

Project report on bamboo

[Science](#), [Biology](#)



Chapter-1 PREFACE A growth oriented Entrepreneur will always be in search of opportunities, which can generate income, enhance long-term value and command recognition and respect in the society. Looking at the present upbeat atmosphere in the NE Region for development of industry, thrust by Government of India for the development of environment friendly alternate resources and last but not the least, the spectacular progress made by China in the bamboo based industry – The KOTHARI group has decided to put up a unit in Guwahati to manufacture Bamboo Flooring, Board & related products.

During the exploratory phase, we reviewed reports & journals published by forest department / NGOs on Bamboo resource in NE Region, visited & discussed with the Bamboo growers, met with machinery manufacturers in India & abroad, attended seminars, studied market for flooring and its development potential, consulted technocrats from India and abroad about the possibility of making flooring in India using India Bamboo. We received encouraging response and could feel the potential. Now we are determined to put up project and this report provides details on various aspects of the same.

Chapter-II PROJECT AT A GLANCE PRODUCT : Bamboo Flooring & Bamboo Panel Boards. PRODUCT DESCRIPTION: Bamboo flooring/board is the newest and most revolutionary products in the flooring and interior decoration concept. The unique Bamboo grain provides an exotic oriental beauty to the interior of any room, and the high quality of Bamboo compared to wood guarantees a lifetime of enjoyment. Bamboo Flooring and Bamboo Board is also the most environment friendly construction material available.

Although Bamboo looks and behaves like a superior hardwood, it is actual a grass. Unlike wood forests, which take decades to regenerate, the Bamboo groves only take a few years to renew themselves. As consumer (especially in developed markets such as North America, Europe and Japan) become increasingly environment conscious, this has become a strong marketing aspect of Bamboo products. Bamboo's natural versatility is suitable to a variety of environments. The finished product is all-around coated and protected against insects and fungus.

It is suitable for all residential and commercial installations- in bedrooms, living room, kitchens, offices, schools and hospitals. **PRODUCT FEATURES :** Bamboo Flooring & Boards are made from 100% renewable resource, which saves precious timbers. Apart from this, it has so many salient features- Incredible tensile strength.

Light weight . Excellent appearance. Harder and more stable than wood. Easy to install. Creates friendly atmosphere for Asthma & Allergy patients. Excellent insulator of heat/cold. Environment friendliness Water- resistant. Numerous uses. **MARKET POTENTIAL :** The demand for Bamboo Flooring & Bamboo Panels are expanding from South- East Asian Countries to European and American markets.

The international market for bamboo flooring is estimated at Rs. 750 cores and it is expanding at a rate of 50% p. a. Current trends in the interior decoration industry are ' back to nature' i. e. away from synthetics and towards more natural products such as wood / bamboo. Due to health reasons, wood/ bamboo floors are taking away the market share from carpets (bamboo floors are hypo-allergenic and as a consequence, do

not suffer from dust mite infection like other floor coverings. In addition, wood sources are becoming increasingly depleted and the consumer is becoming environmentally conscious, the market for bamboo products has increased exponentially- for flooring, paneling, and a variety of products limited only by the imagination such as doors, frames, table tops, gift items, photoframes etc. Market response to Bamboo flooring is more than encouraging particularly for its look, strength and high-class protective coating. With support from international agencies and technical experts we are very optimistic about achieving quality standards.

INDIAN SCENARIO: With booming construction activities, scope for interior decoration activities has increased substantially. Of late, growth in use of marble and granite is reducing as Interior decoration industry always looks for new products. There have been imports of wooden and laminated floors but prohibitive duties and resultant landed price is restricting growth of such alternative products. In the domestic market, the size of the organized flooring market has been estimated at Rs. 1500 crores for all type of flooring. As the supply creates its own demand and if the Bamboo flooring can capture even 6-7 % of the market for flooring, it will mean a market of Rs. 100 Crores to be going with and it is likely to grow at a rate of at least 15% per annum. Source: INBAR Report Our initial market survey has given us all the reasons to be excited about huge potential not only for flooring but also for wall panels where there is absolutely no new product since last decade. Moreover, a product made in India will have better acceptability to larger cross section of price sensitive India consumers.

PROPOSED CAPACITY : Bamboo Flooring / Panel 60000 Mtr² / p. a. LOCATION : Export Promotion Industrial Park, Guwahati. CAPACITY UTILISATION : 1st Year 70% p. a. 2nd Year 80% p. a. 3rd year & onwards 90% p. a. COST OF PROJECT : (Estimated) (Rs. in Lakhs) (a) Land & Development 19. 68 (b) Building 51. 76 (c) Plant & Machinery 245. 52 (d) Misc. Fixed Assets 57. 10 (e) Preliminary Expense 0. 0 (f) Preoperative Expenses 49. 29 (g) Technical Know how & training 15. 91 (h) Margin for Working Capital 26. 07 (i) Contingencies 24. 81 MEANS OF FINANCE Contribution by the Promoters: Equity by promoters 97. 3 Grant from NEC 50. 00 Contribution by the Funding Agencies: (i) Technology Development Assistance from TIFAC 245. 00 (ii) Term Loan by Institution 98. 31 490. 44 Guarantee: Apart from above, Guarantee in favour of Government of India to the tune of Rs. 0 Lacs for import of machines under EPCG Scheme at concessional Customs duty. Subsidies and other incentives of capital nature have not been considered while deciding means of finance. The same can be directly reimbursed of loan. PROFITABILITY The profitability projections are as follows: [III year / normal year of operation] (Rs. in Lakhs) Sales Proceeds 494. 0 Cost of Sales 338. 18 Gross Profit Before financial expenses 155. 92 Financial Expenses 34. 59 Depreciation 28. 53 Operating Profit 92. 0 Profit After Tax 91. 18 Note: Incentives such as transport subsidy etc. have not been considered in the cost of production. The same can be directly reimbursed (as and when due) to the lending institutions as per-payment of loans. This will improve working of the company substantially. Chapter -III INTRODUCTION Flooring plays a vital role in the total appearance of any house /shop / building, whereas, very

little emphasis was given in improvement and innovation of flooring material in India.

Since last few years the awareness about the importance of flooring has increased amongst Indian consumers and now there is a visible shift from conventional cemented or mosaic flooring to Granite, Marble, Italian Marble, and Glazed Ceramic Tiles etc. for many advantages over traditional flooring. Of late, due to ease in import, demand for wooden flooring and laminated flooring is also increasing. Since most of these products are imported hence higher cost and we are sure environmental awareness will always keep Bamboo flooring ahead of wooden flooring.

There is huge market potential of Bamboo Flooring and Boards in India as well as abroad. As per the 'Country Report India' prepared by International Network for Bamboo and Rattan (INBAR) on Bamboo Value-added industry, size of the domestic organized flooring market has been estimated at Rs. 1500 Crore for all types of premium flooring. Architects are of the opinion that since supply creates its own demand, it would be possible for Bamboo Flooring to capture 6-7 % of the market. This will result in a domestic market size of Rs. 100 Crore to begin with.

Growth of the industry is estimated at 15% in the Indian market. DESCRIPTION OF THE PRODUCT AND USES World over Wooden Flooring is considered to be more up market compared to cement, marble, tiles etc. It enhances the warmth of any house and complements the decor of room. However with scarce timber resources and increasing environmental awareness people are shifting towards Bamboo Flooring, which is equally attractive and technically better than Wooden Flooring. The natural grains of

Bamboo show up clearly and look very attractive. It looks very unique, elegant, and serene.

The flooring is resistant to moisture, pressure, and scratch. It is flexible and lasts longer than wood. It also acts as sound and heat insulator. Bamboo flooring/board is the newest and most revolutionary product in the flooring and interior decoration industries. The unique Bamboo grain provides an exotic oriental beauty to the interior of any room, and the high quality of Bamboo compared to wood guarantees a lifetime of enjoyment. Bamboo Flooring and bamboo board is also the most environmental friendly construction material available.

Although Bamboo looks and behaves like a superior hardwood, Bamboo is actual grass-unlike wood forest, which take decades to regenerate, the Bamboo groves only take a few years to renew themselves. As consumers (especially in developed markets such as North America, Europe and Japan) have become increasingly environmentally conscious, this has become a strong marketing aspect of Bamboo. Bamboo's natural versatility is suitable to a variety of environments. The finished product is all-around coated and protected against damp, insects, and fungus.

It is suitable for all residential and commercial installations – in bedrooms, living rooms, offices, showrooms, hotels, restaurants, banquet halls, discotheques etc. Standard Bamboo flooring is manufactured as an all around tongue and groove board; a variety of sizes can be produced, the most popular being 900 mm X 90mm X 15mm, 600mm X 90mm X 15mm. Among the many possible lamination, the most common are protected with 3-layers of UV coating. COMPETING PRODUCTS Marble Granite Wooden

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Flooring Carpet PVC Flooring Ceramic Tiles Laminated Flooring ADVANTAGES OF BAMBOO FLOORING) Bamboo is harder than various species of wood. It is 25% harder than oak, 23% harder than Rock Maple. So it is more stable. Tensile strength of Bamboo is 28000 psi, which is even more than steel. ii) Bamboo floors are hypoallergenic and as a consequence, do not suffer from dust mite infection like other floor coverings. It creates friendly atmosphere for Asthma & Allergy patients. iii) It is an excellent insulator. So in cold climate it helps by keeping the room temperature warm, and in air-conditioned atmosphere, it helps in power saving by maintaining room temperature. v) Bamboo flooring is U. V. Coated, which is very hard, scratch resistant, moisture resistant. v) It is easy to maintain. It can be easily cleaned with vacuum cleaner. vi) It has got excellent appearance. vii) It is lightweight and easy to install. viii) Bamboo flooring are impregnated with chemicals which makes it termite proof. ix) It is made from 100% renewable resource, which saves precious timber. So it is environment friendly too. THE LOCATIONAL ADVANTAGES The proposed unit is to be set up in the Export Promotion Industrial Park (EPIP), Amingaon , Guwahati.

We have considered different factors while selecting the site and found that there are various advantages of putting up the unit in Guwahati. Some of them are as under- a) Availability of raw as material: Due to high volume and low weight, any Bamboo related production has to be near the source. Major raw material, Bamboo is abundantly available in and around Guwahati. Bamboo can be procured from farmers in Assam, Meghalaya, Mizoram, Agartalla and North Bengal. b) Availability of Skilled Manpower: The local people of Assam have gained natural skill of Bamboo craft.

They understand bamboo very well. For these reasons, it will be much easier to train a local person. c) Availability of Land: This unit requires a converted shed of 8000 sq. ft. and additional space for storage utility and for future expansion. AIDC has confirmed availability of required land at EPIP, Amingaon. d) Availability of Utilities: Power: Uninterrupted power supply is available to all the units set up in EPIP. This will be an advantageous situation. Water: Water is also easily available. Steam:

Steam will be required for manufacturing of Bamboo Flooring, which is planned to be produced by putting up a coal-fired boiler. Good quality coal is available from Meghalaya at a very economical price. e) Availability of Transport: EPIP, Amingaon is located adjacent to Guwahati dry port. All the dispatches to overseas market can be booked from there itself. Moreover, Guwahati is well connected by rail and road links with other parts of the country hence; transportation of finished product & raw material will have no difficulty at all. f) Subsidies & Incentives:

Government of India & Governments of Assam is giving various incentives and concessions for the new unit put up in Assam such as Sales Tax exemption. Excise exemption, Income tax exemption, and various other subsidies. g) Infrastructure facility: Guwahati, the proposed location of the unit, is the capital city of Assam which has got all the required amenities such as schools, hotels, hospitals, colleges and other entertainment facilities.

Chapter -IV RAW MATERIAL BAMBOO AN INTRODUCTION As the name suggest, the Bamboo Flooring are manufactured using Bamboo. Bamboo is an immensely useful and highly renewable natural resource.

It has been used by people – most notable in Asia – since time immemorial, and its remarkable versatility as raw material is attested to in our day by a list of products which is as long as that of the 1, 573 known bamboo species. From food, folder, fencing and fuel to flooring and furniture to flutes, fishing rods and even false teeth, bamboo products are used by an estimated 2.5 billion people, or almost half of the world's population. Although we in India are using Bamboo in various application but not much has been done for technical improvement of the manufacturing process of various products made by Bamboo.

Comparatively a lot of research has been done in China to make better products. Value addition to Bamboo has been negligible in India. Bamboo, the world's most useful plant, is a very large grass rather than a tree, yet has a timber-like quality when used as a construction material. It is the fastest growing plant in the world and certain species can reach heights of over 100 feet at rates of up to 5 centimeters per hour. It is harvested for commercial usage after three to five years.

This botanical cousin to rice and corn has over 1, 000 species of varying sized and characteristics makes it amazingly versatile it may be used for building whole houses, furniture, cases, baskets, screens, farm tools, fishing rods, windmill blades, boat building, record needles, paper, kites, blowguns, polish, diesel fuel, scales, food, medicine, chopsticks, incense sticks, musical instruments, blinds, concrete reinforcement, plastic reinforcement, scaffolding, cables, both substitutes, piping, bike frames, various other structures and a host of other durable, useful, crafted items. Bamboo is also used for brewing beer.

An Edison light bulb in the Smithsonian Institute in Washington, D. C. has a bamboo filament, which is still capable of burning after more than a century. The bamboo cable-supported Min Bridge in Szechwan is over 1, 000 years old. BAMBOO AND ITS USES China: In a remarkably short p of time, the bamboo sector in China has transformed technologically and structurally. The last decade has seen China emerge as a pioneer in bamboo utilization and a market leader offering a variety of new products and processing techniques. The latest development in China has been the usage of bamboo as a viable replacement for wood.

Bamboo mat boards have been acknowledged as an excellent substitute for plywood. Rapid growth of the bamboo plywood industry has instilled a new vibrancy in the sector. Bamboo has also been used to substitute plastics, steel and cement in new application in construction of houses, and manufacturing of furniture and agricultural tools and implements with application of sophisticated design, knowledge and use of improved composite technologies. Bamboo has an important industrial role in paper & pulp manufacturing in China. With a large and expending market, China is the world leader in bamboo shoot production and consumption.

Growth of significant scale in China bamboo sector has been possible through coordinated research and its application, incentive regimes, provisioning of support services, changes in agro forestry practices, and the fostering of close linkages with markets. Other Southeast Asian Countries: In other Southeast countries, however, apart from Thailand, which now boasts of bamboo shoot export equivalent to that of China, there has been little or on progress. It is still only the rural poor who continue to be principal users of

bamboo. In Bangladesh, 80-90 % of rural houses are constructed from bamboo, as are many rural dwellings in India.

Philippines, Nepal and Thailand. South America: In South America, bamboo utilization is small compared to Asia, except in localized areas. A large bamboo specie – *Guadua anaustifolia*, has been used for a housing programme in Costa Rica through a large-scale internationally funded bamboo project. All Central American countries have shown interest in this project. South Africa: Bamboo is valued in Kenya for soil stabilization. It is used to some extent in construction and fuel. India: In India, the principal usage of bamboo is in the paper industry, as scaffolding in construction material or in the handicrafts sector.

Among other uses, bamboo splits or wholes are used as a fencing material and for making various types of tool handles, ladders, and scaffolding. Splits as well as slivers types of tool handles, ladders, and scaffolding. Splits as well as slivers are used to make a wide range of products such as baskets, the core of incense-sticks, kites and toys, flutes and a large number of handicraft items. They are used to make cages for poultry, drying, packaging, and transport of grains. Bamboo slivers are woven into mats and used to manufacture mat boards. However there is very limited value addition that takes place on these products.

Also, since there is no automation in the manufacturing process, the manually made products are often of non-standard sizes. The majority of these products are consumed and sold at the local market-level only. The bulk utilization of bamboo in industry is in the manufacture of paper & pulp. The 13. 47 million tones of bamboo harvested annual gets utilized

industrially in paper mills, as scaffolding in fencing, for internal consumption in bamboo-growing householders, handicrafts and miscellaneous items like incense-sticks, ladders, ice-cream sticks, agricultural implements etc.

Again, no reliable estimates of quantities are available for any of these items. The estimate of consumption in each of the above categories is based on primary information and on an analysis of the industry size and growth rates. Paper: The total production of paper in India is 205 million tones. Paper industry experts have indicates that 25% of the raw material requirement of the industry is currently met through bamboo. Hence, the quantity of wet bamboo required for this is 2. 5 million tones (4 kg of wet bamboo is needed to produce 1 kg of paper.)

Internal Consumption: According to the survey among grower households in the NER, internal consumption for fencing, baskets, temporary structure, fishing rod etc. is 10% of the harvest. Of 13. 47 million tones, this translates to 1. 35 million tones approximately. Scaffolding: The value of scaffolding is 0. 1% to 0. 5% of the total value of the construction industry. The total value of the construction industry in India comprising the residential, commercial, industry and infrastructure segments is currently estimated as Rs. 292, 000 crore. Assuming 0. 25% value of bamboo scaffolding in the residential and commercial segments and 0. % in industrial and infrastructure construction, the total value of bamboo used for scaffolding is Rs. 340 crore (for 3. 4 million tones-price of one tone of bamboo is Rs. 1000) Handicrafts: About 5. 9 million tones of bamboo is utilized in commercial consumption in the paper industry and for scaffolding purpose. Taking a ratio of 3. 2 for commercial to internal consumption and making of handicraft, etc. the figure arrived at is 3.

9 million tones. Of this, 1. 35 million tones are used for internal consumption, leaving a balance of 2. 55 million tones, which is used for handicraft.

These include baskets for decorative as well as packaging purpose (for carrying fruits, vegetables and livestock, etc.), sericulture trays, mats, wall coverings, and furniture items such as stool, chairs, tables etc.

Miscellaneous: Bamboo is also used for incense-sticks, ice-cream sticks, toothpicks, chopsticks, agricultural props in field, implements and tools, ladders, lathis, walking-sticks, fishing rods, boat masts, bows and arrows, flag poles, paddles, kites, fire crackers, etc. Agrabatti (Incense-stick): About 1, 000, 000 million incense-sticks are produced annually.

Since 1000 sticks weight 1 Kg, the weight of 1, 000, 000, million sticks is 1 million tones. The weight of bamboo in 1 million tones of incense-sticks amounts to 0. 33 million tones. To produce 1 Kg of bamboo sticks, for incense-sticks, 2 Kg of bamboo is needed. Thus 0. 67 million tones of bamboo is consumed by the incense-sticks industry. Ladder: The construction industry is currently valued at Rs. 292, 000 crore, if 0. 02% is attributed to ladders used for construction the value of the ladder industry is in the reign of Rs. 58 crore which is equivalent to 0. 29 million tones of bamboo.

As per Hindu custom, biers are used to carry the dead to the cremation ground. The death rate is currently 7. 8% which amounts to 7. 8 crore deaths per year. If bamboo biers are used in 5% of the cases, there would be a requirement of 400, 000 bamboo annually, which is equivalent to 0. 08 million tones of bamboo (assuming 20 Kg bamboo per bier). The total bamboo consumed in ladder production is 0. 37 million tones. Other

Application: Ice-cream sticks, chopsticks, toothpicks, agriculture props, implement and tool handles, walking sticks and lathis, boat masts and paddles as well as fishing rods, etc. consume at least another 0.93 million tones of bamboo annually. The total consumption of bamboo for miscellaneous purposes thus amounts to 1.97 million tones. Illegal Exports: Of the total harvested quantity of 13.47 million tones, 11.77 million tones are used as described in the foregoing. The balance 1.7 million tones could be attributed to the illegal trade between the NER and neighboring countries (Bangladesh, Nepal and Myanmar). BAMBOO STOCK POSITION [1995 TO 2001] Experts suggest that 150 million tones of bamboo was available in the year 1995.

There are limits to the regeneration of bamboo since it can be regenerated only to the extent of the harvesting that takes place. The growing stock of bamboo is 150 million tones, of which 2.35 million tones harvested from private forest can be assumed to be depleted every year from forest. The current net availability of bamboo is 133 million on an "as-is basis". However, all of this is not in usable form. There are certain factors that have to be used to discount the quantity of available bamboo. CHARACTERISTIC OF BAMBOO CULMS

Thickness of the culms: The culm of the bamboo is hollow in most cases and its wall thickness varies across species. Different species of bamboo have different wall thickness. A few species of bamboo, however, are solid. The general properties of the bamboo culm vary according to its anatomical, chemical, physical and mechanical characteristics. Bamboo is particularly strong at the node where there is an inner disc called septum, which

connects the outside walls, strengthening the stalk and separating it into compartments. Bamboo is widest at ground level, but is quite consistent in diameter throughout its length.

Anatomical structure of the culms: The bamboo culm consists of two epidermal layers, the inner one is thicker and highly lignified while the outer one is covered by a cutinised layer with a wax coating. The outside portion of the culm wall is dense, containing about 5 percent silica. It has an exterior waterproof film on the softer interior portion as well. The cells in the culm are axially oriented in the inter-nodal region and provide transverse interconnections in the nodal region. There are no radial cell elements and therefore, lateral movements of nutrients or liquids is greatly hindered.

The internodes of almost all bamboo species have a culm wall of varying thickness surrounding a large cavity called a lacuna. The density of bamboo varies from 500 to 800 Kg/m³, depending on the moisture content. It increases progressively from the central to the peripheral parts of the culms. Chemical characteristics of the culms: The culm consists of about 50% parenchyma, 40% fiber and 10% conducting tissues with some variation depending upon species. The major chemical constituents of a bamboo culm are cellulose; hemicellulose and lignin while minor constituents are resins, tannins, waxes and inorganic salts.

The chemical composition varies with species, condition of growth, age, season, and part of the culm. The nodes contain less water-soluble extractives, pentosans and lignin but more cellulose than internodes. The silica content is high in the epidermis, very little in the nodes and none in the internodes. The nodal portion of a culm has lower hemicellulose

content, but a higher content of extractives, pentosans, lignin and ash than the inter nodal portion. As a result the node is not elastic enough for splitting or for making strips and matting.

Bamboo culms for weaving are therefore chosen from species that are easy to split and are not old enough to be brittle (preferably below two years). Physical characteristics of the culm: One aspect of the structure of bamboo is noteworthy: unlike wood it does not have any “ rays” (the dark spots on the surface). Rays transport and store food, mostly sugar, but they weaken the material. Consequently, bamboo is stronger than wood, especially in shear. The wall thickness and length of the bamboo makes it naturally durable. The basal portion is therefore more durable than the top.

Bamboo possesses very high moisture content, which varies with age and the season of felling. The moisture content also varies from bottom to top and from the innermost layers to the periphery, and decreases with age. The shrinkage is related to wall thickness and culm diameter. Mechanical characteristics of culms: Bamboo is known for its high tensile strength. To reach its optimum strength there is an age of maturity for each species. In air-dry bamboos depending on the species, the moisture content varies from 7 to 18%, specific gravity from 0.428 to 0.17, fiber stress at elastic limit from 16 to 120 N/mm² modulus of rupture from 33 to 160 N/mm², modulus of elasticity from 3 to 22 kN/mm² and compression strength parallel to grain from 26-78 N/mm². The Physiological Structure of Bamboo: The vegetative parts of a bamboo plant consist of roots, rhizome, culm, culm-sheaths, branches, and leaves. Roots: The profuse, fibrous roots form a dense network in the soil. Rhizome: The basal portion of the culm, which grows

horizontally under the soil surface with short internodes, is called the rhizome. In its natural habitat, the bamboo plant grows from seeds or rhizomes.

Unlike trees bamboo does not have a central trunk; the rhizomes provide the foundation. The extensive rhizome system stores the nutrients required for the plant's rapid growth. The rhizome branches out from the root to facilitate vegetative propagation. This reproductive characteristic makes bamboo an "active spreading plant" which "unless inhibited will extend growth over a large area". There are two types of rhizome system namely Sympodial and Monopodial. In the sympodial system, the apex of the rhizome gives rise to a shoot that grows into a culm, the woody stem of bamboo. These culms grow together as clump.

In the monopodial system, the lateral bud from each internode develops into a culm or a rhizome. As the apex of the rhizome grows horizontal to the ground at a distance from one another. Culm: A shoot of bamboo is usually hollow except at the nodes, which are often swollen. A young shoot is protected by a number of sheaths, which fall off as the shoot grows into a mature culm. In the hollow inner area, there are some horizontal partitions called diaphragms. On the outside these partitions have a ring around the culm. The diaphragm and the ring outside together form a node. Branches grow from these nodes.

The part between two nodes is called an inter-node. The internodes of most bamboos are hollow, that is, they have a cavity. The wall of the culm is simply the culm wall. Chapter V MARKET POTENTIAL The Bamboo Flooring is becoming popular because of its better look and superior quality over other

flooring materials. THE INDIAN SCENARIO The materials commonly used for flooring in India are Granite, Marble, Mosaic, Cemented floor etc. Since last few years, wooden flooring has also becoming popular in India. These different types of flooring are available in wide range of prices starting from Rs. 0 per sq. ft to Rs. 700 per sq. ft. The use of wooden is increasing particularly for application in offices & showrooms, banquet halls, discotheques, hotels, restaurants, conference rooms etc. There is a myth among the consumers that it is not suitable for Indian climate whereas wooden flooring is considered to be very convenient and it also helps in power saving particularly in the air-conditioned atmosphere. The consumers are required to be educated about the advantages of these flooring. Bamboo flooring has not yet been introduced in the Indian market.

But considering its advantages over Wooden as well as bring shift from some of premium flooring presently available in the market. Bamboo flooring which is less expensive than other premium flooring is scratch & moisture resistant because of high quality U V Coating, there should be good demand for the product in India. As per the Country Report: India published by International Network for Bamboo And Rattan (INBAR) on Bamboo Value-added Industry, the total market for Bamboo flooring in India has been estimated at Rs. 200 Crores which is likely to grow at a rate of at least 15% per year.

THE INTERNATIONAL SCENARIO There is an export potential, which can be realized for bamboo-based flooring. There is Rs. 750 Crores market for Bamboo flooring which is growing at a rate of 50% per annum. Indian companies can trap this growing demand. China is a major player in the field

of Bamboo flooring. They have been constantly researching on the manufacturing technique of Bamboo flooring & related products and hence they have an edge. However, for India companies, it will not be a problem to compete technically with China considering developed wood working industry in India.

Moreover the species of Bamboo available in India are also considered better for manufacturing of Bamboo flooring because these are harder than the species available in China. Chapter VI TECHNICAL FEASIBILITY TECHNICAL KNOWHOW Although not much been done in India respect to technicalities of Bamboo Flooring manufacturing. We feel Indian machinery manufacturers will have no difficulties in providing most of the machines by modifying there existing machines as per process requirement. Moreover, well-developed wood working machinery industry in India will be an additional advantages.

All the basic machines required for this project are either readily available in India or needs little modification to make them suitable for this specific application only very few finishing machines are proposed to be imported from Taiwan/Europe. In 2001, United Nations Industrial Development Organization (UNIDO) established Cane & Bamboo Technology Center (CBTC) in Guwahati which helps in implementation of Bamboo & Cane related project, delivers technical assistance and arrange for training of man power required for this project.

The United Nations Development Programme (UNDP) assisted “ Cane and Bamboo Technical Up gradation and Networking Project”, covering the seven North Eastern States of India. The Cane and Bamboo Technology “ Project” is a sub-programme of the large Technology Management Programme (TMP).

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The Development of Science and Technology, Government of India is the Executing Agency for the TMP. While the United Nations Industrial Development Organization (UNIDO) is the assigned Implementation Agency. The CBTC acts as the secretariat and coordination body of the Network and is the conduit for the network's linkages.

OBJECTIVES: The Cane and Bamboo Technological Up technologies and Networking Projects envisages the following as its major areas of interest: Identification, adaptation and dissemination of technologies for economic enhancement of craftspeople small entrepreneurs in the Cane and Bamboo Sector of North East India. Strengthening existing institutions by enhancing their networking capacities and linking them with specialized institution in India and abroad through the Cane and Bamboo Technology Center (CBTC).

Enhancing access of craftspeople and small entrepreneurs to improved technology and knowledge thereby promoting employment opportunities and income generation **ROLE OF THE CBTS:** The CBTS is expected to play multiple roles, which constitute: Acting as a repository of information and technologies Playing out the role of a coordinator of sub-programme activities Being a vehicle for the sharing of information amongst resource and support institution, entrepreneurs, craftsmen and villagers. Acting as a platform for networking amongst constituent elements of the sector

Performing as a catalyst to enhance the scale and depth of economic activity in the sector **FOCUS AREAS:** Generally speaking, the primary and secondary areas of focus are firstly, on promoting poverty eradication and sustainable livelihoods, and secondly on generation of sustainable livelihood and employment opportunities. The main focus areas are: The need to

evolve and promote a better understanding of the sector Set agenda for coordinated R & D activities, strengthen institutions and agencies and create coordination mechanisms for the sector

Review the regulatory and access regime-in forest areas, for agro-forestry and at the household/homestead level Disseminate technologies and knowledge Provides support services for the sector

MANUFACTURING PROCESS

The process for manufacturing of Bamboo Flooring can be divided into three parts:

1. Making of Bamboo Strips:
 - a) Straight, 4-5 years matured Bamboo is cross cut into the required length.
 - b) Out-side knots are removed.
 - c) Bamboo is put through a splitting machine to split the strips of required width.
 - d) Inside knots and outside skin is removed.
 - e) Strips are boiled and treated in a mixture of water, hydrogen peroxide and boric acid to remove sugar, starch, mildew, and pests.
 - f) Strips are put in Impregnation plant where chemicals are injected under high pressure to protect the same from insect/pest attack for lifelong.
 - g) After open drying, the strips the same are further dried in a Kiln to bring down the moisture level to 8-10%.
 - h) For giving darker brownish shade to final products, strips can be given Carbon treatment by putting the same under high heat/pressure causing coloration impregnated throughout the sticks.
 - i) Each strip is then passed through Four-side planning machine to get accurate rectangular shape.
2. Making of Bamboo Board:

After thorough sorting,

 - i) Strips are cut into the required length in the sizing machine.
 - ii) Glue is applied in the Gluing machine.
 - iii) Glued strips are assembled together into rough board.
 - iv) These rough boards are given required pressure in Hot Press (specially designed for this process).
 - v) Boards are put into a Chilling Press for something till the temperature comes

down to normal. i) One surface of duly pressed boards is finished on Planing machine. . Making of Bamboo Parquets: a) The specific size of Bamboo boards is passed through a rip saw to make one side plain. b) The side tongue & groove is milled into the board. c) The board is passed through a cutting and shaping machine where the end tongue & groove is milled. d) The parquet is passed through a wide belt sander for the top sanding. e) UV Basecoat is sprayed on the bottom and side of the parquets to make it moisture resistant and then again through a roller coater for top coating of UV Basecoat. f) Painted parquet is passed through U. V. Curing machine for hardening of the chemical (coat).) It is again passed through a wide belt sander for smoother sanding. h) The above process (e, f & g) is repeated again for better finishing. i) U. V. finishing coat is applied on the Parquets through Roller Coating machine. j) Parquets are passed through U. V. Curing machine for hardening. k) Each and every parquet is thoroughly inspected and the same is packed in the corrugated boxes. Process flow has been shown in the next Sheet. EFFLUENT TREATMENT There will not be any Water/Air/Soundpollution. It has been proposed to install. Dust collectors for the collection of Dust generated in the process.

The Bamboo dust can later be used for manufacturing of Particle Board. Similarly Dust collector & Chimney will be installed with the coal boiler. AVAILABILITY OF RAW MATERIAL The major raw material required for this project is Bamboo, which is abundantly available of bamboo in India, particularly in North East Region. India has the second largest reserve of bamboo in the world out of which NE Region accounts for 54% In NE Region,

apart from the Bamboo available in the forest, there is a tradition to grow bamboo in the homestead, garden, field barriers etc.

AVAILABILITY OF MACHINERY Different machines required for the primary processing of bamboo are available in India. Other machine such as Strip Sizing Machine, Gluing Machine, Bamboo Board Joining Machine. One Side Planer, Rip-Saw etc. are available in India particularly for wood working however, the same can easily be modified to make them suitable for this specific application. Some important finishing machines such as Five Side Grinding Machine, Double end Cutting Machine, Wide Belt Sanders, U V Coating Machine etc. Are being proposed to be imported.

Wherever possible, we have opted for the Indian machines so that after-sales services and spares can be made easily available as and when needed and it will also reduce the cost of the project and thereby reduces the financial burden. We are ensuring better machines without compromising the quality. Selection of the plant and machinery has been done considering different stages of manufacturing process and balancing the capacity. **PROPOSED PLANT CAPACITY** The manufacturing capacity of the proposed plant will be 60000 meter² per annum. This is the minimum viable capacity. The same can be increased in shorter duration.

It is unlikely for a new unit to achieve maximum capacity utilization in the initial years of operation owing to various factors like stability in process coordination, training of working, supply of required quality of raw material and consumables etc. therefore, all the calculation have been made of 70%, 80%, 90% capacity utilization in 1st, 2nd, & 3rd year onward respectively.

PRODUCT SPECIFICATIONS The Bamboo flooring are available in different

styles, colours, finished and sizes, which are as under- A) styles: I Horizontal: Bamboo strips are joined horizontally. II. Vertical:

Bamboo strips are joined vertically. B) Colours: Coffee 7 Natural There can be different shades from normal to dark brown. C) Finish: Matte & Glossy. Other finish such as semi-gloss, 65: 35 Matte & Gloss etc. can also be made as per the market demands. D) Sizes: 900 mm X 90 mm X 15 mm. 600 mm X 90 mm X 15 mm 900 mm X 90 mm X 12 mm 600 mm X 90 mm X 12 mm These are the sizes commonly sold in the market but Parquets can be manufactured in different sizes and thickness. MAN POWER REQUIREMENT

Total requirement of manpower can be broadly divided into two categories:

1. Technical Personnel:

The technical personnel include engaged in production, maintenance, running of utilities and services facilities etc. These can further be categorized as: a) Factory Staffs b) Workers Chapter VII ECONOMIC VIABILITY

h) Land & development: The plant is proposed be put up in Export Promotion Industrial Park (EPIP), Amingaon, guwahati, developed by AIDC. We have already approached AIDC for availability of land and they have assured us land as per our requirement on long-term lease (60 years). Various other expenses on site development such as land leveling, boundary wall, internal roads, etc. ave been considered while calculating the total cost of land and site development. The details of which are shown in the table below- h)

Building: A covered shed of 8000 sq, ft. will be required for smooth operation of the plant. Apart from this, a semi pucca shed will be required for preliminary Bamboo processing and space will be required for administration, storage, utilities etc. We have planned the layout for the

building considering different areas of operation, safety regulation, provision for ventilation, free movements of men and material etc.

The building construction cost has been estimated based on the offers received from local builders. The total cost of building is estimated at Rs. 51. 76 Lacs as explained in the Table below- c) Plant & Machinery: The selection of Plant & Machinery has been done based on the offers received from various machinery suppliers, their technical competitiveness, price, after-sale service simplicity of operation, efficiency of the machine, guarantee etc. The total cost of Imported & Indigenous Plant & machinery are shown in the Tables on the next sheet. d) Miscellaneous Fixed Assets:

Apart from the main plant & machinery, various other equipment will be required such as Boiler, D. G. Set, Compressor, material handling equipments, fire fighting equipments, furniture & fixtures, office equipments etc. We have worked out the requirements of such equipments, the details of which are as under: e) Preliminary & pre-operative expenses: This includes the expenses for company formation, interest during construction period, initial expenses on traveling, communication and other basic expenses during the pre-operation period. Total preliminary expenses are Rs. . 30 Lacs and preoperative expenses has been estimated at Rs. 49. 29 Lacs. f) Contingencies: Provision has been made towards contingencies in the total cost of project. The details of which is as under: g) Technical Know-how & Training: The total cost for Technical Know-how, Training of technical personnel & consultants' fee has been estimated at Rs. 15. 91 Lacs. The detailed calculation has been shown in the next table. h) Margin money for working capital: The total requirement of working of capital is estimated at

Rs. 6.07 Lacs. The detailed calculation of requirement of Working capital has been shown in the next table. SOURCES OF FUNDS The total long-term fund requirement of the proposed unit is estimated to be Rs. 490.44 Lacs, which is proposed to be financed as under: Subsidies & other incentives of capital nature have not been considered while deciding means of finance. The same can be directly reimbursed to the lending institutions towards repayment of loan. We seek equity participation from institutions for reducing interest outgo at least for a period of 3-5 years.

The same can be brought back by the promoters at mutually agreed terms. TOTAL COST OF MANUFACTURING: It has been calculated by calculating cost of raw material, salary & wages, power & fuel, consumables, repair & maintenance, factory overheads etc. These calculations are based on certain assumption during the 1st, 2nd, & 3rd years & onwards of operation has been assumed to be 70%, 80%, & 90% respectively of the installed capacity. The installed capacity of the proposed unit is estimated at 60000 meter². the cost of various items has been calculated as per the prevailing rates in the market.

Incentives such as transport subsidy, D. G. Set subsidy etc. have not been considered. The same can be directly reimbursed, as and when received, to the lending institutions as prepayment of loan. This will improve the working of the cost of manufacturing estimated for the next 10 years. RAW MATERIAL: Bamboo is the main raw material for making Flooring. We have worked out requirement of Bamboo after considering wastage. Farmer have to be educated to harvest our required quality of Bamboo which may take some time.

It is therefore estimated that in the 1st year of operation we shall have higher wastage. Such wastage will gradually reduce. We shall have incentive scheme to encourage farmers for regular flow of homogeneous quality of Bamboo. This will lead to lower wastage, reduced cost of production and smooth operation on the machine. We assume after 3rd year we shall get advantage of regulated supply of Bamboo clums. CONSUMEABLE AND STORES: This includes Glue, U V coating material, various chemicals for pre processing of bamboo, packing material, stores & spares etc.

Requirement of the same at 100% capacity utilization has been shown below: POWER: The total annual requirement of the proposed unit works out to 791900 KVA at installed capacity. Calculation of requirements of power and cost has been shown as under: FULE: The total annual requirement of Coal for running the boiler has been worked out at 1408 MT per annum at installed capacity. Calculation of requirements of Coal and cost has been shown as under: SALARY & WAGES: The requirements of Skilled, Semi skilled and unskilled labour has been orked out as per the production process and machine hours. The requirement of Technical & Supervisory personnel & their total Salary & Wages has been calculated in the Table on the next sheet. We have also estimated an annual increases of 5% in the Salary & Wages and have also provided for Fringe benefits @ 25% of Salary & Wages. REPAIRS AND MAINTENANCE: The repair and maintenance of the capital assets has been taken at 1%, 2%, & 3% of the total cost of fixed assets in the 1st year, 2nd year, and 3rd year & onwards respectively.

FACTORY OVERHEADS: Overheads such as Rent and Taxes, Insurance, miscellaneous expenses have been considered on best judgment basis to

make adequate provision in the total cost of production. These have been estimated at Rs. 13. 74 Lacs in the first year of operation. We have also made a provision of increase in this cost @ 10% per annum. ESTIMATE OF COST OF SALES, AND PROFITABILITY The estimate of cost of sales, realization & profitability for the next 10 years of operation has been shown as under: ADMINISTRATIVE & SALES SALARY:

The requirements of Administrative & Sales personnel & total Salary & Wages has been calculated as under: We have also estimated an annual increase of 5% in the Salary & Wages and have also provided for Fringe benefits @ 25% of Salary & Wages. ADMINISTRATIVE OVERHEADS: Adequate provision has been made for administrative overheads and estimated at Rs. 12. 83 in the subsequent years. SELLING OVERHEADS: Being a consumer product planned sales promotion and regular advertising will be essential apart from organizing sales meet and participation in fairs.

Total sales expenses have been estimated at Rs. 33. 68 Lacs in the first year of operation. This includes 7% of sales realization of finished goods towards advertisement & publicity and balance towards miscellaneous sales expenses. A provision of an annual increase of expenses at 10% has been made in the subsequent years. PRODUCTION SALES REALISATION: Calculations of the sales realization are based on the prevailing selling price of the product in the international market. The details of sales realization at 100% capacity utilization are as under: INTEREST:

Interest on term loans for capital investment and bank borrowing for working capital has been worked out as under: Working capital from Bank - 15. 00% Term loan from Financial Institution - 15. 00% Technology Development

Assistance from TIFCA - 4% The details of repayment of term loan and interest thereon have been shown in the next two tables. FINANCIAL PROJECTIONS Various financial projections calculated for the proposed unit which confirm the economic viability of the project, are: . CASH FLOW STATEMENT: The cash estimates for 10 years are given in the table below- 2. BREAK-EVEN ANALYSIS The details working on break-even point has been shown in the table below: We have taken the figures of 3rd year of operation i. e. optimum year for the purpose of calculating break-even point. 3. UNIT COST OF PRODUCTION: Total Works Cost of Sales, Contributing & Net Contribution of each square meter/Square feet has been shown in the table below: 4. BALANCE SHEET: Project Balance Sheet for next 10 years of operation is as under: SWOT ANALYSIS

Strengths: Vast Bamboo source for commercial exploitation at competitive price. Local people with skill to make Bamboo handicraft will be suitable for this project. Same set of machines can produce other related products such as ceiling boards, door panels, wooden flooring etc. Weakness: There is no defined goal or policy for encouraging planned bamboo cultivation. Wastage will be higher in the initial phase. Farmers have to be educated for maintaining quality requirements. Opportunities: The usage of wood is on an increases but wood resources are declining in India.

Moreover the Supreme Court has banned felling of timber in North East region resulting in closure of plywood units. Wood import can be reduced if Bamboo-based products. Threats: Bamboo Flooring industry is well established in China. Their product is already acceptable in the international market. We will have to compete with them in future. There can be shortage

of particular of Bamboo after flooring, which is likely to take place between 2003-2007. Poor infrastructure in the North East. SENSITIVITY ANALYSIS Sensitivity Analysis gives an indication of how sensitive the project is to changes in certain assumptions.

This analysis has been carried out to see how the profitability would change if there is certain change in the factor concerned. This sensitivity shows the effect of increases and reductions in raw material price, capacity utilization, selling price, publicity expenses and the profitability shows the impact of that particular factor. PEST ANALYSIS The following analysis gives an overview of the environment in which the Bamboo flooring industry will have to operate. We have analyzed the Political, Economic, Socio-cultural and Technological environment for the industry.

POLITICAL ENVIRONMENT I Finished Product Even if Bamboo flooring is imported at '0' duty from China, the landed cost is quite high compared to our proposed selling price. The local selling price in Nepal market is also quite high due to higher Bamboo procurement price to them. Hence we do not see any threat from imported Bamboo Flooring. We may however have to compete with the other Bamboo Flooring manufacturers in the country but that would also add to overall market growth and awareness of the product.

II Import Duties on Consumables

Import duty on consumables is also very high. The only consumable, which is required to be imported at the initial stage, is U V coating. Cost of U V Coating to the total cost of production is 3. 50% only (including duty), hence it will not significantly affect the profitability. III Other Levies Since this unit is being put up in Assam, products will be exempted from Sales tax & excise

duty. Thus it will be at an advantageous position as compared to any other unit, which may come up in other parts of the country. IV Ban on felling of Trees Supreme Court of India banned felling of trees in NE Region.

This will make wooden flooring a costly substitute. In the recent years, Government of India is giving all thrust for adding value and creating awareness about uses of Bamboo. ECONOMIC ENVIRONMENT I Disposable Income of the Population With the sustained growth in the GDP of approximately 5-6% in the last few years there has been a high rate of growth in the disposable income of the Indian households. The NCAER data reveals that the middle (annual household income between Rs. 62, 000 and 86, 000) and the high (annual household income higher than Rs. 6, 000) income segments have growth at a compounded average growth rate of 13% and 17% respectively between 1989-90 and 1993-94. This increases demand for the luxury products. II Availability of Easy Housing Finance Housing finance has picked up substantially in India as the rate of interest for housing loan has been reduced substantial. It has gone down to as low as 10%. Moreover there are other income tax advantages too for the investment made in housing. Hence the construction industry is bamboo. This will in turn boost demand for various products that obviously includes flooring material.

As is evident from above Tables, India has about 157. 2 million households of which about 52 percent fall in the low income (upto Rs. 20. 000) category; a further 20 percent have purchasing power of about Rs. 9, 000 p. a. constitute another 12% of total. Conclusions drawn from the NCAER data is of great significance from the point of view of the purchasing power of the

consumer. When compared with the data from the previous estimates it appears that the upper middle and high-income segment of the population has been growing faster. Since a major chunk of demand for this sector is expected to get larger in the near future.

Within the upper middle and high-income segment, the rural households are growing at a far more impressive rate than their urban counterparts. Roughly about 137 million people belong to upper middle and high-income categories i. e. income of Rs. 34, 500 p. a. This is a fairly large size indicating that the marketing of ‘ niche’ products can be the promising area. II Lifestyle Changes With more and more workingwomen in the Indian families, there participation in decision making at home is increasing. Women are always expected to be connoisseur of rich test & beauty.

Bamboo flooring being user friendly, easy to clean & maintain shall get attention of women and help shift from other flooring materials. The Indian families are on the lookout for alternate ways to do household chores. Also declining supply of household workers has led to demand for products, which required less maintenance. Bamboo flooring does not required mopping, cleaning etc. It can be easily cleaned with Vacuum Cleaner. This will have an impact on the mental makeup of women in particular & in the urbanized in general. III Health Consciousness Pollution is one of the main reasons for Asthma and Allergy.

People with these diseases have started avoiding woolen / synthetic carpets because these diseases these carpets become the storehouse of dust mites, which aggravates their problem. Part of the market for carpet will definitely shift towards Bamboo flooring. TECHNOLOGICAL I Life Cycle Every product

has lifecycle. With technological department everyday new products are introduced in the market, but customers prefer the product, which meets their requirement. Bamboo flooring, which looks better & makes one feel better will create its own niche market.

Being a natural product, it is unlikely to loose its charm for long time to come. II New Development Manufacturing of Bamboo flooring is comparatively a new technology. There is likely to be continuous research on the subject and regular improvement in all aspects of manufacturing. The areas, which require attention, are a) Saving on wastage b) Further mechanization c) Better & economical coating material d) Alternative uses. This will result in better flooring at a reasonable price. So it will further gear up to meet any challenge from any new products.