

UNIVERSIDAD DE COSTA RICA
INSTITUTO DE INVESTIGACIONES
EN CIENCIAS ECONOMICAS

FINAL REPORT

SOCIECONOMIC STUDY FOR THE BAMBOO SECTOR
IN COSTA RICA

FINANCING BY INTERNATIONAL NETWORK FOR BAMBOO
AND RATTAN

M.Sc. Marcos Adamson, PI.
M.Sc. Diego López,

Abril, 2001

CHAPTER 1 3

<u>THE BAMBOO SECTOR IN COSTA RICA</u>	3
1. THE BAMBOO SECTOR IN COSTA RICA	4
1.1. <i>Origins and first uses of the Bamboo and the "Caña Brava (cane)"</i>	4
1.2. <i>Training and handicrafts sector of Bamboo and Rattan in Costa Rica</i>	4
1.3. <i>Investigation and technological development of the cultivation and use of the bamboo</i>	5
1.3.1. <i>Stage of conceptualisation: 1983-1985.</i>	6
1.3.2. <i>Preparatory stage: 1986-1987.</i>	7
1.3.3. <i>Execution stage of the Project CO 87/001: 1988-1992</i>	7
1.3.4. <i>Execution stage of the Project CO 90/005: 1992-1995</i>	7
1.4. <i>Competitive arena of the bamboo sector in Costa Rica</i>	13
CHAPTER 2	15
2.1. <i>Methodology</i>	16
2.2. <i>Results</i>	17
2.2.1. <i>The productive chain participants of the bamboo in Costa Rica</i>	18
2.2.2. <i>Seasonal framework in the production and distribution of activities</i>	19
2.2.3. <i>The workers' socio-economic characterisation for the bamboo sector and consumers of bamboo housing, bamboo furniture, and bamboo and rattan souvenirs</i>	20
2.2.4. <i>The bamboo sector workers' additional income sources</i>	22
2.2.5. <i>Family income per source</i>	23
2.2.6. <i>Household living conditions of the workers in the bamboo sector</i>	24
2.2.7. <i>Bamboo houses, furniture, bamboo souvenirs and rattan goods consumers' profile</i>	26
CHAPTER 3	29
3.1. <i>Description of the pattern of production consumption of bamboo</i>	30
3.2. <i>The plantation of Bamboo</i>	31
3.3. <i>The bamboo as an alternative of production combined with other agricultural products</i>	38
3.4. <i>The housing construction and the factory of panels</i>	40
3.5. <i>Sector bottlenecks</i>	44
3.5.1. <i>Financing</i>	44
3.5.2. <i>Idiosyncrasy in the consumption, promotion of exports and new markets</i>	48
3.5.3. <i>Development and technological transfer institution</i>	49
CONCLUSIONS AND RECOMMENDATIONS	51

CHAPTER 1

THE BAMBOO SECTOR IN COSTA RICA

CHAPTER ABSTRACT

The bamboo sector in Costa Rica is extremely small, as much in actors as in extension of plantations, that country has an important investigation process and technological development in cultivation and construction of bamboo housing, achieved by Funbambú, main agent in that sector.

The development of plantations and of construction technology has contributed to solve the housing problem of marginal sectors, through the use of a public subsidy granted to the beneficiaries, also known as "housing voucher (bond)" This action taken by Funbambú has prevented it to develop nexuses with other national and international commercial agents.

The development of the sector depends on the specific politics that the current governments adopt in relation with the "housing voucher." Although the bamboo for export is an attractive option, currently, the scarce plantations are not in a crop phase that allows making front to other contracts of importance. The same thing happens to other options of industrialisation of the bamboo, which are limited due to the scarce size of the existent plantations.

1. THE BAMBOO SECTOR IN COSTA RICA

The development of the productive sector of bamboo in Costa Rica has been scarce both in number as in size of the plantations. Next, a brief revision of the evolution and state of this sector is exposed.

1.1. Origins and first uses of the Bamboo and the "Caña Brava (cane)"

Strictly speaking, it should be pointed out that the first ones to use the bamboo were the indigenous tribes, which used them to point out the trade route between Central and South America, known as "El Paso de las Mulas". More recently, and for a lingering period, the species *Vulgaris* and the "caña brava" were used in the banana plantations of the Atlantic area as a curtain to avoid winds. It was also used as a pointer to support the plants before harvesting the banana plant cluster. Due to the handling easiness and mainly for lower costs of polypropylene, the use of bamboo and "caña brava" was stopped in the banana plantations.

The 99.9% of the banana plantations use the polypropylene rope (piola), as prop for its plantations. It is the producers of plantain who recently use the "caña brava" and, in smaller proportion, the bamboo in their plantations. These last producers still use "caña brava" and bamboo because their plantations are in the river margin, which present more favourable conditions for the development of the "caña brava) and the bamboo.

1.2. Training and handicrafts sector of Bamboo and Rattan in Costa Rica

In the field of the training, furniture manufacturing, and the creation of souvenirs with bamboo and rattan, the work deployed by the international co-operation of the Chinese Mission (Taiwan) stands out, which has imparted courses to more than 500¹ people. This co-operation began 18 years ago (1981) when Costa Rica signed an agreement of collaboration with that country. The project begins in the facilities of JAPDEVA (Junta de Administración Portuaria de la Vertiente Atlántica), in the province of Limon, under the name of *School of Production of Furniture in Bamboo and Rattan*, and with financial support of that Mission. The objective was to qualify people in the production and self-commercialisation of its products: furniture and crafts in bamboo and rattan.

That program has experienced changes, due to budgetary decreases, added to other changes in priorities. From 1994 the program becomes denominated "*Taller*" (Workshop), and began working only with bamboo. The rattan, imported from Asia, is not used anymore.

These new changes seek that those people qualified in the area, remain working in the facilities of JAPDEVA, which provides not only the space but also other services such as

¹ Information based on the Chinese Mission (Taiwan) data (JAPDEVA)

electricity and water. Additionally, this Mission supports with productive inputs and helps with the commercialisation of the final products. The previous experience had a low application of factory knowledge in the utilisation of those materials and, therefore, found itself with very little contribution to the generation of income for the people involved. The above mentioned was owed mainly to the lack of resources that prevented the strengthening of the commercialisation phase.

This course is imparted twice a year, beginning the first of these courses in February. It has three instructors, to which are assigned a total of five students each. However, in spite of the advantages offered by the program, not all the people that participate in the program decide to work in this activity, and the majority opts not to stay working with the Program.

For the development of this work it was attempted by several means, to locate a sample of people that received this training course. However, these people inhabit far away rural areas and they don't have access to a telephone near their homes. Some of them are even available only through a long journey by horse. This explains partly the little effectiveness that program has had due to training in the manufacturing of such products, and not training for the pursuit in the commercialisation.

1.3. Investigation and technological development of the cultivation and use of the bamboo

At investigation level, the work by the University of Costa Rica, carried out during the last ten years, in studies on the cultivation and use of the bamboo in a Neotropical nation like Costa Rica, stands out. This investigation has been focused in the adaptation and growth of Asian species in Costa Rica.²

However, where they have concentrated the most efforts on the bamboo sector of Costa Rica has been in the technological development of the cultivation, preservation process, as well as in the development of construction technology and the design of housing and other bamboo structures. Formally, the first institution in Costa Rica that dedicated efforts and resources to the development of that sector began as the National Project of Bamboo (PNB, 1983-1999), which later became the National Foundation of the Bamboo (Funbambú).

This Foundation began that complex technological development (in cultivation, physical and mechanical properties, design of structures, development of preservation systems, etc.) mainly to supply itself with the necessary inputs to use for the construction of bamboo housing that allowed to diminish the costs of housing construction for social purposes. That is to say, it dedicates its efforts to developing housing for lower income families with unsatisfied residence necessity. After two decades, the technological development has evolved and right now Funbambú uses bamboo for the manufacturing of

² As an example see: Montiel, Mayrs *Planting & Using Bamboo in the Neotropics*. International Journal of Tropical Biology and Conservation, Vol.46 June 1998 Suppl. 3, ISSN-0034-7744

pre-fabricated construction panels. Recently it has incorporated the use of "caña brava", which has stimulated the emergence of a very small sector that takes advantage of wild plantations of "caña brava"³

Our impression is that in the course of the involvement of the Foundation in the bamboo sector, they discovered investigation fields and development that overcame their expectations, beginning to transform the original project, born to satisfy housing needs, into one involving sustainable development, advanced technology and efficient assignment of the natural resources.

The main challenge that Funbambú has faced in the achievement of its objectives of social character and without ends of lucre (rural development, reforestation, woman's promotion, and the generation of employment, among others), is the financial sustainability. Due to the social relevance of their projects, the PNB and the Foundation have had an important support by different government entities and international institutions, as the Program of the United Nations for the Development (PNUD), HABITAT, the Central American Bank of Economic Integration (BCIE) and The Royal Government of the Netherlands.

However, the period of investigation and development required the development of the technology, the same financing granted to projects that didn't contemplate the achievement of financial sustainability, the lapse required to take advantage of the first crop of the bamboo plantations, among other, explain the budgetary dependence -under the financing modality and donations-, of the institution to assure the continuity of its operations.

Considering that Funbambú doesn't have a network of contacts in the financial system that is the result of an interaction of several years, and that it doesn't have experience in the use of resources coming from bank or market sources ("leasing" mechanisms or discount of invoices, significant investment services, etc.), it is perceived by the actors of the national financial system as a new potential client, of a relatively new product and with little publicity, more than specialised articles. This generates caution and scepticism as a result on the part of the actors of the financial system to allocate resources to Funbambú.

Funbambú (1997) carries out a division of the National Project of the Bamboo in four stages:

1.3.1 Stage of conceptualisation: 1983-1985.

It consists on a first approach that studies the technical viability of production of construction materials related with the bamboo, which was financed by the International Organisation of the Work (ILO) and by the Ministry of Housing and Human Settlements, which gave beginning to the National Program of Bamboo. This stage had the support of

³ In houses whose area is 37m², 950 units of "caña brava" are used in their construction, and in houses whose area is 42m², 1200 "caña brava" units are used.

the Mixed Institute of Social Help (IMAS), the National Institute of Learning (INA), the Ministry of Agriculture and Cattle (MAG), the Forest General Address (DGF) and the Institute of Agrarian Development (IDA), which facilitated the allocation of funds from the Program of the United Nations for the Development (PNUD), HABITAT and the Central American Bank of Economic Integration (BCIE).

1.3.2. Preparatory stage: 1986-1987.

During this stage, the University of Costa Rica and the Technological Institute were involved in the process, by means of the training and the technical testing of materials related with the bamboo. During this stage, the Foundation also commits the government of Costa Rica to facilitate lands to promote the cultivation of bamboo. This was achieved by means of donations of the Royal Government of The Netherlands and the United Nations Development Program (PNUD).

1.3.3. Execution stage of the Project CO 87/001: 1988-1992

With the support of PNUD and of the Dutch Government, the project of "Use of the bamboo in the construction of housing for social interests" began in 1998. In this stage the construction of bamboo housing, wood and "caña brava" begins in rural and indigenous communities of social interest. At that moment it already had proven technology that demonstrated the structural advantages of bamboo housing, when struck by earthquakes of important magnitude (e.g. in the community of Banano, province of Limon, 7.4 Richter, 1991, 30 bamboo houses faced the disaster without any damage, while other surrounding structures didn't resist the shock).

Additionally, in this stage, the cultivation of the *Guadua* bamboo began in extensions, which would later allow for the massive construction of houses. With the Dutch Government's support, the project determines its self-financing challenges and profitability, the necessity of competing in the construction market for social interest housing inside the framework of the System for Housing of Costa Rica. The necessity to generate new products of high aggregated value is introduced, which was the work object of the following phase.

1.3.4. Execution stage of the Project CO 90/005: 1992-1995

From the financial point of view, this stage is denominated the Mezzanine, in which the technology is already developed, the product is proven and what is required is to penetrate markets in a permanent and competitive way. This phase looked for to form a managerial and self-sufficient character of the National Project of Bamboo, which in 1996 becomes Funbambú.

The main projects' objectives that the National Program of Bamboo has developed are the following ones:

General objective: ***"To satisfy the housing necessities for the scarce resource rural population by means of a low cost solution that in turn contributes to the development of productive activities based on local natural resources that do not damage the environment and allows for sustainable development. The housing sector will be used as a motor directed to promote the economic and social development of the country, to diminish the current unemployment levels and underemployment, and to impel profitable short and long term economic activities that take place or increase of families' income and that contribute to an equal distribution of the national wealth"***⁴. For this purpose the crop capacity and treatment technology would be consolidated, the construction of housing for social interest would be intensified, and the use of the bamboo would be promoted.

Funbambú has focused its efforts in the technological development of the cultivation and manufacturing of *Guadua*.⁵ In the cultivation aspect they have achieved a technology that allows them to harvest material that gathers favourable physical-mechanical characteristics for the housing construction.

The national project of the bamboo has mainly produced *Guadua* Sur (*Guadua Angustifolia*). This is profitably used starting after the fourth year of being planted. The main advantages of the cultivation are outlined next⁶:

- ❑ Helps to the conservation of water resources.
- ❑ Protects the land from erosion.
- ❑ Offers refuge to the wild fauna.
- ❑ Mitigates the pressure of the forests.
- ❑ Offers wood of excellent quality.
- ❑ Is one of the most efficient species in the fixation of carbon.

In Costa Rica it is used mainly for:

- ❑ Furniture manufacturing.
- ❑ Construction materials.
- ❑ Export.

⁴ Funbambú, National Bamboo Project, Project COS-90-HOLLAND-MIVAH. May, 1997

⁵ In Costa Rica there are four Bamboo species: i) *Guadua* (South and Atlantic), ii) *Phyllostakys*, iii) *Bambusa* iv) *Dendrocalamus*. The Atlantic *Guadua* was originated in Brazil (it was introduced approximately 40 years ago) and in 1986 “macollas” (bunches) were used, already adapted to the Costa Rican conditions, to elaborate a first greenhouse. It is believed that the natives who traded in Central and South America introduced the *Guadua* Sur. It was planted in a similar way to the one on the “Paso de las Mulas”, used by the traders as sign that identified water or alimentary sources. The species *Phyllostakys* and the *Dendrocalamus* are cultivated in small quantities, mainly for experimental centres of the University of Costa Rica. The species *Vulgaris* is used to solve problems of erosion of the land, mainly in the margins of the rivers. However, no controlled or supervised process exist for this species’ use, instead you can classify it as a common practice.

⁶ In Costa Rica there are two autochthonous species of *Guadua*: the *Guadua Amplexifolia* and the *Guadua Paniculata*, located in the North area of the country, they are both considered to be medium size and they don't reach superior diameters to the 8 centimetres. Taken of Funbambú: “The *Guadua*, an alternative in your farm”, Fomento Agroforestal.

- Fence posts.
- Ecological Tourism

The capable areas for the plantation of *Guadua* go from the 0 meters to the 1200 meters high, which means that you can cultivate in almost the whole country's extension. The basic requirements are fertile soil, loose, humid floors prone to floods and of medium depth. The floors of better use are the sandy-oozy, clay-oozy or franc-clay-sandy, with minimum annual precipitation of 1300 mm, evenly distributed during the whole year. The temperatures should oscillate between the 20 and 26 centigrade degrees (op cit.).

A. Reproduction and cultivation of Guadua plantations.

The *Guadua* can be reproduced in a sexual and asexual way. The first one presents a great importance from the point of view of the genetic engineering and the resistance development to the atmospheric conditions where it is sowed, however this method is slow and the seed is not easy to gather (*Funbambú, Final Report, 1997*).⁷

The second is related with the asexual or vegetative propagation and it is the more used in the propagation of *Guadua* in Costa Rica, which can be through rhizome, section of the culms, branches or of cultivated meristemons in *in-vitro* form. Funbambú recommends for the culms asexual reproduction of *Guadua*, the use of shafts 2 to 3 years of age, in which the rooting is favoured, they will be taken to a greenhouse for their sows in bags and care taking during a period of approximately 6 months, After this period they are to be replanted in the field. Considering the costs (manpower, time, inputs, etc.), this reproduction method is more efficient.

In relation to the establishment and maintenance of the plantations, the best sowing time is the beginning of the rainy station (April and May), since the plants require vital conditions of humidity, at least during the initial five months. An appropriate preparation of the land, through improvement of the physical-chemical conditions and the elimination of weeds, favours the development of the plantlets and their faster growth, which at the same time allows the plant to compete better against the overgrowth, to which is very susceptible.

Product of the technological development in the cultivation that Funbambú has achieved, it has been determined that in that species it is essential to control the density of sows, due to its high multiplication speed. The optimised results of cultivation obtained by Funbambú indicate that the sowing techniques vary according to the land: from plantations of 5 x 5 (five meters x five meters) to the plantations of 5 x 10. The variations are carried out according to the land type, in which is recommended for loamy and heavy lands a smaller distance among the plants and for fertile and well-irrigated lands a larger extension.

⁷Funbambú gathered near 6000 plantlets, product of the flowering of *Guadua Atlantica* in its experimental station "Los Diamantes" in Guápiles, establishing in this way a propagation bank.

The better the conditions the floor presents, the greater the distance should be between the plants. The economic yield of the plantation is dependent on the distancing between the sows of the *Guadua*, because the maintenance costs, competition for the space, and finally the yield per hectare are dependent on the extension (op cit.).

At the moment in Costa Rica there is little more than 150 hectares of bamboo. Funbambú has 118 hectares of bamboo (the annex 1.1 shows a map with the localisation of these areas, according to the number that is indicated inside the parenthesis), distributed in the following way: 38 hectares in Guápiles, Limón (1) where there are two bamboo species found, the South and Atlantic *Guadua*; 16 hectares in Golfito, Puntarenas (2), where the *Guadua* Sur species is found; 30 hectares in Arenal, Guanacaste (3), where it has field the species *Guadua* Sur; 6 hectares in Río Jiménez, Limón (4) where the *Guadua* Sur and Atlantic species are sowed; 2 hectares in Turrialba, Cartago (5) with *Guadua* Sur, 4 hectares in La Estrella del Guarco, Cartago (6) where the *Phyllostachys* spp species is found; 6 hectares in Parrita, Puntarenas (7) with *Guadua* Sur species; 10 hectares in the EARTH (Agricultural College), Limón (8) where the species *Guadua* Sur is tinted; 4 hectares in Abangares, Guanacaste (9) where both the *Guadua* Sur and Atlantic species are found; and 2 hectares in Tortuguero, Limón (10) where *Guadua* Sur is found. AGROINDEBA in turn has 35 hectares, located in Pérez Zeledón, San José (11) where *Phyllostachys*, *Guadua* Sur and Atlantic are found.

B. Housing Construction

In the development of the bamboo sector in Costa Rica the fundamental final objective of Funbambú is the construction of "popular housing". The construction of these housings involves not only an economic activity but a social activity as well. In the process of construction, the Foundation uses a self-involvement plan; in others words, it incorporates the beneficiaries in the construction process. In order to diminish the costs and/or to improve the structural conditions, quality and durability of the materials, the construction technology and the design has experienced a constant evolution.

The government politics on popular housing in Costa Rica is fundamentally applied through a program denominated as the "*housing bond (voucher)*", which is a subsidy that surrenders families of scarce resources, which averages near \$4,113 per family during 1999. This amount is conceived as a partial support in the construction of that type of housing.

As it was indicated, the interest population's work force is involved. This workforce has to complete a series of requirements and characteristic of social character to qualify as beneficiary and to receive the government's subsidy. The Foundation takes care of qualifying the population's members in the construction of bamboo housing, through the use of speeches , videos and other tools within its reach. Once the population is trained, the construction of the houses begins.

One of the Foundation's biggest advantages is the price at which it can sell their houses in relation to the price of their competitors. The competitors' price is considerably larger due to their systems fundamentally based on concrete structures (*prefabricated and of integrated system*). According to data by Funbambú, for 1996 the price of a prefabricated *system* house, with rubbed floors, wooden roof structure, HG 28 cover, burnt bluster, without flat ceiling, without veneering, without furniture, is of ¢37.349 the m² (\$126.22), while the cost for an integral system house, rubbed floor, wooden structure roof, HG28 cover, burnt cement overlay, without flat ceiling, without veneering, and without furniture is ¢39.788 the m² (\$134.46). On the other hand, a house built by the Foundation has a cost of ¢28.594.00 for m² (\$96.63/m²).

The Foundation's first experiences with housing construction were carried out in the indigenous communities of Boruca, Térraba, and Rey Curre. At the beginning there was an aversion to the use of bamboo as construction material on the part of the potential housing users. To this material they related potential lower quality finishing or a less aesthetic look, and they believed the reason they offered them an option that contemplated bamboo was their scarce monetary resources. At the moment, after the construction of more than 1884 housings that perception is disappearing.

The communities interested in building with bamboo should complete the following requirements:⁸

- “Adequate accessibility and distance to the construction area and to each one of the lots (two-wheel drive vehicle transit able roads, existence of no dangerous bridges, proximity to the construction material's storage places, sand, stones, wood, bamboo, etc.)
- Concentration of the demand in the area. In population centres the distribution of materials and the inspection of the constructions is easier, this redounds as savings of the financial resources.
- Necessity of the housing: the community is inspected to evaluate the necessity and conditions encountered by the beneficiaries' families.
- Existent services, water supply, electricity services , storage cellars for materials, lodging for construction technicians.
- Other contributions: other institutions that can collaborate with the construction process exist: Municipalities, Development Associations, The Institute of Agrarian Development (IDA), Ministry of Public Works and Transportation (MOPT) and others.

However, the bamboo sector's development in Costa Rica faces a paradox: having directed to Funbambú all the attention to contribute to solve the problem of popular housing, under an outline of government financing, it transformed its goal into their main restrictive factor. At the moment, the level of activity of the Foundation in the construction area -that as mentioned above, energises the whole bamboo sector -, it totally depends on governments policies in regards to popular housing.

⁸ *Op cit.* page 20.

The main limitation is in *the quantity of housing bonds (vouchers) that are dedicated to that priority*, number that has become more and more restricted. On the other hand, the international financing abiding to the Foundation's objective is quite limited. That has put pressure on Funbambú to become financially self-sufficient, in order to maintain the continuity of the same operations the Foundation has to compete and take possession of the popular housing market, which for the same reasons is narrowed consistently. In summary, the dynamism of the bamboo sector in Costa Rica is subordinate to the politics adopted by current governments in matter resource readiness for popular housing.

The delivery of these housing bonds has been an instrument used by the political presidential candidates of the country, which tends to increase the expectations of the construction sector⁹ during the electoral campaign. In a country like Costa Rica that shows a relatively high fiscal deficit, and that has a political target to decrease subsidies, generating a permanent flow of funds to maintain the operating activities of the Foundation in a continuous form and at a level of efficient plant is less plausible.

Therefore, to energise the bamboo sector in Costa Rica in a sustained way it is imperious to generate new products that depend more on the market and less on the shifting resources, which politicians and the state are willing and are able of assigning. This not only will free the sector; but rather it will facilitate entrance of a larger quantity of actors.

C. Construction technology of bamboo

When beginning the housing construction stage, it became necessary to investigate topics related with the bamboo as a raw material for housing construction, for this purpose the Department of Investigation and Development was formed.

The investigation went mainly to the following topics: i) preservation and drying of the *Guadua*, ii) economic feasibility analysis, iii) drying and storage of the bamboo, and iv) anti-seismic and winds resisting capacity of the bamboo houses.

According to Funbambú, after that development process, the main conclusions are the following ones:¹⁰

- “Inside a holistic conception of the housing, the structural security is a fundamental element to guarantee its durability and to safeguard lives and goods against the agents of the nature.
- It is erroneous to suppose that the structural security should necessarily decrease, if lowered costs in social interest housing are wanted. It is perfectly possible to produce safe designs in housings of low cost, if the necessary technological

⁹ This is also demonstrated by the strength achieved by the National Project of Bamboo during the Government between 1986-90, which committed to build 80 thousand popular houses a year (this implied a growth of 33% in the annual growth rate in this type of construction.).

¹⁰ Op cit. Page 72.

support is generated and the technical attendance that guarantees the quality of the construction process is offered.

- The structural capacity and the low weight of the structural frame bamboo or wooden panels, the "esterilla" (laths) or "caña brava" closing, ", and cement mortar makes them excellent structural elements to resist earthquakes, such as demonstrated in the Limón earthquake on April 22 1991."

In 1996 the Costa Rican government expresses that it wants to expand the bamboo-cultivated hectares from 310 to 2000 in four years. That same year an agreement was signed between the IDA and the National Program of Bamboo. That bamboo extension would supply the raw materials to achieve proposals of joint venture with some Japanese firms. However, those plans were not materialised.

It is in fact during 1996 when the PNB becomes Funbambú, and to continue with the activities of I+D the *Centre of Investigation and Applied Technology for Bamboo* (CITAB) is founded. Among other projects they seek to develop the bamboo like a renewable natural polymer of high aggregated value, as a substitute that would displace the derived polymers of the petroleum when for its shortage the prices tend to increase and the traditional forest options tend to also be relatively more expensive. Other objectives are the investigation and promotion of the use and industrialisation of the bamboo; the transfer of technologies and knowledge associated to the use and manufacturing of the bamboo, and the development of new derived products of bamboo. Some of the proposals of the CITAB for the development of the sector bamboo have been:

- a) To establish experimental centres and training for the sustainable development
- b) To establish bamboo plantations for pulp and paper in Central America
- c) Industrialisation of the bamboo for the parquet production, plyboo roof sheets, crafts, etc.

1.4. Competitive arena of the bamboo sector in Costa Rica

A bamboo sector, which is dominated by a single producer (Funbambú) that has not still been able to enter a sustainable financial managerial dynamic, where there is only another small company (Agroindeba) that cultivates bamboo and is engaged in the manufacturing of bamboo furniture, and also engages few artisans trained by the Project of the Chinese Mission (Taiwan), in the use of a bamboo variety that is not cultivated in the country, is a very weak economic sector, in spite of all the technological development in cultivation and construction.

Recently, Funbambú and Agroindeba have begun the bamboo export in heaps (trozas) to the American market. For Funbambú, due to the height, thickness and rightness of the *Guadua*, that activity is much more profitable than the construction of houses for social interest. However, due to the reduced size of the plantations and to the fact that the

plantations are not in the harvest season they have not been able to assume important contracts.

On the other hand, Funbambú introduced the use of the "caña brava" as substitute for bamboo in construction. This happened due to the opportunity cost that implies using them in the construction process facing the export market. In this way, a very small third sector that takes advantage of wild extensions of "caña brava" has been stimulated.

In synthesis, the number of actors of the bamboo sector is reduced. The capacity installed in plantations is limited to the industrialisation options; the export of larger quantities will have to wait at least to the year 2002.

CHAPTER 2

Socioeconomic study of the workers of the bamboo sector in Costa Rica and the consumer group profile

CHAPTER ABSTRACT

The productive chain of bamboo and "caña brava" in Costa Rica is quite reduced in participants' number and in scale of operations. Two organisations stand out: Funbambú and Agroindeba (only private company). In the process of sows and harvesting, the primary one and the secondary one do not use female manpower. Women, who are generally young, with an average age of 22 years, intervene for the most part (88%) as salespersons in retail establishments.

In the process of sows and gathering, secondary and retail, the bamboo represents the main activity for the workers. Less than 50% of the workers of the secondary process are devoted to the bamboo as the main activity. In general, the workers have an education of at most elementary school and, to a smaller degree the secondary education; yet the majority of the consumers of furniture and souvenirs have a university level education. The bamboo house consumers, according to the social class to whom the "housing bond" is given, the majority of them have achieved only elementary school education.

Most of the workers are employees by contract. For the worker in the primary process, the highest wage average is of US \$416 and the lower one is on average US \$2,660 annually. The annual average income of the consumers of bamboo houses is of US \$3,715 similar to that of the workers in the sector. However, the consumer group for furniture and rattan souvenirs present an annual income of US \$12,000 per year and higher. The bamboo activity generates 76% and 73% of the revenues for the workers of the secondary process and the process of sows and gathering, respectively; as well as 100% of the revenues for those of the primary process and of the retailers. On average, the homes of the workers receive nearly 80% of their revenues from the bamboo sector. Most of these homes have a wide covering of basic services.

2.1. Methodology

At the beginning of this studied it was agreed (with INBAR) to reduce the sample size, due mainly to the fact that Costa Rica is a small country, and that it also has a relatively newly born and small bamboo sector in relation to countries like Ethiopia and other Asians countries of greater size, where the economic activity of the bamboo has a wide socio-economic importance.

In that way, finally it was agreed to carry out 180 surveys, distributed by process in the following way:

- a) Collecting/harvesting communities (villages/camps): 50 individual surveys.
- b) Primary processing communities (rural towns): 50 individual surveys.
- c) Secondary processing/manufacturing communities (rural/urban towns): at least 25 individual surveys.
- d) Retail sellers: 25 surveys.
- e) Consumers (market enters in urban towns/cities). 30 surveys.
- f) Policy bodies (urban towns/cities)-expert discussions will be conducted with appropriate government officials and stakeholders when possible.

As the project continued it was detected that the sector was even smaller than it was foreseen, and therefore that the most convenient thing was to develop a census on some workers of the productive processes a), b) and c).

The processes that are included in this work are structured in the following way:

- *Sows*: The actual sows, gathering, preparation and nursery care taking, plants cultivation, the bamboo plantation (of seeds or plants) and the maintenance of the plantations (it incorporates these same processes for the plantations of "caña brava").
- *Primary process*: it includes the transportation from the bamboo to the factory, their bamboo splints sawing (in Funbambú or Agroindeba), the drying and the preservation process of bamboo.
- *Secondary process*: It includes the manufacturing of furniture, the panel manufacturing for house construction, and the actual bamboo house construction.
- *Retailer*: It includes the sale of furniture, and bamboo souvenirs and rattan.
- *Consumer*: It includes the consumption of bamboo houses, furniture, and bamboo and rattan souvenirs.

The table 2.1 samples the origin of the data for type of productive process, as they come from census or sample information. In total 158 interviews were taken. These 158 interviews include eight of workers of sows of "caña brava" (the figures inside the parenthesis of that table include those workers), the 32% of the information comes from census information and the rest is random sampling. The *census information includes the whole process of sows* (as previously defined, except in "caña brava" where a random sampling survey was applied); *the primary and the secondary process* (except in the

construction of housings, where a sampling survey was applied in the projects that are developed at the moment). The information coming from retailers and consumers was taken from surveys. *In summary, most of the information of the productive activity of the bamboo sector (included “caña brava”) comes from a census; and the information of retailers and consumers (housing and bamboo and rattan products) of a sample.*

Table 2.1^{1/}

Sample Characteristics

Data Type	Sows	Primary Process	Secondary Process	Retailer	Consumer	TOTAL
	Sows and gathering, seed nursery plantlets, plantation and maintenance	Sawing, drying treatment, transport	Factories, panels sale and plantlets	House construction		
Census						
Sample						
Total	12 (20)	9	21	14	25	69
%	8% (13%)	6% (5.7%)	14% (13.2)	9% (8.7%)	17% (15.8%)	46% (43.7%)

Source: Instituto de Investigaciones Económicas, UCR

^{1/} Data in parenthesis includes a sample of "caña brava" sector.

2.2. Results

The following sections present the main results of the surveys carried out in the bamboo sector in Costa Rica. The annex 2.1, presents the surveys used. The annex 2.1.1. shows the survey applied to the worker (peon) of seed nurseries, plantation and maintenance. The annex 2.1.2 samples the survey applied to collectors; and the annex 2.1.3 the survey designed for workers of the primary process (sawed; drying; preservation and transportation) and of the secondary process (shop of Funbambú and Agroindeba S.A.; plantlets; factory of panels; construction of bamboo houses; bamboo export). The annex 2.1.4, presents the survey applied to the workers of retail establishments for furniture, bamboo and rattan souvenirs. The annex 2.1.5 is the survey used with the owners of those establishments. Finally, the annex 2.1.6 presents the survey applied to the consumers of houses, bamboo furniture, and bamboo and rattan souvenirs.

Before the results, the section 2.2.1 studies the origin of the information: census or sampling distribution, according to the productive processes. The section 2.2.2 discusses the stationary of the production and the distribution of activities. The workers' socio-economic characterisation of the bamboo sector and the socio-economic characterisation of bamboo housing, bamboo and rattan souvenirs and furniture consumers are presented in the section 2.2.3. This characterisation includes generalities; education aspects; recruiting formalisation, wages and revenues and other activities developed by the workers of the bamboo sector. The section 2.2.4 studies the bamboo sector workers' additional income sources. The section 2.2.5 shows the family income per source. Section 2.2.6 details the bamboo sector workers' household living conditions. Finally, the section 2.2.7 samples a profile of the consumers for bamboo houses, furniture and bamboo and rattan souvenirs.

2.2.1. The productive chain participants of the bamboo in Costa Rica

The table 2.2 shows that *in Costa Rica the productive chain of bamboo has a reduced number of participants*: a) Funbambú; b) Agroindeba S.A.; c) salespersons of "caña brava" and other salespersons and d) consumers of bamboo goods (others). The 23% of the population under study are Funbambú workers, 13% work in Agroindeba, only private company in Costa Rica that devotes to the cultivation manufacturing and distribution of bamboo furniture, located in Pérez Zeledón County. The elaboration of construction panels (by Funbambú) using "caña brava" has stimulated this small sector that is devoted to the use of wild extensions of "caña brava" (5%). The remaining 59% of the workers population of this sector that was studied is located in the "others" sector, which includes retailers and consumers of bamboo houses as well as of furniture and bamboo and rattan souvenirs.

Table 2.2
Studied population size by process and main entity

Process	Entity	Funbambú	Agroindeba	Caña brava	Others	Total	%
Sows, gathering, plantlets ^{1/}		4	8	8	0	20	13%
Sawing, drying, transport ^{2/}		9	0	0	0	9	6%
Panel factory		7	0	0	0	7	4%
Housing construction		14	0	0	0	14	9%
Furniture manufacturers		2	12	0	0	14	9%
Retailers		0	0	0	25	25	16%
Housing							
Consumers		0	0	0	43	43	27%
Others		0	0	0	26	26	16%
Total		36	20	8	94	<u>158</u>	
%		23%	13%	5%	59%		

Source: Instituto de Investigaciones Económicas, UCR

^{1/} Includes: The work in seed nurseries, plantlets care tanking, sows, bamboo, gathering and maintenance.

^{2/} Are included: factories with these process, due to the function duality performed by he workers in this process, which are in factories, sawing and drying.

The sow is the process that involves a larger participation of workers (13%).¹¹ It is interesting to note (table 2) that Agroindeba dedicates 60% of its workers to furniture manufacturing, while Funbambú only dedicates a 5% of its manpower to that process. On the other hand, Funbambú concentrates 25% on sawing and preservation, 19% in the manufacturing of panels and 39% of its workers in the actual construction of houses. *In summary, Funbambú is devoted fundamentally to the bamboo cultivation and the associate processes until the construction of bamboo housings. Agroindeba cultivates bamboo, but it mainly manufactures furniture.*

¹¹ Although the retail workers represent 16%, they don't dedicate 100% of their time to the sale of bamboo and rattan products. This aspect will be further discussed later on in this project.

2.2.2. Seasonal framework in the production and distribution of activities

Most of the processes are developed during all twelve months of the year (table 2.3). The process of sows and bamboo harvesting doesn't show stationary; but the harvesting of "caña brava" and the other processes have marked timeframes of low and high activity. The period of greater activity is during the months of September to December, and the one of lesser activity goes from December to March. In Costa Rica rattan is not sowed, but there is a demand for furniture manufactured with that material.¹² In house construction and the rest of the secondary process the products used are fundamentally the other bamboo varieties, except for the Vulgaris. The table 2.3 shows that only the workers of the primary process also carry out activities in another process (in this case the secondary one, the 56% of these workers do).

Table 2.3
Bamboo types used and stationary of the productive process

Variable	Sows and gathering ^{1/}		Primary process ^{2/}	Secondary House construction ^{3/}	Process other process ^{4/}	Retailer commerce ^{5/}
	bamboo	caña brava				
	N = 12	N = 8	N = 9	n = 14	N = 21	n = 17
Months in which it is developed	12	12	12	12	12	12
Bamboo species						
Guadua Atlántica	✓		✓	✓	✓	
Guadua Sur	✓		✓	✓	✓	
Vulgaris						
Phyllostakys	✓		✓	✓	✓	✓
Caña brava		✓		✓	✓	
Rattan						✓
Greater activity timeframe	None	Set-Oct	Oct-Dec	Oct-Nov	Oct-Dec	December
Lesser activity timeframe	None	Dec-Jan	Jan-Feb	Feb-Mar	Jan-Feb	Jan-Mar
% of workers performed by other process						
Process type:	0	0	0	0	0	0
Sows and gathering	0	0	0	0	0	0
Primary	0	0	0	0	0	0
Secondary	0	0	56%	0	0	0
Retail	0	0	0	0	0	0
Other	0	0	0	0	0	0
% of workers who own a bamboo plantation	0	0	0	0	5%	0
% of workers that want to continue working with bamboo	100	100	89%	Indifferent	100	100

Source: Instituto de Investigaciones Económicas, UCR

^{1/} Includes: The work in seed nurseries, plantlets care tanking, sows, bamboo, gathering and maintenance.

^{2/} Includes: Sawing, drying, treatment and transportation.

^{3/} This type of worker is dedicated to construction as their main activity.

^{4/} Includes: furniture factory of Funbambú and Agroindeba, plantlets, panel manufacturing and bamboo and rattan export.

^{5/} This type of worker is mainly dedicated to sales as their main activity, does not include the owners.

¹² During some time the Chinese Mission (Taiwan) imparted training courses on the manufacturing of rattan furniture. During that time small quantities of that material were imported, but at this moment these courses practically are not imparted.

It is interesting to notice that in most of the processes the workers don't have own bamboo plantations. The exception is presented in "*another secondary process*", which includes *a case* of a designer of bamboo furniture (for Funbambú). The 100% of the workers of sows and gathering, another secondary process (different to that of construction) and retailers manifest that they want to continue working with bamboo. In turn, near 90% of the workers of primary process want to continue working in this sector and the workers in construction are indifferent.

2.2.3. The workers' socio-economic characterisation for the bamboo sector and consumers of bamboo housing, bamboo furniture, and bamboo and rattan souvenirs

Table 2.4 shows a summary of the socio-economic characterisation of the workers of the bamboo sector (excluding the workers of "caña brava") per productive process. The columns identify the process (N indicates the number of observations per process, when is a census and n indicates the number of observation per process, when is a sample): sows and gathering; primary; secondary; retailer; and the final process of consumption of houses on one hand and of furniture and other (souvenirs) made of bamboo and rattan. The table is organised in five modules: A) generalities; B) education; C) employment condition; D) revenues; E) the worker's weekly costs associated to their work.

A. Generalities

The generalities module shows that the sows and gathering, the primary and secondary process do not use female manpower. The women-mainly young, with an average 22 years of age- take part in 88% of the retail sale process of the furniture and bamboo and rattan souvenirs. The men's age on average ranges between 29 and 40 years per process. In the sows and gathering, secondary process and retailers, the bamboo represents the main activity for the workers, except for the workers of the secondary process, where less than 50% are devoted to bamboo as their main activity. These workers work, on the average, more than 43 hours a week. It is interesting to observe that the age of consumer's group is greater than that of the working group, and that the furniture and souvenirs are consumed almost by the same proportion of women and men.

B. Education

The education module shows a duality: the workers achieved a maximum education level of primary school and, to a lesser degree, the secondary school level; but the majority of the consumers, particularly of furniture and souvenirs have an university education. The retail sales process is an exception, it uses workers which have (all) a primary education and an important proportion of them have secondary school level (47%), in 53% of the cases they even have university level education¹³. The house consumers, due to the social segment to which the bond of the housing is directed, in its majority have no education or reach a primary school level (secondary to a lesser degree). However, the consumer class

¹³ In general it is university youths that work as salespersons to supplement their revenues.

for furniture and souvenirs possess in its majority as a higher level of education the university level (88%) or as minimum level the secondary school (12%).¹⁴

Table 2.4
Socio-economic characterization of the bamboo process workers ^{1/}

Variable	Sows and gathering ^{2/} n = 12	Primary process ^{3/} n = 9	Secondary process ^{4/} n = 35	Retail ^{5/} n = 17	Consumer of house n = 43	Final furniture & other n = 26
A. Generalities:						
A. 1. Gender (% of men)	100	100	100	24	67	42
A. 2. Average age	33	40	29	22	44	40
A. 3 % Main activity	92	100	48	100	ND	ND
A.4. Weekly hour work	44	48	43	48	ND	ND
B. Education: (%)						
B. 1. None	0	11	0	0	21	0
B. 2. Elementary	84	56	51	0	60	0
B. 3. Secondary	15	33	49	47	19	12
B.4. University	1	0	0	53	0	88
C. Employment condition:						
C.1. By contract	75	78	36	82	NA	NA
C. 2. Per fact	25	22	67	18	NA	NA
D. Income: (US \$)						
D. 1 Weekly wage	63 (21)	74 (22)	72 (19)	54 (9) ^{6/}	66 (0) * ^{7/}	217 *
D. 2. Months worked per year	9	12	10	10 ^{8/}	12 **	12 **
D. 3. Derived annual wage ^{9/}	2660	4165	3377	2533	3715	12215
<i>D. 4. Other income sources:</i>						
Agricultural	67%	0	43%	0	ND	ND
Non agricultural	33%	0	57%	0	ND	ND
Weekly income for alt. sources	23 (51)	0	23 (49)	0	ND	ND
Annual income for alt. sources ^{10/}	598	0	498	0	ND	ND
D. 5. Total weekly income ^{11/}	86	74	95	54	66	217
D. 6. = (D.1/D.5) * 100	73%	100%	76%	100%	NA	NA
E. Weekly cost (US \$)						
E.1. Transportation	0	3.7	4.3	3.65	NA	NA
E.2. Food	0	0	0	0	NA	NA
E.3. Tools	0	0	0	0	NA	NA
E.4. Comissions	0	0	0	0	NA	NA
E. 5. Other costs	0	0	0	0	NA	NA

Source: Instituto de Investigaciones Económicas, UCR

^{1/} Not including the caña brava workers.

^{2/} Includes: nursery work, plantlets care taking, sows, gathering of bamboo and plantation maintenance.

^{3/} Includes: sawing, drying, treatment and transportation.

^{4/} Includes: furniture factory of Funbambú and Agroindeba, plantles, panel factory, housing construction, and bamboo and rattan exports.

^{5/} This column only includes data for the retail workers.

^{6/} A 53.75% of this income may attributed to sales of bamboo and rattan products, because that is the average ratio of the total sales that correspond to the sale of these articles in the sampled retail sector, the remaining 46.25% correspond to the average proportion of sales of other products.

^{7/} All the people interviewed are part of the same wage range.

^{8/} A two months frictional unemployment is assumed.

^{9/} The annual income includes a 13th month which is calculated with the formula: $((63*4.33)*9)+((63*4.33)*9/12)$.

^{10/} The alternative source derived annual income does not include a 13th month due to its temporary nature. Such is the case the banana plantation the workers do not work the required three months to receive this benefit.

^{11/} The total weekly income results of the sum of the weekly income(D.1), derived from the bamboo activity and other sources' weekly income(D.4).

* The income ranges change for these classes, the respective interviews are presented in the annex 2.1

** Supposedly they work all year long.

¹⁴ The above-mentioned should be emphasised, because it opens an interesting possibility to explore so that Funbambú directs a promotional campaign of housing construction directed to the professional middle class, which already consumes furniture and bamboo and rattan souvenirs. This is associated to the idiosyncrasy of the residence consumption, which perceives bamboo residence directed the poor and excluded strata. In that aspect an aggressive demonstrative effect is required that demonstrates the opposite.

C. Recruitment formality, wages and income

Most of workers are hired by contract, except in the secondary process in which the relationship is less formal ("in fact"). With relationship to the wage average of the workers *directly derived* from the productive processes in the sector of bamboo of Costa Rica, the table 2.4 shows that the highest weekly wage and the highest number of months worked during the year are presented in the primary process (US \$74 per week and 12 months a year respectively), which results in an annual average wage of US \$4,165. It is followed by the secondary process (US \$3,377). Next come the retailers (US \$2,433) and finally the workers of the primary process (US \$2,660). Note that the income of the consumer stratum for bamboo houses (bond of the housing through Funbambú) has an average income similar (US \$3,715 a year) to that of the workers of the sector. However, the consumer group for furniture and rattan souvenirs presents a higher annual income, which exceeds the US\$ 12,000 a year. *Again, in the entrance a duality is presented: the consumers of furniture and souvenirs present an income (wage) that is almost three times as large as that of the workers in the bamboo sector.*

D. Other worker activities of the bamboo sector

Table 4 indicates that the workers of the process of sows and bamboo gathering are devoted to other activities, mainly agricultural (67%), for which they receive an additional annual income of US\$598. In a similar way, the workers of the secondary process receive, mainly from non-agricultural activities, an additional average annual income of US \$498. The workers of the primary process and retailers are not devoted to additional activities. *In summary, the bamboo activity generates 76% and 73% of the revenues for the workers of the secondary process and of sows and gathering, respectively; as well as 100% of the revenues of those of the primary process and of the retailers.* Table 2.4, also shows that with the exception of a modest expense in transportation (less than US\$4.5 a week), these workers don't include any other costs to fulfil their functions.

2.2.4 The bamboo sector workers' additional income sources

Deepening on the alternative sources of income, table 2.5 indicates that 25% of the workers of the process of sows and bamboo gathering get other revenue. Of these, two thirds gain it through agricultural activities (coffee plantations) and the remaining third gain their additional income from another non-agricultural activity. In the case of the workers of sows and gathering of "caña brava", 75% work in the banana plantations. Note that within the secondary process, the construction workers are only devoted to the construction of bamboo housing or of another type (concrete, wood, mixed, etc.); but of the furniture manufacturing workers, construction panel manufacturing, or another manufacturing, 33% is devoted to other activities like coffee plantations (farm owners) or as salaried workers in the banana plantations and other activities.

Table 2.5

Alternative income sources for the workers in the bamboo sector in Costa Rica
(Amounts in US dollars)

Variable	Sows and gatherin ^{1/}		Primary process ^{2/}	Secondary House construction ^{3/}	process other process ^{4/}	Retail commerce ^{5/}
	bamboo	caña brava				
	N = 12	N = 8	N = 9	n = 14	N = 21	n = 17
	z = 3	z = 6			z = 7	
% that has another income source	25%	75%	0	0	33%	0
% Agricultural activity	67%	100%	0	0	43%	0
% Non agricultural activity	33%	0	0	0	57%	0
Weekly income per type of additional activity (\$) ^{6/}						
cane	0	0	0	0	0	0
coffe	96 (103) ^{7/}	0	0	0	127 (25)	0
banana	0	68 (0)	0	0	84 (0)	0
cattle	0	0	0	0	0	0
citric	0	0	0	0	0	0
other	78*	0	0	0	74 (30)	0
Month/year realizing that activity	6	3	0	0	3	0

Source: Instituto de Investigaciones Económicas, U.C.R.

^{1/} Includes: the nursery work, plantlets care taking, sows, bamboo gathering and plantation maintenance.

^{2/} Includes: sowing, drying, treatment and transportation.

^{3/} This type of worker is mainly dedicated to construction as their main activity.

^{4/} Includes: Furniture factory Funbambú and of Agroindeba, plantlets, panel factory and the bamboo and rattan exports.

^{5/} This type of worker are dedicated to sales as their main activity. It does not include the commerce owners.

^{6/} z represents the number of workers who have another source of income.

^{7/} Averages with respect to those reported by other income, standard deviation in parenthesis and exchange rate used
¢295.9/\$ US. (colones/dollar)

^{8/} The data results from only two extreme values.

* Only data

2.2.5. Family income per source

Table 2.6 presents a detail of the *family income* per source. The first line again indicates the average income derived by household in the bamboo sector. To study the homogeneity inside each process, the standard deviation is shown in parenthesis. In general, it can be observed that the revenues derived by the workers of the sector are quite homogeneous (except in "caña brava", where the standard deviation is almost of 50% of the wage). On average, the workers of the sector obtain US\$79 dollars a week (standard deviation of 11%). The 33% of the households possess alternative sources of income. Of these homes that have another source of revenues, the men contribute on average US \$39 a week and the women US \$74. When averaging the household income derived from the bamboo sector with the household income of other sources, a weekly income of US \$89 is obtained. This indicates that almost 80% of the family income is generated in the bamboo sector.

Table 2.6 ^{1/}

Structures of the family's weekly average income, of the workers of the bamboo sector in Costa Rica
(The first numbers in the column of sows and gathering excludes the workers of caña brava, the second includes them.) (In US dollars)

Variable	Sows and gathering ^{2/} n = 12/20		Primary process ^{3/} n = 9	Secondary process ^{4/} n = 35	Retailers ^{5/} n = 17	Average Income ? n = 73/81	
Bamboo income							
Sector Workers	63(21)	49(24)	74 (22)	72 (19)	54 (9)	72(9)	67(14)
Other family member's income ^{6/}							
% of households with other income	25%	45%	11%	20%	100% ^{7/}	33%	37%
Male	23(51)	34(46)	0	23 (49)	101 (2)	39 (51)	
Female	0	0	3 (8)	3 (11)	52 (17)	74 (34)	
Total weekly income	86	73	77	98	189	89	86
% generated in the bamboo sector	73%	67%	96%	74%	22%	78%	73%
# of family members per household	5 (2)	4(2)	5 (1)	5 (2)	4 (2)	5 (2)	
Household per capita annual income	651	554	864	788	2634	987	968

Source: Instituto de Investigaciones Económicas, U.C.R.

^{1/} Standard deviation in parenthesis and exchange rate used ¢295.9/\$ US (colones/dollar).

^{2/} Includes: work in seed nurseries, plantlets care taking, sows, bamboo gathering and plantation maintenance.

^{3/} Includes: sawing, drying, treatment and transportation.

^{4/} Includes: the furniture factory of Funbambú and Agroindeba, plantlets, panel factory, house construction and bamboo and rattan exports.

^{5/} This type of worker is mainly dedicated to sales as their main activity, it does not include the commerce owners.

^{6/} Members younger than 12 between 12 and 17 are not included in others family members, due to the fact that income is not reported for any of the two groups.

^{7/} The retail worker are not household heads, and the households which they are part of have alternative income sources.

On average (table 2.6), those homes are composed of five members and they have a per capita annual income of nearly US \$1,000. The individual annual per capita household income of the retail workers stands out, due to the fact that most homes have an additional source of income; therefore, when considering the family income (parents), the annual per capita income amounts to more than US \$2,500. The lowest annual per capita income is that of the household of the workers of sows and bamboo gathering (US \$651).

2.2.6. Household living conditions of the workers in the bamboo sector

To study the living conditions of these households, table 2.7 presents several indicators of quality of life: More than 50% of these homes (80% in the case of those of workers of sows and gathering) have their own housing. The 100% of the retailer's homes are his or her own (which is the workers parents' property). On average their house's size ranges between 40 to 70 m², and practically 100% of the households have electricity, drinkable water, bathroom, and public transportation.

Table 2.7 ^{1/}

Workers' quality of life indicators in the bamboo sector
(data in percentages)

Variable	Sows and gathering ^{3/} N = 12	Primary process ^{4/} N = 9	Secondary process ^{5/} N = 35	Retailer ^{6/} n = 17
Property:				
Own	80 [10]	56 [5]	58 [20]	100 [17]
Rented	10 [1]	11 [1]	15 [6]	0
Loaned	10 [1]	11 [1]	6 [2]	0
Other	0	22 [2]	21 [7]	0
Size:				
Less 40 m ²	35 [4]	33 [3]	18 [6]	0
40-70 m ²	60 [7]	55 [5]	47 [17]	47 [8]
70-100m ²	5 [1]	12 [1]	21 [7]	24 [4]
100 m ² +	0	0	14 [5]	29 [5]
Type:				
Concrete	40 [5]	33 [3]	45 [16]	100 [17]
Wood	20 [2]	37 [3]	15 [5]	0
Socle	40 [5]	30 [3]	40 [14]	0
Basic Service:				
% w/ toilet	100 [12]	100 [9]	100 [35]	100 [17]
% w/ electricity	100 [12]	100 [9]	100 [35]	100 [17]
% w/ potable water	100 [12]	88 [8]	100 [35]	100 [17]
% w/ public transport	95 [11]	100 [9]	100 [35]	100 [17]
Others services:				
% w/ medical insurance	75 [9]	89 [8]	58 [20]	18 [3]

Source: Instituto de Investigaciones Económicas, U.C.R.

^{1/} Clasp totals

^{2/} Does not include caña brava workers

^{3/} Includes: nursery work, plantlets care-tanking, sows, bamboo gathering and maintenance

^{4/} Includes: sawing, drying, treatment and transportation.

^{5/} Includes: furniture factory of Funbambú and Agroindeba, plantlets, panel factory, house construct.

^{6/} This column only includes retail workers.

2.2.7. Bamboo houses, furniture, bamboo souvenirs and rattan goods consumers' profile

In addition to the previous information, the information on the consumers is presented next. Table 2.8, indicates that the two thirds of the bamboo housing consumers (of social interest) are men, most with completed elementary school education and less than 20% with completed secondary school education. On average their monthly income is located between US\$101-US\$473. This is contrary to the profile of the furniture and souvenir consumers, which consume these goods in practically the same proportion, independently of their sex. In this case, near 90% have an university degree, with an approximate monthly income of US \$1,000, of which have spent, on the average, little more than US\$73 per month in furniture and bamboo and rattan souvenirs in the last year.

Table 2.8 ^{1/}
Consumer characteristics

Variable ^{2/}	House	Furniture and souvenirs
	n = 43	n = 26
Average age	45	40
Gender		
% male	67% [29]	42% [11]
% female	33% [14]	58% [15]
Education:		
Elementary	60% [26]	0
Secondary	19% [8]	11% [3]
University	0	89% [23]
None	21% [9]	0
Montly average income	\$101 -\$473	\$938
Expense on product during last year	ND	\$73

Source: Instituto de Investigaciones Eeónmicas, U.C.R.

^{1/} Clasp totals

^{2/} At first, the survey asked for plant consumption, but there was none.

^{3/} Income expressed in dollars using an exchange rate of ¢295.9/\$ US.(colones/dollar)

The table 2.9 indicates that, of the studied sample of bamboo housing consumers, 98% consider that those houses are of same or better (72%) quality than those of another material. 100% consider that they have a lower price, with a same or greater useful life (72%) and 100% consider the houses have the same look and 60% a better look. The table 2.10 shows that on average, 95% of the consumers of furniture and souvenirs say that the quality of those products is of same, or better quality (42%) compared to that of the substitutes. The 85% consider that the price is the same or smaller (62%) and 100%

say that they have the same quality that the substitutes, with the same attractiveness (88%) or better.

The table 2.11 indicates that most of consumers (65%) indicate that they would enjoy bamboo furniture. The table 2.12 presents the improvements recommended by the consumers: 33% of them consider that they should improve (the finish), 33% say that they should improve *the variety*. 72% of the suggestions were directed to aspects associated to the *housing* (price and size, which is of 40 m2).

Table 2.9

Average evaluation of the bamboo and rattan product quality by consumers (data in percentages, number of housing consumer surveys:43)

HOUSES

Aspect	Greater	Lesser	Same	NS/NR
In quality	72	2	26	0
In price	0	100	0	0
In useful life	72	12	16	0
In attractiveness	60	0	40	0

Source: Instituto de Investigaciones Económicas, U.C.R.

Table 2.10

Average evaluation of the bamboo and rattan product quality by consumers (data in percentages, total of consumers surveys: 23)

FURNITURE

Aspect	Greater	Lesser	Same	NS/NR
In quality	42	0	53	5
In price	15	62	23	0
In useful life	0	0	100	0
In attractiveness	8	0	88	4

Source: Instituto de Investigaciones Económicas, U.C.R.

Table 2.11 ^{1/}

Other suggested bamboo products consumers would like

Products	Percentage
Furniture	65%
Other furniture ^{1/}	21%
Ornament	14%

Source: Instituto de Investigaciones Económicas, U.C.R.

^{1/} Clasificación for the furniture consumers that suggested other types of furniture.

Table 2.12

Aspects that should be improved according to the consumers in the bamboo product

Aspects	Percentage ^{1/}
Finish	33%
Variety	33%
Quality	27%
Other ^{2/}	72%

Source: Instituto de Investigaciones Económicas, U.C.R.

^{1/} It does not add to 100% because one consumer may choose more than one option.

^{2/} In housing, there were suggestions with respect to price and size that were categorized as others.

Chapter 3

Financial analysis of the bamboo sector in Costa Rica

CHAPTER ABSTRACT

The activities related with the bamboo sector in Costa Rica present appropriate levels of profitability that vary proportionally with the scale of the plant, the rate of extraction of culms and the percentage of the sales for export, and it varies inversely with the density of the plantation.

Three restrictions that impede the good development of the sector exist. The first one is related with financing, which increases the rates of the shareholders' return substantially on the investments and it facilitates the caña brava allocation of private resources through the sector. The second is related to the concern of the discontinuity in the investigation that has been generated recently in the country because the credibility that this investigation generates in managers is vital for the good development of the sector. The third restriction is related with the marked differential in prices that exists between the international market and the national one, based mainly in the lack of alternative uses of the material in Costa Rica, investment is required in technical and processes development that allow to balance the prices with the international markets.

In connection with the housing construction of bamboo materials, it is observed that Costa Rica has overcome the technological barriers associated to the handling of the material. Currently the project is in a stage with high possibilities of growth and it generates appropriate levels of profitability; in contrast with an initial phase in which the investment in technological development and positioning in the market, demands investment levels that diminish the profitability of these projects considerably. During the last three years, the subsidy to the popular housing has been diminishing, resulting in a decrease in the market goal of bamboo housing construction. Therefore, the activities of housing construction should be expanded to new social sectors that guarantee the financial sustainability of the project in the long term.

3.1 Description of the pattern of production consumption of bamboo

The chain of production of the bamboo begins in the *seed nursery*, as can be noticed in diagram 3.1. The existent nurseries in the country are not of commercial character, they are inside the same plantations, and due to this they are the main demanders of their product. Occasionally plants is sold to the public, who uses them with ornamental ends, plants have also been sold for export in isolated cases, mainly to the rest of Central America. The Centre of Agricultural Investigations of the University of Costa Rica maintains bamboo nurseries, for investigation purposes and not commercial.

The bamboo production cannot be considered an economic activity per se. This should be seen in conjunction with the plantation, since for the limitations of the market it would be impossible for this segment of the chain to economically sustainable in isolated form. The production chain should be understood in separate form for didactic ends. However, one must be practical and coherent when defining it in economic terms, since the activities should be supplemented to each other to achieve an appropriate level of profitability for the different projects.

The second link of the production chain is the *plantation*, which begins with the preparation of the land for the sows and it concludes with the harvest of the bamboo. The time, inputs and costs associated with this activity are described in detail in the section 3.2. Four years lapse from the moment of the plantation, until the moment of the first crop of shafts. However, they reach smaller diameters (they are used in small furniture and souvenirs), and it won't be until the sixth year that an enough diameter is reached to be used in exports activities and production of panels for the construction of houses.

In the same plantation there are two productive plants, a denominated "*reglillas*" (*laths*) *factory* and another *preservation and drying plant*. The time required by the bamboo from the moment that it is cut until the moment is treated or sawed is relatively scarce (less than 24 hours); therefore, these processes should be carried out as soon as possible, and for that reason both plants are installed in the plantations. Again, the problem of the separation between the links of the chain of production consumption is present. The sawing process and the treatment process can be studied as isolated activities, however from an economic point of view it would not be viable if they were not inside the same plantation. For this reason, for the effects of the financial analysis a block denominated plantation will be created. It includes the nursery, the treatment and the sawing of the material.

The following link in the production chain is the industrialisation of the material, which has been divided in three different items: the first one is the export, the second the panel manufacturing and housing construction and the third, the handmade shops.

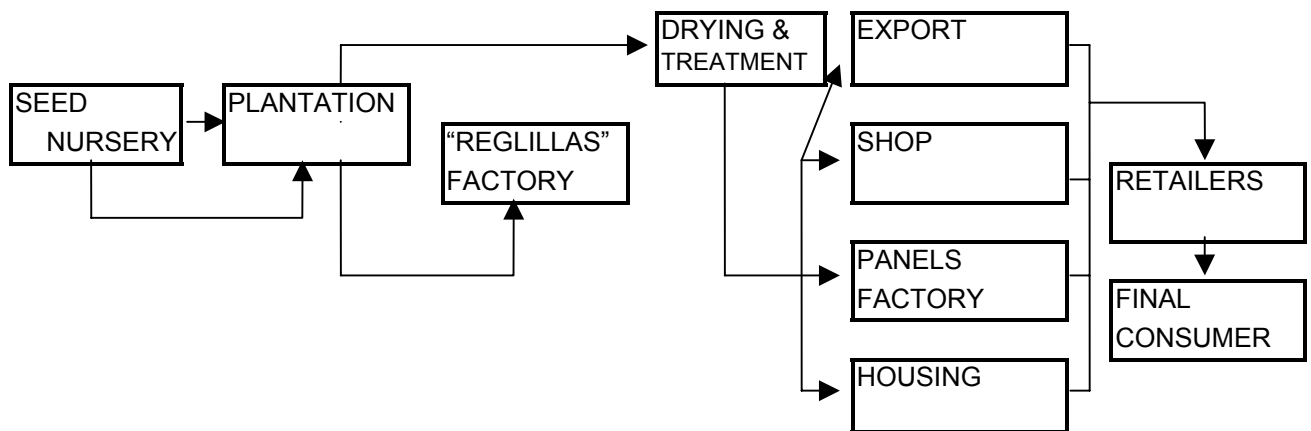
As it will be analysed in detail in the following section, an important price differential with respect to bamboo exists between the national market and the international market. The international market larger magnitude makes the profitability of the plantation projects an increasing function of the exports. Secondly, due to the vertical integration of

the process, the manufacturing of panels and the housing construction should be understood as a single activity from an economic point of view.

The activity related with the small handcrafts' shops is not considered a profitable industry currently, since the final product is not competitive, but rather a product carried out with raw material and little elaboration. The only factory that elaborates products of good quality is the factory of Funbambú. However, more than a factory is an investigation centre and development of techniques for the production of bamboo furniture, for this reason the final product, although it is of good quality, it doesn't reach the quality of the traditional woodworks, and its price is relatively high.

Later on the product is taken to the retailers who don't specialise in the sale of one single product; but rather they are distributors of several final products, such as wooden furniture, crafts, etc. and who ultimately have the contact with the final consumers.

Diagram 3.1 Production-Consumption system for bamboo



Source: Own elaboration based on Funbambú.

Next, financial simulations of the different economic activities are carried out, which are summarised in the plantation and in the construction of housings, which as mentioned earlier, include as paragraphs the other activities.

3.2 The plantation of Bamboo

The process of bamboo plantation includes the nursery process, the sawing process and the materials treatment, which may later be used for national and foreign export. In both cases the sales are carried out in place, in other words, without freights included, which means that the transportation activities are not included in the financial analysis.

The costs and revenues that are projected in the analysis are the product of several interviews with officials of the National Bamboo Foundation and the document

denominated "Establishment, handling and maintenance cost per hectare."¹⁵ All the figures are presented in US dollars. This facilitated the comparison of the internal rates of return.

The plantation begins to perceive revenues the fourth year, time in which 800 culms of smaller diameter can be exploited per hectare for the elaboration of furniture, which has a price in the national market of \$0.13 the lineal meter. On average the height of these shafts is of 2.75 meters, for what the revenues reach the \$286/Ha. For the fifth year those culms reach a height of 3 meters, for what the revenues are increased to \$312/Ha. The sixth year, the bamboo reaches a bigger diameter, and it is quoted at \$0.26/meter, taking advantage of 800 pieces 9 meters each one, for what the expectation of revenues reaches \$1.638/Ha. That figure continues growing until reaching its maximum of \$2.808/Ha in the ninth year.

The *bamboo price* varies according to its characteristics, the fourth year it is of \$0.13 per lineal meter and later on it reaches the value of \$0.26 in the national market. However, the export prices differ substantially from the national prices, and a possibility is not glimpsed for these prices spread to a balance in the medium term. This basically for two reasons: first the technology lack that exists in the country to process the bamboo (Ply boo), which would increase the value of the same one in a competitive atmosphere, and second, the consumption of the bamboo in the exotic market (particularly in the United States of North America), could not be reached in the nationally. The effective international prices for the export vary between \$2.39 and \$3.08 the lineal meter. Table 3.1 shows the export prices:

Table 3.1 Effective prices for export

DIAMETER	METER	US \$	US \$/METER
3-4 IN	3.05	7.5	2.46
3-4 IN	3.66	8.75	2.39
3-4 IN	4.27	10.5	2.46
3-4 IN	4.88	13.5	2.77
3-4 IN	5.49	15	2.73
4- 5 IN	3.05	8.5	2.79
4- 5 IN	3.66	10	2.73
4- 5 IN	4.27	12	2.81
4- 5 IN	4.88	15	3.08
4- 5 IN	5.49	16.5	3.01

Source: Funbambú.

To carry out the projections from the attributable cash flows to a bamboo plantation, several assumptions should be made. The first one is that the price remains constant. This may not happen if the effect is analysed on the price of an increment in the offer of the

¹⁵ Funbambú. Cost, Handling and Maintenance. Forest Industrialisation Division, Forest Unit. November 1996.

country, but at the same time it could be true if that country is a small exporter in the international markets. With the purpose of being conservative in the projections an international price of \$2.10 per lineal meter is assumed. The projection of the cash flows depends on some variables, for example:

- ❑ Type of reproductive material
- ❑ Topography of the land
- ❑ Type of vegetation (charral, tacotal, herdsman, etc.)
- ❑ Climatic factors (precipitation, temperature, hours of light, etc.)
- ❑ Density of sows
- ❑ Manpower quality
- ❑ Roads and access to the plantation
- ❑ Transportation of the reproductive material

It is determined by the assumptions that the previous conditions are normal in the country. The non-qualified manpower is measured in wages, which have 8 hours each. The cost of labour is of \$9.92, including social, insurance, holiday compensation, worker compensation and schooling voucher. The first costs that should be taken into account for the establishment of a plantation are shown in the table 3.2.

Table 3.2 Establishment costs per Ha.

	Labour	US \$ Costs
Veneering	4.30	
Cutting of stakes and	3.00	
Rounding	2.00	
Plantlets distribution, drilled & sows	4.20	
Labour Totals	13.50	133.92
Plantlets		440.00
TOTAL		573.92

Source: Funbambú .

In relationship to the maintenance and handling during the first three years of plantation, the topography of the land, the types of vegetation, the climatic factors and the quality of the manpower should be kept in mind. The costs used are the effective values in the market. The applications of fertilisers are made in the following way, 10-30-10 after the sows, complete formula and "nutrán" (a kind of fertiliser) in following applications. These costs are shown in table 3.3. It is observed that the main component of these costs is manpower.

Table 3.3 Maintenance costs and handling per Ha.

	Year 1	Year 2	Year 3
Maintenance (labour numbers)			
Total veneering	8.00	6.00	4.00
Veneering per	1.00	1.00	
Rounding	4.00	2.00	
Herbicide application	3.00	3.00	
Fertilisation	1.00	2.00	3.00
Handling			
Un-Branching		4.00	11.00
Labor totals (dollars)	178.56	178.56	179.28
Consumption (dollars)			
Herbicide Roundup (dollars)	18.10	18.10	
Fertilizers (dollars)			
10-30-10 (dollars)	29.78	43.26	57.68
Nutran (dollars)	22.84	22.84	22.84
Total (dollars)	249.28	262.76	259.08

Source: Funbambú.

The variable costs of the sows of bamboo are shown in the following table that as in the previous table are taken from estimates of Funbambú, and they are considered on the base of the market value. The costs of handling of the plantation vary starting from the year 4, these shown in the table 3.4. One can observe that these costs diminish for the years 5 and 6, and again increase in the following years, mainly for the increment in the manpower use.

Table 3.4 Handling costs for year 4 and on

	Year 4	Year 5	Year 6	Year 7-8	Year 9+
Number of					
Wages					
Fertilisation	1.00	1.00	1.00	1.00	1.00
Un-branching	3.00	3.00	3.00	3.00	3.00
Sparse	12.00	18.00	22.00	25.00	28.00
Total of Wages	16.00	21.00	26.00	29.00	32.00
Total of Wages (\$)	158.72	218.24	257.92	287.68	317.44
Inputs (\$)					
Complete formula	115.36	115.36	115.36	115.36	115.36
Total	274.08	333.60	373.28	403.04	432.80

Source: Funbambú.

Three alternative methods of plantation exist. Which is chosen depends on the characteristics of the land and of the quality of the floor. The bamboo can be sowed with different distances between each other: from five square meters in between to seven square meters. The organisation of the land can be carried out in the following ways; the first one is the plantation 5x5 that is for heavy, humid and loamy floors, the second 7x7 for light floors, and 6x6 in the middle. Three rates of extraction of mature culms also exist: 50%, 33% and 25%. With the three extraction rates the plantation is sustainable. The different combinations of extraction rates per hectare according to plantation type and extraction rate are shown in table 3.5.

Table 3.5 Rates of extraction of the bamboo per Hectare according to plantation type and extraction rate (number of culms)

PLANT	EXT	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11+
5X5	50%	1,100.00	2,700.00	3,900.00	5,000.00	5,000.00	5,000.00
	33%	740.00	1,840.00	3,300.00	4,040.00	4,040.00	4,040.00
	25%	600.00	1,450.00	2,700.00	3,300.00	3,300.00	3,300.00
6X6	50%	760.00	2,150.00	3,105.00	3,975.00	5,000.00	5,000.00
	33%	510.00	1,465.00	2,625.00	3,360.00	4,040.00	4,040.00
	25%	415.00	1,550.00	2,150.00	2,750.00	3,300.00	3,300.00
7X7	50%	560.00	1,600.00	2,280.00	2,920.00	3,675.00	5,000.00
	33%	375.00	1,075.00	1,920.00	2,460.00	3,100.00	4,040.00
	25%	300.00	845.00	1,575.00	2,020.00	2,545.00	3,300.00

Other expenses taken into account are those of marketing and sales, administration, drying, treatment, sawing, vehicles, cellars, security, etc. A complete model of the projections is shown in the tables A.3.1.1 at A.3.1.7 in the annex 1. The used methodology was that of projection of operative cash flows, for which were defined the different administrative expenses and investments in the project, and revenues are modelled according to the methodology described previously in this section. To estimate the internal rates of return of the projects projections for 38 years were carried out, which for financial effects, is considered perpetuity. The models that were formulated have basically two variables, the size of the plantation and the percentage of export of the total sales. The size of the plantation varies in increments of 20 Ha., from 20 up to 100 Has, and the export percentages change 0% up to 100% in increments of 25%.

The first results can be observed in table 3.6. The rate of relevant discount for the risk related with this project is of 20%, due to its agricultural nature, its dependence of the international markets, and for the investment alternatives that could generate those yields.

One can observe that a direct relationship exists between the IRR of the plantation projects and its size, the larger the project, the larger its profitability, mainly for the implicit economies of scale in the operation of the same ones. However, none of the projects reach a profitability level associated to the risk of the project that justifies their investment in this scale, therefore they are not profitable.

Table 3.6 Analysis of profitability of the bamboo plantation with 100% of the sales in the country and 0% abroad

Sows	Extraction	100 have	80 have	60 have	40 have	20 have
	50%	17.19%	16.24%	14.80%	12.32%	6.81%
5X5	33%	14.51%	13.58%	12.15%	9.68%	3.99%
	25%	12.18%	11.23%	9.80%	7.28%	N.D.
6X6	50%	16.36%	15.45%	14.06%	11.68%	6.37%
	33%	13.88%	12.97%	11.60%	9.21%	3.67%
	25%	11.78%	10.86%	9.46%	6.99%	N.D.
7X7	50%	15.27%	14.41%	13.10%	10.84%	5.78%
	33%	12.97%	12.09%	10.76%	8.46%	3.08%
	25%	10.83%	9.94%	8.59%	6.22%	N.D.

Source: Own elaboration based on Funbambú data.

As may be seen in the table 3.7, when being increasing the export percentage of exports to a 25% of the total sales, one can observe that the great majority of the projects present an appropriate profitability with relationship to its level of risk. The above-mentioned exception is the small plantations (20 Has) whose profitability doesn't reach the wanted level.

Table 3.7 Analysis of the profitability of the bamboo plantation with 75% of the sales in the country and 25% abroad

Sows	Extraction	100 ha	80 ha	60 ha	40 ha	20 ha
5X5	50%	30.52%	29.51%	27.97%	25.31%	19.54%
	33%	27.21%	26.23%	24.73%	22.16%	16.58%
	25%	24.48%	23.51%	22.04%	19.51%	14.04%
6X6	50%	28.97%	28.01%	26.54%	24.01%	18.53%
	33%	25.98%	25.04%	23.61%	21.15%	15.81%
	25%	23.71%	22.77%	21.33%	18.88%	13.57%
7X7	50%	27.03%	26.12%	24.74%	22.36%	17.23%
	33%	24.52%	23.61%	22.23%	19.86%	14.75%
	25%	22.06%	21.16%	19.80%	17.47%	12.44%

Source: Own elaboration based on Funbambú data.

With a level of exports of 50% (table 3.8), practically all the production scales are profitable. The problem persists with some extraction rates in the plantations of 20 and 40 Ha. Consistent with the previous models, one can observe that the level of profitability is a direct function of the size of the plantation and of the level of exports.

Table 3.8 Analysis of profitability of the bamboo plantation with 50% of the sales in the country and 50% abroad

Sows	Extraction	100 ha	80 ha	60 ha	40 ha	20 ha
5X5	50%	37.82%	36.78%	35.19%	32.43%	26.35%
	33%	34.14%	33.13%	31.59%	28.91%	23.06%
	25%	31.18%	30.18%	28.66%	26.03%	20.31%
6X6	50%	35.87%	34.87%	33.35%	30.72%	24.95%
	33%	32.56%	31.59%	30.11%	27.56%	21.97%
	25%	30.19%	29.21%	27.73%	25.18%	19.63%
7X7	50%	33.45%	32.51%	31.08%	28.60%	23.20%
	33%	30.81%	29.87%	28.44%	25.97%	20.61%
	25%	28.13%	27.21%	25.80%	23.38%	18.14%

Source: Own elaboration based on Funbambú data.

With a level of 75% of exports (table 3.9) the problems of profitability are solved, independently of the scale of the plantation all the projects are profitable for the associated risk. The positive and direct relationship with the level of export of the final product is still observed, that is to say, the greater the export level, more profitable the plantation project.

Table 3.9 Analysis of profitability of the bamboo plantation with 25% of the sales in the country and 75% abroad

Sows	Extraction	100 ha	80 ha	60 ha	40 ha	20 ha
5X5	50%	43.01%	41.96%	40.33%	37.50%	31.21%
	33%	39.07%	38.04%	36.46%	33.72%	27.67%
	25%	35.94%	34.93%	33.37%	30.68%	24.76%
6X6	50%	40.77%	39.76%	38.20%	35.50%	29.54%
	33%	37.24%	36.25%	34.74%	32.12%	26.35%
	25%	34.79%	33.80%	32.29%	29.67%	23.93%
7X7	50%	38.02%	37.06%	35.59%	33.04%	27.45%
	33%	35.28%	34.32%	32.86%	30.32%	24.77%
	25%	32.45%	31.51%	30.07%	27.58%	22.16%

Source: Own elaboration based on Funbambú data.

With 100% of the total sales directed to exports (table 3.10), the profitability of this scenario reaches an amount of almost twice as much as the first scenario, base on this financial analysis, it is evident that, efforts should be directed toward the plantations for export.

Table 3.10 Analysis of profitability of the plantation of bamboo with 0% of the sales in the country and 100% abroad

Sows	Extraction	100 ha	80 ha	60 ha	40 ha	20 ha
5X5	50%	47.10%	46.02%	44.37%	41.48%	35.04%
	33%	42.94%	41.90%	40.30%	37.50%	31.30%
	25%	39.68%	38.65%	37.07%	34.33%	28.26%
6X6	50%	44.62%	43.59%	42.02%	39.26%	33.15%
	33%	40.91%	39.91%	38.37%	35.70%	29.79%
	25%	38.41%	37.41%	35.87%	33.20%	27.32%
7X7	50%	41.61%	40.63%	39.14%	36.54%	30.79%
	33%	38.80%	37.82%	36.33%	33.74%	28.05%
	25%	35.85%	34.89%	33.42%	30.88%	25.32%

Source: Own elaboration based on Funbambú data.

3.3 The bamboo as an alternative of production combined with other agricultural products

The bamboo is a complementary production alternative to other products, mainly the acorn squash, corn, and beans, all considered profitable activities in Costa Rica. In this way, the financial analysis of production only considers the profitability of the complementary project; all the costs and revenues of the project are considered variables,

for which the analysis of profitability is carried out per Ha. The assumptions made for the previous sections are still valid for this section.

In table 3.11 it is observed that the profitability increases as a function of the export capacity the company has, going from 38% for 0% export to 86% for 100% export. The conclusion as for the direct relationship between the export level and the profitability of the plantation projects are still valid.

Table 3.11 Internal rate of return of the bamboo as a complementary activity on the basis of the export volume

Percentage of export	IRR
0%	38%
25%	59%
50%	71%
75%	80%
100%	86%

Source: Funbambú.

Although the rates of profitability are high, it is convenient to analyse what would happen if financing possibilities were granted to the complementary activity of sows of bamboo. One can observe in a conservative scenario with the level of leverage from 2 to 1 and the interest rate of 8%, significant increments are observed in the internal rates of return of the projects, additional scenarios are shown in the annex 3.2 where a positive relationship is observed between the return of the shareholders of the company and the level of leverage, as well as an inverse relationship between the return of the shareholders and the rate of the debt.

Table 3.12 Internal Rate of Return of the bamboo like complementary activity on the basis of the export volume, a level of leverage of 2 to 1 and an interest rate of 8%

Percentage of export	IRR
0%	77%
25%	125%
50%	152%
75%	173%
100%	189%

Source: Own elaboration based on Funbambú data.

This financing type not only increases the profitability; but also makes feasible the realisation of the complementary project, because many of the farmers that have the possibility to carry out the project don't have the economic capacity, and the banks are not alternative at the moment to grant this type of credits.

3.4 The housing construction and the factory of panels¹⁶

As it was already said, the solution of housing of social interest has become the motor of development for the bamboo sector in Costa Rica. The National Program of Bamboo had as one of its main objectives the development of the technology for the construction of housing at low costs. In this field, the work the Foundation has been qualified of successful, since through the years it has developed construction techniques, which have equalled and improved the existent technologies in the country.

The focus of the Foundation was directed toward excluded social sectors that depend on a direct subsidy to be able to build it's housing. For this reason the factor of costs minimisation has always been present in the projects of the Foundation. The construction projects with bamboo techniques, except in isolated cases, and have not left the denominated "Popular Housing in Costa Rica" area.

One of the biggest problems Funbambú has faced is the corruption of the financing system for housing, in which the community leaders, in exchange for "commissions" or monetary compensation, direct the community to activities that are not necessarily the best option for them, but activities that respond better to their individual interests.

The main arguments of the leaders of the communities against the bamboo construction, are related with the material and with their social condition, where they argue that due to the poverty level of these communities, their housing problems are solved with lower quality materials, this in spite of the qualities and characteristics of the bamboo. Resistance has been presented on the part of some communities to accept this problem.

The descriptions of the popular housing that Funbambú offers are the following ones:

- ❑ Area of construction: 37 square meters
- ❑ Includes interior walls similar to the outside ones with average mortar (not burnt)
- ❑ Without flat ceiling
- ❑ Exterior doors and one interior door
- ❑ Septic tank and drainage with approval of the Ministry of Health
- ❑ Exterior painting
- ❑ Floors of rubbed concrete
- ❑ Bathroom and sanitary services, laundry facilities and accessories
- ❑ With roof sides without canoes
- ❑ Electric installation, hydraulic piping, and complete swage

Some of the assumptions that Funbambú uses in the costs estimate for housing are the following:

- ❑ Degree of dispersion of the normal housing

¹⁶ The estimates of costs for this section are taken from the document: "Fundamental Considerations for the Analysis of Costs of A Built Typical Housing for FUNMAMBÚ." Funbambú, 1999.

- ❑ Distances to the project between 50 Km and 100 Km. of the panel factory
- ❑ Regular conditions of accessibility
- ❑ Readiness of basic services (water, electricity and access routes)
- ❑ Acceptable and permanent readiness of manpower
- ❑ Readiness of materials

It can be observed in table 3.13, the costs of construction of a housing add up to \$4,491 which equals \$121 per square meter. The main item in that cost corresponds to materials, which is equal to 51% of the total. It is followed by the indirect costs, which include: accidental, administrative, authorised commission, engineering, and legal expenses. The manpower and the operation costs are other smaller expenses; the detail of these expenses is shown in the annex 3.3.

Table 3.13 Cost of a 37 square meter house

ITEM	COST (\$)	PERCENTAGE
MATERIALS	2,295.15	51%
LABOR	771.93	17%
OPERATION COSTS	376.19	8%
INDIRECT COSTS	1,047.95	23%
TOTAL	4,491.23	100%

Source: Funbambú.

According to the Federated School of Engineers and Architects in Costa Rica, the costs of a house between 30 and 70 square meters varies between \$151 and \$165 per square meter, therefore the Funbambú houses are competitive. The cost of the bamboo is the only thing that should be noted separately because it represents a 5.3% of the materials. That cost is valued with its national price, which differs significantly from the international one. If it is valued at the opportunity cost, the square meter arises to \$145, which results competitive in the national market.

So that a company in the Costa Rican market of the construction can operate efficiently, it requires administrative expenses that range between \$100.000 and \$130.000¹⁷ per year. This would imply that to reach the equilibrium point, between 290 and 370 houses per year should be built.

The high stationary that the construction sector in this country presents, as well as the dependence of these companies on the delivery of funds from the government, leads the companies to require large sums of working capital and good financing lines. Nowadays, those conditions don't exist in the market, mainly for the ignorance towards the product.

The construction of bamboo housing is justified mainly for a social objective. The rates of profitability of the projects of administration of the bamboo housing construction

¹⁷ Including labour, leases, equipment, personal expenses and others. Investigation is not included

companies are very low when the levels of initial investment overcome the million of dollars. This profitability can be increased by means of a financing plan to the sector.

To analyse the internal rates of return of the projects of bamboo housing construction, several scenarios are used, where the main variable is the investment that should be carried out to begin a construction project. This investment varies in increments of \$500.000, beginning at \$500.000, until it reaches the invested figure in the development of the construction technology with bamboo in Costa Rica, which is of \$8.000.000 (annex 3.3.). The manufacturer's gain is considered as a 10% of the value of the work, which represents the amount currently received by the Foundation for this purpose (\$344.44¹⁸). The number of houses varies as a function of the market participation covered. In the previous scenarios the numbers of built houses are increased from 100 to up to 500, in increments of 100 houses, which implies that Funbambú has a market participation in the construction of popular housings (housing bond (voucher)) of 2% to 10%¹⁹.

In the case of Costa Rica, the technology for the housing construction is developed, which means that the initial investment to begin a construction company is relatively low, between \$500,000 and \$1.000,000. This allows for a significant increase in the internal rates of return contrasting it to when investments are made of more than \$1.000,000 in technological development. This generates a competitive advantage in the construction of housings. The profitability results are shown in table 3.14 and the results of the scenarios are shown in annex 3.3. The results of the scenarios with financing are not included because their profitability is very low; therefore, the financing is not a viable alternative when the investment is increased. For this, donations or unilateral transfers should be used to develop the technology; such is the case in Costa Rica.

Table 3.14 Scenario of profitability of the housing construction projects an investment of US\$500,000 and sales of 100 to 500 housings per year.

INVESTMENT	NUMBER OF HOUSINGS	IRR
500,000.00	100.00	6.89%
	200.00	13.77%
	300.00	20.66%
	400.00	27.55%
	500.00	34.43%

Source: Instituto de Investigaciones Económicas, UCR

Those rates of profitability are improved with a financing plan, which is assumed to have an interest rate of 8% and at a level of 2 at 1. The results of the projects with those rates

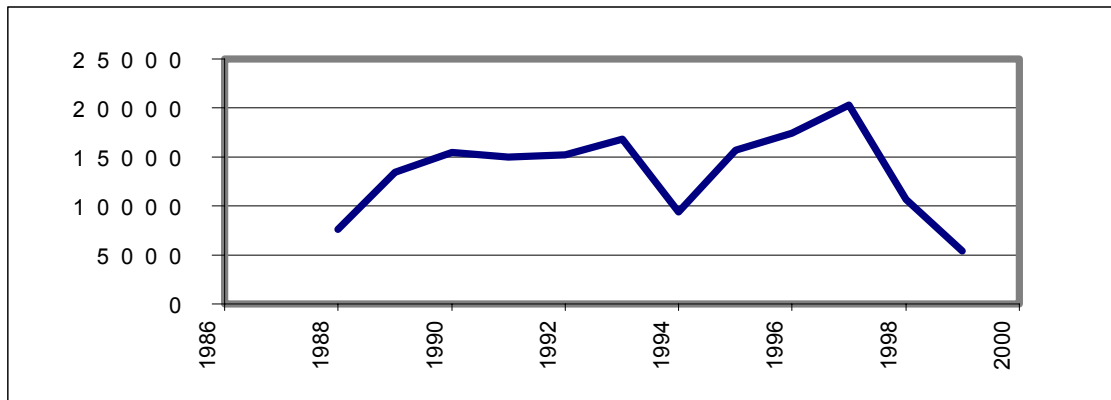
¹⁸ This fact is shown in the annex 3.

¹⁹ The market participation for Funbambú is the 1988 participation average. The participation percentage in the rural popular housing market is of 2%. In total terms (urban + rural) this participation is 1.2% on average. Data elaborated with base in the report by the Hypothecary Housing Bank named "Paid funds according to geographical area."

of leverage are those that shown in the table 3.14. Although the previous results indicate that the leverage increases the internal rates of return considerably, the narrowing of the market of popular housing restricts this option.

The market of popular housing, generated by the housing vouchers, are a result of a public politics, as a result, it has been drastically contracted during the last three years. This is clear, when observing that during 1997, 20.287 funds were granted and during 1999 there were only 5.416²⁰ housing bonds (vouchers) distributed. As shown in the graph 3.1, the number of funds assigned per year has presented a recurrent behaviour. However, the decreases have not been as evident as in the last three years.

Graph 3.1 Paid bonds (vouchers) for housing in Costa Rica (1986-1999)



Source: Own with data from Hypothecary Bank of Housing (BANHVI).

Even though, the above-mentioned decrease directly affects the bamboo construction activity in popular housing, it doesn't imply that the profitability of the projects necessarily diminish in the medium term. On the contrary, it opens other options so that the activity of bamboo construction explores new niches in the construction market, which would bring additional benefits from the point of view of diversification of the production as well as accesses to new markets.

²⁰ The figure for the year 1999 includes the funds assigned up to the 14/11/99.

Table 3.14 Scenario of profitability of the housing construction project with an investment of \$500,000 and sales from 100 to 500 houses per year and financing to 8% interest rate.

INVESTMENT	NUMBER OF HOUSES	IRR
500,000.00	100.00	5.33%
	200.00	21.86%
	300.00	38.38%
	400.00	54.91%

Source: Instituto de Investigaciones Económicas, UCR.

3.5 Sector bottlenecks

The sectors bottlenecks are the internal or external factors in the market that explain the little development of the sector in the country. The following ones have been identified:

- ❑ Financing
- ❑ Idiosyncrasy, promotion of exports and new markets
- ❑ Institute of Development and Technological Transfer

During the last years the bamboo sector has presented a significant increase. However, it should be taken into account that it began from scratch, as an initiative of the National Bamboo Plan . The bottlenecks are explained in the following paragraphs.

3.5.1. Financing

Financing is considered the main sector bottleneck. This due to two situations: the first one is that the commercial banks, when not knowing this activity thoroughly, become hesitant to grant credits. The second is that the institution that has been involved with the activity has got their funds from international organisations. That is to say, it was not forced to generate a net of contacts in the national financial sector.

In a country like Costa Rica it is important to analyse the variables in which the investment decisions depend. These many times don't respond to an economic approach; but respond to the facilities and the investors' customs.

As it is indicated later on, the financing would substantially increase the profitability rates of the projects to be carried out. To analyse the effect on the rates of profitability of the projects, the yield is calculated on the investment of increasing the leverage level on the same scenarios developed in the section corresponding to the bamboo plantation. Additional scenarios are also added, designed as a function of the leverage characteristics, resulting as variables the rates of leverage (passive ratio to patrimony) that varies from a ratio of one to one to a ratio of four to one, which is approximately the

leverage levels range that allows for the financial system of that country, including from a bank credit to a market opening.

In the canalisation of these resources, it is recommended to follow the approach of the Second Floor Bank. This is basically for two reasons: the first one is the knowledge that it is required of the sector to channel these resources toward activities that can possibly be profitable, which a commercial bank would not detect as easily as would an institution that has been in the area for some time. The second reason is related with the little agility of the non government organisations to support funds, which many times reach the final users due to their lack of knowledge, since they end up never finding out that these funds are available. If the financing institution knows the sector, somehow the canalisation of these resources becomes efficient.

In this section it is not considered pertinent to carry out a detail of the costs of the program, since these should be attributed to an institution that is already operating, which implies a series of economies of scale in the administration expenses. It is recommended to grant a competitive rate of 2% on the interest rate for the administration of credits.

In table 3.15 the effect is observed on the rates of profitability with relationship to the scenarios without leverage. If the effects of a leverage are analysed from one to one, to a net rate for the user of 8%, one can observe that when the sales are 100% locally, the profitability is increased by 57% on average for the models with rates of extraction of 50% in plantations of 5x5, by 39% for those of 33% extraction, and 29% for those of 25% extraction. The greater increments in profitability are presented in the models of plantation of 5x5. However, to the net interest rate of 8%, the problem is not solved for small plantations, which continue to not be very profitable.

Table 3.15 Analysis of profitability of the plantation of bamboo with 100% of the sales in the country and 0% abroad, a level of leverage of 2 to 1 and an interest rate of 8%

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	30.07%	27.78%	24.31%	18.36%	5.14%
	33%	23.63%	21.38%	17.95%	12.04%	N.D.
	25%	18.02%	15.76%	12.31%	6.27%	N.D.
6X6	50%	28.06%	25.87%	22.55%	16.84%	4.10%
	33%	22.11%	19.94%	16.63%	10.91%	N.D.
	25%	17.08%	14.87%	11.49%	5.58%	N.D.
7X7	50%	25.45%	23.38%	20.23%	14.82%	2.66%
	33%	19.93%	17.83%	14.63%	9.11%	N.D.
	25%	14.78%	12.67%	9.42%	3.73%	N.D.

Source: Own elaboration based on Funbambú data.

The results are also significant in all the models that show local sales at 75% and the rest abroad. An increment can be observed in table 3.16 from 80% to 98% in terms of the profitability of the project for the shareholders. An inverse relationship is shown among the increment in the profitability and the increment in the distance of the plantation. That

is to say, the plantations of 5x5 are more profitable than those of 7x7 (this is also true for conclusions of the models without financing).

Table 3.16 Analysis of profitability of the bamboo plantation with 75% of the sales in the country and 25% abroad, a level of leverage of 2 to 1 and an interest rate of 8%

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	62.04%	59.62%	55.92%	49.55%	35.70%
	33%	54.10%	51.74%	48.15%	41.98%	28.60%
	25%	47.55%	45.22%	41.69%	35.63%	22.49%
6X6	50%	58.33%	56.02%	52.49%	46.43%	33.27%
	33%	51.15%	48.89%	45.45%	39.55%	26.76%
	25%	45.70%	43.44%	40.00%	34.11%	21.36%
7X7	50%	53.67%	51.49%	48.17%	42.47%	30.15%
	33%	47.65%	45.47%	42.15%	36.47%	24.20%
	25%	41.74%	39.59%	36.32%	30.73%	18.67%

Source: Own elaboration based on Funbambú data.

In the plantations that sell 50% of the sales in the country and the rest abroad, a growth in the profitability is observed in the table 3.17, which shows the same inverse relationship between the plantation density and the exploitation.

Table 3.17 Analysis of profitability of the bamboo plantation with 50% of the sales in the country and 50% abroad, a level of leverage of 2 to 1 and an interest rate of 8%

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	79.57%	77.08%	73.26%	66.63%	52.04%
	33%	70.74%	68.32%	64.61%	58.19%	44.14%
	25%	63.62%	61.23%	57.58%	51.28%	37.54%
6X6	50%	74.88%	72.50%	68.85%	62.54%	48.69%
	33%	66.95%	64.62%	61.07%	54.94%	41.53%
	25%	61.24%	58.92%	55.36%	49.24%	35.92%
7X7	50%	69.08%	66.82%	63.38%	57.44%	44.47%
	33%	62.74%	60.49%	57.05%	51.13%	38.27%
	25%	56.32%	54.10%	50.72%	44.91%	32.33%

Source: Own elaboration based on Funbambú data.

The average increment in the internal rates of return shows a direct relationship with the abroad sales, the financing increases the rates in a greater proportion. For the case of 25% of local sales, increments are observed from 101% to 111% (Table 3.16).

Table 3.18 Analysis of profitability of the bamboo plantation with 25% of the sales in the country and 75% abroad, a level of leverage of 2 to 1 and an interest rate of 8%

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
	50%	92.04%	89.50%	85.59%	78.79%	63.71%
5X5	33%	82.57%	80.10%	76.32%	69.73%	55.21%
	25%	75.06%	72.62%	68.89%	62.42%	48.22%
6X6	50%	86.65%	84.22%	80.49%	74.01%	59.69%
	33%	78.17%	75.80%	72.17%	65.88%	52.03%
	25%	72.30%	69.93%	66.29%	60.01%	46.24%
7X7	50%	80.04%	77.74%	74.21%	68.10%	54.67%
	33%	73.47%	71.17%	67.65%	61.57%	48.25%
	25%	66.68%	64.42%	60.96%	54.99%	41.98%

Source: Own elaboration based on Funbambú data.

The biggest increase in the shareholders return is observed in the case in which the sales are foreign. The increments go from 105% to 114%, maintaining the relationships described for the previous models. A relaxing of the levels of leverage is shown in the annex 3.5 where models are carried out for the combinations of two interest rates, 10% and 6%, and for leverage levels of 1, 3 and 4, and of 2 with the other interest rates, where the direct relationships between the level of exports and at the leverage level is still present.

Table 3.19 Analysis of profitability of the bamboo plantation with 0% of the sales in the country and 100% abroad, a leverage level of 2 to 1 and an interest rate of 8%

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
	50%	101.83%	99.26%	95.29%	88.36%	72.91%
5X5	33%	91.86%	89.36%	85.51%	78.81%	63.93%
	25%	84.04%	81.57%	77.78%	71.19%	56.63%
6X6	50%	95.89%	93.43%	89.64%	83.03%	68.35%
	33%	86.98%	84.58%	80.89%	74.47%	60.29%
	25%	80.98%	78.58%	74.88%	68.48%	54.36%
7X7	50%	88.66%	86.32%	82.73%	76.49%	62.71%
	33%	81.91%	79.57%	75.99%	69.78%	56.12%
	25%	74.83%	72.53%	69.01%	62.92%	49.57%

Source: Own elaboration based on Funbambú data.

Of the diverse financial models one may conclude that the small-scale plantations continue presenting a problem of profitability, generated mainly by the fixed expenses. Therefore financing is one of the necessary requirements to foment the development of the sector. However, this increase in financing should come accompanied by an increment in the level of exports. That is to say, the development of these projects should be directed toward the external markets, or in its defect, to stimulate a national industry that allows obtaining the benefits of this material reached abroad. These are two bottlenecks that will be discussed in the following sections.

3.5.2 Idiosyncrasy in the consumption, promotion of exports and new markets

In the previous sections the problem of the idiosyncrasy has been mentioned in the consumption of the bamboo articles and the new markets, which refers to the form, which the consumers perceive the bamboo in Costa Rica. This may be derived from the fact that the bamboo material has been used for social well-being.

The development of the bamboo industry in the international markets has moved toward prime quality materials, such as the parquet for example, the playboo and others derivatives. In Costa Rica these technologies have not been implemented for scaling reasons, since the production doesn't generate enough volume to justify the investment in the necessary equipment to carry out the stated processes. Estimates given to Funbambú by some managers, present a minimum of about 2000 Ha. planted in order for the investment to be profitable.

If a playboo panel factory is established in the country, this material may be used for floors, flat ceilings, boat construction materials, and other products of high aggregated value. This would represent a rise in the products' price in national process that would compare to those prices of the international markets. An increment in the profitability of the projects of sows would result. In an increase in financing, the number of sowed hectares of bamboo would be increased, beginning a development process the country's sector. The results of the increase in the profitability were shown in the previous section, where the increase in the profitability of two projects the financing and exports, is noticed (as shown in sections 3.5.1 and 3.5.2.).

The investment costs in the plant are stated next:²¹

1.	Land:	US\$ 5.000
2.	Construction and Buildings	US\$ 18.500
3.	Equipment and Machinery:	
	3.1 Jointer, Planer	US\$ 60.000
	3.2 Cross cutter	US\$ 7.000
	3.3 Sharpening tools	US\$ 30.000
	3.4 Dust Collector	US\$ 6.000
	3.5 Gluing Press Machine	US\$ 15.000
	3.6 Glue injector	US\$ 8.000
	3.7 Sander	US\$ 10.000
	3.8 Dryer	US\$ 15.000
4.	Equipment Installation	US\$ 35.750
5.	Transport equipment	US\$ 20.000
6.	Furniture	US\$ 5.000
7.	Unexpected expenses	US\$ 13.800
8.	Working capital	US\$ 12.000
9.	Feasibility Study	US\$ 181.333
	TOTAL INVESTMENT	US\$ 437.383

²¹ Funbambú, Factory of laminated bamboo beams and bamboo parquet. Project Proposal. 1999.

It is difficult to predict the profitability of these projects since at the moment they don't operate in the country, for this reason only the required investment amount is included, in fact the social profitability of this project is justified by the increment in the profitability of the alternative projects.

The promotion of exports and the access to new markets may be achieved by means of organised fairs at a national and international level, where the achievements of Funbambú are shown, and the proper incentives are made for investment in these projects. The benefits are quantified in the estimates of profitability of the plantations with high export percentages in section 3.2. The budget that would be requested to carry out this promotion work is the following one:

At national level:

Physical local for the presentations	US \$6.000
Exhibitors	US \$5.000
Decoration	US \$2.000
Promotion of the event	US \$5.000
TOTAL INVESTMENT	US\$ 23.000

At international level:

Physical local for the presentations	US \$6.000
Exhibitors	US \$5.000
Decoration	US \$2.000
Promotion of the event	US \$5.000
Expenses	US \$10.000
TOTAL INVESTMENT²²	US \$33.000

3.5.3 Development and technological transfer institution

It is imperative for the country to have an institution that carries out the activities that Funbambú has carried out in the last years. The development and personnel training carried out by Funbambú, as well as its multiple investigations have made possible the development of this sector. If an institution that offers both technological assistance and granted trust in the products does not exist, it is difficult for the investments to be carried out.

Although the property rights increasingly acquire importance in the developed markets, it seems that in the gestation stage of the bamboo industry, it is not convenient to affect the projects with a charge for the concepts of investigation and development, for it would negatively impact the profitability of the projects. For this reason it is recommended to have an exogenous budget during five years of development of the sector. Starting from

²² At least three exhibitions are recommended abroad.

the sixth year, it is considered that the quantity of companies would already have enough force to maintain its own organisation.

The annual budget is the following one:

General co-ordinator	US \$36.000
10 researchers	US \$288.000
5 office workers (administration)	US \$30.000
Local	US \$18.000
Materials and others	US \$150.000
Expenses	US \$20.000
Accidental (10%)	US \$55.000
TOTAL INVESTMENT	US\$ 597,000

Conclusions and Recommendations

The number of actors of the bamboo sector is reduced. The installed capacity in the plantations, limited to the industrialisation options and the large quantity export will have to wait until at least the year 2002.

Although it is certain that the Chinese Mission (Taiwan) has trained some 500 people in the production of rattan crafts, these have not had the financial or logistical methods to be devoted to that activity. The handmade factory are not developed in the country. Rather, there are some individuals that elaborate some bamboo and rattan products as a means for alternative income. At a national level there are only two known companies, Funbambú and a private company (Agroindeba) that cultivate bamboo and manufacture furniture with that material.

Regarding the socio-economic situation of the workers of the bamboo sector the conclusions are:

1. Only men work in the sector, except for the retail sale process where a great majority of the workers (88%) are young women. The workers of the sector show a low level of education (elementary school, in general). The same is true for the consumers of bamboo housing. However, this contrasts with the consumers of furniture, bamboo and rattan souvenirs, which in their majority have a high level of education (university level).
2. Most of the workers are hired by explicit contract. The annual average wage ranges between US \$4.165 and US \$2.660, which are comparable or greater than the minimum wage (US \$2.760). The average yearly income for the bamboo housing consumers is of US \$3. 715, similar to that of the workers of this sector. However, the consumer group for furniture, bamboo souvenirs and rattan souvenirs present an annual income superior to US \$12,000 a year, and they indicate to have spent an average of US\$73 in those goods during the last year.
3. On average, the 33% of these workers' household has alternative sources of income. These homes receive nearly 80% of their revenues from the bamboo sector and in their majority have a wide coverage of basic services. On average, those households are composed of five members and they have an approximate annual per capita income of US \$1000, and more than 50% own their house.
4. Most of the consumers consider that these houses are the same or better quality than those built with other materials and with the same or greater useful life. This situation is similar to that of the consumers of furniture, and bamboo and rattan souvenirs. The consumers suggest that there should improvement in the finishing and the variety of the furniture and souvenirs. The 73% consider that the bamboo houses should be larger and/or smaller price per m².

5. In the financial analyses elaborated on the chain of consumption production of bamboo in Costa Rica, the following conclusion were reached:
6. The financial simulations in which the sales percentage is increased, the results evidence a direct relationship between the profitability of the plantation projects and the level of bamboo exports. It is justified mainly by the price differential that prevails between both markets, in favour of the international price.
7. The relationship between the level of profitability and the density of the plantation is inversely proportional. That is to say, when diminishing the density of sows of the plantation the levels of profitability increase. This is due mainly to a more efficient use of the land in which the plantations are developed.
8. The extraction percentages that are presented in the developed scenarios are sustainable. There is a direct relationship between the rate of extraction of shafts in the plantations and the level of profitability. The rate of effective extraction will depend on the conditions of the land.
9. The economies of scale in the investments and the fixed expenses, generate a positive relationship between the profitability of the projects and their scaling, being more profitable the projects of greater scaling. The above-mentioned opens possibilities to stimulate associations of producers and co-operative projects as mechanism to increase the profitability of the plantation projects.
10. Bamboo can be analysed as a complementary project with other products, mainly beans, acorn squash and corn. In these cases, the financial results are satisfactory since the activity of planting bamboo is a complementary form and is profitable. Also, relationship between the export level and the profitability of the complementary project is maintained.
11. The activity that has stimulated the growth of the bamboo sector in Costa Rica is related mainly with the housing construction. In this activity advanced technology has been developed that allows building housings for a lower cost. The housing construction is an activity that presents a low profitability in the phase of initial investment on technological development. It is considered that in Costa Rica these barriers have been overcome, which makes the investment amount to build those houses relatively low. Therefore, the profitability of the popular housing construction project, given the investment that is required in the national market, is considered satisfactory.
12. This profitability is lightly increased when the operations scale level (market participation) increases. The same is true if financing options are used. Due to the quick decrease of the market popular housing construction (housing voucher), this profitability will only be sustainable, or improbable, if the production is diversified, and new construction markets are accessed. This will require two

things, an activity that will work on the perception that consumers of bamboo have; as well as the development of industrialisation activities, which will present bamboo as a competitive construction material.

13. An additional obstacle is related with the alternative uses of bamboo in the country. The greater the alternative uses are, the smaller the price differential between the prices of the national market and the international one will be, since the final products will be similar.
14. It becomes necessary to have a Research Institute and development of techniques associated with bamboo. The main reason is the credibility and credibility that an Institute of this nature can create in the bamboo sector, and it is considered indispensable in the future development of the sector.

Bibliography

Montiel, Mayrs *Planting & Using Bamboo in the Neotropics*. International Journal of Tropical Biology and Conservation, Vol.46 June 1998.

Funbambú, *National Bamboo Project*, Project COS-90-HOLLAND-MIVAH. May, 1997.

Funbambú. *Cost, Handling and Maintenance*. Forest Industrialisation Division, Forest Unit. November 1996.

Funbambú . *“Fundamental Considerations for the Analysis of Costs of A Built Typical Housing for FUNMAMBÚ.”* Funbambú, 1999.

Funbambú, *Factory of laminated bamboo beams and bamboo parquet*. Project Proposal. 1999

ANNEX

ANNEX 2.1

SURVEYS

ANNEX 2.1.1

PLANTERS SURVEYS

Number:
Date:

BAMBOO PLANTERS (E2)

Name:	
Company name:	
Address:	
Telephone:	

Planters (Workers)

1. Gender

M F

2. Age: _____

3. Nationality: _____

4. ¿Educational Attainment?

Elementary Secondary University None
Last grade _____

5. Household living conditions:

Bathroom Potable Water
Ground hole _____ Toilet _____ Yes_ No_, AyA Municipal Junta de Vecinos

Electricity Children school attend
Yes _____ No _____ Yes _____, Public _____ Private _____
No _____, ¿Why? _____

Public transport Kitchen
Yes _____ No _____ Yes_ No _____, Firewood Gas Electric

Refrigerator Medical insurance
Yes _____ No _____ Yes _____ No _____

5. Your house is:

Own _____ Rented _____ Loaned _____ other _____, Specify: _____
Type of house: Concrete _____ Wood _____ Bamboo _____

Size of house : Less than 40 mtrs2. _____ from 40 to 70 mtrs2. _____ from 70 to 100 mtrs2. _____ More than 100 mtrs2. _____

6. Number of household members?

7. ¿ Is the Bamboo your primary source of income?

Yes _____ No _____

8. ¿How many hours a week do you work in bamboo activities?

9. ¿What is your position in the company? _____

10. ¿When were you employed? _____

11. ¿Hours worked per day? _____

12. ¿How do get your job?

By yourself Other Specify: _____

13. ¿Number of household member involved in bamboo activities?

Yourself Others ¿Number of male? _____

¿Number of female? _____

¿Number of children under 12? _____

¿Number of children between 12 & 17 years old? _____

14. ¿Type of activities engaged in by each?

Male:

Seed Maintenance Collecting Primary Process Secondary Retailing

Female:

Seed Maintenance Collecting Primary Process Secondary Retailing

Under 12:

Seed Maintenance Collecting Primary Process Secondary Retailing

Between 12 & 17:

Seed Maintenance Collecting Primary Process Secondary Retailing

15. ¿ What are the species/varieties of bamboo planted?

Guadua Atlantica Guadua Sur Bulgaris Filostaquis

16. ¿How much income do you make per week from seed of bamboo? ¿Number of months that seed takes place? ¿Employment terms?

Lees than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10mil to 15 mil ___ ¢ 15mil to 20 mil ___ ¢ 20mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

_____ Months per year BContract Pect

Do you do your work:

Individually Crew How many? _____

¿Average number of persons in the collection team? _____

17 . Costs per day:

Transportation: ¢ _____

Food: ¢ _____

Tools: ¢ _____

Commissions: ¢ _____

Other expenses: ¢ _____

18. ¿ What is the household weekly income?

Male:

Less than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10 mil to 15 mil ___ ¢ 15 mil to 20 mil ___ ¢ 20 mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

Female:

Less than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10 mil to 15 mil ___ ¢ 15 mil to 20 mil ___ ¢ 20 mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

Under 12:

Less than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10 mil to 15 mil ___ ¢ 15 mil to 20 mil ___ ¢ 20 mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

Between 12 &17 :

Less than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10 mil to 15 mil ___ ¢ 15 mil to 20 mil ___ ¢ 20 mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

19. ¿Other sources of income?

Yes No agriculture activities ____ No
Agriculture activities ____
__ sugar cane ¢ ____ /weekly __ coffee ¢ ____ __ banana ¢ ____
__ cattle ¢ ____ __ citric ¢ ____ __ other ¢ ____

¿Months per year when this activities is carry out? _____

20. Describe the bamboo seed process

21. ¿What tools are required when the bamboo is sown?

22. ¿Months when bamboo planting is carried out? _____

23. ¿Do you yourself own any bamboo sown field ?

Yes No _____ Ha.

¿How is it used? _____

24. ¿Do you work in other bamboo process?

Yes No

Seed Maintenance Collecting Primary Process Secondary Retailing

25. ¿What are some of the problems encountered in a bamboo plantation?

26. ¿What are some of the dangerous encountered in a bamboo plantation?

27. ¿Are you interesting in keep your job in bamboo?

Yes _____ No _____, Why? _____

ANNEX 2.1.2
HARVEST SURVEY

Number:
Date:

BAMBOO HARVEST (E3)

Name:	
Company name:	
Address:	
Telephone:	

COLLECTORS (Workers)

1. Gender

M F

2. Age: _____

3. Nationality: _____

4. ¿Educational Attainment?

Elementary Secondary University None
Last grade _____

5. Household living conditions:

Bathroom Potable Water
Ground hole _____ Toilet _____ Yes_ No_, AyA Municipal Junta de Vecinos

Electricity Children school attend
Yes _____ No _____ Yes _____, Public _____ Private _____
No _____, ¿Why? _____

Public transport Kitchen
Yes _____ No _____ Yes_ No _____, Firewood Gas Electric

Refrigerator Medical insurance
Yes _____ No _____ Yes _____ No _____

5. Your house is:

Own _____ Rented _____ Loaned _____ other _____, Specify: _____
Type of house: Concrete _____ Wood _____ Bamboo _____

Size of house : Less than 40 mtrs2. _____ from 40 to 70 mtrs2. _____ from 70 to 100 mtrs2. _____ More than 100 mtrs2. _____

6. Number of household members?

7. ¿ Is the Bamboo your primary source of income?

Yes _____ No _____

8. ¿ How many hours a week do you work in bamboo activities?

9. ¿ What is your position in the company? _____

10. ¿ When were you employed? _____

11. ¿ Hours worked per day? _____

12. ¿ How do get your job?

By yourself Other Specify: _____

13. ¿ Number of household member involved in bamboo activities?

Yourself Others ¿ Number of male? _____

¿ Number of female? _____

¿ Number of children under 12? _____

¿ Number of children between 12 & 17 years old? _____

14. ¿ Type of activities engaged in by each?

Male:

Seed Maintenance Collecting Primary Process Secondary Retailing

Female:

Seed Maintenance Collecting Primary Process Secondary Retailing

Under 12:

Seed Maintenance Collecting Primary Process Secondary Retailing

Between 12 & 17:

Seed Maintenance Collecting Primary Process Secondary Retailing

15. ¿ What are the species/varieties of bamboo harvested?

Guadua Atlantica Guadua Sur Bulgaris Filostaquis

16. ¿How much income do you make per week from the harvest of bamboo? ¿Number of months that harvest takes place? ¿Employment terms?

Lees than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10mil to 15 mil ___ ¢ 15mil to 20 mil ___ ¢ 20mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

_____ Months per year B Contract Pe ct

Do you do your work:

Individually Crew How many? _____

¿Average number of persons in the collection team? _____

17 . Costs per day:

Transportation: ¢ _____

Food: ¢ _____

Tools: ¢ _____

Commissions: ¢ _____

Other expenses: ¢ _____

18. ¿ What is the household weekly income?

Male:

Less than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10mil to 15 mil ___ ¢ 15mil to 20 mil ___ ¢ 20mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

Female:

Less than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10mil to 15 mil ___ ¢ 15mil to 20 mil ___ ¢ 20mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

Under 12:

Less than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10mil to 15 mil ___ ¢ 15mil to 20 mil ___ ¢ 20mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

Between 12 &17 :

Less than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10mil to 15 mil ___ ¢ 15mil to 20 mil ___ ¢ 20mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

19. ¿Other sources of income?

Yes No agriculture activities _____ No
Agriculture activities _____
__ sugar cane ¢ _____ /weekly __ coffee ¢ _____ __ banana ¢ _____
__ cattle ¢ _____ __ citric ¢ _____ __ other ¢ _____

¿Months per year when this activities is carry out? _____

20. Describe the bamboo harvest process

21. ¿What tools are required when the bamboo is harvested?

22. ¿Months when bamboo collecting is carried out? _____

23. ¿Do you yourself own any bamboo sown field ?

Yes No _____ Ha.

¿How is it used? _____

24. ¿Do you work in other bamboo process?

Yes No

Seed Maintenance Collecting Primary Process Secondary Retailing

25. ¿What are some of the problems encountered in a bamboo plantation?

26. ¿What are some of the dangerous encountered in a bamboo plantation?

27. ¿Are you interested to keep up your job in bamboo?

Yes _____ No _____, Why? _____

28. ¿Quantity of raw bamboo collected per day? _____

29. ¿Is any of the raw bamboo collected used for your household?

Yes No

How much? _____

How is it
used? _____

30. ¿What are the factors affecting the volume of bamboo harvested?

ANNEX 2.1.3

PROCESSORS SURVEY

Number:
Date:

BAMBOO PROCESSORS (E4)

Name:	
Company name:	
Address:	
Telephone:	

Processors (Workers)

1. Gender

M F

2. Age: _____

3. Nationality: _____

4. ¿Educational Attainment?

Elementary Secondary University None
Last grade _____

5. Household living conditions:

Bathroom Potable Water
Ground hole _____ Toilet _____ Yes_ No_, AyA Municipal Junta de Vecinos

Electricity Children school attend
Yes _____ No _____ Yes _____, Public _____ Private _____
No _____, ¿Why? _____

Public transport Kitchen
Yes _____ No _____ Yes_ No _____, Firewood Gas Electric

Refrigerator Medical insurance
Yes _____ No _____ Yes _____ No _____

5. Your house is:

Own _____ Rented _____ Loaned _____ other _____, Specify: _____
Type of house: Concrete _____ Wood _____ Bamboo _____

Size of house : Less than 40 mtrs2. _____ from 40 to 70 mtrs2. _____ from 70 to 100 mtrs2. _____ More than 100 mtrs2. _____

6. Number of household members?

7. ¿ Is the Bamboo your primary source of income?

Yes _____ No _____

8. ¿ How many hours a week do you work in bamboo activities?

9. ¿ What is your position in the company? _____

10. ¿ When were you employed? _____

11. ¿ Hours worked per day? _____

12. ¿ How do get your job?

By yourself Other Specify: _____

13. ¿ Number of household member involved in bamboo activities?

Yourself Others ¿ Number of male? _____

¿ Number of female? _____

¿ Number of children under 12? _____

¿ Number of children between 12 & 17 years old? _____

14. ¿ Type of activities engaged in by each?

Male:

Seed Maintenance Collecting Primary Process Secondary Retailing

Female:

Seed Maintenance Collecting Primary Process Secondary Retailing

Under 12:

Seed Maintenance Collecting Primary Process Secondary Retailing

Between 12 & 17:

Seed Maintenance Collecting Primary Process Secondary Retailing

15. ¿ What are the species/varieties of bamboo processed?

Guadua Atlantica Guadua Sur Bulgaris Filostaquis

16. ¿How much income do you make per week from the processing of bamboo?
¿Number of months that processing takes place? ¿Employment terms?

Lees than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10mil to 15 mil ___ ¢ 15mil to 20 mil
___ ¢ 20mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

_____ Months per year B Contract P Oct

Do you do your work:

Individually Crew How many? _____

¿Average number of persons in the processing team? _____

17 . Costs per day:

Transportation: ¢ _____

Food: ¢ _____

Tools: ¢ _____

Commissions: ¢ _____

Other expenses: ¢ _____

18. ¿ What is the household weekly income?

Male:

Less than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10 mil to 15 mil ___ ¢ 15 mil to 20
mil ___ ¢ 20 mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

Female:

Less than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10 mil to 15 mil ___ ¢ 15 mil to 20
mil ___ ¢ 20 mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

Under 12:

Less than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10 mil to 15 mil ___ ¢ 15 mil to 20
mil ___ ¢ 20 mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

Between 12 &17 :

Less than ¢ 5.000 ___ ¢ 5.000 to 10.000 ___ ¢ 10 mil to 15 mil ___ ¢ 15 mil to 20
mil ___ ¢ 20 mil to 25 mil ___ ¢ 26 mil to 30 mil ___ More than ¢30 mil ___

19. ¿Other sources of income?

Yes No agriculture activities _____ No
Agriculture activities _____
__ sugar cane ¢ _____ /weekly __ coffee ¢ _____ __ banana ¢ _____
__ cattle ¢ _____ __ citric ¢ _____ __ other ¢ _____

¿Months per year when this activities is carry out? _____

20. Describe the bamboo processing process

21. ¿What tools are required when the bamboo is processing?

22. ¿Months when bamboo processing is carried out? _____

23. ¿Do you yourself own any bamboo sown field ?

Yes No _____ Ha.

¿How is it used? _____

24. ¿Do you work in other bamboo process?

Yes No

Seed Maintenance Collecting Primary Process Secondary Retailing

25. ¿What are some of the problems encountered in the bamboo processing?

26. ¿What are some of the dangerous encountered in the bamboo processing?

27. ¿Are you interesting in keep your job in bamboo?

Yes _____ No _____, Why? _____

28. ¿When is processing at its peak? _____
¿Its low point? _____

29. ¿Where did you train in the processing techniques?

_____ ¿For how long? _____

¿Where you an apprentice? _____.

¿Did you become contractually employed by your master afterwards? _____

ANNEX 2.1.4

**SURVEY OF PRODUCT RETAILERS
(WORKERS)**

Number:
Date:

BAMBOO PRODUCT RETAILERS (E5)

Name:	
Company name:	
Address:	
Telephone:	

Retailers (Workers)

1. Gender

M F

2. Age: _____

3. Nationality: _____

4. ¿Educational Attainment?

Elementary Secondary University None
Last grade _____

5. Household living conditions:

Bathroom Potable Water
Ground hole _____ Toilet _____ Yes_ No_, AyA Municipal Junta de Vecinos

Electricity Children school attend
Yes _____ No _____ Yes _____, Public _____ Private _____
No _____, ¿Why? _____

Public transport Kitchen
Yes _____ No _____ Yes_ No _____, Firewood Gas Electric

Refrigerator Medical insurance
Yes _____ No _____ Yes _____ No _____

5. Your house is:

Own _____ Rented _____ Loaned _____ other _____, Specify: _____
Type of house: Concrete _____ Wood _____ Bamboo _____

Size of house : Less than 40 mtrs2. _____ from 40 to 70 mtrs2. _____ from 70 to 100 mtrs2. _____ More than 100 mtrs2. _____

6. Number of household members?

7. ¿ Is the Bamboo your primary source of income?

Yes _____ No _____

8. ¿ How many hours a week do you work in bamboo activities?

9. ¿ What is your position in the company? _____

10. ¿ When were you employed? _____

11. ¿ Hours worked per day? _____

12. ¿ How do get your job?

By yourself Other Specify: _____

13. ¿ Number of household member involved in bamboo activities?

Yourself Others ¿ Number of male? _____

¿ Number of female? _____

¿ Number of children under 12? _____

¿ Number of children between 12 & 17 years old? _____

14. ¿ Type of activity engaged in by each

Male:

Seed Maintenance Collecting Primary Process Secondary Retailing

Female:

Seed Maintenance Collecting Primary Process Secondary Retailing

Under 12:

Seed Maintenance Collecting Primary Process Secondary Retailing

Between 12 & 17 :
 Less than ₪ 5.000 ___ ₪ 5.000 to 10.000 ___ ₪ 10 mil to 15 mil ___ ₪ 15 mil to 20 mil ___ ₪ 20 mil to 25 mil ___ ₪ 26 mil to 30 mil ___ More than ₪30 mil ___

19. ¿Other sources of income?

Yes No agriculture activities ___ No
 Agriculture activities ___
 ___ sugar cane ₪ _____ /weekly ___ coffee ₪ _____ ___ banana ₪ _____
 ___ cattle ₪ _____ ___ citric ₪ _____ ___ other ₪ _____

¿Months per year when this activities is carry out? _____

20. Describe the bamboo retailing process

21. ¿What tools are required when the bamboo is sown?

22. ¿Months when bamboo retailing is carried out? _____

23. ¿Do you yourself own any bamboo sown field ?

Yes No _____ Ha.

¿How is it used? _____

24. ¿Do you work in other bamboo process?

Yes No

Seed Maintenance Collecting Primary Process Secondary Retailing

25. ¿What are some of the problems encountered in a bamboo retailing?

26. ¿What are some of the dangerous encountered in a bamboo retailing?

27. ¿Are you interesting in keep your job in bamboo?

Yes _____ No _____, Why? _____

28. ¿ How long have you been selling bamboo and rattan products?

_____ % bamboo _____ % rattan _____

29. ¿Which bamboo products do you sell?

_____ Furniture _____ Souvenirs

30. ¿Which rattan products do you sell?

31. ¿ What other non-bamboo and rattan products do you sell?

ANNEX 2.1.5

**SURVEY OF PRODUCT RETAILERS
(OWNERS)**

Number:
Date:

BAMBOO PRODUCT RETAILERS (E6)

Name:	
Company name:	
Address:	
Telephone:	

Retailers (Owner)

1. ¿ Do you have any special arrangements with the suppliers of your bamboo products?

Sales/ Income of main bamboo products

Product	Quantity Sold	Customer	Price range	% of Sales

Average sales per month: _____

2. ¿ How much do you sell of bamboo products?

% _____

3. ¿ How do bamboo products compare profitably to similar products not made from bamboo?

More _____ Equal _____ Less _____

4. ¿ What is the consumer perception of bamboo products?

Very bad ____ bad _____ Regular _____ Good ____ Very good _____

5. ¿What type of tendency have you had observed with bamboo products?

Lesser Equal Greater

Demand _____

Cost _____

Kind of products _____

6. ¿What other products would you like to make from bamboo and rattan?

7. ¿What are the problems encountered in selling bamboo and rattan products ?

8. ¿Do you work in other bamboo process?

Yes

No

Primary _____

Secondary _____

ANNEX 2.1.6

SURVEY OF FINAL CONSUMER OF BAMBOO PRODUCTS

Number
Place

FINAL CONSUMER OF BAMBOO PRODUCTS (E7)

1. ¿Educational Attainment?

Elementary Secondary University None
 Last grade _____

2. Gender

M F

3. Age _____

4. ¿ What is your monthly income?

₱ 30 -140mil ___ ₱141 -210mil ___ ₱211 -300mil ___ 300 -400mil ___ More than ₱400
 mil___

5. ¿ What bamboo products have you purchased last year?

Furniture ___ Souvenirs ___ Houses ___ Plants ___ Others ___

6. ¿How much money did you spend in bamboo and rattan products last year?

7. ¿ How do bamboo products compare to similar products not-made from bamboo?

	More than	Less than	Equal to
In quality			
In price			
In length of useful life			
In attractiveness			

8. ¿What do you think about the quality of bamboo and rattan products?

Excellent_____ Good_____ Regular_____ bad_____ very bad_____

9. ¿What other products would you like to see made from bamboo ?

10. As consumer, what improvements in bamboo products do you think would be beneficial?

ANNEX 3

FINANCIAL ASPECTS

ANNEX 3.1
PROJECTION OF INTERNAL RATE OF RETURN
100 Ha

Table A.3.1.1. *Extraction of culms per Hectare*

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
Bamboo minor diameter						28,600	31,200							
Bamboo mayor diameter								163,800	218,400	218,400	280,800	280,800	280,800	280,800
Culms extraction per hectare														
	50%					800	800	1,100	2,700	3,900	5,000	5,000	5,000	5,000
5X5	33%					800	800	740	1,840	3,300	4,040	4,040	4,040	4,040
	25%					800	800	600	1,450	2,700	3,300	3,300	3,300	3,300
	50%					800	800	760	2,150	3,105	3,975	5,000	5,000	5,000
6X6	33%					800	800	510	1,465	2,625	3,360	4,040	4,040	4,040
	25%					800	800	415	1,550	2,150	2,750	3,300	3,300	3,300
	50%					800	800	560	1,600	2,280	2,920	3,675	5,000	5,000
7X7	33%					800	800	375	1,075	1,920	2,460	3,100	4,040	4,040
	25%					800	800	300	845	1,575	2,020	2,545	3,300	3,300

Source: *Own elaboration based on FUNBAMBU data*

Table A.3.1.2 Lineal metres extracted per Hectare

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
5X5	50%					2,200	2,400	9,900	28,350	40,950	52,500	60,000	60,000	60,000
	33%					2,200	2,400	6,660	19,320	34,650	42,420	48,480	48,480	48,480
	25%					2,200	2,400	5,400	15,225	28,350	34,650	39,600	39,600	39,600
6X6	50%					2,200	2,400	6,840	22,575	32,603	41,738	60,000	60,000	60,000
	33%					2,200	2,400	4,590	15,383	27,563	35,280	48,480	48,480	48,480
	25%					2,200	2,400	3,735	16,275	22,575	28,875	39,600	39,600	39,600
7X7	50%					2,200	2,400	5,040	16,800	23,940	30,660	44,100	60,000	60,000
	33%					2,200	2,400	3,375	11,288	20,160	25,830	37,200	48,480	48,480
	25%					2,200	2,400	2,700	8,873	16,538	21,210	30,540	39,600	39,600

Source: Own elaboration based on FUNBAMBU data

Table A.3.1.3. Income projections per ha

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
5X5	50%					286	312	2,574	7,371	10,647	13,650	15,600	15,600	15,600
	33%					286	312	1,732	5,023	9,009	11,029	12,605	12,605	12,605
	25%					286	312	1,404	3,959	7,371	9,009	10,296	10,296	10,296
6X6	50%					286	312	1,778	5,870	8,477	10,852	15,600	15,600	15,600
	33%					286	312	1,193	3,999	7,166	9,173	12,605	12,605	12,605
	25%					286	312	971	4,232	5,870	7,508	10,296	10,296	10,296
7X7	50%					286	312	1,310	4,368	6,224	7,972	11,466	15,600	15,600
	33%					286	312	878	2,935	5,242	6,716	9,672	12,605	12,605
	25%					286	312	702	2,307	4,300	5,515	7,940	10,296	10,296

Source: Own elaboration based on FUNBAMBU data

Table A.3.1.4. Annual variable cost estimation per ha

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
VARIABLE COST FUNBAMBÚ													
COSTS PER HA													
MAINTENANCE													
TOTAL													
VENEERING		79	60	40									
VENEERING PER		10	10	-									
ROUNDING		40	20	-									
HERBICIDE APPLCATION		30	30	-									
FERTILIZATIÓN		20	20	30	10	10	10	10	10	10	10	10	10
HANDLING													
UN-BRANCHING			40	109	30	30	30	30	30	30	30	30	30
					119	179	218	248	248	278	278	278	278
INPUTS													
HERBICIDE		18	18	18									
FERTILIZERS													
10-30-10		30											
COMPLEX FORMULA			43	58	115	115	115	115	115	115	115	115	115
NUTRAN		23	23	23									
TOTAL EXPENSES OF HANDLING AND		249	263	277	274	334	373	403	403	433	433	433	433
MAINTENANCE													

Source: Own elaboration based on FUNBAMBU data

Table A.3.1.5. Other administrative expenses estimation

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
ADMINISTRATIVE EXPENSES													
FORESTAL INGENIERING		25,935	25,935	25,935	25,935	25,935	25,935	25,935	25,935	25,935	25,935	25,935	25,935
FOREMAN		10,374	10,374	10,374	10,374	10,374	10,374	10,374	10,374	10,374	10,374	10,374	10,374
SECRETARY		5,187	5,187	5,187	5,187	5,187	5,187	5,187	5,187	5,187	5,187	5,187	5,187
OFFICE		4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800
SELLER		17,290	17,290	17,290	17,290	17,290	17,290	17,290	17,290	17,290	17,290	17,290	17,290
MISCELLANEOUS		9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600	9,600
VEHICLE MAINT.		4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800
VEHICLE DEPRECIATION		7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200	7,200
CONSTRUCTION DEPRECIACIÓN		37,153	37,153	37,153	37,153	37,153	37,153	37,153	37,153	37,153	37,153	37,153	37,153
VIGILANCE		21,613	21,613	21,613	21,613	21,613	21,613	21,613	21,613	21,613	21,613	21,613	
PRESERVACIÓN STAFF		30,258	30,258	30,258	30,258	30,258	30,258	30,258	30,258	30,258	30,258	30,258	30,258
LAND STAFF		108,063	108,063	108,063	108,063	108,063	108,063	108,063	108,063	108,063	108,063	108,063	108,063
TOTAL ADMINISTRATIVE EXPENSES		282,271	282,271	282,271	282,271	282,271	282,271	282,271	282,271	282,271	282,271	282,271	260,659

Source: Own elaboration based on FUNBAMBU data

Table A.3.1.6. Other investment

Other investment	
ALL TRACK VEHICLE	30,000
CHAPULIN Y CARRETA	15,000
EDIFICE STOREROOM	271,186
GUARD HOUSE	100,339
PRESERVING PLANT	5,000
“REGLILLAS” FACTORY	5,000
CONSERVATOR Y LAND	2,500
	100,000
TOTAL OTHER INVESTMENT	529,025

Source: Own elaboration based on FUNBAMBU data

Table A.3.1.7. Establishment Cost

ESTABLISHMENT	
VENERING	43
CUTTING OS STAKES	30
ROUNDING	20
DISTRIBUTION OF PLANTLETS	42
PRICE PER HA	1,000
PLANTLETS	440
TOTAL ESTABLISHMENT	1,574

Source: Own elaboration based on FUNBAMBU data

ANNEX 3.2
***BAMBOO PLANTATION PROJECT AS COMPLEMENTARY
ACTIVITY TO OTHERS ACTIVITIES.
(INCLUDE ALTERNATIVE SOURCE OF FINANCING)***

Table A3.2.1. . Internal Rate of Return of the bamboo like complementary activity on the basis of the export volume, a level of leverage of 1 to 1 and an interest rate of 6%

Percentage of export	IIR
0%	60%
25%	61%
50%	71%
75%	80%
100%	86%

Source: Own elaboration based on FUNBAMBU data

Table A3.2.2. Internal Rate of Return of the bamboo like complementary activity on the basis of the export volume, a level of leverage of 1 to 1 and an interest rate of 8%

Percentage of export	IIR
0%	59%
25%	62%
50%	71%
75%	80%
100%	86%

Source: Own elaboration based on FUNBAMBU data

Table A.3.2.3. Internal Rate of Return of the bamboo like complementary activity on the basis of the export volume, a level of leverage of 1 to 1 and an interest rate of 10%

Percentage of export	IIR
0%	58%
25%	63%
50%	71%
75%	80%
100%	86%

Source: Own elaboration based on FUNBAMBU data

Table A3.2.4 Internal Rate of Return of the bamboo like complementary activity on the basis of the export volume, a level of leverage of 2 to 1 and an interest rate of 6%

Percentage of export	IIR
0%	83%
25%	61%
50%	71%
75%	80%
100%	86%

Source: Own elaboration based on FUNBAMBU data

Table A3.2.5. 4 Internal Rate of Return of the bamboo like complementary activity on the basis of the export volume, a level of leverage of 2 to 1 and an interest rate of 10%

Percentage of export	IIR
0%	77%
25%	63%
50%	71%
75%	80%
100%	86%

Source: Own elaboration based on FUNBAMBU data

Table A3.2.6. Internal Rate of Return of the bamboo like complementary activity on the basis of the export volume, a level of leverage of 3 to 1 and an interest rate of 6%

Percentage of export	IIR
0%	105%
25%	61%
50%	71%
75%	80%
100%	86%

Source: Own elaboration based on FUNBAMBU data

Table A3.2.7. Internal Rate of Return of the bamboo like complementary activity on the basis of the export volume, a level of leverage of 3 to 1 and an interest rate of 8%

Percentage of export	IIR
0%	101%
25%	62%
50%	71%
75%	80%
100%	86%

Source: Own elaboration based on FUNBAMBU data

Table A3.2.8. Internal Rate of Return of the bamboo like complementary activity on the basis of the export volume, a level of leverage of 3 to 1 and an interest rate of 10%

Percentage of export	IIR
0%	97%
25%	63%
50%	71%
75%	80%
100%	86%

Source: Own elaboration based on FUNBAMBU data

Table A3.2.9. Internal Rate of Return of the bamboo like complementary activity on the basis of the export volume, a level of leverage of 4 to 1 and an interest rate of 6%

Percentage of export	IIR
0%	128%
25%	61%
50%	71%
75%	80%
100%	86%

Source: Own elaboration based on FUNBAMBU data

Table A3.2.10. Internal Rate of Return of the bamboo like complementary activity on the basis of the export volume, a level of leverage of 4 to 1 and an interest rate of 8%

Percentage of export	IIR
0%	122%
25%	62%
50%	71%
75%	80%
100%	86%

Source: Own elaboration based on FUNBAMBU data

Cuadro A3.2.11. Internal Rate of Return of the bamboo like complementary activity on the basis of the export volume, a level of leverage of 4 to 1 and an interest rate of 10%

Percentage of export	IIR
0%	116%
25%	63%
50%	71%
75%	80%
100%	86%

Source: Own elaboration based on FUNBAMBU data

ANNEX 3.3
***PROFITABILITY OF THE HOUSING CONSTRUCTION
PROJECT***

Table A.3.3.1. Scenario of profitability of the housing construction projects an investment of US\$1.000.000 and sales of 100 to 500 housings per year.

INVESTMENT	NUMBER OF HOUSINGS	IRR
1,000,000.00	100.00	3.44%
	200.00	6.89%
	300.00	10.33%
	400.00	13.77%
	500.00	17.22%

Source: Own elaboration based on FUNBAMBU data

Table A.3.3.2 Scenario of profitability of the housing construction projects an investment of US\$1.500.000 and sales of 100 to 500 housings per year.

INVESTMENT	NUMBER OF HOUSINGS	IRR
1,500,000.00	100.00	2.30%
	200.00	4.59%
	300.00	6.89%
	400.00	9.18%
	500.00	11.48%

Source: Own elaboration based on FUNBAMBU data

Table A.3.3.3. Scenario of profitability of the housing construction projects an investment of US\$2.000.000 and sales of 100 to 500 housings per year.

INVESTMENT	NUMBER OF HOUSINGS	IRR
2,000,000.00	100.00	1.72%
	200.00	3.44%
	300.00	5.16%
	400.00	6.89%
	500.00	8.61%

Source: Own elaboration based on FUNBAMBU data

Table A.3.3.4. Scenario of profitability of the housing construction projects an investment of US\$2.500.000 and sales of 100 to 500 housings per year.

INVESTMENT	NUMBER OF HOUSINGS	IRR
2,500,000.00	100.00	1.38%
	200.00	2.75%
	300.00	4.13%
	400.00	5.51%
	500.00	6.89%

Source: Own elaboration based on FUNBAMBU data

Table A.3.3.5. Scenario of profitability of the housing construction projects an investment of US\$3.000.000 and sales of 100 to 500 housings per year.

INVESTMENT	NUMBER OF HOUSINGS	IRR
3,000,000.00	100.00	1.15%
	200.00	2.30%
	300.00	3.44%
	400.00	4.59%
	500.00	5.74%

Source: Own elaboration based on FUNBAMBU data

Table A.3.3.6. Scenario of profitability of the housing construction projects an investment of US\$3.500.000 and sales of 100 to 500 housings per year.

INVESTMENT	NUMBER OF HOUSINGS	IRR
3,500,000.00	100.00	0.98%
	200.00	1.97%
	300.00	2.95%
	400.00	3.94%
	500.00	4.92%

Source: Own elaboration based on FUNBAMBU data

Table A.3.3.7. Scenario of profitability of the housing construction projects an investment of US\$4.000.000 and sales of 100 to 500 housings per year.

INVESTMENT	NUMBER OF HOUSINGS	IRR
4,000,000.00	100.00	0.86%
	200.00	1.72%
	300.00	2.58%
	400.00	3.44%
	500.00	4.30%

Source: Own elaboration based on FUNBAMBU data

Table A.3.3.8. Scenario of profitability of the housing construction projects an investment of US\$4.500.000 and sales of 100 to 500 housings per year

INVESTMENT	NUMBER OF HOUSINGS	IRR
4,500,000.00	100.00	0.77%
	200.00	1.53%
	300.00	2.30%
	400.00	3.06%
	500.00	3.83%

Source: Own elaboration based on FUNBAMBU data

Table A.3.3.9. Scenario of profitability of the housing construction projects an investment of US\$5.000.000 and sales of 100 to 500 housings per year

INVESTMENT	NUMBER OF HOUSINGS	IRR
5,000,000.00	100.00	0.69%
	200.00	1.38%
	300.00	2.07%
	400.00	2.75%
	500.00	3.44%

Source: Own elaboration based on FUNBAMBU data

Table A.3.3.10. Scenario of profitability of the housing construction projects an investment of US\$5.500.000 and sales of 100 to 500 housings per year

INVESTMENT	NUMBER OF HOUSINGS	IRR
5,500,000.00	100.00	0.63%
	200.00	1.25%
	300.00	1.88%
	400.00	2.50%
	500.00	3.13%

Source: Own elaboration based on FUNBAMBU data

Table A.3.3.11. Scenario of profitability of the housing construction projects an investment of US\$6.000.000 and sales of 100 to 500 housings per year

INVESTMENT	NUMBER OF HOUSINGS	IRR
6,000,000.00	100.00	0.57%
	200.00	1.15%
	300.00	1.72%
	400.00	2.30%
	500.00	2.87%

Source: Own elaboration based on FUNBAMBU data

Table A.3.3.12. Scenario of profitability of the housing construction projects an investment of US\$6.500.000 and sales of 100 to 500 housings per year

INVESTMENT	NUMBER OF HOUSINGS	IRR
6,500,000.00	100.00	0.53%
	200.00	1.06%
	300.00	1.59%
	400.00	2.12%
	500.00	2.65%

Source: Own elaboration based on FUNBAMBU data

Table A.3.3.13. Scenario of profitability of the housing construction projects an investment of US\$7.000.000 and sales of 100 to 500 housings per year

INVESTMENT	NUMBER OF HOUSINGS	IRR
7,000,000.00	100.00	0.49%
	200.00	0.98%
	300.00	1.48%
	400.00	1.97%
	500.00	2.46%

Source: Own elaboration based on FUNBAMBU data

Table A.3.3.14. Scenario of profitability of the housing construction projects an investment of US\$7.500.000 and sales of 100 to 500 housings per year

INVESTMENT	NUMBER OF HOUSINGS	IRR
7,500,000.00	100.00	0.46%
	200.00	0.92%
	300.00	1.38%
	400.00	1.84%
	500.00	2.30%

Source: Own elaboration based on FUNBAMBU data

Table A.3.3.15. Scenario of profitability of the housing construction projects an investment of US\$8.000.000 and sales of 100 to 500 housings per year

INVESTMENT	NUMBER OF HOUSINGS	IRR
8,000,000.00	100.00	0.43%
	200.00	0.86%
	300.00	1.29%
	400.00	1.72%
	500.00	2.15%

Source: Own elaboration based on FUNBAMBU data

ANNEX 3.4
DETAIL OF HOUSING CONSTRUCTION COSTS

Table 1. Average cost per house
(to July of 1996)

CONCEPT	COST (\$)	%
1. MATERIAL	2,295.15	51%
1.1 PRELIMINARY ACTIVITIES	11.89	0%
1.2 GROUNDWORK	238.41	5%
1.3 WALLS	615.05	14%
1.4 CEILING STRUCTURE	330.07	7%
1.5 GROUNDS	133.67	3%
1.6 HYDRAULIC INSTALLATION	134.04	3%
1.7 DOORS, WINDOWS, CORNICE IRONWORK, GLASSES.	259.54	6%
1.8 ELECTRIC INSTALLATION	105.08	2%
1.9 SEPTIC TANK Y DRYNAGE	123.94	3%
1.10 OUTSIDE PAINTING	71.69	2%
1.11 INSIDE AND OUTSIDE TRANSPORT	271.78	6%
2. LABOR	771.93	17%
3. OPERATIONAL COST (1)	376.19	8%
A. SUBTOTAL DIRECT COST (2)	3,443.28	77%
B. SUBTOTAL INDIRECT COST	1,047.95	23%
B.1. UNEXPECTED EXPENSES (10% DE A)	344.33	8%
B.2. MANAGMENT OVERHEAD (10% DE A)	344.33	8%
B.3. PERMITS AND COMSISSION (2% DE C) (3)	89.82	2%
B.4. INGENIERY OVERHEAD (5.25% DE C)	235.79	5%
B.5. ATTORNEY (0.75% DE C) (3)	33.68	1%
C. TOTAL COST (A+B)	4,491.23	100%

(1) INCLUDES WAGES, PER-DIEMS AND OTHER TRAVEL COST,
RESIDENTS ENGINEER, HOUSE RENT AND
OFFICE, GENERAL EXPENSES, STOREROOM RENT AND
STOREROOM STAFF SALARY

(2) ADD 1 + 2 + 3

(3) OTHER COMMISSIONS

(4) AVERAGE HOUSE BONDS

Source: FUNBAMBÚ

Table 2. House material Costs

CONCEPT	COSTS		TOTAL	%
	MATERIAL	TRANSPORT		
1. WOOD (1)	150305		150305	23.0%
2. CEMENT	106944	13160	120104	18.4%
3. QUARRY MATERIALS	67150	36765	103915	15.9%
4. CEELING AND OTHERS	46103		46103	7.0%
5. BAMBOO OR CANA BRAVA	34440		34440	5.3%
6. OTHERS METALIC PARTS	30264		30264	4.6%
7. PVC PLASTIC PRODUCTS	25322		25322	3.9%
8. SÉPTIC TANK AND WASH AREA	18650	6000	24650	3.8%
9. PAINT Y OTHERS	23724		23724	3.6%
10. GLASESS	21646		21646	3.3%
11. ELÉCTRIC MATERIAL	20287		20287	3.1%
12. CONCRET BLOCKS	13160	3572	16732	2.6%
13. FLAGSTONE	10750		10750	1.6%
14. PRESERVATIVE	4879		4879	0.7%
15. TRADE OF A LOCKSMITH	3039		3039	0.5%
16. TRANSPORT (2)		17959	17959	2.7%
A. SUBTOTAL MATERIALS	592797			
B. SUBTOTAL TRANSPORTS (3)		77456		
TOTAL A+B			654119	100%

THE WOOD USE HAS BEEN REDUCIED
 INSIDE TRANSPORTS
 THE AVERAGE IS 11.8% OF THE MATERIALS

Source: FUNBAMBÚ

ANNEX 3.5
***PROFITABILITY ANALYSIS IN THE BAMBOO LEVERAGE
PROJECT***

Table A.3.5.1. Analysis of profitability of the plantation of bamboo with 100% of the sales in the country and 0% abroad, a level of leverage of 1 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	25.03%	23.41%	20.95%	16.74%	7.38%
	33%	20.47%	18.88%	16.45%	12.26%	N.D.
	25%	16.50%	14.90%	12.45%	8.17%	N.D.
6X6	50%	23.61%	22.06%	19.70%	15.66%	6.63%
	33%	19.40%	17.86%	15.51%	11.46%	N.D.
	25%	15.83%	14.27%	11.87%	7.68%	N.D.
7X7	50%	21.76%	20.29%	18.06%	14.23%	5.62%
	33%	17.85%	16.36%	14.10%	10.18%	N.D.
	25%	14.20%	12.70%	10.41%	6.38%	N.D.

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.2. Analysis of profitability of the plantation of bamboo with 75% of the sales in the country and 25% abroad, a level of leverage of 1 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	47.68%	45.96%	43.35%	38.83%	29.02%
	33%	42.05%	40.38%	37.84%	33.47%	23.99%
	25%	37.41%	35.77%	33.26%	28.97%	19.67%
6X6	50%	45.05%	43.41%	40.92%	36.62%	27.30%
	33%	39.97%	38.37%	35.93%	31.75%	22.68%
	25%	36.10%	34.50%	32.07%	27.89%	18.86%
7X7	50%	41.75%	40.21%	37.85%	33.82%	25.09%
	33%	37.49%	35.94%	33.59%	29.57%	20.88%
	25%	33.30%	31.77%	29.46%	25.50%	16.95%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.3. Analysis of profitability of the plantation of bamboo with 50% of the sales in the country and 50% abroad, a level of leverage of 1 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	60.09%	58.33%	55.62%	50.93%	40.59%
	33%	53.84%	52.13%	49.50%	44.95%	35.00%
	25%	48.80%	47.11%	44.52%	40.05%	30.32%
6X6	50%	56.77%	55.09%	52.50%	48.03%	38.22%
	33%	51.16%	49.51%	46.99%	42.65%	33.15%
	25%	47.11%	45.47%	42.95%	38.61%	29.18%
7X7	50%	52.66%	51.07%	48.63%	44.42%	35.24%
	33%	48.17%	46.58%	44.14%	39.95%	30.84%
	25%	43.62%	42.05%	39.66%	35.54%	26.64%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.4. Analysis of profitability of the plantation of bamboo with 25% of the sales in the country and 75% abroad, a level of leverage of 1 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	68.93%	67.13%	64.36%	59.55%	48.86%
	33%	62.22%	60.47%	57.79%	53.13%	42.84%
	25%	56.90%	55.17%	52.53%	47.95%	37.89%
6X6	50%	65.11%	63.39%	60.75%	56.16%	46.01%
	33%	59.10%	57.43%	54.85%	50.40%	40.59%
	25%	54.95%	53.26%	50.69%	46.24%	36.48%
7X7	50%	60.43%	58.80%	56.30%	51.97%	42.46%
	33%	55.78%	54.15%	51.65%	47.34%	37.91%
	25%	50.97%	49.36%	46.91%	42.68%	33.47%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.5. Analysis of profitability of the plantation of bamboo with 0% of the sales in the country and 100% abroad, a level of leverage of 1 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	75.86%	74.04%	71.23%	66.32%	55.38%
	33%	68.80%	67.03%	64.30%	59.56%	49.02%
	25%	63.26%	61.51%	58.83%	54.16%	43.85%
6X6	50%	71.66%	69.91%	67.23%	62.55%	52.15%
	33%	65.34%	63.64%	61.03%	56.49%	46.44%
	25%	61.10%	59.39%	56.78%	52.24%	42.24%
7X7	50%	66.53%	64.88%	62.33%	57.91%	48.15%
	33%	61.75%	60.10%	57.56%	53.16%	43.48%
	25%	56.74%	55.11%	52.62%	48.30%	38.85%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.6. Analysis of profitability of the plantation of bamboo with 100% of the sales in the country and 0% abroad, a level of leverage of 1 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	23.63%	22.01%	19.55%	15.34%	5.98%
	33%	19.07%	17.48%	15.05%	10.86%	N.D.
	25%	15.10%	13.50%	11.05%	6.77%	N.D.
6X6	50%	22.21%	20.66%	18.30%	14.26%	5.23%
	33%	18.00%	16.46%	14.11%	10.06%	N.D.
	25%	14.43%	12.87%	10.47%	6.28%	N.D.
7X7	50%	20.36%	18.89%	16.66%	12.83%	4.22%
	33%	16.45%	14.96%	12.70%	8.78%	N.D.
	25%	12.80%	11.30%	9.01%	4.98%	N.D.

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.7. Analysis of profitability of the plantation of bamboo with 75% of the sales in the country and 25% abroad, a level of leverage of 1 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	46.28%	44.56%	41.95%	37.43%	27.62%
	33%	40.65%	38.98%	36.44%	32.07%	22.59%
	25%	36.01%	34.37%	31.86%	27.57%	18.27%
6X6	50%	43.65%	42.01%	39.52%	35.22%	25.90%
	33%	38.57%	36.97%	34.53%	30.35%	21.28%
	25%	34.70%	33.10%	30.67%	26.49%	17.46%
7X7	50%	40.35%	38.81%	36.45%	32.42%	23.69%
	33%	36.09%	34.54%	32.19%	28.17%	19.48%
	25%	31.90%	30.37%	28.06%	24.10%	15.55%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.8. Analysis of profitability of the plantation of bamboo with 50% of the sales in the country and 50% abroad, a level of leverage of 1 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	58.69%	56.93%	54.22%	49.53%	39.19%
	33%	52.44%	50.73%	48.10%	43.55%	33.60%
	25%	47.40%	45.71%	43.12%	38.65%	28.92%
6X6	50%	55.37%	53.69%	51.10%	46.63%	36.82%
	33%	49.76%	48.11%	45.59%	41.25%	31.75%
	25%	45.71%	44.07%	41.55%	37.21%	27.78%
7X7	50%	51.26%	49.67%	47.23%	43.02%	33.84%
	33%	46.77%	45.18%	42.74%	38.55%	29.44%
	25%	42.22%	40.65%	38.26%	34.14%	25.24%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.9. Analysis of profitability of the plantation of bamboo with 25% of the sales in the country and 75% abroad, a level of leverage of 1 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	67.53%	65.73%	62.96%	58.15%	47.46%
	33%	60.82%	59.07%	56.39%	51.73%	41.44%
	25%	55.50%	53.77%	51.13%	46.55%	36.49%
6X6	50%	63.71%	61.99%	59.35%	54.76%	44.61%
	33%	57.70%	56.03%	53.45%	49.00%	39.19%
	25%	53.55%	51.86%	49.29%	44.84%	35.08%
7X7	50%	59.03%	57.40%	54.90%	50.57%	41.06%
	33%	54.38%	52.75%	50.25%	45.94%	36.51%
	25%	49.57%	47.96%	45.51%	41.28%	32.07%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.10. Analysis of profitability of the plantation of bamboo with 0% of the sales in the country and 100% abroad, a level of leverage of 1 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	74.46%	72.64%	69.83%	64.92%	53.98%
	33%	67.40%	65.63%	62.90%	58.16%	47.62%
	25%	61.86%	60.11%	57.43%	52.76%	42.45%
6X6	50%	70.26%	68.51%	65.83%	61.15%	50.75%
	33%	63.94%	62.24%	59.63%	55.09%	45.04%
	25%	59.70%	57.99%	55.38%	50.84%	40.84%
7X7	50%	65.13%	63.48%	60.93%	56.51%	46.75%
	33%	60.35%	58.70%	56.16%	51.76%	42.08%
	25%	55.34%	53.71%	51.22%	46.90%	37.45%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.11. Analysis of profitability of the plantation of bamboo with 100% of the sales in the country and 0% abroad, a level of leverage of 1 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	22.23%	20.61%	18.15%	13.94%	4.58%
	33%	17.67%	16.08%	13.65%	9.46%	N.D.
	25%	13.70%	12.10%	9.65%	5.37%	N.D.
6X6	50%	20.81%	19.26%	16.90%	12.86%	3.83%
	33%	16.60%	15.06%	12.71%	8.66%	N.D.
	25%	13.03%	11.47%	9.07%	4.88%	N.D.
7X7	50%	18.96%	17.49%	15.26%	11.43%	2.82%
	33%	15.05%	13.56%	11.30%	7.38%	N.D.
	25%	11.40%	9.90%	7.61%	3.58%	N.D.

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.12. Analysis of profitability of the plantation of bamboo with 75% of the sales in the country and 25% abroad, a level of leverage of 1 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	44.88%	43.16%	40.55%	36.03%	26.22%
	33%	39.25%	37.58%	35.04%	30.67%	21.19%
	25%	34.61%	32.97%	30.46%	26.17%	16.87%
6X6	50%	42.25%	40.61%	38.12%	33.82%	24.50%
	33%	37.17%	35.57%	33.13%	28.95%	19.88%
	25%	33.30%	31.70%	29.27%	25.09%	16.06%
7X7	50%	38.95%	37.41%	35.05%	31.02%	22.29%
	33%	34.69%	33.14%	30.79%	26.77%	18.08%
	25%	30.50%	28.97%	26.66%	22.70%	14.15%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.13. Analysis of profitability of the plantation of bamboo with 50% of the sales in the country and 50% abroad, a level of leverage of 1 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	57.29%	55.53%	52.82%	48.13%	37.79%
	33%	51.04%	49.33%	46.70%	42.15%	32.20%
	25%	46.00%	44.31%	41.72%	37.25%	27.52%
6X6	50%	53.97%	52.29%	49.70%	45.23%	35.42%
	33%	48.36%	46.71%	44.19%	39.85%	30.35%
	25%	44.31%	42.67%	40.15%	35.81%	26.38%
7X7	50%	49.86%	48.27%	45.83%	41.62%	32.44%
	33%	45.37%	43.78%	41.34%	37.15%	28.04%
	25%	40.82%	39.25%	36.86%	32.74%	23.84%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.14. Analysis of profitability of the plantation of bamboo with 25% of the sales in the country and 75% abroad, a level of leverage of 1 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	66.13%	64.33%	61.56%	56.75%	46.06%
	33%	59.42%	57.67%	54.99%	50.33%	40.04%
	25%	54.10%	52.37%	49.73%	45.15%	35.09%
6X6	50%	62.31%	60.59%	57.95%	53.36%	43.21%
	33%	56.30%	54.63%	52.05%	47.60%	37.79%
	25%	52.15%	50.46%	47.89%	43.44%	33.68%
7X7	50%	57.63%	56.00%	53.50%	49.17%	39.66%
	33%	52.98%	51.35%	48.85%	44.54%	35.11%
	25%	48.17%	46.56%	44.11%	39.88%	30.67%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.15. Analysis of profitability of the plantation of bamboo with 0% of the sales in the country and 100% abroad, a level of leverage of 1 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	73.06%	71.24%	68.43%	63.52%	52.58%
	33%	66.00%	64.23%	61.50%	56.76%	46.22%
	25%	60.46%	58.71%	56.03%	51.36%	41.05%
6X6	50%	68.86%	67.11%	64.43%	59.75%	49.35%
	33%	62.54%	60.84%	58.23%	53.69%	43.64%
	25%	58.30%	56.59%	53.98%	49.44%	39.44%
7X7	50%	63.73%	62.08%	59.53%	55.11%	45.35%
	33%	58.95%	57.30%	54.76%	50.36%	40.68%
	25%	53.94%	52.31%	49.82%	45.50%	36.05%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.16. Analysis of profitability of the plantation of bamboo with 100% of the sales in the country and 0% abroad, a level of leverage of 2 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	32.87%	30.58%	27.11%	21.16%	7.94%
	33%	26.43%	24.18%	20.75%	14.84%	N.D.
	25%	20.82%	18.56%	15.11%	9.07%	N.D.
6X6	50%	30.86%	28.67%	25.35%	19.64%	6.90%
	33%	24.91%	22.74%	19.43%	13.71%	N.D.
	25%	19.88%	17.67%	14.29%	8.38%	N.D.
7X7	50%	28.25%	26.18%	23.03%	17.62%	5.46%
	33%	22.73%	20.63%	17.43%	11.91%	N.D.
	25%	17.58%	15.47%	12.22%	6.53%	N.D.

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.17. Analysis of profitability of the plantation of bamboo with 75% of the sales in the country and 25% abroad, a level of leverage of 2 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	64.84%	62.42%	58.72%	52.35%	38.50%
	33%	56.90%	54.54%	50.95%	44.78%	31.40%
	25%	50.35%	48.02%	44.49%	38.43%	25.29%
6X6	50%	61.13%	58.82%	55.29%	49.23%	36.07%
	33%	53.95%	51.69%	48.25%	42.35%	29.56%
	25%	48.50%	46.24%	42.80%	36.91%	24.16%
7X7	50%	56.47%	54.29%	50.97%	45.27%	32.95%
	33%	50.45%	48.27%	44.95%	39.27%	27.00%
	25%	44.54%	42.39%	39.12%	33.53%	21.47%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.18. Analysis of profitability of the plantation of bamboo with 50% of the sales in the country and 50% abroad, a level of leverage of 2 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	82.37%	79.88%	76.06%	69.43%	54.84%
	33%	73.54%	71.12%	67.41%	60.99%	46.94%
	25%	66.42%	64.03%	60.38%	54.08%	40.34%
6X6	50%	77.68%	75.30%	71.65%	65.34%	51.49%
	33%	69.75%	67.42%	63.87%	57.74%	44.33%
	25%	64.04%	61.72%	58.16%	52.04%	38.72%
7X7	50%	71.88%	69.62%	66.18%	60.24%	47.27%
	33%	65.54%	63.29%	59.85%	53.93%	41.07%
	25%	59.12%	56.90%	53.52%	47.71%	35.13%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.19. Analysis of profitability of the plantation of bamboo with 25% of the sales in the country and 75% abroad, a level of leverage of 2 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	94.84%	92.30%	88.39%	81.59%	66.51%
	33%	85.37%	82.90%	79.12%	72.53%	58.01%
	25%	77.86%	75.42%	71.69%	65.22%	51.02%
6X6	50%	89.45%	87.02%	83.29%	76.81%	62.49%
	33%	80.97%	78.60%	74.97%	68.68%	54.83%
	25%	75.10%	72.73%	69.09%	62.81%	49.04%
7X7	50%	82.84%	80.54%	77.01%	70.90%	57.47%
	33%	76.27%	73.97%	70.45%	64.37%	51.05%
	25%	69.48%	67.22%	63.76%	57.79%	44.78%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.20. Analysis of profitability of the plantation of bamboo with 0% of the sales in the country and 100% abroad, a level of leverage of 2 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	104.63%	102.06%	98.09%	91.16%	75.71%
	33%	94.66%	92.16%	88.31%	81.61%	66.73%
	25%	86.84%	84.37%	80.58%	73.99%	59.43%
6X6	50%	98.69%	96.23%	92.44%	85.83%	71.15%
	33%	89.78%	87.38%	83.69%	77.27%	63.09%
	25%	83.78%	81.38%	77.68%	71.28%	57.16%
7X7	50%	91.46%	89.12%	85.53%	79.29%	65.51%
	33%	84.71%	82.37%	78.79%	72.58%	58.92%
	25%	77.63%	75.33%	71.81%	65.72%	52.37%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.21. Analysis of profitability of the plantation of bamboo with 100% of the sales in the country and 0% abroad, a level of leverage of 2 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	27.27%	24.98%	21.51%	15.56%	2.34%
	33%	20.83%	18.58%	15.15%	9.24%	N.D.
	25%	15.22%	12.96%	9.51%	3.47%	N.D.
6X6	50%	25.26%	23.07%	19.75%	14.04%	1.30%
	33%	19.31%	17.14%	13.83%	8.11%	N.D.
	25%	14.28%	12.07%	8.69%	2.78%	N.D.
7X7	50%	22.65%	20.58%	17.43%	12.02%	N.D.
	33%	17.13%	15.03%	11.83%	6.31%	N.D.
	25%	11.98%	9.87%	6.62%	0.93%	N.D.

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.22. Analysis of profitability of the plantation of bamboo with 75% of the sales in the country and 25% abroad, a level of leverage of 2 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	59.24%	56.82%	53.12%	46.75%	32.90%
	33%	51.30%	48.94%	45.35%	39.18%	25.80%
	25%	44.75%	42.42%	38.89%	32.83%	19.69%
6X6	50%	55.53%	53.22%	49.69%	43.63%	30.47%
	33%	48.35%	46.09%	42.65%	36.75%	23.96%
	25%	42.90%	40.64%	37.20%	31.31%	18.56%
7X7	50%	50.87%	48.69%	45.37%	39.67%	27.35%
	33%	44.85%	42.67%	39.35%	33.67%	21.40%
	25%	38.94%	36.79%	33.52%	27.93%	15.87%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.23. Analysis of profitability of the plantation of bamboo with 50% of the sales in the country and 50% abroad, a level of leverage of 2 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	76.77%	74.28%	70.46%	63.83%	49.24%
	33%	67.94%	65.52%	61.81%	55.39%	41.34%
	25%	60.82%	58.43%	54.78%	48.48%	34.74%
6X6	50%	72.08%	69.70%	66.05%	59.74%	45.89%
	33%	64.15%	61.82%	58.27%	52.14%	38.73%
	25%	58.44%	56.12%	52.56%	46.44%	33.12%
7X7	50%	66.28%	64.02%	60.58%	54.64%	41.67%
	33%	59.94%	57.69%	54.25%	48.33%	35.47%
	25%	53.52%	51.30%	47.92%	42.11%	29.53%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.24. Analysis of profitability of the plantation of bamboo with 25% of the sales in the country and 75% abroad, a level of leverage of 2 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	89.24%	86.70%	82.79%	75.99%	60.91%
	33%	79.77%	77.30%	73.52%	66.93%	52.41%
	25%	72.26%	69.82%	66.09%	59.62%	45.42%
6X6	50%	83.85%	81.42%	77.69%	71.21%	56.89%
	33%	75.37%	73.00%	69.37%	63.08%	49.23%
	25%	69.50%	67.13%	63.49%	57.21%	43.44%
7X7	50%	77.24%	74.94%	71.41%	65.30%	51.87%
	33%	70.67%	68.37%	64.85%	58.77%	45.45%
	25%	63.88%	61.62%	58.16%	52.19%	39.18%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.25. Analysis of profitability of the plantation of bamboo with 0% of the sales in the country and 100% abroad, a level of leverage of 2 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	99.03%	96.46%	92.49%	85.56%	70.11%
	33%	89.06%	86.56%	82.71%	76.01%	61.13%
	25%	81.24%	78.77%	74.98%	68.39%	53.83%
6X6	50%	93.09%	90.63%	86.84%	80.23%	65.55%
	33%	84.18%	81.78%	78.09%	71.67%	57.49%
	25%	78.18%	75.78%	72.08%	65.68%	51.56%
7X7	50%	85.86%	83.52%	79.93%	73.69%	59.91%
	33%	79.11%	76.77%	73.19%	66.98%	53.32%
	25%	72.03%	69.73%	66.21%	60.12%	46.77%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.26. Analysis of profitability of the plantation of bamboo with 100% of the sales in the country and 0% abroad, a level of leverage of 3 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	40.70%	37.75%	33.27%	25.58%	8.51%
	33%	32.39%	29.48%	25.06%	17.42%	N.D.
	25%	25.15%	22.23%	17.77%	9.96%	N.D.
6X6	50%	38.11%	35.28%	30.99%	23.62%	7.16%
	33%	30.43%	27.62%	23.35%	15.96%	N.D.
	25%	23.93%	21.08%	16.71%	9.07%	N.D.
7X7	50%	34.74%	32.06%	28.00%	21.01%	5.31%
	33%	27.61%	24.89%	20.77%	13.63%	N.D.
	25%	20.96%	18.23%	14.04%	6.69%	N.D.

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.27. Analysis of profitability of the plantation of bamboo with 75% of the sales in the country and 25% abroad, a level of leverage of 3 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	82.00%	78.87%	74.10%	65.87%	47.98%
	33%	71.74%	68.70%	64.06%	56.09%	38.81%
	25%	63.28%	60.28%	55.71%	47.88%	30.92%
6X6	50%	77.21%	74.22%	69.67%	61.84%	44.84%
	33%	67.94%	65.02%	60.58%	52.95%	36.43%
	25%	60.90%	57.98%	53.53%	45.93%	29.45%
7X7	50%	71.20%	68.38%	64.09%	56.73%	40.81%
	33%	63.42%	60.60%	56.31%	48.97%	33.13%
	25%	55.78%	53.00%	48.78%	41.57%	25.98%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.28. Analysis of profitability of the plantation of bamboo with 50% of the sales in the country and 50% abroad, a level of leverage of 3 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	104.64%	101.42%	96.49%	87.93%	69.08%
	33%	93.24%	90.11%	85.32%	77.03%	58.88%
	25%	84.05%	80.96%	76.24%	68.10%	50.35%
6X6	50%	98.59%	95.51%	90.80%	82.65%	64.76%
	33%	88.34%	85.34%	80.75%	72.82%	55.51%
	25%	80.97%	77.97%	73.38%	65.47%	48.26%
7X7	50%	91.09%	88.18%	83.73%	76.06%	59.31%
	33%	82.91%	80.00%	75.55%	67.91%	51.30%
	25%	74.61%	71.74%	67.37%	59.87%	43.63%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.29. Analysis of profitability of the plantation of bamboo with 25% of the sales in the country and 75% abroad, a level of leverage of 3 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	120.75%	117.47%	112.43%	103.64%	84.16%
	33%	108.52%	105.33%	100.44%	91.94%	73.18%
	25%	98.82%	95.67%	90.85%	82.50%	64.15%
6X6	50%	113.79%	110.65%	105.83%	97.46%	78.96%
	33%	102.84%	99.78%	95.09%	86.96%	69.07%
	25%	95.25%	92.19%	87.49%	79.38%	61.59%
7X7	50%	105.25%	102.28%	97.72%	89.83%	72.49%
	33%	96.77%	93.80%	89.25%	81.39%	64.20%
	25%	88.00%	85.07%	80.60%	72.89%	56.09%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.30. Analysis of profitability of the plantation of bamboo with 0% of the sales in the country and 100% abroad, a level of leverage of 3 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	133.40%	130.07%	124.95%	116.00%	96.04%
	33%	120.52%	117.29%	112.32%	103.66%	84.44%
	25%	110.42%	107.23%	102.33%	93.82%	75.02%
6X6	50%	125.73%	122.54%	117.65%	109.11%	90.15%
	33%	114.21%	111.11%	106.35%	98.06%	79.74%
	25%	106.47%	103.36%	98.59%	90.32%	72.08%
7X7	50%	116.39%	113.36%	108.72%	100.66%	82.86%
	33%	107.67%	104.65%	100.02%	92.00%	74.35%
	25%	98.53%	95.55%	91.00%	83.13%	65.90%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.31. Analysis of profitability of the plantation of bamboo with 100% of the sales in the country and 0% abroad, a level of leverage of 3 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	36.50%	33.55%	29.07%	21.38%	4.31%
	33%	28.19%	25.28%	20.86%	13.22%	N.D.
	25%	20.95%	18.03%	13.57%	5.76%	N.D.
6X6	50%	33.91%	31.08%	26.79%	19.42%	2.96%
	33%	26.23%	23.42%	19.15%	11.76%	N.D.
	25%	19.73%	16.88%	12.51%	4.87%	N.D.
7X7	50%	30.54%	27.86%	23.80%	16.81%	1.11%
	33%	23.41%	20.69%	16.57%	9.43%	N.D.
	25%	16.76%	14.03%	9.84%	2.49%	N.D.

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.32. Analysis of profitability of the plantation of bamboo with 75% of the sales in the country and 25% abroad, a level of leverage of 3 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	77.80%	74.67%	69.90%	61.67%	43.78%
	33%	67.54%	64.50%	59.86%	51.89%	34.61%
	25%	59.08%	56.08%	51.51%	43.68%	26.72%
6X6	50%	73.01%	70.02%	65.47%	57.64%	40.64%
	33%	63.74%	60.82%	56.38%	48.75%	32.23%
	25%	56.70%	53.78%	49.33%	41.73%	25.25%
7X7	50%	67.00%	64.18%	59.89%	52.53%	36.61%
	33%	59.22%	56.40%	52.11%	44.77%	28.93%
	25%	51.58%	48.80%	44.58%	37.37%	21.78%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.33. Analysis of profitability of the plantation of bamboo with 50% of the sales in the country and 50% abroad, a level of leverage of 3 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	100.44%	97.22%	92.29%	83.73%	64.88%
	33%	89.04%	85.91%	81.12%	72.83%	54.68%
	25%	79.85%	76.76%	72.04%	63.90%	46.15%
6X6	50%	94.39%	91.31%	86.60%	78.45%	60.56%
	33%	84.14%	81.14%	76.55%	68.62%	51.31%
	25%	76.77%	73.77%	69.18%	61.27%	44.06%
7X7	50%	86.89%	83.98%	79.53%	71.86%	55.11%
	33%	78.71%	75.80%	71.35%	63.71%	47.10%
	25%	70.41%	67.54%	63.17%	55.67%	39.43%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.34. Analysis of profitability of the plantation of bamboo with 25% of the sales in the country and 75% abroad, a level of leverage of 3 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	116.55%	113.27%	108.23%	99.44%	79.96%
	33%	104.32%	101.13%	96.24%	87.74%	68.98%
	25%	94.62%	91.47%	86.65%	78.30%	59.95%
6X6	50%	109.59%	106.45%	101.63%	93.26%	74.76%
	33%	98.64%	95.58%	90.89%	82.76%	64.87%
	25%	91.05%	87.99%	83.29%	75.18%	57.39%
7X7	50%	101.05%	98.08%	93.52%	85.63%	68.29%
	33%	92.57%	89.60%	85.05%	77.19%	60.00%
	25%	83.80%	80.87%	76.40%	68.69%	51.89%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.35. Analysis of profitability of the plantation of bamboo with 0% of the sales in the country and 100% abroad, a level of leverage of 3 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	129.20%	125.87%	120.75%	111.80%	91.84%
	33%	116.32%	113.09%	108.12%	99.46%	80.24%
	25%	106.22%	103.03%	98.13%	89.62%	70.82%
6X6	50%	121.53%	118.34%	113.45%	104.91%	85.95%
	33%	110.01%	106.91%	102.15%	93.86%	75.54%
	25%	102.27%	99.16%	94.39%	86.12%	67.88%
7X7	50%	112.19%	109.16%	104.52%	96.46%	78.66%
	33%	103.47%	100.45%	95.82%	87.80%	70.15%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.36. Analysis of profitability of the plantation of bamboo with 100% of the sales in the country and 0% abroad, a level of leverage of 3 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	32.30%	29.35%	24.87%	17.18%	0.11%
	33%	23.99%	21.08%	16.66%	9.02%	N.D.
	25%	16.75%	13.83%	9.37%	1.56%	N.D.
6X6	50%	29.71%	26.88%	22.59%	15.22%	N.D.
	33%	22.03%	19.22%	14.95%	7.56%	N.D.
	25%	15.53%	12.68%	8.31%	0.67%	N.D.
7X7	50%	26.34%	23.66%	19.60%	12.61%	N.D.
	33%	19.21%	16.49%	12.37%	5.23%	N.D.
	25%	12.56%	9.83%	5.64%	N.D.	N.D.

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.37. Analysis of profitability of the plantation of bamboo with 75% of the sales in the country and 25% abroad, a level of leverage of 3 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	73.60%	70.47%	65.70%	57.47%	39.58%
	33%	63.34%	60.30%	55.66%	47.69%	30.41%
	25%	54.88%	51.88%	47.31%	39.48%	22.52%
6X6	50%	68.81%	65.82%	61.27%	53.44%	36.44%
	33%	59.54%	56.62%	52.18%	44.55%	28.03%
	25%	52.50%	49.58%	45.13%	37.53%	21.05%
7X7	50%	62.80%	59.98%	55.69%	48.33%	32.41%
	33%	55.02%	52.20%	47.91%	40.57%	24.73%
	25%	47.38%	44.60%	40.38%	33.17%	17.58%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.38. Analysis of profitability of the plantation of bamboo with 50% of the sales in the country and 50% abroad, a level of leverage of 3 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	96.24%	93.02%	88.09%	79.53%	60.68%
	33%	84.84%	81.71%	76.92%	68.63%	50.48%
	25%	75.65%	72.56%	67.84%	59.70%	41.95%
6X6	50%	90.19%	87.11%	82.40%	74.25%	56.36%
	33%	79.94%	76.94%	72.35%	64.42%	47.11%
	25%	72.57%	69.57%	64.98%	57.07%	39.86%
7X7	50%	82.69%	79.78%	75.33%	67.66%	50.91%
	33%	74.51%	71.60%	67.15%	59.51%	42.90%
	25%	66.21%	63.34%	58.97%	51.47%	35.23%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.39. Analysis of profitability of the plantation of bamboo with 25% of the sales in the country and 75% abroad, a level of leverage of 3 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	112.35%	109.07%	104.03%	95.24%	75.76%
	33%	100.12%	96.93%	92.04%	83.54%	64.78%
	25%	90.42%	87.27%	82.45%	74.10%	55.75%
6X6	50%	105.39%	102.25%	97.43%	89.06%	70.56%
	33%	94.44%	91.38%	86.69%	78.56%	60.67%
	25%	86.85%	83.79%	79.09%	70.98%	53.19%
7X7	50%	96.85%	93.88%	89.32%	81.43%	64.09%
	33%	88.37%	85.40%	80.85%	72.99%	55.80%
	25%	79.60%	76.67%	72.20%	64.49%	47.69%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.40. Analysis of profitability of the plantation of bamboo with 0% of the sales in the country and 100% abroad, a level of leverage of 3 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	125.00%	121.67%	116.55%	107.60%	87.64%
	33%	112.12%	108.89%	103.92%	95.26%	76.04%
	25%	102.02%	98.83%	93.93%	85.42%	66.62%
6X6	50%	117.33%	114.14%	109.25%	100.71%	81.75%
	33%	105.81%	102.71%	97.95%	89.66%	71.34%
	25%	98.07%	94.96%	90.19%	81.92%	63.68%
7X7	50%	107.99%	104.96%	100.32%	92.26%	74.46%
	33%	99.27%	96.25%	91.62%	83.60%	65.95%
	25%	90.13%	87.15%	82.60%	74.73%	57.50%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.41. Analysis of profitability of the plantation of bamboo with 100% of the sales in the country and 0% abroad, a level of leverage of 4 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	48.54%	44.92%	39.43%	30.01%	9.08%
	33%	38.35%	34.79%	29.36%	19.99%	N.D.
	25%	29.47%	25.89%	20.42%	10.86%	N.D.
6X6	50%	45.36%	41.90%	36.63%	27.60%	7.42%
	33%	35.94%	32.50%	27.27%	18.21%	N.D.
	25%	27.98%	24.48%	19.13%	9.76%	N.D.
7X7	50%	41.23%	37.95%	32.97%	24.40%	5.15%
	33%	32.48%	29.16%	24.10%	15.35%	N.D.
	25%	24.34%	20.99%	15.85%	6.85%	N.D.

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.42. Analysis of profitability of the plantation of bamboo with 75% of the sales in the country and 25% abroad, a level of leverage of 4 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	99.16%	95.33%	89.48%	79.39%	57.46%
	33%	86.59%	82.86%	77.17%	67.41%	46.22%
	25%	76.22%	72.54%	66.94%	57.34%	36.55%
6X6	50%	93.29%	89.63%	84.05%	74.45%	53.61%
	33%	81.92%	78.35%	72.90%	63.55%	43.30%
	25%	73.29%	69.71%	64.27%	54.94%	34.75%
7X7	50%	85.92%	82.46%	77.20%	68.18%	48.66%
	33%	76.38%	72.92%	67.67%	58.68%	39.26%
	25%	67.02%	63.61%	58.44%	49.60%	30.49%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.43. Analysis of profitability of the plantation of bamboo with 50% of the sales in the country and 50% abroad, a level of leverage of 4 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	126.92%	122.97%	116.92%	106.43%	83.33%
	33%	112.94%	109.10%	103.23%	93.07%	70.82%
	25%	101.67%	97.89%	92.10%	82.12%	60.37%
6X6	50%	119.50%	115.72%	109.95%	99.95%	78.03%
	33%	106.94%	103.26%	97.63%	87.91%	66.69%
	25%	97.90%	94.22%	88.59%	78.89%	57.80%
7X7	50%	110.31%	106.74%	101.29%	91.88%	71.35%
	33%	100.27%	96.70%	91.26%	81.89%	61.52%
	25%	90.10%	86.59%	81.23%	72.04%	52.13%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.44. Analysis of profitability of the plantation of bamboo with 25% of the sales in the country and 75% abroad, a level of leverage of 4 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	146.66%	142.64%	136.46%	125.69%	101.81%
	33%	131.67%	127.77%	121.77%	111.35%	88.35%
	25%	119.78%	115.92%	110.01%	99.77%	77.28%
6X6	50%	138.13%	134.28%	128.38%	118.12%	95.44%
	33%	124.70%	120.95%	115.20%	105.24%	83.31%
	25%	115.41%	111.65%	105.90%	95.94%	74.14%
7X7	50%	127.67%	124.02%	118.43%	108.75%	87.50%
	33%	117.27%	113.62%	108.05%	98.42%	77.34%
	25%	106.52%	102.93%	97.45%	88.00%	67.40%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.45. Analysis of profitability of the plantation of bamboo with 0% of the sales in the country and 100% abroad, a level of leverage of 4 to 1 and an interest rate of 6%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	162.16%	158.09%	151.81%	140.84%	116.37%
	33%	146.38%	142.42%	136.33%	125.71%	102.15%
	25%	134.00%	130.09%	124.08%	113.65%	90.60%
6X6	50%	152.76%	148.86%	142.86%	132.40%	109.15%
	33%	138.65%	134.84%	129.00%	118.85%	96.39%
	25%	129.16%	125.35%	119.50%	109.35%	87.00%
7X7	50%	141.31%	137.61%	131.92%	122.04%	100.22%
	33%	130.62%	126.92%	121.25%	111.42%	89.79%
	25%	119.42%	115.78%	110.20%	100.55%	79.42%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.46. Analysis of profitability of the plantation of bamboo with 100% of the sales in the country and 0% abroad, a level of leverage of 4 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	42.94%	39.32%	33.83%	24.41%	3.48%
	33%	32.75%	29.19%	23.76%	14.39%	N.D.
	25%	23.87%	20.29%	14.82%	5.26%	N.D.
6X6	50%	39.76%	36.30%	31.03%	22.00%	1.82%
	33%	30.34%	26.90%	21.67%	12.61%	N.D.
	25%	22.38%	18.88%	13.53%	4.16%	N.D.
7X7	50%	35.63%	32.35%	27.37%	18.80%	N.D.
	33%	26.88%	23.56%	18.50%	9.75%	N.D.
	25%	18.74%	15.39%	10.25%	1.25%	N.D.

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.47. Analysis of profitability of the plantation of bamboo with 75% of the sales in the country and 25% abroad, a level of leverage of 4 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	93.56%	89.73%	83.88%	73.79%	51.86%
	33%	80.99%	77.26%	71.57%	61.81%	40.62%
	25%	70.62%	66.94%	61.34%	51.74%	30.95%
6X6	50%	87.69%	84.03%	78.45%	68.85%	48.01%
	33%	76.32%	72.75%	67.30%	57.95%	37.70%
	25%	67.69%	64.11%	58.67%	49.34%	29.15%
7X7	50%	80.32%	76.86%	71.60%	62.58%	43.06%
	33%	70.78%	67.32%	62.07%	53.08%	33.66%
	25%	61.42%	58.01%	52.84%	44.00%	24.89%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.48. Analysis of profitability of the plantation of bamboo with 50% of the sales in the country and 50% abroad, a level of leverage of 4 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	121.32%	117.37%	111.32%	100.83%	77.73%
	33%	107.34%	103.50%	97.63%	87.47%	65.22%
	25%	96.07%	92.29%	86.50%	76.52%	54.77%
6X6	50%	113.90%	110.12%	104.35%	94.35%	72.43%
	33%	101.34%	97.66%	92.03%	82.31%	61.09%
	25%	92.30%	88.62%	82.99%	73.29%	52.20%
7X7	50%	104.71%	101.14%	95.69%	86.28%	65.75%
	33%	94.67%	91.10%	85.66%	76.29%	55.92%
	25%	84.50%	80.99%	75.63%	66.44%	46.53%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.49. Analysis of profitability of the plantation of bamboo with 25% of the sales in the country and 75% abroad, a level of leverage of 4 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	141.06%	137.04%	130.86%	120.09%	96.21%
	33%	126.07%	122.17%	116.17%	105.75%	82.75%
	25%	114.18%	110.32%	104.41%	94.17%	71.68%
6X6	50%	132.53%	128.68%	122.78%	112.52%	89.84%
	33%	119.10%	115.35%	109.60%	99.64%	77.71%
	25%	109.81%	106.05%	100.30%	90.34%	68.54%
7X7	50%	122.07%	118.42%	112.83%	103.15%	81.90%
	33%	111.67%	108.02%	102.45%	92.82%	71.74%
	25%	100.92%	97.33%	91.85%	82.40%	61.80%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.50. Analysis of profitability of the plantation of bamboo with 0% of the sales in the country and 100% abroad, a level of leverage of 4 to 1 and an interest rate of 8%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	156.56%	152.49%	146.21%	135.24%	110.77%
	33%	140.78%	136.82%	130.73%	120.11%	96.55%
	25%	128.40%	124.49%	118.48%	108.05%	85.00%
6X6	50%	147.16%	143.26%	137.26%	126.80%	103.55%
	33%	133.05%	129.24%	123.40%	113.25%	90.79%
	25%	123.56%	119.75%	113.90%	103.75%	81.40%
7X7	50%	135.71%	132.01%	126.32%	116.44%	94.62%
	33%	125.02%	121.32%	115.65%	105.82%	84.19%
	25%	113.82%	110.18%	104.60%	94.95%	73.82%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.51. Analysis of profitability of the plantation of bamboo with 100% of the sales in the country and 0% abroad, a level of leverage of 4 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	37.34%	33.72%	28.23%	18.81%	N.D.
	33%	27.15%	23.59%	18.16%	8.79%	N.D.
	25%	18.27%	14.69%	9.22%	N.D.	N.D.
6X6	50%	34.16%	30.70%	25.43%	16.40%	N.D.
	33%	24.74%	21.30%	16.07%	7.01%	N.D.
	25%	16.78%	13.28%	7.93%	N.D.	N.D.
7X7	50%	30.03%	26.75%	21.77%	13.20%	N.D.
	33%	21.28%	17.96%	12.90%	4.15%	N.D.
	25%	13.14%	9.79%	4.65%	N.D.	N.D.

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.52. Analysis of profitability of the plantation of bamboo with 75% of the sales in the country and 25% abroad, a level of leverage of 4 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	87.96%	84.13%	78.28%	68.19%	46.26%
	33%	75.39%	71.66%	65.97%	56.21%	35.02%
	25%	65.02%	61.34%	55.74%	46.14%	25.35%
6X6	50%	82.09%	78.43%	72.85%	63.25%	42.41%
	33%	70.72%	67.15%	61.70%	52.35%	32.10%
	25%	62.09%	58.51%	53.07%	43.74%	23.55%
7X7	50%	74.72%	71.26%	66.00%	56.98%	37.46%
	33%	65.18%	61.72%	56.47%	47.48%	28.06%
	25%	55.82%	52.41%	47.24%	38.40%	19.29%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.53. Analysis of profitability of the plantation of bamboo with 50% of the sales in the country and 50% abroad, a level of leverage of 4 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	115.72%	111.77%	105.72%	95.23%	72.13%
	33%	101.74%	97.90%	92.03%	81.87%	59.62%
	25%	90.47%	86.69%	80.90%	70.92%	49.17%
6X6	50%	108.30%	104.52%	98.75%	88.75%	66.83%
	33%	95.74%	92.06%	86.43%	76.71%	55.49%
	25%	86.70%	83.02%	77.39%	67.69%	46.60%
7X7	50%	99.11%	95.54%	90.09%	80.68%	60.15%
	33%	89.07%	85.50%	80.06%	70.69%	50.32%
	25%	78.90%	75.39%	70.03%	60.84%	40.93%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.54. Analysis of profitability of the plantation of bamboo with 25% of the sales in the country and 75% abroad, a level of leverage of 4 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	135.46%	131.44%	125.26%	114.49%	90.61%
	33%	120.47%	116.57%	110.57%	100.15%	77.15%
	25%	108.58%	104.72%	98.81%	88.57%	66.08%
6X6	50%	126.93%	123.08%	117.18%	106.92%	84.24%
	33%	113.50%	109.75%	104.00%	94.04%	72.11%
	25%	104.21%	100.45%	94.70%	84.74%	62.94%
7X7	50%	116.47%	112.82%	107.23%	97.55%	76.30%
	33%	106.07%	102.42%	96.85%	87.22%	66.14%
	25%	95.32%	91.73%	86.25%	76.80%	56.20%

Source: Own elaboration based on FUNBAMBU data

Table A.3.5.55. Analysis of profitability of the plantation of bamboo with 0% of the sales in the country and 100% abroad, a level of leverage of 4 to 1 and an interest rate of 10%.

Sows	Extraction	100 Ha	80 Ha	60 Ha	40 Ha	20 Ha
5X5	50%	150.96%	146.89%	140.61%	129.64%	105.17%
	33%	135.18%	131.22%	125.13%	114.51%	90.95%
	25%	122.80%	118.89%	112.88%	102.45%	79.40%
6X6	50%	141.56%	137.66%	131.66%	121.20%	97.95%
	33%	127.45%	123.64%	117.80%	107.65%	85.19%
	25%	117.96%	114.15%	108.30%	98.15%	75.80%
7X7	50%	130.11%	126.41%	120.72%	110.84%	89.02%
	33%	119.42%	115.72%	110.05%	100.22%	78.59%
	25%	108.22%	104.58%	99.00%	89.35%	68.22%

Source: Own elaboration based on FUNBAMBU data