivation is about 8.5 million hectares and the production is around 15.5 million bales of 170 kg each. There are three agroclimatic zones in India where cotton is grown. In Northern Zone cotton is grown entirely under irrigation in sandy loam soils, In Central zone it is grown predominantly under rain fed conditions on black and loamy soils and in Southern zone under rain fed conditions in black and red soils. Sixty five percent of the crop is rain fed. Species-wise distribution of area under cotton in India is as given below:

Species		**Area (Million hectares)**
1.	G. *hirsutum*	2.20 (26 %)
2.	G. *herbaceum* and G. *arboreum*	2.20 (26 %)
3.	G. *barbadense*	Marginal
4.	Hybrids	4.10 (48 %)

Cotton is cultivated during the period June to November and the crop is harvested from November to February. Cotton is cultivated almost throughout the country. The availability and quality of cotton stalks was recently surveyed as recommended by the Common Fund's Consultative Committee. A consultant was appointed to assess the current situation in the various zones of India. The results were presented at a workshop on utilization of cotton plant by produce for value added products, held at CIRCOT in Mumbai on 26-27 May 2003.

The average yield of seed cotton is around one tonne per hectare. The estimated production of cotton stalks for every tonne of seed cotton is 3-5 tonnes. The yield of biomass is highest in the case of hybrids and lowest in the case of G. *arboreum* species. However, on an average about 3 tonnes of cotton stalks are available per hectare. Depending upon the variety and the crop condition the sticks are 1 to 1.75 meter long and their diameter just above the ground may vary from 1 to 2.5 cm. The specific weight of short chopped stick is about 160 kg/m^3. Most of the stalk produced is treated as waste, though a small part of it is used as domestic fuel. The bulk of the stalk is burnt off in the fields after the harvest of cotton crop. Cotton stalk possesses fibre properties comparable to most commonly available species of hardwood. It could therefore be used profitability for the manufacture of particle boards and binderless boards.

Logistics and pre-processing of cotton stalks

Supplies of cotton stalk raw material to board manufacturing plants need to be organised from farm to factory. Storage and transport of sufficient quantities of good quality chipped stalks

are essential for commercial success. Being a seasonal crop whole year supplies of equal quality stalk chip are of concern and require investigation. The method of handling at the farm, transport and storage will affect the chip quality and its utility in board manufacturing. Various scenarios and their impact on chip quality require investigation from chipping at the field at harvest with small chippers to chipping in a central chipping centre or at the board manufacturing mill. The effects of equipment used for pre-processing and cleaning on yield and particle size is relevant for constant quality supplies. Scenarios for disposal of residues (briquetting for fuel, mushroom substrate, composting to soil improvement) are relevant for a sustainable industrial development. Also the cost of transportation will affect the economic feasibility. So the bulky stalk material will require chipping or compacting for transportation and storage. The effects of ageing and weathering of the chips in stock piles and the risks of fire hazard need to be considered. Careful weighing of the costs and value addition in pre-processing steps determines largely the chances for successful introduction of this raw material for industrial use.

Particle Boards from Cotton Stalks

Particleboard is produced by compressing small particles of wood by bonding them with an adhesive. The various types of particleboards differ in the size and geometry of the particles, the amount of resin (adhesive), and density of the board. The properties and potential uses of board differ with these variables. The world production of particle board is estimated to be around 40 million m^3 and the share of India is only 0.06 percent. The major types of particles used for production of board are wood chips from different tree species and bamboo but also agroresidues like bagasse, and rice husk are employed. Particle board is manufactured out of dry woody particles (chips) or fibres, which are coated with a synthetic resin binder alongwith wax and formed into flat sheets. Heat is applied with the pressure, to cure the resin binder. Urea formaldehyde (UF) is generally applied for particle board production. CIRCOT has standardized the process of production of particle boards from cotton stalks which involves chipping of stalk to 1.5 – 2.0 cm size, rechipping to smaller particles. Mixing of chips with urea formaldehyde is followed by production of a three-layered mat comprising coarser particles in the core and finer at top and bottom layers respectively. Finally, in a hydraulic press the mat is hot pressed. The boards are then cut to the desired size. By using different chemicals and additives, these boards can be made water proof, fire proof, termite resistant, etc. These boards have been found to meet BIS (Bureau of Indian Standards) specifications and can be used for interior decoration, false ceiling, partitioning, paneling etc.

Particle Boards from cotton stalks (Table 1) possess all the desirable properties for internal applications such as false ceiling, partitioning, paneling, etc. However, boards made from cotton stalks using urea formaldehyde lack in water resistance as compared to wood based boards.
The advantages of particle board to be mentioned are:

- It is free from natural defects of wood, like warping.
- It is easy to fix. For instance, the factory made panel doors with particle board are available in ready-to-fix form. Similarly, for wall paneling, false ceilings, table tops, etc., pre-laminated or pre-veneered particle boards can be used with advantage.
- It is cheaper than substitute materials such as timber, MDF and plywood.
- With proper protective surface coating and edge covering, particle board can be made termite proof and fire resistant. It can take a variety of surface finishes, like laminations, veneers, paint, varnish polish, etc. Attractive wallpaper can also be used as surface finish.

Flow Chart of Particle Board Production

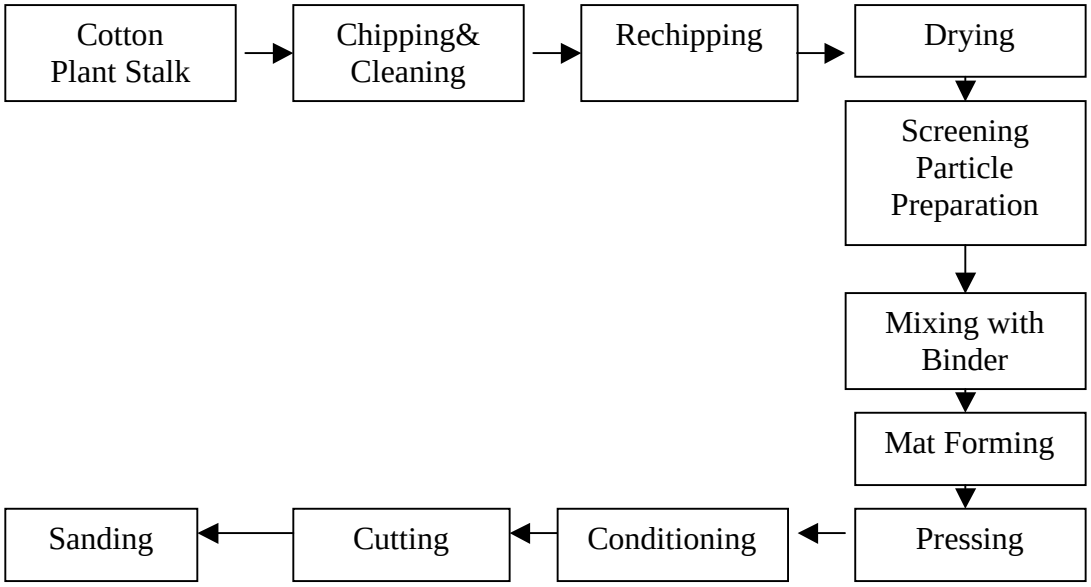


Table 1. Properties of Three Layered Particle Boards from Cotton Stalks

	Properties	Unit	Flat pressed Threelayer/ multilayer particle board BIS 3087-1985	* CIRCOT Board
1.	Density	Kg/m^3	500-900	750
2.	Average Moisture Content	%	5-15	11
3	Water Absorption a) 2 h. soaking ii) 24 h. soaking	%	 40 80	 20 40
4	Swelling Thickness	%	12	9
5	Swelling due to surface absorption	%	9	6
6	Modulus of Rupture i) Up to 20 mm ii) Above 20 mm	N/mm^2	 11.0 11.0	 17.6 -
7	Internal bond strength i) Upto 20 mm thickness ii) Above 20 mm	N/mm^2	 0.3 0.3	 0.51 -
8	Screw withdrawal strength Face Edge	N	 1250 700	 1400 860
9	Nail withdrawal strength	N	---	1300

BIS – Bureau of Indian Standard

Binderless Boards from Cotton Stalks

The fibre board is defined as a sheet of material manufactured from wood or other lignocellulosic materials with the primary bond strength derived from the inherent adhesive property of the fibres and the hydrogen bonding of the cellulose molecules. Additional additives may be included during manufacture to increase strength, resistance to moisture, fire resistance and other properties of the product. Presently, fibre boards are manufactured from hard wood.

A process has been developed at CIRCOT to prepare binderless boards from cotton stalks. The process comprises chipping of cotton stalks, conversion of chips into pulp under high temperature and pressure in a thermo-mechanical pulper, mat formation and then pressing in a hydraulic press by a three step pressure cycle to get binderless boards. These boards possess all the desirable properties specified by the Bureau of Indian Standards (Table 2). The process is eco-friendly as no chemicals are used either in pulping or in the blending process. It is the lignin present in the raw material that acts as the binder. The boards find applications in furniture making, partitioning, paneling, false ceiling, etc.

Flow Chart of Fibre Board Production

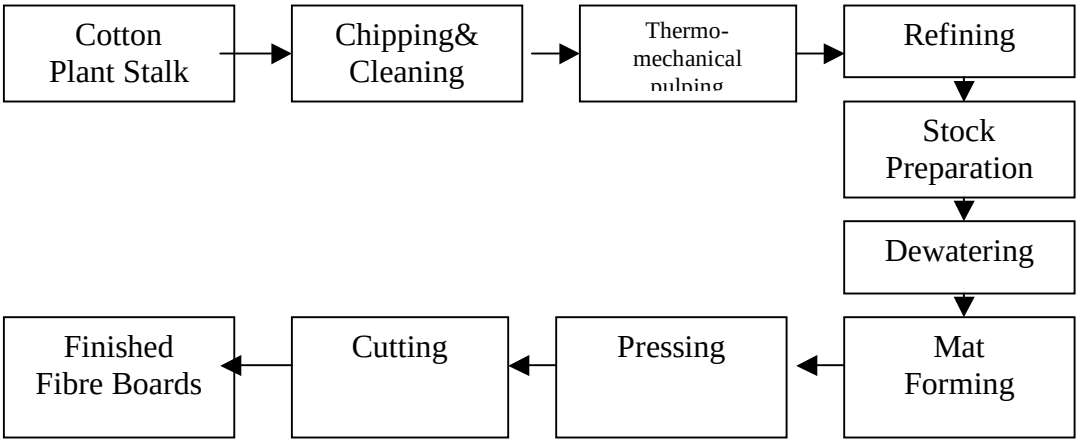


Table 2: Properties of Binderless boards

Properties	Cotton Stalk	BIS Specification
Thickness (mm)	6.0	3-8
Density (g/cm^3)	1.0	0.8-1.2
Bursting Strength (kg/cm^2)	340	300
Water Absorption (%)	50	40
Tensile Strength (kg/cm^2)	68.0	-----

BIS – Bureau of Indian Standard

ANNEX III

EQUIPMENT AND MACHINERY DESCRIPTION

Cotton plant stalks are collected from the farm after harvesting the seed cotton. The remains are mainly trunks with its branches together with leaves, a few flowers and other impurities. The plant stalk will be cut at the farm itself at root point and brought to the factory for cleaning. Cotton stalks will be kept on a platform for feeding to the "chain slat conveyor" to carry the stalk to the processing section. It will be passed to "Air Washing Pressure chamber", equipped with high pressure air nozzles that will loosen boll rinds, leaf bits, sticking cotton fibres and other light impurities present in cotton stalks. In this chamber the stalk will be subjected to heavy air pressure for loosening / separating the boll rinds, leaf bits and other impurities attached to the plant stalk.

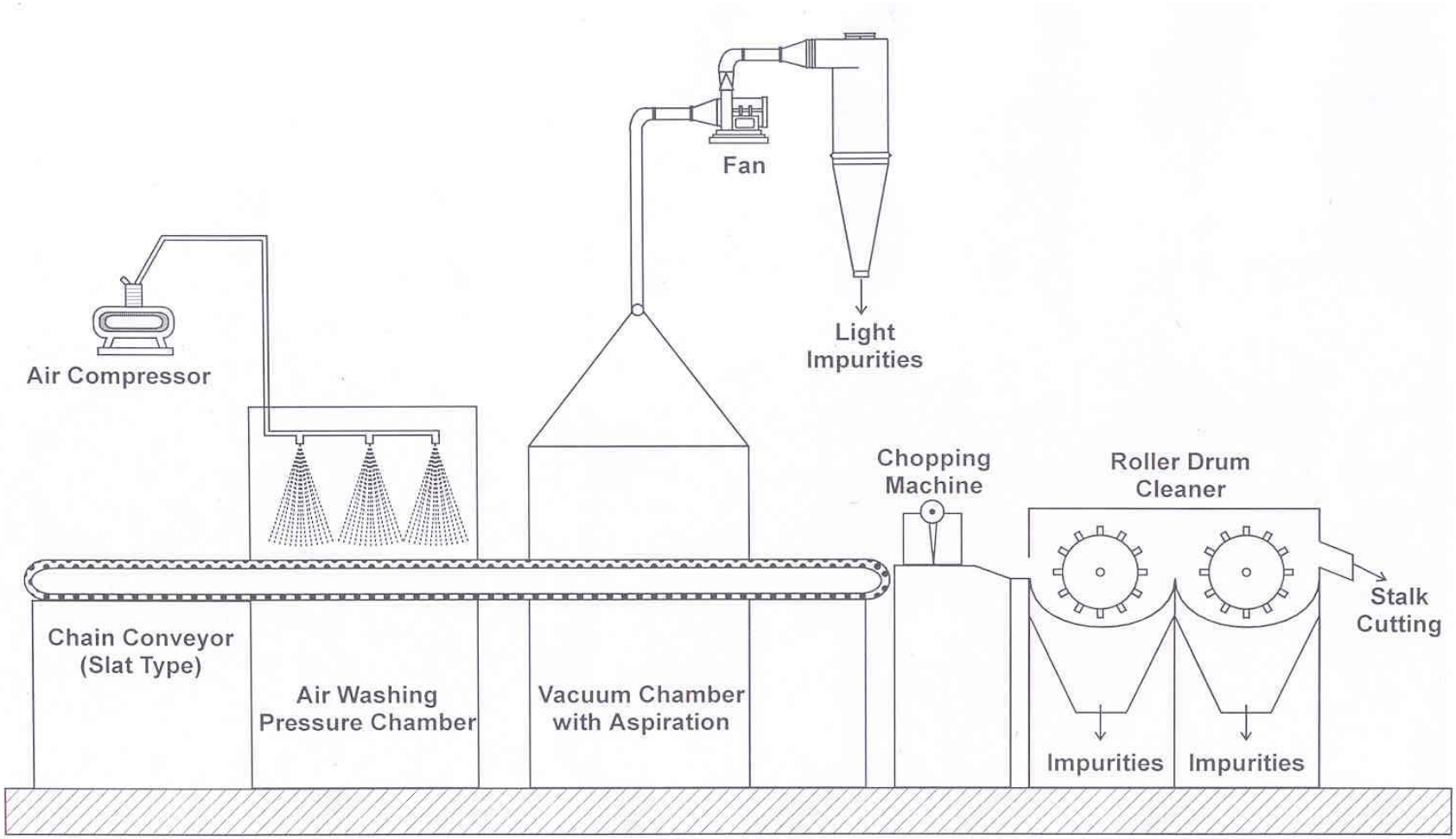
Then the stalk will move to the "Vacuum chamber" through a "chain conveyer", where all the impurities loosened in the air pressure chamber will be sucked. An "air aspirator system" is also included in the "vacuum blower", "piping" and "H. E. cyclone system'. Lighter impurities like leaf bits, loose cotton, dust, etc. will be picked up and collected in the cyclone and the arrangement will work as a pre-cleaner for the stalks.

Next the stalk is transferred to a guillotine type shearing machine called "chopper machine" to cut the stalk with branches to about 300-500 mm length, since stalks with branches come in uncertain sizes and lengths. After cutting, the stalks will pass through the "Rotary Roller Cleaner" equipped with a grid bar basket having suitable spacing, which will clean and separate the heavy particles and other impurities. This machine will have two drums for cleaning purpose.

After cutting and cleaning the stalks will pass through a "chaff cutter" where it will be chipped into smaller chips of about 25-50 mm and from there it can be either stored or taken for further processing at the production plant to prepare the end product. Small chips of size about 25-50 mm will pass through a "Vertical Rotary type Disintegration" which will pulverize the incoming material and as per perforation size of metal or wire mesh, the rechipped material is obtained. The output will contain a mixture of main trunk, fine powder and also bark fibres. The bark fibres and fine powder is removed by passing the material through a pneumatic attachment.

Cotton Stalk Cleaning & Cutting System to be installed at Experimental Plant

S. No.	Item/Equipment	**Quantity**	**Cost In US $**	**Justification**
1	Chain Conveyor : With wood slot arrangement complete with chain drive and wooden platform for carrying the cotton stalk with 3 hp drive	**1**	**4,600**	**For carrying the cotton stalks to cleaning chamber**
2	Air washing pressure chamber : Totally closed complete with high pressure air device connected to air nozzle arrangement in the chamber and also having sealing arrangement for avoiding air leaking	**1**	**5,500**	**For cleaning of cotton stalks**
3	Vacuum chamber with aspiration : Totally closed mounted on chain conveyor complete with air aspiration system including suction nozzle fixed on head blower #35-24 PW with 10 HP motor and cyclone, piping, bend etc for system	**1**	**6,300**	**For removal of separated trash**
4	Chopping Machine : For cutting the cotton stalk into 300-500 mm length with cutting blade assembled with eccentric arrangements and cutting table	**1**	**4,120**	**For cutting of stalks**
5	Roller drums cleaning machine : complete with two drums with beaters having grid bar basket arrangement for cleaning impurities complete with 7.5 HP electric motor, reduction gear and drive	**1**	**6,240**	**For cleaning of stalks from dust**
6	Erection & commissioning charges	**1**	**3,210**	
7	Packing, forwarding, transportation		**2,700**	
8	All civil works at site		**1,350**	
9	Taxes		**4,100**	
Total A			**38,120**	

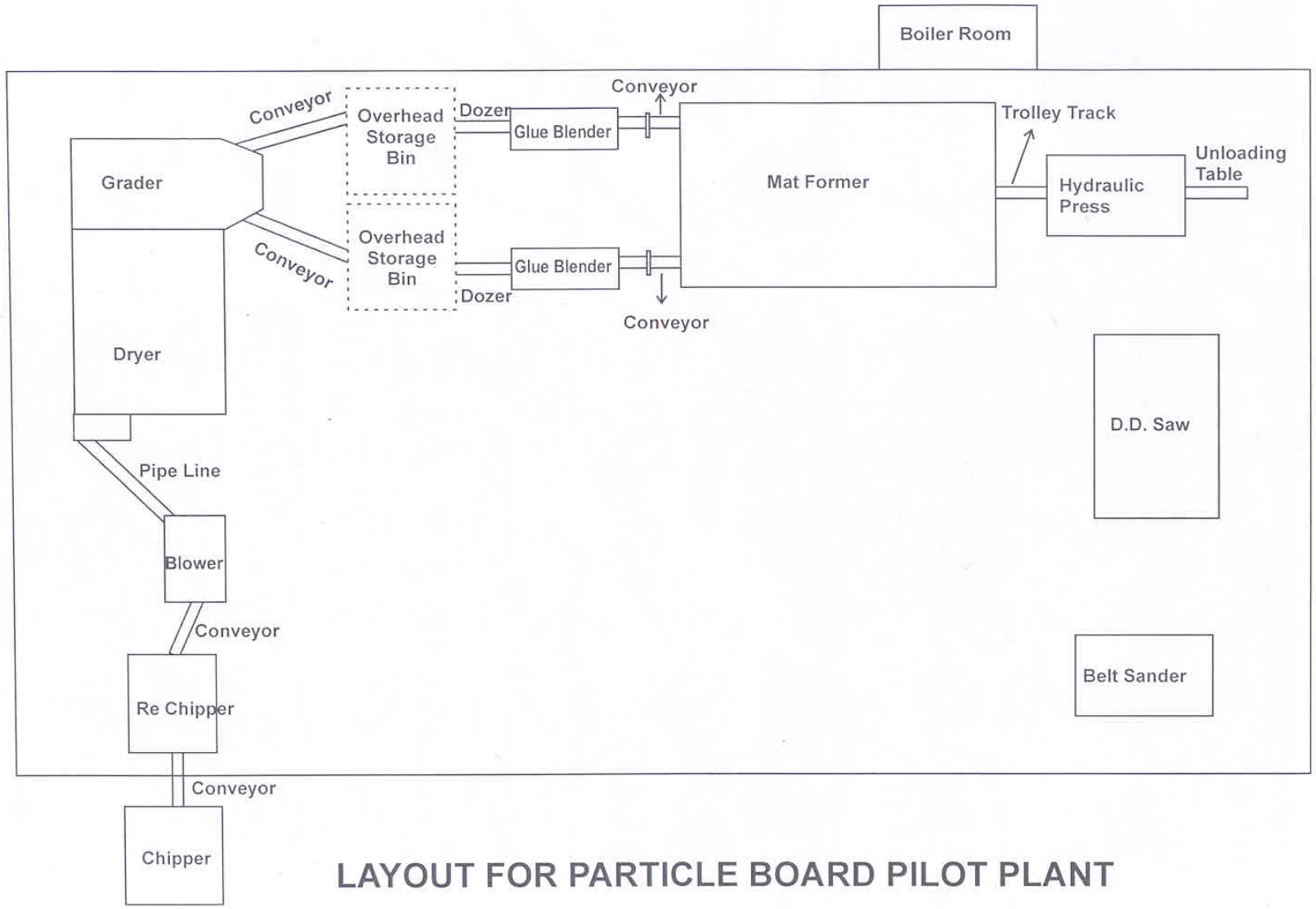


Cotton Plant Stalk Cleaning & Cutting Plant

SPECIFICATIONS AND COST OF THE MACHINERY & EQUIPMENT FOR PARTICLE BOARDS

PRODUCT : Three layer Particle Board (Cotton stalk based)
CAPACITY: 1 Ton per day
BOARD SIZE: 3' x 4' (92 cm x 122 cm)
THICKNESS: 12 - 25 mm

	S. NO	Particulars	Qty	Price (Rs. In lakhs)	Price (Rs. In US $ @ 50)
A)	1)	Hammer Mill with Pneumatic attachment for Raw material cleaning & impurities removal	1	02.50	5,000
	2)	Belt conveyor, 4 metre length	1	01.20	2,400
	3)	Drum chipper, 500 kg/h	1	02.50	5,000
	4)	Re-chipper (Ring flaker) 500 kg/h	1	02.00	4,000
	5)	Pneumatic conveyer	1	00.75	1,500
	6)	Rotary Dryer 300 kg/h (Thermic fluid heated)	1	05.50	11,000
	7)	Grader (Mechanical type)	1	01.25	2,500
	8)	Pneumatic Conveyer	2	01.50	3,000
	9)	Particle storage silos & dosing system	2	03.00	6,000
	10)	Resin dosing Unit (Suitable)	2	02.00	4,000
	11)	Glue Blender (Batch type)	2	04.00	8,000
	12)	Glued chip conveyors	2	02.00	4,000
	13)	Mat former for face and core	2	08.00	16,000
	14)	Forming Street with trey	1	01.50	3,000
	15)	Pre press (cold)	1	04.50	9,000
	16)	Hydraulic Hot Press (3 day light) (Thermic fluid heated) 3'x4' size	1	10.00	20,000
	17)	D D saw machine – (3'x4' size)	1	01.50	3,000
	18)	Sanding machine	1	02.00	4,000
	19)	Dust extraction system	1	02.50	5,000
	20)	Conveyors	1	02.00	4,000
	21)	Thermo pack with pipe line	1	04.25	8,500
	22)	Transformer 150 KVA	1	01.50	3,000
Total				65.95	131,900
B)		Transportation charges	Actual	01.50	3,000
C)		Erection & installation charges		03.40	6,800
D)		Electrification charges		05.00	10,000
E)		Commissioning & Trial run charges		03.00	6,000
F)		Octroi		02.72	5,440
G)		Taxes		07.00	14,000
H)		Civil Works		05.00	10,000
TOTAL				**93.57**	**187,140**



LAYOUT FOR PARTICLE BOARD PILOT PLANT

ANNEX IV

PROJECT IMPLEMENTATION SCHEDULE

A tentative schedule of project activities has been prepared. This will be adjusted on an annual basis through the preparation of detailed Annual Work Programmes and Budgets.

Project Implementation Scheme

Components, outputs and activities	*1. Description*	Year I	Year II	Year III	Year IV
Component 1	**Analysis and optimization trials of required logistical (including organisational) arrangements for collection and transportation of cotton stalks from the field to the production units, including possible setting-up of pre-processing units at the field level;**				
Activity 1	Establishment of Cotton Stalk Availability				
1.1					
1.2					
Activity 2	Methodology for Collection and handling of Cotton Stalks				
2.1					
2.2					
2.3					
Activity 3	Methodology of Chipping Cotton Stalks				
3.1					
3.2					
3.3					
3.4					
Activity 4	Logistics for Economic Collection of Cotton Stalks				
4.1					
4.2					

4.3					
4.4					
4.5					
Activity 5	Establishment of Most Suitable Practice for Collection and Transportation of Cotton Stalks				
5.1					
Activity 6	Verification of the Workability of the Established Model of Collection and Transportation of Stalks to a Larger Area				
6.1					
6.2					
6.3					
Component 2	**Trials for minimum and optimum levels of cleaning and pre-processing of cotton stalks into chips suitable for processing, at field level and at factory site;**				
Activity 1	Installation of Prototype Chip Cleaning Machine				
1.1					
1.2					
1.3					
Activity 2	Evaluation of Performance of Chip Cleaning System				
2.1					
2.2					
2.3					
Activity 3	Evaluation of Particle Boards Relating to Chip Quality				
3.1					
3.2					
3.3					
3.4					
Activity 4	Utilisation of Wastes Obtained During Chip Cleaning				
4.1					

4.2					
4.3					
4.4					
Activity 5	Pesticide Residue Analysis on Cotton Stalks and Chips Obtained from Different Modes				
5.1					
5.2					
5.3					
Component 3	**Pilot production of cotton stalks-based particle board production;**				
Activity 1	Establishment of an Experimental Demonstration Plant Facility for Particle Board Production				
1.1					
1.2					
1.3					
Activity 2	Particle Board Preparation				
2.1					
2.2					
2.3					
2.4					
2.5					
2.6					
2.7					
Activity 3	UP-scaling and Commercial Trials				
3.1					
3.2					
3.3					
3.4					
Component 4	**Utilisation of cotton stalks for the production of binderless fibre boards;**				
Activity 1	Establishment of Processing Parameters for Binderless Boards Production from Cotton Stalks at Laboratory Scale				

1.1					
1.2					
1.3					
Activity 2	Up-scaling and Commercial Trials				
2.1					
2.2					
2.3					
2.4					
2.5					
Component 5	**Evaluation of technical/financial feasibility of the proposed processes;**				
Activity 1	Data on Techno-Economic Aspects of Cotton Stalk feasibility				
1.1					
1.2					
1.3					
1.4					
1.5					
1.6					
Activity 2	Marketing Information on Acceptability of Cotton Stalk Based Board				
2.1					
2.2					
Component 6	**Dissemination of project results at national and international level.**				
Activity 1	Encouraging Farmers for Participation and Co-operation of Primary Production Chain to Supply Cotton Stalks for Board Production				
1.1					
1.2					
Activity 2	Convincing the Participants and Private Sector Investors for Commercialisation of Cotton Stalks Board Production				
2.1					
2.2					
2.3					
Activity 3	Publication of Comprehensive Handbook in English and Aprtial Translation in Hindi				

3.1					
Activity 4	Transfer of Technology				
4.1					
4.2					
4.3					
4.4					
Activity 5	International Workshop				
5.1					
5.2					
5.3					
5.4					
Component 7	**Project management, monitoring, supervision and evaluation**				
Activity 1	Project Monitoring				
1.1					
1.2					
1.3					
1.4					
1.5					
1.5					
1.6					
Activity 2	Co-ordination of the Project Activities by the PEA				
2.1					
2.2					

ANNEX V

PROJECTION FOR 30 TPD PLANT

PARTICLE BOARD : COST ESTIMATION AND PROFITABILITY

Production Capacity : 30 TPD (1158 boards of 8'x4',12 mm)
No. of working days : 300 days/year
No. of shift : 3
No. of h./shift : 8

A. CAPITAL INVESTMENT

	In 000 US$
A) Land & Building	
i) Land (Land 80,000 sq. ft., Site development)	020.00
ii) Building Cost (Building area 10, 000 sq. ft., @ US $ 4 /-)	040.00
Total land & building cost	**060.00**
B) Plant & Equipment Cost (Plant & Machinery cost , Erection @ 7.5% of the plant and equipment cost, Freight, insurance, duties etc. @5% of the plant & equipment cost)	
i) Plant & machinery	460.00
ii) Erection & commissioning Freight, Insurance, Taxes	
iii) Civil works for Installation of plant & machinery	184.00
Total cost of plant & machinery	**644.00**
C) Auxiliary and Service Equipment (Fire fighting equipment, Office furniture etc., Miscellaneous, Water treatment plant, Weighing machine, Electrical transformer etc.)	030.00
D) Preliminary and Pre-operative Expenses	030.00
E) Technology & Engineering Fees	030.00
F) Contingency Provision @ 10% of fixed capital	070.40
G) Margin money for working capital (25% of working capital)	047.00
Total Project Cost (A+B+C+D+E+F+G)	**911.40**

B (I) COST OF PRODUCTION	
a) Raw materials	
1) Cotton stalks (13440 T @ US $ 18/-)	241.92
2) Resin + chemicals (720 T @ US $ 700 /-)	504.00
b) Utilities (Electricity, fuel, Water etc.)	190.00
c) Labour and Supervision	152.64
d) Repairs & maintenance	014.00
e) plant overheads @ 2% of plant and machinery	012.80
f) Stores consumable	015.20
g) Operating supplies	002.10
h) Taxes & insurance	014.08
Total manufacturing cost	**1146.74**
i) GENRAL EXPENSES	
i) Administrative overheads	22.94
ii) Selling cost	34.40
j) DEPRECIATION & INTEREST	
a) Depreciation	
(Plant @ 10% of plant & machinery cost,	64.40
Building @ 5% of land & building cost)	03.00
b) Interest	
On long term loan @ 10%	70.40
On short term loan @ 13%	24.90
Total	**1366.78**
k) Royalty on sales	
2.5 % on ex factory sales	41.68
Cost of production	**1408.46**
Cost of production/kg	0.1566 US $
Cost of production per sq ft	0.1266 US $
Profitability (at 8% production capacity)	
a) Selling Price per unit (sq. ft.) in US $.	0.15 US $
b) Gross annual income in US $.	1667.52
c) Annual cost of production in US $.	1408.46
d) Annual return (2-3) in US $.	258.62
e) Return on investment (%)	28.38 %

ANNEX VI

PILOT PLANT MANAGER

QUALIFICATIONS :

Post graduate degree in Org. Che., Ind. Chem., Paper/Board Technology, M. Tech/Bachelors degree in Org. Che., Ind. Chem., Paper/Board Technology with at least 10 years experience.

Experience:

About 5-7 years experience in the manufacture of particle board, fibre board and soft board from wood based raw materials and agricultural residues. He should possess supervisory ability for day to day running of the particle board plant, should have good knowledge on installation of particle board manufacturing plant.

Duties to be performed:

He will be overall in charge of the pilot plant of particle board to be installed at G. T. C. Nagpur and work under the supervision of In charge G. T. C. Nagpur/ Head T. T. D. He should provide all necessary specifications and relevant data for procurement of plant and machinery for a one TPD pilot plant for particle board manufacture.

- Supervise construction of shed for the pilot plant
- Supervise installation and commissioning of pilot plant
- Should train R.A.'s and Technicians in operation of various machinery connected with the pilot plant
- Should undertake research trials both on lab as well as in pilot plant as per the guidance and instructions of the scientists and keep a proper record of all the data
- Should be responsible for the day to day running of the plant
- Should assist in undertaking trials in commercial plants for manufacture of particle board/hard board, etc.
- Should be able to collect all necessary data for working out the cost and the techno-economic feasibility
- Should be able to manufacture particle boards on a regular basis on the pilot plant and assist in finding out the market potential
- Should be able to impart training to interested entrepreneurs on the manufacture of particle boards/ hard boards etc.
- Should keep proper records of raw material, chemicals, boards produced, boards marketed etc.
- Should be able to demonstrate particle board production trials to interested parties, trainees, NGO's etc. and
- Any other responsibility assigned to him by the Director, Principal Investigator and other Senior Officials.

ANNEX VII

Table 1

Summary Project Cost by Component (in US$)

Component	CFC	CIRCOT	Total Base cost
1. Analysis and optimisation trials of required logistical (including organisational) arrangements for collection and transportation of cotton stalks from the field to the production units, including possible setting-up of pre-processing units at the field level;	36,000	13,300	49,300
2. Trials for minimum and optimum levels of cleaning and pre-processing of cotton stalks into chips suitable for processing, at field level and at factory site;	137,580	21,500	159,080
3. Pilot production of cotton stalks-based particle board production	297,110	1,074,600	1,371,710
4. Utilisation of Cotton stalks for production of the binderless fibre boards	63,170	110,600	173,770
5. Evaluation of technical/financial feasibility of the proposed processes;	2,800	21,000	23,800
6. Dissemination of project results at national and international level;	134,700	14,000	148,700
7. Project management, monitoring, supervision and evaluation	189,140	16,600	205,740
Sub Total	**860,500**	**1,271,600**	**2,132,100**
Contingency	**58,386**	**0**	**58,386**
Total	**918,886**	**1,271,600**	**2,190,486**

* With contingency

Table 2

Summary Project Cost by Component by Year

Component Inputs	Estimated Costs				Total		
	PY1	PY2	PY3	PY4	Base Cost	Contingency	Total Cost
8. Analysis and optimization trials of required llogistical (including organisational) arrangements for collection and transportation of cotton stalks from the field to the production units, including possible setting-up of pre-processing units at the field level;	26,850	20,850	750	850	49,300	1,800	51,100
9. Trials for minimum and optimum levels of cleaning and pre-processing of cotton stalks into chips suitable for processing, at field level and at factory site;	90,010	36,320	26,020	6,730	1,59,080	10,558	169,638
10. Pilot production of cotton stalks-based particle board production;	1,258,540	26,190	43,690	43,290	1,371,710	25,962	1,397,672
11. Utilisation of cotton stalks for the production of binderless fibre boards;	127,675	9,400	21,385	15,310	173,770	3,734	177,504
12. Evaluation of technical/financial feasibility of the proposed processes;	2,100	2,200	9,700	9,800	23,800	140	23,940
13. Dissemination of project results at national and international level.	3,400	8,900	16,200	120,200	148,700	6,735	155,435
14. Project management, monitoring, supervision and evaluation	27,260	66,410	38,010	74,060	205,740	9,457	215,197
Sub Total	1,535,835	170,270	155,755	270,240	2,132,100	58,386	2,190,486
Contingency					58,386		
Total					2,190,486		

Table : 3

Detailed Project Costs in US $
Utilisation of Cotton Plant By-produce for Value–added Products

Cat code	Component inputs	Unit	Year 1	Year 2	Year 3	Year 4	Unit price	Year 1	Year 2	Year 3	Year 4	Total base cost	Cont. %	Cont. US$	Total cost	Financing source
			Quantities					Estimated cost								
Component:1																
	Analysis and optimisation trials of required logistical arrangements for collection and transportation of cotton stalks from the field to the production units, including possible setting-up of pre-processing units at the field level															
III	**Materials and**															
	Raw Materials	60	30	30	0	0	15	450	450	0	0	900	5	45	945	CFC
	Stationery							0	400	0	0	400	5	20	420	CFC
	SUBTOTAL III							**450**	**850**	**0**	**0**	**1,300**		**65**	**1,365**	
IV	**Personnel**		m/m													
	Principal		4	2	0	0	700	2,800	1,400	0	0	4,200		0	4,200	CIRCOT
	Principal scientist		4	4	0	0	700	2,800	2,800	0	0	5,600		0	5,600	CIRCOT
	Scientist Sr. scale		4	3	0	0	500	2,000	1,500	0	0	3,500		0	3,500	CIRCOT
	Research associate		27	3	0	0	300	8,100	900	0	0	9,000	5	450	9,450	CFC
	Pilot plant manager		1	4	0	0	400	400	1,600	0	0	2,000	5	100	2,100	CFC
	Technician		24	8	0	0	120	2,880	960	0	0	3,840	5	192	4,032	CFC
	Unskilled worker		36	24	0	0	75	2,700	1,800	0	0	4,500	5	225	4,725	CFC
	Subtotal IV							**21,680**	**10,960**	**0**	**0**	**32,640**		**967**	**33,607**	
VIII	**Operational Costs**															
	Maintenance of plant and machinery							200	200	200	200	800	5	40	840	CFC
	Sundries (Gas, oil, transportation of material etc.)							200	200	400	500	1,300	5	65	1,365	CFC
	Techno economic feasibility report							300	100	0	0	400	5	20	420	CFC
	Reporting cost							250	250	150	150	800	5	40	840	CFC
	Subtotal VIII							**950**	**750**	**750**	**850**	**3,300**		**165**	**3,465**	

Cat code	Component inputs	Unit	Year 1	Year 2	Year 3	Year 4	Unit price	Year 1	Year 2	Year 3	Year 4	Total base cost	Cont. %	Cont. US$	Total cost	Financing source
			Quantities					Estimated cost								
X	**Unallocated**							**3,770**	**8,290**	**0**	**0**	**12,060**		**603**	**12,663**	CFC
	Total Component 1							**26,850**	**20,850**	**750**	**850**	**49,300**		**1,800**	**51,100**	

Component: 2																
	Trials for minimum and optimum levels of cleaning and pre-processing of cotton stalks into suitable for processing, at field level and at factory site															
I	**Vehicle, machinery & equipment**															
	Vehicle	1					14,000	14,000	0	0	0	14,000	5	700	14,700	CFC
	Chip conveyor	1					4,600	4,600	0	0	0	4,600	10	460	5,060	CFC
	Air Washing pressure chamber	1					5,500	5,500	0	0	0	5,500	10	550	6,050	CFC
	Vacuum chamber with aspiration	1					6,300	6,300	0	0	0	6,300	10	630	6,930	CFC
	Chopping machine	1					4,120	4,120	0	0	0	4,120	10	412	4,532	CFC
	Roller drums cleaning machine	1					6,240	6,240	0	0	0	6,240	10	624	6,864	CFC
	Erection & commissioning						3,210	3,210	0	0	0	3,210	10	321	3,531	CFC
	Packing, forwarding , transportation						2,700	2,700	0	0	0	2,700	10	270	2,970	CFC
	Civil works						1,350	1,350	0	0	0	1,350	10	135	1,485	CFC
	taxes						4,100	4,100	0	0	0	4,100	0	0	4,100	CIRCOT
	Briquetting machine	1					6,000	0	6,000	0	0	6,000	10	600	6,600	CFC
	Bomb Calori meter	1					10,000	0	10,000	0	0	10,000	10	1,000	11,000	CFC
	Spares							0	0	10,000	0	10,000	10	1,000	11,000	CFC
	Subtotal I							**52,120**	**16,000**	**10,000**	**0**	**78,120**		**6,702**	**84,822**	
III	**Materials &**															

Cat code	Component inputs	Unit	Year 1	Year 2	Year 3	Year 4	Unit price	Year 1	Year 2	Year 3	Year 4	Total base cost	Cont. %	Cont. US$	Total cost	Financing source
			Quantities					Estimated cost								
	supplies															
	Raw material	20	10	10	0	0	15	150	150	0	0	300	5	15	315	CFC
	Stationery							300	400	500	100	1,300	5	65	1,365	CFC
	Chemicals							1,000	1,000	1,000	0	3,000	5	150	3,150	CFC
	Glass wares							100	1,000	500	0	1,600	5	80	1,680	CFC
	Subtotal III							**1,550**	**2,550**	**2,000**	**100**	**6,200**		**310**	**6,510**	
IV	**Personnel**		m/m													
	Principal Investigator		1	1	0	0	700	700	700	0	0	1,400		0	1,400	CIRCOT
	Principal scientist		3	3	0	0	700	2,100	2,100	0	0	4,200		0	4,200	CIRCOT
	Scientist Sr. scale		1	1	0	0	500	500	500	0	0	1,000		0	1,000	CIRCOT
	Technicians		4	4	0	0	300	1,200	1,200	0	0	2,400		0	2,400	CIRCOT
	Pilot plant manager		2	2	2	2	400	800	800	800	800	3,200	5	160	3,360	CFC
	Research associate		4	10	9	9	300	1,200	3,000	2,700	2,700	9,600	5	480	10,080	CFC
	Technicians		24	16	12	0	120	2,880	1,920	1,440	0	6,240	5	312	6,552	CFC
	Unskilled workers		12	24	18	18	75	900	1,800	1,350	1,350	5,400	5	270	5,670	CFC
	Subtotal IV							**10,280**	**12,020**	**6,290**	**4,850**	**33,440**		**1,222**	**34,662**	
VIII	**Operational Costs**															
	Taxes + Insurance for other equipments							8,400	0	0	0	8,400		0	8,400	CIRCOT
	Water, electricity, fuel, etc. phone, fax, bills							750	2,000	500	500	3,750	5	188	3,938	CFC
	Maintenance of plant and machinery							200	500	1,000	800	2,500	5	125	2,625	CFC
	Audit fee							500	500	500	500	2,000	5	100	2,100	CFC
	Sundries (Gas, oil, transportation of material etc.)							100	400	600	500	1,600	5	80	1,680	CFC
	Techno economic feasibility report							100	100	500	100	800	5	40	840	CFC
	Reporting cost							200	200	100	100	600	5	30	630	CFC
	Subtotal VIII							**10,250**	**3,700**	**3,200**	**2,500**	**19,650**		**563**	**20,213**	
X	**Unallocated**							**15,810**	**2,050**	**4,530**	**-720**	**21,670**		**1,761**	**23,431**	**CFC**

Cat code	Component inputs	Unit	Year 1	Year 2	Year 3	Year 4	Unit price	Year 1	Year 2	Year 3	Year 4	Total base cost	Cont. %	Cont. US$	Total cost	Financing source
			Quantities					Estimated cost								
	Total Component 2							**90,010**	**36,320**	**26,020**	**6,730**	**159,080**		**10,558**	**169,638**	

	Component 3 :															
	Pilot production of cotton stalks-based particle board production															
I	**Vehicle machinery & equipment**															
	Hammer Mill	1					5,000	5,000	0	0	0	5,000	10	500	5,500	CFC
	Belt conveyor	1					2,400	2,400	0	0	0	2,400	10	240	2,640	CFC
	Drum chipper	1					5,000	5,000	0	0	0	5,000	10	500	5,500	CFC
	Re-chipper	1					4,000	4,000	0	0	0	4,000	10	400	4,400	CFC
	Pneumatic conveyor	1					1,500	1,500	0	0	0	1,500	10	150	1,650	CFC
	Dryer	1					11,000	11,000	0	0	0	11,000	10	1,100	12,100	CFC
	Srew Conveyor	1					1,000	1,000	0	0	0	1,000	10	100	1,100	CFC
	Grader	1					2,500	2,500	0	0	0	2,500	10	250	2,750	CFC
	Pneumatic conveyors	2					3,000	3,000	0	0	0	3,000	10	300	3,300	CFC
	Particle storage silos with dosing system	2					6,000	6,000	0	0	0	6,000	10	600	6,600	CFC
	Resin dosing unit	2					4,000	4,000	0	0	0	4,000	10	400	4,400	CFC
	Glue blender	2					8,000	8,000	0	0	0	8,000	10	800	8,800	CFC
	Glued chips conveyors	2					4,000	4,000	0	0	0	4,000	10	400	4,400	CFC
	Mat former	2					16,000	16,000	0	0	0	16,000	10	1,600	17,600	CFC
	Forming Street with trey	1					3,000	3,000	0	0	0	3,000	10	300	3,300	CFC
	Pre press	1					9,000	9,000	0	0	0	9,000	10	900	9,900	CFC
	Hydraulic press	1					20,00	20,000	0	0	0	20,000	10	2,000	22,000	CFC

Cat code	Component inputs	Unit	Year 1	Year 2	Year 3	Year 4	Unit price	Year 1	Year 2	Year 3	Year 4	Total base cost	Cont. %	Cont. US$	Total cost	Financing source
			Quantities					Estimated cost								
							0									
	D. D. Saw machine	1					3,000	3,000	0	0	0	3,000	10	300	3,300	CFC
	Hand operated sanding machine	1					4,000	4,000	0	0	0	4,000	10	400	4,400	CFC
	Dust extraction system	1					5,000	5,000	0	0	0	5,000	10	500	5,500	CFC
	Plate conveying system	1					4,000	4,000	0	0	0	4,000	10	400	4,400	CFC
	Thermo pack with pipe line	1					8,500	8,500	0	0	0	8,500	10	850	9,350	CFC
	Transformer 150 KVA	1					3,000	3,000	0	0	0	3,000	10	300	3,300	CFC
	Transportation charges	1					3,000	3,000	0	0	0	3,000	10	300	3,300	CFC
	Erection & installation						6,800	6,800	0	0	0	6,800	10	680	7,480	CFC
	Electrification charges						10,000	10,000	0	0	0	10,000	10	1,000	11,000	CFC
	Commissioning & trial run						6,000	6,000	0	0	0	6,000	10	600	6,600	CFC
	Octroi						5,440	5,440	0	0	0	5,440	0	0	5,440	CIRCOT
	taxes						14,000	14,000	0	0	0	14,000	0	0	14,000	CIRCOT
	Civil Works						10,000	10,000	0	0	0	10,000	10	1,000	11,000	CFC
	Glue making kettle	1					8,000	8,000	0	0	0	8,000	10	800	8,800	CFC
	Universal testing machine	1					20,000	20,000	0	0	0	20,000	10	2,000	22,000	CFC
	Weighing machine	1					2,000	2,000	0	0	0	2,000	10	200	2,200	CFC
	Metal detector and chute	1					3,000	3,000	0	0	0	3,000	10	300	3,300	CFC
	Lab. model	1		-	-	-	20,00	20,000	0	0	0	20,000		0	20,000	CIRCOT

Cat code	Component inputs	Unit	Year 1	Year 2	Year 3	Year 4	Unit price	Year 1	Year 2	Year 3	Year 4	Total base cost	Cont. %	Cont. US$	Total cost	Financing source
			Quantities					Estimated cost								
	electrically heated hydraulic press						0									
	Lab. model steam heated hydraulic press	1		-	-	-	25,000	25,000	0	0	0	25,000		0	25,000	CIRCOT
	Baby boiler	2		-	-	-	20,000	40,000	0	0	0	40,000		0	40,000	CIRCOT
	Instron	1		-	-	-	50,000	50,000	0	0	0	50,000		0	50,000	CIRCOT
	Computer + printer	2		-	-	-	10,000	20,000	0	0	0	20,000		0	20,000	CIRCOT
	Power supply KVA	1		-	-	-	30,000	30,000	0	0	0	30,000		0	30,000	CIRCOT
	Chaff cutters	2		-	-	-	600	1,200	0	0	0	1,200		0	1,200	CIRCOT
	Lab. model rechipper	1		-	-	-	1,000	1,000	0	0	0	1,000		0	1,000	CIRCOT
	Precision electronic balances	3		-	-	-	6,000	18,000	0	0	0	18,000		0	18,000	CIRCOT
	Oven	3		-	-	-	1,000	3,000	0	0	0	3,000		0	3,000	CIRCOT
	Screw press	1		-	-	-	2,500	2,500	0	0	0	2,500		0	2,500	CIRCOT
	Reaction vessel	1		-	-	-	4,000	4,000	0	0	0	4,000		0	4,000	CIRCOT
	Scanning electron microscope	1		-	-	-	80,000	80,000	0	0	0	80,000		0	80,000	CIRCOT
	Subtotal I							**515,840**	**0**	**0**	**0**	**515,840**		**20,170**	**536,010**	
II	**Civil Works**															
	Land for Pilot Plant + Godown	80,000 SQ. FT					4.564 us $	365,100	0	0	0	365,100		0	365,100	CIRCOT
	Cost of land building for Laboratories at GTC Nagpur							210,000	0	0	0	210,000		0	210,000	CIRCOT
	Development of land and construction of	20,000 sq ft					6 US $	120,000	0	0	0	120,000		0	120,000	CIRCOT

Cat code	Component inputs	Unit	Year 1	Year 2	Year 3	Year 4	Unit price	Year 1	Year 2	Year 3	Year 4	Total base cost	Cont. %	Cont. US$	Total cost	Financing source
			Quantities					Estimated cost								
	building for pilot plant															
	Subtotal II							**695,100**	**0**	**0**	**0**	**695,100**		**0**	**695,100**	
III	**Materials & supplies**															
	Raw material	400 TONS	0	100	150	150	15	0	1,500	2,250	2,250	6,000	5	300	6,300	CFC
	Chemicals							0	250	1,250	1,500	3,000	5	150	3,150	CFC
	Glass ware							0	1,000	500	500	2,000	5	100	2,100	CFC
	Stationery							0	200	200	200	600	5	30	630	CFC
	Subtotal III							**0**	**2,950**	**4,200**	**4,450**	**11,600**		**580**	**12,180**	
IV	**Personnel**		m/m													
	Principal investigator		0	1	1	1	700	0	700	700	700	2,100		0	2,100	CIRCOT
	Principal Scientist		8	4	12	12	700	5,600	2,800	8,400	8,400	25,200		0	25,200	CIRCOT
	Scientist (Sr. Scale)		3	3	3	3	500	1,500	1,500	1,500	1,500	6,000		0	6,000	CIRCOT
	Scientist		2	2	2	2	500	1,000	1,000	1,000	1,000	4,000		0	4,000	CIRCOT
	Pilot plant manager		3	3	5	5	400	1,200	1,200	2,000	2,000	6,400	5	320	6,720	CFC
	Consultant		-	-	-	-	-	0	0	1,000	500	1,500	5	75	1,575	CFC
	Research associate		0	15	18	18	300	0	4,500	5,400	5,400	15,300	5	765	16,065	CFC
	Technicians		0	20	20	28	120	0	2,400	2,400	3,360	8,160	5	408	8,568	CFC
	Unskilled workers		12	12	42	48	75	900	900	3,150	3,600	8,550	5	428	8,978	CFC
	Subtotal IV							**10,200**	**15,000**	**25,550**	**26,460**	**77,210**		**1,996**	**79,206**	
VIII	**Operational Costs**															
	Taxes + Insurance for other equipments							18,060	0	0	0	18,060		0	18,060	CIRCOT
	Annual insurance							1,000	2,000	3,500	3,500	10,000		0	10,000	CIRCOT
	Water, electricity, fuel, etc. phone, fax, bills							0	250	500	2,000	2,750	5	138	2,888	CFC
	Maintenance of plant and machinery							0	250	600	1,500	2,350	5	118	2,468	CFC
	Audit fee							0	200	200	200	600	5	30	630	CFC

Cat code	Component inputs	Unit	Year 1	Year 2	Year 3	Year 4	Unit price	Year 1	Year 2	Year 3	Year 4	Total base cost	Cont. %	Cont. US$	Total cost	Financing source
			Quantities					Estimated cost								
	Sundries (Gas, oil, transportation of material etc.)							0	150	800	1,000	1,950	5	98	2,048	CFC
	Techno economic feasibility report							0	0	400	1,000	1,400	5	70	1,470	CFC
	Reporting cost							0	250	500	700	1,450	5	73	1,523	CFC
	Conducting commercial trials							0	2,500	5,000	2,500	10,000	5	500	10,500	CFC
	Subtotal VIII							**19,060**	**5,600**	**11,500**	**12,400**	**48,560**		**1,025**	**49,585**	
X	**Unallocated**							**18,340**	**2,640**	**2,440**	**-20**	**23,400**		**2,192**	**25,592**	**CFC**
	Total Component 3							**1,258,540**	**26,190**	**43,690**	**43,290**	**1,371,710**		**25,963**	**1,397,673**	
	Component 4:															
	Utilisation of cotton stalks for the production of binderless fibre boards															
I	**Vehicle machinery & equipment**															
	Cutting machine						8,000	8,000	0	0	0	8,000	10	800	8,800	CFC
	Top pan balance						1,500	1,500	0	0	0	1,500	10	150	1,650	CFC
	Analytical balance						2,000	2,000	0	0	0	2,000	10	200	2,200	CFC
	Computer							4,200	0	0	0	4,200	5	210	4,410	CFC
	Furniture						6,200	6,200	0	0	0	6,200	5	310	6,510	CFC
	Refiner	1		-	-	-	1,000	1,000	0	0	0	1,000		0	1,000	CIRCOT
	Bomb digester	1		-	-	-	10,000	10,000	0	0	0	10,000		0	10,000	CIRCOT
	Research digester	1		-	-	-	4,000	4,000	0	0	0	4,000		0	4,000	CIRCOT
	Sheet press	1		-	-	-	2,000	2,000	0	0	0	2,000		0	2,000	CIRCOT
	Pulp screen	1		-	-	-	2,000	2,000	0	0	0	2,000		0	2,000	CIRCOT
	Disintegrator	1		-	-	-	1,000	1,000	0	0	0	1,000		0	1,000	CIRCOT
	PFI mill	1		-	-	-	30,000	30,000	0	0	0	30,000		0	30,000	CIRCOT

Cat code	Component inputs	Unit	Year 1	Year 2	Year 3	Year 4	Unit price	Year 1	Year 2	Year 3	Year 4	Total base cost	Cont. %	Cont. US$	Total cost	Financing source
			Quantities					Estimated cost								
	Pulp defibrator	1		-	-	-	2,400	2,400	0	0	0	2,400		0	2,400	CIRCOT
	Sheet maker	1		-	-	-	6,000	6,000	0	0	0	6,000		0	6,000	CIRCOT
	Tensile tester for paper	1		-	-	-	10,000	10,000	0	0	0	10,000		0	10,000	CIRCOT
	Porosity & smoothness tester	1		-	-	-	8,000	8,000	0	0	0	8,000		0	8,000	CIRCOT
	Brightness tester	1		-	-	-	4,000	4,000	0	0	0	4,000		0	4,000	CIRCOT
	Stiffness tester	1		-	-	-	4,000	4,000	0	0	0	4,000		0	4,000	CIRCOT
	Thickness tester	1		-	-	-	2,500	2,500	0	0	0	2,500		0	2,500	CIRCOT
	Bursting strength tester	1		-	-	-	3,000	3,000	0	0	0	3,000		0	3,000	CIRCOT
	Folding tester	1		-	-	-	3,000	3,000	0	0	0	3,000		0	3,000	CIRCOT
	Grammage tester	1		-	-	-	800	800	0	0	0	800		0	800	CIRCOT
	Water absorption tester	1		-	-	-	800	800	0	0	0	800		0	800	CIRCOT
	Cobb tester	1		-	-	-	800	800	0	0	0	800		0	800	CIRCOT
	Calendering machine	1		-	-	-	3,000	3,000	0	0	0	3,000		0	3,000	CIRCOT
	Paper vat	1		-	-	-	2,500	2,500	0	0	0	2,500		0	2,500	CIRCOT
	Subtotal I							**122,700**	**0**	**0**	**0**	**122,700**		**1,670**	**124,370**	
III	**Materials & supplies**															
	Raw material	100			50	50	15	0	0	750	750	1,500	5	75	1,575	CFC
	Chemicals							0	0	1,000	1,000	2,000	5	100	2,100	CFC
	Subtotal III							**0**	**0**	**1,750**	**1,750**	**3,500**		**175**	**3,675**	
IV	**Personnel**		m/m													
	Principal Investigator		0	0	1	1	700	0	0	700	700	1,400		0	1,400	CIRCOT
	Principal scientist		6	0	3	3	700	4,200	0	2,100	2,100	8,400		0	8,400	CIRCOT
	Pilot plant manager		1	1	1	1	400	400	400	400	400	1,600	5	80	1,680	CFC
	Research associate		5	8	5	5	300	1,500	2,400	1,500	1,500	6,900	5	345	7,245	CFC

Cat code	Component inputs	Unit	Year 1	Year 2	Year 3	Year 4	Unit price	Year 1	Year 2	Year 3	Year 4	Total base cost	Cont. %	Cont. US$	Total cost	Financing source
			Quantities					Estimated cost								
	Technician		0	4	8	12	120	0	480	960	1,440	2,880	5	144	3,024	CFC
	Unskilled workers		12	12	12	6	75	900	900	900	450	3,150	5	158	3,308	CFC
	Subtotal IV							**7,000**	**4,180**	**6,560**	**6,590**	**24,330**		**727**	**25,057**	
VIII	**Operational Costs**															
	Water, electricity, fuel, etc. phone, fax, bills							250	500	1,000	2,500	4,250	5	213	4,463	CFC
	Maintenance of plant and machinery							50	250	200	500	1,000	5	50	1,050	CFC
	Audit fee							125	150	175	200	650	5	33	683	CFC
	Sundries (Gas, oil, transportation of material etc.)							100	150	800	1,000	2,050	5	103	2,153	CFC
	Techno economic feasibility report							0	0	400	1,000	1,400	5	70	1,470	CFC
	Reporting cost							250	250	500	700	1,700	5	85	1,785	CFC
	Conducting commercial trials							0	5,000	5,000	0	10,000	5	500	10,500	CFC
	Subtotal VIII							**775**	**6,300**	**8,075**	**5,900**	**21,050**		**1,053**	**22,103**	
	Unallocated							**-2800**	**-1080**	**5,000**	**1,070**	**2,190**		**110**	**2,300**	**CFC**
	Total Component 4							**127,675**	**9,400**	**21,385**	**15,310**	**173,770**		**3,734**	**177,504**	

	Component 5:															
	Evaluation of technical/financial feasibility of the proposed processes															
III	**Materials & supplies**															
	Stationery							0	100	400	500	1,000	5	50	1,050	CFC
	Subtotal III							**0**	**100**	**400**	**500**	**1,000**		**50**	**1,050**	
IV	**Personnel**		m/m													
	Principal investigator		1	1	4	4	700	700	700	2,800	2,800	7,000		0	7,000	CIRCOT

Cat code	Component inputs	Unit	Year 1	Year 2	Year 3	Year 4	Unit price	Year 1	Year 2	Year 3	Year 4	Total base cost	Cont. %	Cont. US$	Total cost	Financing source
			Quantities					Estimated cost								
	Principal scientist		2	2	8	8	700	1,400	1,400	5,600	5,600	14,000		0	14,000	CIRCOT
	Research associate		0	0	3	3	300	0	0	900	900	1,800	5	90	1,890	CFC
	Subtotal IV							**2,100**	**2,100**	**9,300**	**9,300**	**22,800**		**90**	**22,890**	
	Total Component 5							**2,100**	**2,200**	**9,700**	**9,800**	**23,800**	**0**	**140**	**23,940**	
	Component 6:															
	Dissemination of project results at national and international level															
IV	**Personnel**		m/m													
	Principal investigator		1	1	2	2	700	700	700	1,400	1,400	4,200		0	4,200	CIRCOT
	Principal scientist		1	1	6	6	700	700	700	4,200	4,200	9,800		0	9,800	CIRCOT
	Pilot plant manager		0	0	1	1	400	0	0	400	400	800	5	40	840	CFC
	Research associate		0	0	1	0	300	0	0	300	0	300	5	15	315	CFC
	Technician		0	0	0	4	120	0	0	0	480	480	5	24	504	CFC
	Subtotal IV							**1,400**	**1,400**	**6,300**	**6,480**	**15,580**		**79**	**15,659**	
VII	**Dissemination , Training & I. W.**															
	Workshops (Local)	4	1	1	1	1	1,000	1,000	1,000	1,000	1,000	4,000	5	200	4,200	CFC
	Training programmes	2	0	0	1	1	1,000	0	0	1,000	1,000	2,000	5	100	2,100	CFC
	Seminar	2	0	1	0	1	4,000	0	4,000	0	4,000	8,000	5	400	8,400	CFC
	Special workshop for NGO's & entrepreneurs	2	0	0	1	1	3,000	0	0	3,000	3,000	6,000	5	300	6,300	CFC
	Assessment of consumer reaction	2	0	0	1	1	2,500	0	0	2,500	2,500	5,000	5	250	5,250	CFC
	Publication of handbook						10,000	0	0	0	10,000	10,000	5	500	10,500	CFC
	Overheads							1,000	2,500	2,500	2,000	8,000	5	400	8,400	CFC
	Workshop (International)	1	0	0	0	1	40,000	0	0	0	40,000	40,000	5	2,000	42,000	CFC

Cat code	Component inputs	Unit	Year 1	Year 2	Year 3	Year 4	Unit price	Year 1	Year 2	Year 3	Year 4	Total base cost	Cont. %	Cont. US$	Total cost	Financing source
			Quantities					Estimated cost								
	CIRCOT mgd															
	Brochure preparation	1				1	5,000	0	0	0	5,000	5,000	5	250	5,250	CFC
	Technology Demonstration	1	0	0	0	1	1,000	0	0	0	1,000	1,000	5	50	1,050	CFC
	Workshop (International) CFC mgd	1	0	0	0	1	40,000	0	0	0	40,000	40,000	5	2,000	42,000	CFC
	Subtotal VII							**2,000**	**7,500**	**10,000**	**109,500**	**129,000**		**6,450**	**135,450**	
	Unallocated							**0**	**0**	**-100**	**4,220**	**4,120**		**206**	**4,326**	**CFC**
	Total Component 6							**3,400**	**8,900**	**16,200**	**120,200**	**148,700**	**0**	**6,735**	**155,435**	

	Component: 7															
	Project management, monitoring, supervision and evaluation															
IV	**Personnel**		m/m													
	Principal investigator		0	3	0	3	700	0	2,100	0	2,100	4,200		0	4,200	CIRCOT
	Principal scientist		0	6	0	6	700	0	4,200	0	4,200	8,400		0	8,400	CIRCOT
	Scientist Sr. Scale		0	4	0	4	500	0	2,000	0	2,000	4,000		0	4,000	CIRCOT
	Pilot plant manager		5	2	3	3	400	2,000	800	1,200	1,200	5,200	5	260	5,460	CFC
	Research associate		0	0	0	1	300	0	0	0	300	300	5	15	315	CFC
	Technician		0	0	8	4	120	0	0	960	480	1,440	5	72	1,512	CFC
	Subtotal IV							**2,000**	**9,100**	**2,160**	**10,280**	**23,540**		**347**	**23,887**	
V	**T. A. and Consultancy**															
	Consultancy							1,000	2,750	2,750	3,000	9,500	5	475	9,975	CFC
	Subtotal V							**1,000**	**2,750**	**2,750**	**3,000**	**9,500**		**475**	**9,975**	
VI	**Duty Travel**															

Cat code	Component inputs	Unit	Year 1	Year 2	Year 3	Year 4	Unit price	Year 1	Year 2	Year 3	Year 4	Total base cost	Cont. %	Cont. US$	Total cost	Financing source
			Quantities					Estimated cost								
	Domestic travel							1,500	3,000	3,000	3,250	10,750	5	538	11,288	CFC
	International							1,500	3,100	4,000	3,750	12,350	5	618	12,968	CFC
	Room board							2,000	6,800	6,500	7,000	22,300	5	1,115	23,415	CFC
	Subtotal VI							**5,000**	**12,900**	**13,500**	**14,000**	**45,400**		**2,270**	**47,670**	
VIII	**Operational Costs**															
	Driver							960	960	960	960	3,840	5	192	4,032	CFC
	Stationery							0	1,000	0	1,000	2,000	5	100	2,100	CFC
	Preparation of Final project report							0	0	0	4,000	4,000	5	200	4,200	CFC
	Half yearly evaluation (advisory panel)							2,000	2,000	2,000	2,000	8,000	5	400	8,400	CFC
	Project Management							5,000	5,000	5,000	5,000	20,000	5	1,000	21,000	CFC
	Supervision							1,000	1,000	1,000	1,000	4,000	5	200	4,200	CFC
	Subtotal VIII							**8,960**	**9,960**	**8,960**	**13,960**	**41,840**		**2,092**	**43,932**	
IX	**Supervision & Monitoring Charges**															
	Mid term Evaluation							0	20,000	0	0	20,000	5	1,000	21,000	CFC
	Final evaluation							0	0	0	20,000	20,000	5	1,000	21,000	CFC
	ICAC supervision cost							2,500	2,500	2,500	2,500	10,000	5	500	10,500	CFC
	CFC monitoring mission							7,000	7,000	7,000	7,000	28,000	5	1,400	29,400	CFC
	Subtotal IX							**9,500**	**29,500**	**9,500**	**29,500**	**78,000**		**3,900**	**81,900**	
	Unallocated							**800**	**2,200**	**1,140**	**3,320**	**7,460**		**373**	**7,833**	**CFC**
	Total Component 7							**27,260**	**66,410**	**38,010**	**74,060**	**205,740**		**9,457**	**215,197**	
	Project Total							**1,535,835**	**170,270**	**155,755**	**270,240**	**2,132,100**		**58,386**	**2,190,486**	

Table 4

Proposed Financing Plan (US $)			
Component	**CFC**	**CIRCOT**	**Total Base cost**
1. Analysis and optimisation trials of required logistical (including organisational) arrangements for collection and transportation of cotton stalks from the field to the production units, including possible setting-up of pre-processing units at the field level;	36,000	13,300	49,300
2. Trials for minimum and optimum levels of cleaning and pre-processing of cotton stalks into chips suitable for processing, at field level and at factory site;	137,580	21,500	159,080
3. Pilot production of cotton stalks-based particle board production	297,110	1,074,600	1,371,710
4. Utilisation of Cotton stalks for production of the binderless fibre boards	63,170	110,600	173,770
5. Evaluation of technical/financial feasibility of the proposed processes;	2,800	21,000	23,800
6. Dissemination of project results at national and international level;	134,700	14,000	148,700
7. Project management, monitoring, supervision and evaluation	189,140	16,600	205,740
Sub Total	**860,500**	**1,271,600**	**2,132,100**
Contingency	**58,386**	**0**	**58,386**
Total	**918,886**	**1,271,600**	**2,190,486**
% Financed	**42**	**58**	**100**

Table 5

Consolidated Project Cost by Component in US$								
Code	**Input**	**Country**	**Funding**	**Y1**	**Y2**	**Y3**	**Y4**	**Total Base Cost**
	Component 1 :							
I	Vehicle and capital equipment	India	CFC	0	0	0	0	0
			CIRCOT	*0*	*0*	*0*	*0*	0
II	Civil works	India	*CIRCOT*	0	0	0	0	0
III	Material & Supplies	India	CFC	450	850	0	0	1,300
IV	Personnel	India	CFC	14,080	5,260	0	0	19,340
		India	*CIRCOT*	*7,600*	*5,700*	*0*	*0*	*13,300*
V	T A & Consultancy	India	CFC	*0*	*0*	*0*	*0*	*0*
VI	Duty Travel	India	CFC	0	0	0	0	0
VII	Dissemination & training	India	CFC	0	0	0	0	0
VIII	Operational cost	India	CFC	950	750	750	850	3,300
IX	Supervision & Evaluation	India	CFC	0	0	0	0	0
X	Unallocated	India	CFC	3,770	8,290	0	0	12,060
	Contingency			963	758	38	43	1,800
	Total CFC (base cost)			**19,250**	**15,150**	**750**	**850**	**36,000**
	Total CFC (incl. Cont.)			**20,213**	**15,908**	**788**	**893**	**37,800**
	Total CIRCOT			***7,600***	***5,700***	***0***	***0***	***13,300***
	Grand total (base cost)			**26,850**	**20,850**	**750**	**850**	**49,300**
Code	Input	Country	Funding	Y1	Y2	Y3	Y4	Total
	Component 2 :							
I	Vehicle and capital equipment	India	CFC	48,020	16,000	10,000	0	74,020
			CIRCOT	*4,100*	*0*	*0*	*0*	*4,100*
II	Civil works	India	*CIRCOT*	*0*	*0*	*0*	*0*	*0*
III	Material & Supplies	India	CFC	1,550	2,550	2,000	100	6,200
IV	Personnel	India	CFC	5,780	7,520	6,290	4,850	24,440
		India	*CIRCOT*	*4,500*	*4,500*	*0*	*0*	*9,000*
V	T A & Consultancy	India	CFC	*0*	*0*	*0*	*0*	*0*

VI	Duty Travel	India	CFC	0	0	0	0	0
VII	Dissemination & training	India	CFC	0	0	0	0	0
VIII	Operational cost	India	CFC	1,850	3,700	3,200	2,500	11,250
		India	*CIRCOT*	8,400	0	0	0	8,400
IX	Supervision & Evaluation	India	CFC	0	0	0	0	0
X	Unallocated	India	CFC	15,810	2,050	4,530	-720	21,670
	Contingency			6,029	2,391	1,801	337	10,558
	Total CFC (base cost)			**73,010**	**31,820**	**26,020**	**6,730**	**137,580**
	Total CFC (incl. Cont.)			**79,039**	**34,211**	**27,821**	**7,067**	**148,138**
	Total CIRCOT			***17,000***	***4,500***	***0***	***0***	***21,500***
	Grand total (base cost)			**90,010**	**36,320**	**26,020**	**6,730**	**159,080**
Code	Input	Country	Funding	Y1	Y2	Y3	Y4	Total
	Component 3 :							
I	Vehicle and capital equipment	India	CFC	201,700	0	0	0	201,700
			CIRCOT	*314,140*	*0*	*0*	*0*	314,140
II	Civil works	India	*CIRCOT*	*695,100*	*0*	*0*	*0*	*695,100*
III	Material & Supplies	India	CFC	0	2,950	4,200	4,450	11,600
IV	Personnel	India	CFC	2,100	9,000	13,950	14,860	39,910
		India	*CIRCOT*	*8,100*	*6,000*	*11,600*	*11,600*	*37,300*
V	T A & Consultancy	India	CFC	*0*	*0*	*0*	*0*	*0*
VI	Duty Travel	India	CFC	0	0	0	0	0
VII	Dissemination & training	India	CFC	0	0	0	0	0
VIII	Operational cost	India	CFC	0	3,600	8,000	8,900	*20,500*
		India	*CIRCOT*	19,060	2,000	3,500	3,500	*28,060*
IX	Supervision & Evaluation	India	CFC	0	0	0	0	0
X	Unallocated	India	CFC	18,340	2,640	2,440	-20	*23,400*
	Contingency			22,214	910	1,430	1,410	25,963
	Total CFC (base cost)			**222,140**	**18,190**	**28,590**	**28,190**	**297,110**
	Total CFC (incl. Cont.)			**244,354**	**19,100**	**30,020**	**29,600**	**323,073**
	Total CIRCOT			***1,036,400***	***8,000***	***15,100***	***15,100***	***1,074,600***
	Grand total (base cost)			**1,258,540**	**26,190**	**43,690**	**43,290**	**1,371,710**

Code	Input	Country	Funding	Y1	Y2	Y3	Y4	Total
	Component 4 :							
I	Vehicle and capital equipment	India	CFC	21,900	0	0	0	21,900
			CIRCOT	*100,800*	*0*	*0*	*0*	100,800
II	Civil works	India	*CIRCOT*	*0*	*0*	*0*	*0*	*0*
III	Material & Supplies	India	CFC	0	0	1,750	1,750	3,500
IV	Personnel	India	CFC	2,800	4,180	3,760	3,790	14,530
		India	*CIRCOT*	*4,200*	*0*	*2,800*	*2,800*	*9,800*
V	T A & Consultancy	India	CFC	*0*	*0*	*0*	*0*	*0*
VI	Duty Travel	India	CFC	0	0	0	0	0
VII	Dissemination & training	India	CFC	0	0	0	0	0
VIII	Operational cost	India	CFC	775	6,300	8,075	5,900	21,050
IX	Supervision & Evaluation	India	CFC	0	0	0	0	0
X	Unallocated	India	CFC	-2,800	-1,080	5,000	1,070	2,190
	Contingency			1,709	470	929	626	3,734
	Total CFC (base cost)			**22,675**	**9,400**	**18,585**	**12,510**	**63,170**
	Total CFC (incl. Cont.)			**24,384**	**9,870**	**19,514**	**13,136**	**66,904**
	Total CIRCOT			***105,000***	***0***	***2,800***	***2,800***	***110,600***
	Grand total (base cost)			**127,675**	**9,400**	**21,385**	**15,310**	**173,770**
Code	Input	Country	Funding	Y1	Y2	Y3	Y4	Total
	Component 5 :							
I	Vehicle and capital equipment	India	CFC	0	0	0	0	0
			CIRCOT	*0*	*0*	*0*	*0*	0
II	Civil works	India	*CIRCOT*	0	0	0	0	0
III	Material & Supplies	India	CFC	0	100	400	500	1,000
IV	Personnel	India	CFC	0	0	900	900	1,800
		India	*CIRCOT*	*2,100*	*2,100*	*8,400*	*8,400*	*21,000*
V	T A & Consultancy	India	CFC	*0*	*0*	*0*	*0*	*0*
VI	Duty Travel	India	CFC	0	0	0	0	0
VII	Dissemination & training	India	CFC	0	0	0	0	0
VIII	Operational cost	India	CFC	0	0	0	0	0
IX	Supervision & Evaluation	India	CFC	0	0	0	0	0

X	Unallocated	India	CFC	0	0	0	0	0
	Contingency			0	5	65	70	140
	Total CFC (base cost)			**0**	**100**	**1,300**	**1,400**	**2,800**
	Total CFC (incl. Cont.)			**0**	**105**	**1,365**	**1,470**	**2,940**
	Total CIRCOT			***2,100***	***2,100***	***8,400***	***8,400***	***21,000***
	Grand total (base cost)			**2,100**	**2,200**	**9,700**	**9,800**	**23,800**
Code	Input	Country	Funding	Y1	Y2	Y3	Y4	Total
	Component 6 :							
I	Vehicle and capital equipment	India	CFC	0	0	0	0	0
			CIRCOT	*0*	*0*	*0*	*0*	0
II	Civil works	India	*CIRCOT*	0	0	0	0	0
III	Material & Supplies	India	CFC	0	0	0	0	0
IV	Personnel	India	CFC	0	0	700	880	1,580
		India	*CIRCOT*	*1,400*	*1,400*	*5,600*	*5,600*	14,000
V	T A & Consultancy	India	CFC	*0*	*0*	*0*	*0*	0
VI	Duty Travel	India	CFC	0	0	0	0	0
VII	Dissemination & training	India	CFC	2,000	7,500	10,000	109,500	129,000
VIII	Operational cost	India	CFC	0	0	0	0	0
IX	Supervision & Evaluation	India	CFC	0	0	0	0	0
X	Unallocated	India	CFC	0	0	-100	4,220	4,120
	Contingency			100	375	530	5,730	6,735
	Total CFC (base cost)			**2,000**	**7,500**	**10,600**	**114,600**	**134,700**
	Total CFC (incl. Cont.)			**2,100**	**7,875**	**11,130**	**120,330**	**141,435**
	Total CIRCOT			***1,400***	***1,400***	***5,600***	***5,600***	***14,000***
	Grand total (base cost)			**3,400**	**8,900**	**16,200**	**120,200**	**148,700**
Code	Input	Country	Funding	Y1	Y2	Y3	Y4	Total
	Component 7 :							
I	Vehicle and capital equipment	India	CFC	0	0	0	0	0
			CIRCOT	*0*	*0*	*0*	*0*	0
II	Civil works	India	*CIRCOT*	0	0	0	0	0
III	Material & Supplies	India	CFC	0	0	0	0	0
IV	Personnel	India	CFC	2,000	800	2,160	1,980	6,940

		India	*CIRCOT*	*0*	*8,300*	*0*	*8,300*	*16,600*
V	T A & Consultancy	India	CFC	1,000	2,750	2,750	3,000	9,500
VI	Duty Travel	India	CFC	5,000	12,900	13,500	14,000	45,400
VII	Dissemination & training	India	CFC	0	0	0	0	*0*
VIII	Operational cost	India	CFC	8,960	9,960	8,960	13,960	41,840
IX	Supervision & Evaluation	India	CFC	9,500	29,500	9,500	29,500	78,000
X	Unallocated	India	CFC	800	2,200	1,140	3,320	7,460
	Contingency			1,363	2,906	1,901	3,288	9,457
	Total CFC (base cost)			**27,260**	**58,110**	**38,010**	**65,760**	**189,140**
	Total CFC (incl. Cont.)			**28,623**	**61,016**	**39,911**	**69,048**	**198,597**
	Total CIRCOT			***0***	***8,300***	***0***	***8,300***	***16,600***
	Grand total (base cost)			**27,260**	**66,410**	**38,010**	**74,060**	**205,740**

Table 6

Utilisation of Cotton Plant By-produce for Value-added Products.					
Cat.	**Description**	**Total Cost**	**CFC**	**CIRCOT**	% of category total
			Contribution	**Contribution**	
I	Vehicles, Machinery and Equipments	716,660	297,620	419,040	42%
II	Civil works	695,100	0	695,100	0%
III	Materials and Supplies	23,600	23,600	0	100%
IV	Personnel	229,540	108,540	121,000	47%
V	Technical Assistance and Consultancy	9,500	9,500	0	100%
VI	Duty Travel	45,400	45,400	0	100%
VII	Dissemination & Training	129,000	129,000	0	100%
VIII	Operational Costs	134,400	97,940	36,460	73%
IX	Supervision, Monitoring and Evaluation	78,000	78,000	0	100%
X	Unallocated + Contingency	129,286	129,286	**0**	100%
	Total	**2,190,486**	**918,886**	**1,271,600**	42%

Table 7

Counterpart contribution by CIRCOT (India) in US $

Item	Quantity	Price	PY1	PY2	PY3	PY4	Total
Material and equipment							
Lab. model electrically heated hydraulic press	1	20,000	20,000	0	0	0	20,000
Lab. model steam heated hydraulic press	1	25,000	25,000	0	0	0	25,000
Baby boiler	2	20,000	40,000	0	0	0	40,000
Refiner	1	1,000	1,000	0	0	0	1,000
Instron	1	50,000	50,000	0	0	0	50,000
Computer + printer	2	10,000	20,000	0	0	0	20,000
Power supply KVA	1	30,000	30,000	0	0	0	30,000
Chaff cutters	2	600	1,200	0	0	0	1,200
Lab. model rechipper	1	1,000	1,000	0	0	0	1,000
Precision electronic balances	3	6,000	18,000	0	0	0	18,000
Bomb digester	1	10,000	10,000	0	0	0	10,000
Research digester	1	4,000	4,000	0	0	0	4,000
Sheet press	1	2,000	2,000	0	0	0	2,000
Pulp screen	1	2,000	2,000	0	0	0	2,000
Disintegrator	1	1,000	1,000	0	0	0	1,000
PFI mill	1	30,000	30,000	0	0	0	30,000
Pulp defibrator	1	2,400	2,400	0	0	0	2,400
Sheet maker	1	6,000	6,000	0	0	0	6,000
Oven	3	1,000	3,000	0	0	0	3,000
Tensile tester for paper	1	10,000	10,000	0	0	0	10,000
Porosity & smoothness tester	1	8,000	8,000	0	0	0	8,000
Brightness tester	1	4,000	4,000	0	0	0	4,000
Stiffness tester	1	4,000	4,000	0	0	0	4,000

Thickness tester	1	2,500	2,500	0	0	0	2,500
Bursting strength tester	1	3,000	3,000	0	0	0	3,000
Folding tester	1	3,000	3,000	0	0	0	3,000
Grammage tester	1	800	800	0	0	0	800
Water absorption tester	1	800	800	0	0	0	800
Cobb tester	1	800	800	0	0	0	800
Calendering machine	1	3,000	3,000	0	0	0	3,000
Screw press	1	2,500	2,500	0	0	0	2,500
Reaction vessel	1	4,000	4,000	0	0	0	4,000
Paper vat	1	2,500	2,500	0	0	0	2,500
Scanning electron microscope	1	80,000	80,000	0	0	0	80,000
taxes		18,100	18,100	0	0	0	18,100
octroi		5,440	5,440	0	0	0	5,440
Sub total			**419,040**	**0**	**0**	**0**	**419,040**
Personnel							
	Number *	US$/mm					
Principal Investigator		700.00	4,900	6,300	5,600	7,700	24,500
Principal Scientists		700.00	16,800	14,000	20,300	24,500	75,600
Scientists sr. scale		500.00	4,000	5,500	1,500	3,500	14,500
Scientists		500.00	1,000	1,000	1,000	1,000	4,000
Technicians		300.00	1,200	1,200	0	0	2,400
Sub total			**27,900**	**28,000**	**28,400**	**36,700**	**121,000**
Civil work							
	Area	US $					
Cost of Land for pilot plant + godown etc.	80,000 sq. ft.	4.56	365,100	0	0	0	365,100
Cost of land building for Laboratories at GTC CIRCOT			210,000	0	0	0	210,000
Cost of construction of Building for Pilot plant	20000 sq. ft.	6.00	120,000	0	0	0	120,000
Subtotal			**695,100**	**0**	**0**	**0**	**695,100**
Operational Cost							

Taxes + Insurance for equipments			26,460	0	0	0	26,460
Annual insurance			1,000	2,000	3,500	3,500	10,000
Sub-total			27,460	2,000	3,500	3,500	36,460
Grand total			**1,169,500**	**30,000**	**31,900**	**40,200**	**1,271,600**

* mm – man month

Table 8

Summary Financing Plan – Common Fund
Utilisation of Cotton Plant By-produce for Value-added Products.
Name of the Financier: CFC

Category	PY 1	PY 2	PY 3	PY4	Total Cost
I Vehicles, machinery and Equipments	271,620	16,000	10,000	0	297,620
II Civil works	0	0	0	0	0
III Materials and supplies	2,000	6,450	8,350	6,800	23,600
IV Personnel	26,760	26,760	27,760	27,260	108,540
V Technical Assistance and Consultancy	1,000	2,750	2,750	3,000	9,500
VI Duty Travel	5,000	12,900	13,500	14,000	45,400
VII Dissemination, Training & International Workshop	2,000	7,500	10,000	109,500	129,000
VIII Operational Costs	12,535	24,310	28,985	32,110	97,940
IX Supervision and Monitoring charges	9,500	29,500	9,500	29,500	78,000
X Unallocated	35,920	14,100	13,010	7,870	70,900
X Contingency	32,377	7,814	6,693	11,502	58,386
Grand Total	**398,712**	**148,084**	**130,548**	**241,542**	**918,886**

Table 9

Detailed Cost Table by Category and Item of Expenditure
Utilisation of Cotton Plant By-produce for Value-added Products

Category of Expenditure	Sub-category of Expenditure	In 000 US $					
		USD PY 1	USD PY 2	USD PY 3	USD PY 4	Total Cost	Financier
I Vehicles,	I.1 Vehicle	14,000	0	0	0	14,000	CFC
Machinery & Equipments	I.2 Machinery & Equipments	257,620	16,000	10,000	0	283,620	CFC
II Civil works	II.1 Development of land and construction of shed	0	0	0	0	0	CFC
III Materials and supplies	III.1 Raw materials, chemicals, glass wares etc.	2,000	6,450	8,350	6,800	23,600	CFC
IV Personnel	IV.1 Project staff	26,760	26,760	27,760	27,260	108,540	CFC
V Technical Assistance and Consultancy	V.1 Consultant	1,000	2,750	2,750	3,000	9,500	CFC
VI Duty Travel	VI.1 International Travel	1,500	3,100	4,000	3,750	12,350	CFC
	VI.2 Local travel	1,500	3,000	3,000	3,250	10,750	CFC
	VI.3 DSA	2,000	6,800	6,500	7,000	22,300	CFC
VII Dissemination and Training	VII.1 local Workshop	1,000	1,000	1,000	1,000	4,000	CFC
	VII 2 Training	0	0	1,000	1,000	2,000	CFC
	VII.3 Seminar	0	4,000	0	4,000	8,000	CFC
	VII.4 Special workshop for NGO's	0	0	3,000	3,000	6,000	CFC
	VII.5 Assessment of consumer reaction	0	0	2,500	2,500	5,000	CFC
	VII 6 Publication of Handbook	0	0	0	10,000	10,000	CFC
	VII 7 Transfer of Technology	1,000	2,500	2,500	2,000	8,000	CFC

	VII 8 workshop (International)	0	0	0	40,000	40,000	CFC
	VII 9 Brouchure preparation	0	0	0	5,000	5,000	CFC
	VII 10 Technology demonstration	0	0	0	1,000	1,000	CFC
	VII 11 Workshop (International for CFC)	0	0	0	40,000	40,000	CFC
VIII Operational Costs	VIII.1 Utilities	1,000	2,750	2,000	5,000	10,750	CFC
	VIII.2 Maintenance	450	1,200	2,000	3,000	6,650	CFC
	VIII.3 Audit fees	625	850	875	900	3,250	CFC
	VIII.4 Sundries	400	900	2,600	3,000	6,900	CFC
	VIII.5 Financial analysis & Preparation of TEFR	400	200	1,300	2,100	4,000	CFC
	VIII.6 Reporting costs	700	950	1,250	1,650	4,550	CFC
	VIII.7 Commercial trials	0	7,500	10,000	2,500	20,000	
	VIII.8 Driver	960	960	960	960	3,840	CFC
	VIII 9 Supv.& Mgt	8,000	9,000	8,000	13,000	38,000	
IX Supervision & Monitoring (CFC)		9,500	29,500	9,500	29,500	78,000	CFC
X Unallocated		35,920	14,100	13,010	7,870	70,900	CFC
Contingency		32,377	7,814	6,693	11,502	58,386	
Total		**398,712**	**148,084**	**130,548**	**241,542**	**918,886**	

ANNEX VIII

LIST OF MEMBER COUNTRIES OF THE COMMON FUND FOR COMMODITIES
(As at May 2004)

1. Afghanistan
2. Algeria
3. Angola
4. Argentina
5. Austria
6. Bangladesh
7. Belgium
8. Benin
9. Bhutan
10. Botswana
11. Brazil
12. Bulgaria
13. Burkina Faso
14. Burundi
15. Cameroon, Republic of
16. Cape Verde
17. Central African Republic
18. Chad
19. China
20. Colombia
21. Comoros
22. Congo (Brazzaville)
23. Congo, Democratic Republic of
24. Costa Rica
25. Côte d'Ivoire
26. Cuba
27. Denmark
28. Djibouti
29. Ecuador
30. Egypt
31. Equatorial Guinea
32. Ethiopia
33. Finland
34. Gabon
35. Gambia
36. Germany
37. Ghana
38. Greece
39. Guatemala
40. Guinea
41. Guinea-Bissau
42. Haiti
43. Honduras
44. India
45. Indonesia
46. Iraq
47. Ireland
48. Italy
49. Jamaica
50. Japan
51. Kenya
52. Korea, Democratic People's Republic of
53. Korea, Republic of
54. Kuwait
55. Lao People's Democratic Republic
56. Lesotho
57. Luxembourg
58. Madagascar
59. Malawi
60. Malaysia
61. Maldives
62. Mali
63. Mauritania
64. Mexico
65. Morocco
66. Mozambique
67. Myanmar
68. Nepal
69. Netherlands
70. Nicaragua
71. Niger
72. Nigeria
73. Norway
74. Pakistan
75. Papua New Guinea
76. Peru
77. Philippines
78. Portugal
79. Russian Federation
80. Rwanda
81. Samoa
82. Sao Tome and Principe
83. Saudi Arabia
84. Senegal
85. Serbia and Montenegro (the former Yugoslavia)
86. Sierra Leone
87. Singapore
88. Somalia
89. Spain
90. Sri Lanka
91. Sudan
92. Swaziland
93. Sweden
94. Syrian Arab Republic
95. Tanzania, United Repub of
96. Thailand
97. Togo
98. Trinidad and Tobago
99. Tunisia
100. Uganda
101. United Arab Emirates
102. United Kingdom of Great Britain and Northern Ireland
103. Venezuela, Bolivarian Republic of
104. Yemen
105. Zambia
106. Zimbabwe