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# Technische Universiteit Eindhoven

Bamboo housing in  
Costa Rica.  
(La construcción de  
viviendas de bambú  
en Costa Rica)  
Report no. 13.  
Dr. Jules J.A.Janssen.  
TUE BKO 94.01

March 1994.

Report to U.N.Habitat  
Nairobi, dealing with  
project UNCHS COS/90/005.

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Note: The text on the foundation appears in my last report as item E.1. Because of its importance now, it appears in this report as chapter 0. The other chapters have the same titles as before.

## 1. Introduction.

This report deals with my thirteenth visit to the "Proyecto Nacional de Bambú" in Costa Rica, from February 20th till March 4th 1994. Earlier visits have been paid in:

March 1987,  
November 1987,  
August 1988,  
February/March 1989,  
July/August 1989,  
March 1990,  
November 1990,  
July 1991,  
February/March 1992,  
July 1992,  
February/March 1993,  
July 1993.

Reports on these visits have been published.

My counterpart is dr. Jorge Gutierrez, Asesor Investigación y Desarrollo of the said project.

My function has been described by the project (in the budget, line 11.01) as "Supervisor Tecnico" (en Construcción y Cultivo); the terms of reference appear at the end of this report. The contract dealing with this visit has been signed by UNCHS/Habitat in Nairobi on February 8th, 1994.

For my next visit (the fourteenth) an agreement has been made for the period Sunday July 17th till Thursday-evening July 28th, 1994. Terms of reference as usual.

dr. Jules J.A.Janssen,  
Eindhoven, March 15th, 1994.  
\cr94b.

## Chapter 0. The foundation.

Quite some time has been spent on discussions about the change of the Project into a Foundation. Evidently this is a very important subject. Honestly I cannot agree with the actual developments, and I will write here a rather negative chapter.

### First item.

For the discussion with UNDP on Wednesday February 23rd I prepared the next remark, but I did not find the opportunity to make this statement in the meeting. I like to put it here.

I am a little bit surprised about the "founders" of the actual foundation. These "founders" are not the founders but the trustees, with the responsibility to protect the original idea. The original idea was: bamboo as a material for cheap housing for poor people and for job creation.

In my opinion the creator of this original idea is really the authentic founder; I mean Ana Cecilia with her colleagues from the first years. And maybe the Dutch government for her financial support.

Today we see a foundation with a board and the like. The responsibility of this board is to maintain the original idea: bamboo, housing and job creating, and nothing more.

### Second item.

The only thing we need is that the project has the legal right to run its own bank account, to sign contracts, to hire working people, and the like. But now we are facing a foundation with a rather complicated structure of boards and a general assembly. The absolute majority of the members do not know anything about bamboo. I am really afraid about the influence of this structure on the project. The original idea was that the project itself should develop into a foundation; this was agreed some years ago with mr. Bruno Guandalini from UNDP. But now the foundation is parachuted on top of the project.

In my opinion a board of say five members, knowing a lot about bamboo and about housing, authorities in these fields, preferably even on international level, would be a blessing for the project, by meeting twice a year to check the progress of the project, and to discuss the main policy.

### Third item.

It seems likely that the new foundation will nominate an executive director, who will need a salary, and after that a secretary, a car, and the like. Rumours can be heard in these days about who is likely to be nominated. Of course rumours are not to be trusted but sometimes they might give an idea about what is going on. In these days between the elections and the beginning of a new government, many ministers and high ranking staff know they will lose their job shortly. This is all in the game of politics: if you have been elected and have been nominated as e.g. "official mayor" in a ministry or another official office, you have to realize it is a job for four years only.

The project is unable to pay for a new director. This



burden can kill the project. This should be very sad: a project like this which is really successful, being killed by such a bad event.

In my opinion it is about the same as we have had already two times. About 1988 a political friend should have been nominated as director next to Ana Cecilia, and around 1991 a CTA (Chief Technical Advisor) was likely to be nominated. In both cases the project has been saved, but in my opinion all partners who originally signed the project document should do their best to save the project now for the third time.

Fourth item.

In his letter of February 1st Mr. Zawadski, minister of Housing, announces "this is the Foundation". But in my opinion the partners in the project like the Dutch government, Habitat Nairobi and UNDP, have to decide if they agree with the transition of the project into the said foundation. I realize well the Embassy and the UN cannot interfere with interior politics, but in this case the capital in the foundation is from Dutch origin. Evidently it is the Costa Rican government who is the authority in this country, but the said partners (and myself) can express their opinion. Quite personally I think they are the "owners" of the project.

Fifth item.

On Monday February 21st we meet the president elect, Mr. Figueres. We inform him about the project, and he is very positive in his reaction. He expresses the need for a large number of cheap houses to be built in this country for the lower income families. Bamboo housing is appropriate for this purpose. Planting bamboo can help the farmer to be self-supporting.

Personally I would like to know his opinion about all the above problems. And anyhow I think a government like the actual government in Costa Rica, which is in its last weeks before a new government will take over (after the elections), should not take such important decisions. These should be left for the new government.

Sixth item.

In the meetings with UNDP last week a proposal is raised for an evaluation mission. In the meantime Mr. Kotaro from UNDP has requested the project to review the budget in order to arrange for 40 000 US dollar for this mission. But my proposal is: let us first check which participant in the project really raises problems which request such a mission. In my opinion most of the problems can be solved by the participants themselves, if they talk openly with one another, and with high ranking officials. (After I leave the project, I hear about such a meeting on Wednesday March 9th between Mr. Hans Kurz and Ana Cecilia Chaves).

## Chapter A. The plantations.

On Friday february 25th I visit the plantation in Guapiles. The maintenance looks very good. This year enough bamboo culms will be cut for the construction of about 700 houses, and for furniture. They could cut 70 000 culms this year, as agreed upon last year for the construction of 1000 houses. This means that the plantation is able to provide the project with the required quantity of culms.

We hear about the preparation of a centre for visitors , with facilities to show them around the plantation, to give them information about the project and to sell them refreshments and fruits. The design of a kiosk is ready, evidently to be built with bamboo. In my opinion this is a perfect method for public relations, and information to the general public. But the project has to take care that the costs will be paid for by the visitors themselves. For the visitors it is a cheap excursion anyhow, but for the project the total cost might become a burden.

The project has also prepared a report how they act according to the agenda 21, the result of the Rio meeting on the environment. The title is "Preparación del Panorama Ambiental del PNB". It describes very clearly how the project is progressing according to the said agenda. Also weak points and eventual disadvantages are described. All together the outcome is very positive, as might be expected from a bamboo project.

The workplan for 1994 seems to be correct; I do not have any comments.

After the end of my work for the project I visit on my own the plantations near Arenal on Monday March 7th. The one on the West-side of the lake still suffers much from the strong winds. The other, just East from the town Arenal, is growing well.

## Chapter B. The preservation.

The plant for preservation has been visited by me on Friday February 25th. The plant is in full operation. The staff still is going on with improvements in the production process. The control of the process and the quality is good. Much care is taken about the re-use of used chemicals, in order to save money and to protect the environment. They are even able to preserve culms of 11 m long.

## Chapter C. The panels.

On the same day, February 25th, we visit the factory for panel production. The actual production is being done with a timber frame and caña brava. The capacity is 26 panels per day, or 1.5 house. If "reglilla", i.e. laths of sawn or split bamboo is being used, the capacity will grow to 32 panels per day which equals about 2 houses. This change will take place shortly. With pneumatic stapling an increase of production capacity of at least 30 percent is expected; the capacity will be then around 700 houses annually, which meets the demand of this year. With two shifts the plant can produce easily 1000 to 1400 houses each year. Within a couple of months a new factory will be started as well.

Two new developments are under way. Both deal with the use of more bamboo and less timber. The first idea is to compose bamboo laths of e.g. 50 mm square, to be made from sawn bamboo laths which are glued together. Prefabricated panels with a full 100 percent bamboo can be produced with this method.

The other idea is to leave the principle of prefabricated panels and basically to return more or less to the "old days" of the beginning of the project, but in a much more modern way. The idea is to use full bamboo culms with a very nicely designed prefabricated concrete foundation, which can be produced easily. Transport is easy as well. The infill between the columns is prefabricated with esterilla, as a "curtain". This means, the infill is transported on a roll, and on the building site it is mounted on top of the bamboo columns, and rolled down and fixed. The result can be seen in some prototypes at the project's office; they look very promising.

On Monday february 28th we visit a sawing machine for the production of sawn bamboo laths. Some improvements still are needed but it looks promising and it is certainly a good step towards industrialization.

## Chapter D. The construction of houses.

This year more than 700 houses will be built, a bit less than the target of 1000, but I can agree with this production target for 1994 because it is the first year, and the staff of the project had to overcome quite some problems to get to this goal. A waiting list of 2000 interested people shows the demand. The workplan for 1994 looks very well prepared.

A very interesting report is that by the accountant's office of " Venegas Arias and partners", about the costs of the houses, dd. 10 december 1993. This audit was done on request of the minister of Housing, mr. Zawadski, in the tripartite meeting in July 1993. The outcome really is a compliment for the project. No comment whatsoever could be made about the control of costs and the bookkeeping. It is interesting to quote some figures.

The costs of a house can be divided into materials 56 percent, labour force 27 percent, and other costs 17 percent. On November 30th, 1993 the costs of a house of 46 m<sup>2</sup> is a



little bit less than 16000 colones per m2, with a 20 percent of the labour done by the inhabitants. With some minor adaptations a house of 37 m2 could cost 10 to 13 percent less.

Very important is a comparison of the bamboo house with some other types of social housing.

description	PNB	CR/Canada	Fuprovi
area in m2	46	45	43
prices in 1000 colones:			
materials	411	489	346
labour	199	158	52
operational costs	124	118	131
transfer costs	-	30	-
total	734	795	529
in 1000 colones per m2:	16.0	17.7	12.3
self help labour force:	20 %	-	100 %.

The reader can easily see the influence of the self help labour; this explains partially why the Fuprovi house is very cheap. But more differences can be noted.

The PNB-house comes with a central corridor, interior walls which are plastered on both sides, a toilet, electricity, a sidewalk, a finished floor, doors in the interior, and painted walls. Honestly, on arrival in a village, I recognize the bamboo houses from the nice roof with an overhang and from the painted walls, not from the bamboo!

The C.R./Canada house does not have a ceiling, neither a floor, plastering or a corridor.

The Fuprovi house is without plastering, ceiling and interior walls.

The building and structural systems are different, which makes a comparison even more difficult.

The PNB house can be built with a 100 percent self help building, like is being done in the Indian reserves in the South; in that case the price is going down to 12 600 colones per m2 for a house of 31 m2. A PNB house of 46 m2 costs normally 16 000 colones per m2, but if all extra's (like plaster, doors and paint) are skipped the price is going down to 13 100 colones per m2.

Two conclusions can be drawn: first, the bookkeeping and financial control in the PNB is perfect; second, a bamboo house is cheap by itself, but it looks less cheap due to the extra's. Both conclusions are positive.

Finally, the project has developed a strong tool for the design of bamboo houses and other building by the use of a CAD (computer aided design) programme. The way they handle this is really impressive.

The workplan for the construction of houses in 1994 contains many diagrams and timetables. This plan looks well.

After the end of my work for the project I promise them to investigate in Asian countries the market prices for untreated and treated bamboo culms, in order to compare these with the PNB-price: USD 0.50 per metre, treated.

## Chapter E. Other subjects.

Most of the paragraphs in this chapter from my report of last August still are valid; I simply refer to them. Many activities have taken place in the Foundation, but this subject has been covered already in chapter 0.

The programme for sustainable development is in good progress. I discuss this with the Universidad de Costa Rica on Thursday february 24th, and with the Embassy on Tuesday March 1st, and with the ITCR in Cartago on Thursday March 3rd. Evidently bamboo plays a role in all these contacts. A nice detail in the programme is that for each proposal two partners are needed; one should be a university but the other should be an NGO, which gives an opportunity for the PNB to participate in several proposals.

About my remark of August last about a European market waiting for bamboo products, I can report now this is becoming stronger and stronger. China and India take the opportunity to export bamboo products; Costa Rica should follow as quick as possible.

This remark is also valid for furniture. Good designs are present in the workshop of Brian Erickson. A start of industrial production now is necessary. I recommend to start with a small factory and some modest series of selected furniture.

In personal contacts with people all over the country, I meet many who are well informed about the project and about bamboo housing. This is very good.

## Day-to-day report.

Saturday February 19th and Sunday February 20th, 1994.

Travel Eindhoven-Amsterdam-San José. The driver from the project brings me to the hotel. Ana Cecilia Chaves and Jorge Gutierrez come to inform me about recent developments.

Monday 21st.

I am provided with information about developments and problems of last half year in the project, mainly dealing with the new foundation. I give the project a copy on video of some reports on Dutch T.V. about bamboo housing and the project, with a translation in Spanish. In my opinion this might help the project with giving information to visitors.

We spend a visit to the President elect mr. Figueres, and inform him about the opportunities of bamboo for housing, self reliance of small farmers, and the economy of the country by means of export of bamboo products. Roberto Ottolenghi (UNCHS, Nairobi) explains how Habitat works with projects and with social housing, and that bamboo houses are earthquake resistant. Mr. Figueres requests the project to prepare a five pages document about the opportunities of bamboo.

Tuesday 22nd.

All day meeting at UNDP, with Lucien Muñoz and members of his staff, Roberto Ottolenghi, and staff of the project, about problems in recent time, and about the transition of the project into the foundation. For the content I refer to the minutes of this meeting.

Wednesday 23rd.

Morning: meeting at UNDP, as yesterday, see minutes. The afternoon is used for discussions with project staff about the meetings with UNDP.

Thursday 24th.

The morning is used for a meeting at the Universidad de Costa Rica about the programme for sustainable development. In the afternoon I write a fax to the Embassy to prepare the meeting of next Tuesday, and a fax to my University about the outcome of the meeting of this morning. With Jorge Gutierrez I settle the agenda for the next days.

Friday 25th.

A full day trip with Jorge Gutierrez and Guillermo Gonzalez to the plantations in Guapiles, the furniture shop of Brian Erickson, the factory for panels, the preservation plant and some bamboo houses.

Saturday 26th and Sunday 27th.

Reflection and some report writing. Study of reports: one by Mrs. Venegas Arias and partners about the costs of bamboo houses, and the report "Preparación del Panorama ambiental del PNB".

Monday February 28th.

In the morning we visit a machine factory in Alajuela where a sawing machine is being built. It is really a huge machine, but for the industrial processing of bamboo this is really a step forward.

In the afternoon one more meeting with staff about actual problems. Roberto Picado informs me about the compromise

regarding the 3 percent for UNDP. For the houses to be built now this percentage is charged only over the difference between the building costs and the bono familiar.

Tuesday March 1st.

In the morning a long and fruitful discussion with Jorge Gutierrez about technical matters.

(1) The eventual use of a machine for plastering, because manual plastering lasts rather a long time.

(2) The yesterday's visit to the sawing machine.

(3) Laminated bamboo to replace the timber in the prefabricated panels.

(4) The use of full bamboo culms on a prefabricated concrete foundation, and prefabricated bamboo curtain-like panels between these to form the walls. All these technical items are very interesting.

At 1100 hrs a meeting at the Embassy, with Jan Bauer about the sustainable development, and with Mrs. Christina van Kooten about the political problems around the project. In the afternoon I send a fax to my university about the information from Jan Bauer, and next I meet with Ana Cecilia Chaves and Jorge Gutierrez about the meeting of this morning. Some report writing.

Wednesday March 2nd.

At 800 hrs a breakfast meeting with Mr. Faerron and Mr. Segura from the foundation, and staff of the project. Next some very interesting documents are read and discussed in a staff meeting. Report writing.

Thursday March 3rd.

Early in the morning Mrs. Chr. van Kooten (Dutch Embassy) is coming to the project. At 10.15 hrs I have to leave to the ITCR in Cartago, to discuss the next items.

1. Participation in the programme for sustainable development; cooperation between the ITCR, Eindhoven University and the PNB.

2. The proposal to the EEC about research on bamboo.

3. Developments in laminated bamboo and in bamboo fibreboard, results from China and Canada.

4. The future of bamboo research in this country; discussion to be continued in July.

5. Results from recent research on bamboo.

6. Plans for new research.

All this is very useful for bamboo as an engineering material. It will have a positive impact on the project as well.

After my return to the project I write a letter to the Dutch Ambassador to express my concern about the recent political developments, and I finalize most of this report. Last discussions with project staff, new appointments, and good-bye. I request PNB to send chapter 0 of this report by fax to Mr. Ottolenghi in Nairobi.



## Recommendations.

For all participants in the project:

(Dutch government, Habitat Nairobi, UNDP, Costa Rican Government)

To reflect deeply on the actual development around the foundation. See chapter 0 in this report.

For the project.

1. To continue like it is: a good technical project, dealing with bamboo as a material for social housing and job creation.

Some old recommendations are still valid:

2. recommendation f from March 1993, about more publicity; see also par. E.4 in report august 1993.

3. rec. h from march 1993, about pre-feasibility studies for bamboo, see also par. A.5 in report august 1993.

4. rec. e from august 1993, about the use of caña brava.

New:

5. to continue in the development of a 100 percent bamboo house, see this report chapter C.

## Terms of reference.

1. The project has to provide the supervisor which all information which he is likely to need, as soon as it appears. The project has to provide him with other information upon request.

2. The supervisor has to study this information and to report to the Dutch Embassy in San José, PNUD in San José, UNCHS in Nairobi and the Ministry in The Hague.

3. The Embassy and PNUD are entitled to ask the supervisor the check certain points.

4. The supervisor is entitled to give advice and recommendation on request or on his own initiative.

5. If the project turns down such an advice or recommendation, the project and the supervisor should try to arrange an agreement. If they fail the project has to submit the arguments for the refusal to the Embassy and PNUD, who have to decide.

6. The duty of the supervisor is limited to the agreed working time: a week and a half in Costa Rica (two weeks including travel time) plus one week in Holland, each six months. The duty of the supervisor is also limited to the technical aspects of the project (construction, cultivation and preservation); the cultural and social aspects do not belong to his duty.

7. The project has to provide the supervisor with the usual office and travel facilities.