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NIAS RECONSTRUCTION IN THE RESPECT OF THE TRADITION.

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The world heard about Nias for the first time following the tsunami on December 26th 2004, which destroyed coastal villages and tourist resorts around the island¹, but did not have an impact on the traditional architecture of the villages built on hills. The March 28, 2005 earthquake had devastating consequences all over the island. More than 80 % of the modern public buildings collapsed. Traditional buildings resisted quite well and those who collapsed were mostly buildings needing repairs: "Nearly all traditional houses were left standing and remain habitable. Some suffered damage to their roofs and walls, but they appear to be structurally sound"².

On the base of statistics of damages, it was impossible to differentiate between new or traditional houses destruction³. Probably the only one who can give more accurate precisions is Pastor Hämmerle and "Yayasan Pusaka Nias"⁴. The photos they disseminated through internet show that it is the substructure of vertical and slanting pillars supporting the building which collapsed (*kaki patah*). The whole building looks intact, but he left his legs. The same can be seen in other areas of Indonesia, for example in Alor many of the traditional *lopo lopo* houses were brought to ground during the November 2004 earthquake. As the pillars rest on more or less flat stones, horizontal forces make the whole building slip over them and provoke its collapse, especially when the under structure is not sound anymore due to lack of maintenance or inadequate transformation.

The reconstruction

Reconstructions are important in number and all over the island (operated by BRR, NGOs, International organisations like UNHCR and UN Habitat). Materials used are wood, aluminium, zinc, cement, prefabricated slabs and concrete. The types of houses fit the international standards, with a living space, one or two sleeping room, kitchen and bathroom. The size goes from "transitional humanitarian cubicles" (16m².) to "bungalows" (40m²).⁵ None of the examples seen in the media take into account traditional organisation of spaces for Nias people⁶. None of them take care of the specific climatic conditions in Nias (During the dry season it rains every day, during the rainy season it rains all the day), excepting one pilot house by Gadjah Mada University, which was considered too expensive. At least some organisations, in order to take into account the demands of the inhabitants, conveyed community participation exercises.

UNCHR brought to Nias shipments of wood from Kalimantan (20 000 cubic meters) and from South America and Mexico (50 000 cubic meters). They intended to give this wood to NGOs and to 09.07.2007

inhabitants to build new houses (3500 to 4000), or to repair the existing ones. Some NGOs (like North Sumatera Heritage in Medan) have programs of training for carpenters in order to teach how to build with modern materials (planks, plywood) as "all the craftsmen able to repair the traditional homes have died"⁷.

According to local testimonies there is a general lack of coordination between the different projects and thus competition and potential conflicts. Each organisation is building its own project in its village. Different materials are used, different plans, different space organisation, without a comprehensive master plan in terms of climatic, social and cultural utility. No organisation developed a programme of repair for traditional houses.

But to repair or rebuilt earthquake resistant traditional houses seems to be cheaper than to import new models. The main challenge is the stabilisation of the buildings, through replacing pillars and broken beams. According to Pastor Hämmerle, houses had to be dismantled and rebuilt, they can not just be repaired. The cost for their rebuilding is comparable to this of new houses by international organisations.

Reconstruction of two oval houses in Dekha-Mau and in Tulumbaho (Ambukha) Lölöfitu-Moi, North Nias by YPN, funded by the US Embassy in Jakarta: 75 million Rps per house, or 7500 Euro per house. Surface about 125 sqm/house. Cost 60 Euro/sqm.

Reconstruction aid for three houses in Orahili Sibohou, Sifaoro'asi Gomo and Hilizamurugö Sifalagö Gomo, Central Nias by YPN, funded by Stadt Münster: 20 million Rps per house Total cost 60 million Rps/house, 6000 Euro per house Surface about 80 sqm/house Cost 50 Euro/sqm.

Reconstruction of one house in Hili Laora, Lahusa, Central Nias by YPN, funded by YPN: 15 million Rps Total cost 2300 Euro Surface about 40 sqm Cost 60 Euro/sqm.

Reconstruction of one South Nias house in the park of the Museum in Gunung Sitoli by YPN: Total cost 50 million Rps (including transport from Teluk Dalam), 4500 Euro Surface about 60 sqm Cost 75 Euro/sqm. Museum Pusaka Nias/Yayasan Pusaka Nias also rebuilt one North traditional house Omo Laraga and one Southern traditional house in the museum area. Source: Pastor Johannes Hämmerle, Dec. 2006

According to Pastor Hämmerle, the BRR intends to give between 5 and 20 million Rps (500 to 2000 Euro) per house for repairs. Nevertheless BRR will only repair 50 houses in the North and 50 houses in the South. For the moment we don't know how far this project has gone.

BRR provides the cost for a modern house by their owners, anywhere in the island, it means about 55 million Rps (5500 Euro) for a 6 by 7 meters size house (42 sqm), or 137 Euro/sqm.⁸

From the information available on the web, it is difficult to know the cost per housing units built by NGOs and International offices, as the data are global.

UN Habitat Fukuoka (donation of 171 000 US by Fukuoka Prefecture Government, Fukuoka City and civil society organisations).

*Construction of 30 houses in Hilimbösi, **North Nias:** 40m², including one living room, two bed rooms, one kitchen and one bathroom. Bungalows with narrow veranda, similar to Thailand beach resort bungalows. Cost 4 468 US per house, 3480 Euro per house Cost 87 Euro/m².*

Catholic Diocese of Sibolga

Construction of 8 earthquake resistant houses, prefabricated by Akademi Teknik Mesin Industri (ATMI), Solo. House components shipped to Nias. House frame made of stainless steel and walls from composite fibre. Roof made from faded zinc coated with aluminium. Stainless aluminium is used for the door and the window frame. All parts of the house are connected by bolt so that it can be overhauled easily. The appearance is that of a barrack. Cost between 0,5 and 1,5 million Rps/m², 52 to 157 US/m², 50 to 150 Euro/m².

Zero to One Foundation, funded by the Australian Red Cross and Monaco.

Construction of 254 prefabricated houses with a veranda (19,4m²), a living room, a room and a kitchen (39,6m²) in Sirombu. Parallel rows of houses with corrugated roof. No landscaping. The cost per house should have been 3000 US (2300 Euro) for a minimum order of 1000 houses. As we have only this information, the cost should be 58 Euro/m².⁹

From these data we can summarize that to provide a humanitarian shelter or to rebuild a traditional house cost about the same. One reason to repair existing houses would be to avoid the development of a local market selling to the refugees the houses built with the money of the government¹⁰. Another reason is the need of reintroducing cultural identity through the improvement of the existing villages¹¹.

The hierarchy of spaces, as the physical support of social organisation in the village and the house.

The specificity of Nias villages is in their very strong but subtle hierarchy in the use of spaces for social order. The street or square (*ewali*) in front of the houses is divided into a central paved public path (*iri newali*), a semi-private area used to dry crops or washing, a wall of stones (megaliths) indicating the social situation of the owner of the house (*sobewe hare hare, öli batu*), a private path under the lattice

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window (*mbelembele*) and a private stair or veranda (*edu'ö*) to enter the house. When somebody entered a village, first of all he was stopped at the top of the huge stone's stair (*bawagöli*) by guards. These places are still existent, with a small wooden shelter, where men sit. When one's cross the village street, he/she will be asked "where do you go / *Haega gö möi*" ? If he/she approaches of the facades, people inside the houses will stop him, shouting. You have to ask permission, from the central path, to approach or enter a house. The social control is also made through the lattice window, which allows the inhabitants to look to the street, without being seen (see: Marschall 1976, Viaro 1980, etc).¹²

The street (*ewali*) and square (*ewali gorahua*) of the village is also a festive, symbolic and political space (see: Ziegler 1992)¹³. It is the space where the ancestors sit on the stones and participate to the different events, where the participants to the public council (*orahu*) sit either in the men pavilion (*bale*) , or on the megaliths. It is here that dances are performed and social integration feasts (*owasa*) take place.¹⁴

In the reconstruction all these aspects have to be taken into account in the project if it has to be accepted by the inhabitants in the long term. How to have social relations, how to control the space of the settlement, if there is not a central plaza anymore? It is a matter of respect for the local living traditions. This is similar to other situations elsewhere. For example in South India, the new housing estates built following the 2004 tsunami, had to follow the location and orientation of the sacred buildings. Villages built without taking into account these aspects, where refused and the refugees preferred to remain under provisional shelters¹⁵.

What concern the house another type of spatial hierarchy exists. The front room facing the street is a reception and public space. The three platforms composing the slanting facade have each a symbolic and social role. The lower one is used as bed for the guests and as bench for the children or for the women's activities. The upper bench is used to sit. The guest and the owner of the house should sit on the right side, the women and other men on the left side. The last narrow plank is used to repose the arm and for ancestors images.

The *rumah moderen* and the houses built by the international community on the base of international standards, do not offer this hierarchy of space.

Is it possible to sit on an open veranda outside, seen by all the foreigners as the inhabitants?

Has the specialised division of rooms into "living room, sleeping rooms, kitchen, and toilet" a meaning for the locals? If there is only one cement low floor, how can the respect to old persons or guests take place?

Another important point is that the building of a traditional house is the task of the village, of the community. All feasts and meals which took place all along the construction do not take place anymore,

but the carpenters ask for a meal at the beginning of the work and another at the end. The houses built by the NGOs and International Organisations are built outside of the local process, they are given. They can thus not be integrated in the process of continuity of the social environment and are only considered as shelter. As such they can be sold to anybody.

Another point is that in the traditional culture, the male sons lived with their father when married. In the small houses built by NGOs this is no more possible. In consequence you need much more houses, more material, more land (taken over the cultivable surfaces or dangerous non suitable areas), more maintenance and more workmanship. Interesting is the information given by Pastor Hämmerle, that the people who rent their house for International Organisations keep the money for the building of a house for the son, or for buying a car. This is an important change. It means that the money surplus don't go to sustain the system of feasts of social integration anymore, but remains for private uses. It also means that each house is inhabited by a single nuclear family and that the traditional respect and care from the young towards the elderly disappear. The elderly parents can no more maintain the old house, which quickly deteriorate.

Situation of the traditional architecture in Nias prior to the March 2005 earthquake.

During the 1970s and 1980s, we did a comprehensive survey of villages and buildings all over the island. It was a time, where traditional architecture was still a living architecture. Carpenters and even common people in the villages were able to explain in details how to build a house, which kind of woods to use (at least twenty different species), for which static use (compression, tension), which days were favourable for the building (connected to the moon's cycles), which feast to perform at each stage of the construction.

We identified three main regional architectures (South, Centre and North), with three kinds of buildings: chief's houses (*omo sebua*), commoner's houses (*omo hada*) and meeting houses (*bale*). The main types are not only different on their global shapes and settlement, but by their structures. Nonetheless all types are built with slanting and vertical pillars, resting on flat stones. The resulting tri dimensional system offered an accurate elasticity to resist earthquakes. In some cases, mostly in the Centre and North, the pillars were loaded with beams or blocks of stone to increase their resistance. If pillars resting on stones are common through Indonesia (Flores, Timor, Sumba), the bracing with slanting pillars is unique to Nias.

All types have a heavy roof structure, also triangulated. In the South, the roof is supported by the side walls. In the North and the Centre it is supported by four (sometimes six) central vertical pillars (four *silalö yawa*, two or four *tarunahe* and two *taru mbumbu*). The load bearing walls were thus part of the structure in the South and also in Gomo, which

is not the case in the Centre and in the North. Apart for the panels of the roof which are tied to the rafters, the whole structure is assembled and pegged.

In the South, villages are built in rows, with houses grouped together two by two, fronting a central street. They are all the same in dimensions, four by twelve meters. Chief's and noble's houses are bigger, and can reach ten by thirty two meters, with the ridgepole of the roof up to twenty one meter. All have the same building structure. The plan of the house is also always the same: one big space in front, entered by a side stair or balcony, occupied with platforms overlooking the street and used to receive guests or as living space; family rooms in the back with a hearth built in the separating wall. A granary is usually built in front of the house, in the shape of a big box. Sheds for the pigs and chicken are set behind the house, with sometimes a toilet shelter.

In the centre of the village street is built a rectangular building (*bale*), open on all sides, with a bench all around. It is used for communal and public assemblies (*orahu*), a vital component of the village life.

In the centre of Nias, villages have many different shapes. Some are built around a central square, other on terraces, or along the paths. "Bale" is seldom seen. Houses are all detached, except some examples of "long houses" with two or three units. The size of houses differs greatly. Chief's houses, much bigger than common houses, were still built in the 1980s, their façade covered with sculptures of animals, warriors, vegetal and geometric patterns. Due to the different sizes, strictly connected to the social rank of the owner, the number and disposal of pillars differs. The roof structure is supported by four central pillars, the ridgepole by two side pillars. The walls being independent of the loading structure, extensions are easy to add on three sides. The roof structure is lighter and simpler than the one in the South, which also allow the vertical extension of floors. The plan is always the same, with a living/public room in the front and the private rooms in the back. The kitchen and the hearth are usually built in an extension below the back of the building. The sheds for the animals are also in the back.

In the North of Nias, a specific oval form was developed with a different loading structure than in the two other parts of the island. Four to six pillars carry the roof. They origin on the ground and two of them support the ridgepole, and the others (two or four) support the frames of the roof. The last examples of oval houses were built in the 1940s or 50s. Their construction demands an important amount of trunks and beams. The number of pillars supporting the building can be impressive. The size of the buildings differs from one to another area, but also in a same village according to the rank of the owner. The house is entered by a veranda on the small side or by a stair under the floor, opening on a living/public space. Private rooms are in the back and in the sides. The kitchen with the hearth was in some cases of big houses, built on the floor of one of the back rooms. In most cases it is now in a shelter in

the back of the main building. The houses are built along streets, or around a central square. Bale, which it is said were round, circular buildings, does not exist anymore. But one is represented on the flag of North Nias, as symbol of the island.

In 1992-93, on the demand of Pastor Hämmerle, I made some technical surveys of two chief's houses in the South (Bawömataluo and Onohondrö) to prepare budget proposal for their rehabilitation. The big house in Bawömataluo was already under repair, with a budget granted by the Government, but those in Onohondrö and Hilinawalö were in very bad state, with holes in the roof and rain coming in. Their inhabitants did not have any money for any repairs or maintenance.

The traditional buildings were still built or rebuilt in the South and Centre village's, and regularly repaired till the beginning of the 1990s. But due to the lack of sufficient large wood beams (deforestation on the island), and the costs of maintenance (replacement of rotten beams, and of the *bulu zaku* roof covering made of *sago* leaves¹⁶), it became difficult to continue. Furthermore, at the beginning of the 1990s, the Indonesian Government prohibited the use of big trunks for the domestic buildings (as the forest exploitation had to be contracted by national or foreign companies, and was reserved for exportation), making thus rebuilding and repairs almost impossible. That was the reason for which, the Museum I planned for the Catholic Mission in Gunung Sitoli, which was designed in wood, had to be built with concrete pillars.

Teluk Dalam and Gunung Sitoli became small towns, with their modern *pasar*, consisting of one or two storey buildings in concrete and tiles roofs. New administrative buildings, schools, hospitals, churches were built on the model of any intermediate Indonesian town. All these buildings had to get a planning permission from Nias authority. With the development of *nilam* (patchouli) and *cengkeh* (cloves) plantations, latex (*gitö*) and pigs, rich modern houses were built in the suburbs of towns and extension of villages along the roads. *Rumah moderen* meant wealth and modernity.

In hills villages, though, traditional houses were still predominant and construction continued to take place along traditional lines without going through a bureaucratic and exogenous process. I noticed that when carpenters had to build a modern house instead of a *rumah adat*, they were unable to transfer their technology and knowledge to the new type. It is not because you have the knowledge and you are able to fix a roof of *bulu zaku* (sago leaves) with ropes of palms that you have the skill to adjust and to screw a metal roof over cement walls. Consequently, at this time, modern houses were mostly very bad built, with parts of the roof collapsing. Furthermore the name given to the new houses means a lot in terms of change: "*rumah moderen, rumah jawa, rumah melayu*", which does not require a cycle of ceremonies and feasts.

We got the same information last month in Alor. The *rumah adat* or *lopo lopo* is the house which integrates

all aspects of the tradition. When built or rebuilt, ceremonies take place all along the construction. A *rumah jawa* is only a shelter.

To come back to Nias, in village's houses, the pillars substructure was often transformed to fit the needs of modernity: pillars, mostly the slanting ones, were cut to make place for a store or a garage. Cement walls were built all around the basement to create a room, reducing drastically the elasticity of the whole structure. In summary, changes were brought without thinking to the possible consequences in case of earthquake or flooding.

Deforestation was accentuated with the development of palm oil plantation, *nilam* (patchouli), cloves, *havea* (latex) and cacao. In an island with a very unstable geology, this facilitated landslides and flooding. Village extensions were often built on unfit land.

Traditionally, the carpenter had a very simple method to test the ground. He planted a stick of a specific plant. If the next morning the stick was shorter meaning that the ground was spongy, it was not possible to build there. If the stick was longer, meaning that the earth had rejected it and was thick; the ground was a good choice. The core of the old villages is probably on a very stable ground.

Thus a precise geological map of the island is an absolute necessity for the choice of new places for rebuilding.

Economic development in the 1990s

Beginning of the 1990s, development projects were projected for the island with investments from Medan and Singaporean societies (tourist resorts, golf, and international surf competitions). There was the desire, at Government level, to develop there "a second Bali"¹⁷. The ABD produced a report encouraging the creation of a "Growth Triangle" between Indonesia, Malaysia and Thailand¹⁸. The region was on the move. It announced that "the ACCOR Group of France has agreed to operate a 100 rooms resort at the surfing destination of Nias Island"¹⁹. In 1995 a luxury hotel opened on the Sorake Beach, with Dutch management and Malay employees²⁰.

It has to be noted that in these projects the Nias traditional culture is never brought in front. They all insist on surfing opportunities, golf sport or nature trekking. With the exception of the island of Bali, where the culture is the base of the tourist development, most of the advertising for Indonesia is based on nature: Kelimutu craters in Flores, Lake Toba in Sumatra, Bromo volcano in Java, hot springs in Timor...but never traditional architecture.

But this hope was stopped quickly. 1997 saw the financial crisis spreading in Southeast Asia, drastically cutting down investments. In addition earthquakes, flooding and landslides took place in 2001 and 2002 followed by epidemics (chicken and pigs pest)²¹. The fall of the Suharto regime (for which tourism was the

second priority in the Repelita²²), the elections and new governments (for which tourism had to be solely concentrated in Bali) and the decentralisation legislation in 2001 (creating two Regencies which quickly entered into competition), were other events with important consequences in Nias.

To be realistic, the only things which Nias can offer are its beaches and its culture. There are no real opportunities for agricultural development, except copra, latex and cacao. There are no industrial development opportunities, no raw materials. The reconstruction of roads and the redevelopment of public transport are the first priority, either for domestic uses or for tourism.

Tourism related to surfing is quickly recovering as there is a strong demand. It seems that following the geological changes in the coral reef, the waves are even better than before the earthquake. Tourism related to the traditional culture and the visit of the most beautiful traditional architecture existing in South East Asia has to be developed. This catastrophe could be an opportunity for local populations to develop ecotourism and cultural treks²³. But are the local Nias still interested with their culture? Will Nias demonstrate the capacity of resilience found in Bali after the bombings?

Inventing new technical solutions for the rehabilitation of the traditional buildings.

Different problems make difficult to promote a general rehabilitation of traditional houses in place of the building of new ones.

- the lack locally of wood and beams for construction,
- the bad condition of roads and transport infrastructure,
- the international and national standards for housing opposed to traditional building,
- the need of training local carpenters to new techniques and alternative ways of construction,
- the competition between local enterprises and national or international ones.
- the poverty of the village's population and their desire to live in a modern house.

What could be done in this situation is to repair as much as possible the existing houses and to build sanitary extension behind them, which means a sanitation project for the whole settlement. Repairs could be done by local carpenters, but the sanitation system has to be planned by engineers from outside. There is no such tradition in Nias, and waste water goes directly to the river or in the ground.

On the question of using new materials instead of beams, the experience of the building of a small museum in Gunung Sitoli by YPN can be of some help²⁴. We tried to create traditional spaces which could make sense for the population, but using modern materials as it was impossible to import long and large beams. The posts were steel cylinder filled with cement and disposed in a concrete round pipe (of the type used for drains) with sand. This system

is used for lighting posts in stadium. It insures elasticity in case of strong winds. Horizontal pressures due to earthquakes can be compared to those provoked by winds, and it worked as the museum did not collapse. In the design of the internal spaces, I tried my best to recreate the spaces and proportions which locals would experience as a knowledgeable environment. I was very happy to hear from Pastor Hämmerle that visitors felt like to be in a *bale*.

Plywood and narrow planks can replace a heavy structure. Roof beams can be made of light steel tubes bolt together, solution developed by the GTZ and Swisscontact in Alor. Solutions using bamboo should also be experienced and the knowledge of other Indonesian architectures is important in this field. In Flores (Nage), in Alor, in Sumba, where traditional construction is still very much practised, the roofs are made of bamboo poles covered with *alang alang* panels. This makes the structure very light, easily replaceable using only local available materials.

It is really the task of an institute like the Technical University in Vienna to develop innovative solutions and this should be part of the follow-up projects after this conference. It is important to reintroduce into the debate the question of the qualities of the traditional construction, which should not only be seen as a witness of the past, as an object of museum or leisure park, but as a living and viable alternative to Western solutions. As Alor's people said to us few weeks ago: "The government only give funds for building new houses, but for us the *lopo lopo* is our way of life, our identity. Thus we will rebuild "our houses" with our own means".

The question of the conservation of traditional architecture buildings: living structures or museums?

World Conservation Organisations (WMF, New York; UNESCO) listed some of the big South Nias chief's houses as endangered monuments even before the earthquake. Already in 1993, these houses needed urgent repair²⁵.

The idea is to transform these big houses in museums, but for who? Not for the local population, probably not for the Indonesian tourists and sure not for the young Australian surfers in Lagundri beach. These houses are inhabited by people, by families. To preserve them would mean to find new uses while keeping their occupants. For example they could be transformed in guesthouses, managed by the village, and included on trekking itineraries.

For the village's *rumah adat*, techniques should be quickly developed to reinforce them in order to stabilise their building structure. These structures must be kept as living environments and not museums. Individual action like the ones promoted by YPN and Pastor Hämmerle seems at this stage the only ones able to reconstruct traditional houses. They

already rebuilt five of them in the North and Centre of the island.

Through dissemination of information from scientific institutes towards the NGOs and International Organisations to offer simple and cheap technical solutions, the recovering of the traditional environment as a long term project would be surely more valid for the inhabitants than importing alien models. They could be proud of their cultural identity as it is the case in many other islands of Indonesia. Local people should be encouraged to rebuild traditional houses. There are examples of very healthy people who already did it in the North of Nias. Building a traditional house could be a matter of prestige. It could be a way to express his continuity and identity through history and a way to psychologically recover from the destruction.

This traditional architecture, one of the most beautiful wood constructions in the world, which resisted numerous earthquakes, has to be known and protected for the future of the world, the future of Indonesia and the future generations of Nias people.

¹ among them, Sorake built in the 1990s with Singaporean investment on the south-west of the island, and others on Lagundri beach and Hinako Islands run by Australian surfers.

² CNN World, April 1, 2005, testimony in the village of Tumöri near Gunung Sitoli.

³ Web report from 26 March 2006

⁴ The earthquake on March 28, 2005 effected many traditional houses. For example in Hilimondregeraya village, Telukdalam, South Nias, from 92 traditional houses, 40 among them were totally and heavy damaged because of the lack of maintenance long time before. Old wood, leak roof and low quality of wood including the condition of land where the house were erected were the main cause (source: Pastor Hämmerle, January 2007).

⁵ Australian Red Cross handed over one house in Sirombu (26 July 2005), project to build 254 houses. Canadian Red Cross will build 2500 houses in Afulu, Lahewa. Consortium Red Cross (Belgium, Dutch, Spain) will build 2500 houses in Gomo, Telukdalam, Lahusa, Amandraya. HELP World Relief will build 250 houses in Tuhemberua, 782 houses in alasa, 90 houses in Lahewa. ACTED will build 520 houses in Lahewa. Caritas (Sibolga) plan to build 200 houses in Gomo, 50 houses in Sirombu. UNCHR will build 240 houses in Idanö Gawo and Bawölato. French Red Cross will build 200 houses in Gidö. Dela Siga will build 239 houses in Sirombu. Medan Care will build 90 houses in Gunungsitoli. LPAM will build 25 houses in Lahusa and Telukdalam. CWS will build around 100 houses in Gunungsitoli. UN Habitat (UNDP) built 50 houses in Hilimbösi. BRR will build 750 houses in Nias Regency and 500 in South Nias (31 Aug. 2005).

⁶Published examples are wood barracks by the International Federation of Red Cross, Sirombu by Zero to One Foundation and UN Habitat in Hilimbösi.

⁷ CNN, 1 April 2005

⁸ Source: Pastor Hämmerle, 31 Oct. 2006

⁹ Indonesia Relief Web, 2 June 2005

¹⁰ Le Monde, 7 Dec. 2006 „Dons record et polémique après le tsunami“: *des militants anticorruption se sont aperçus que des chefs de village- une vingtaine au moins- avaient revendu à leurs proches des maisons construites pour les survivants avec des fonds d'Etat.*

¹¹ BRR, Aceh and Nias two years after : The tsunami 2006 Progress Report, Dec. 2006, p. 24: *Sensitivity to local traditional architecture and village planning is important in both rehabilitating and building new housing.*

¹² Wolfgang Marschall, *Der Berg des Herrn der Erde*, dtv Wissenschaftliche Reihe, 1976, p. 46; Alain Viaro, *Urbanisme et architecture traditionnels de l'île de Nias*, Unesco, Paris 1980, p. 24-26

¹³ "De la mesure de toutes choses:l'ordre du spatial et l'ordre du social à Nias", in *Architectures et cultures*, Les Cahiers de la recherche architecturale 27-28, Ed. Parenthèses, Marseille 1992, p.59

¹⁴ Arlette Ziegler, "Pratiques festives et mégalithisme dans le centre de Nias", in *Bulletin du Musée d'ethnographie de Genève* n° 28, 1986, p. 53 ; « Festive areas, territories and feasts in the south of Nias », in *Tribal Treasures Nias*, Museum Nusantara, Delft 1990, p. 79

¹⁵ Source : Annette Etienne, *Frères de nos Frères*.

¹⁶ All over Indonesia, the labour costs for the making of *bulu zaku* panels is quite high. Furthermore, the panels have to be changed regularly, every two years for the flat section, and every seven at most for the steep section.

¹⁷ *The study on the integrated regional development for the northern part of Sumatra*, Ministry of Public Works, Republic of Indonesia, Japan International Cooperation Agency, March 1990: p. 176-190, 298-302 "Nias island integrated development programme"; "Nias, island of opportunity", PT. Samaeri Mitracipta Nias (Nias Island Resort), 1991. One first achievement was the Sorake Beach Resort (1999);

¹⁸ Indonesia-Malaysia-Thailand Growth Triangle Development Project, ADB February 1995, 6 volumes.

¹⁹ Vol. VI, p. 22

²⁰ Source Bente Wolff, Nov. 2006

²¹ August 1, 2001 : 95 deaths, 710 houses swept away, 6 schools, 3 churches, 4 bridges destroyed in Gomo, Lahusa and Teluk Dalam Districts. Flooding connected with deforestation at the Masio river's mouth in the District of Lahusa, Bawolata village raged to the ground. March 30, 2002: flooding triggered by day-long heavy rain damaged houses at least nine villages in Amandraya, Gomo, Susua and Eho rivers, at least 11 deaths.

²² Five Years Development Plan.

²³ Such type of activities have been developed by tour operators in Mentawai, the islands south of Nias : www.nativeplanet.org; www.mentawaiadventure.com

²⁴ Project by Alain Viaro, 1993. The engineers were Schwarz & Mantilleri from Geneva. Built by Pastor Hämmerle and inaugurated in 2001.

²⁵ Expertise made by Alain Viaro for a Belgian NGO in January 1993

