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## VERNACULAR ARCHITECTURE: UPHOLDING TRADITION THROUGH MATHEMATICAL EXPRESSION OF ARTISTRY IN THE CONSTRUCTION OF KALINGA HOUSES

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**Abstract:** *Kalinga indigenous house construction is one of the most well-liked ethnic structural designs for having make use of traditional system of construction that is more multipart than its seeming simplicity. The research set out to attain such intention, to visit and document the details on traditional houses for comparison as to the following areas: structural framework that make the various parts of the house, manifestation of mathematical concepts in planning and assembly of the pre-fabricated and nail-free individual parts, types and quality of materials used ; describe the layered structure and the functionality of space of the folk architectural design; and identify the socio-cultural values attached to the house. The research is descriptive narrative type. The study discloses that, the way of life of occupants is of great influence on vernacular house forms. The Kalinga traditional most vital feature that evokes artistic expression in construction is its suitability to the ecology of the place. The Kalinga ancestors may not have acquired a particular education in engineering and architecture, but closer examination of the structure reveals that indigenous carpenters clearly understand and apply principles in construction that give beauty and durability to a building such as balance, proportion, synchronization, space, and among others and built environment, spaces, and the activities of people are inter-related and inseparable.*

**Keywords:** *Vernacular Architecture, Tradition, Mathematical Expression, Artistry, Kalinga House*

### BACKGROUND OF THE STUDY

Vernacular architecture is a category of architecture based on local needs, construction materials and reflecting local traditions. At least originally, vernacular architecture did not use formally-schooled architects, but relied on the design skills and tradition of local builders. However, since the late 19th century many professional architects have worked in versions of the style. It tends to evolve over time to reflect the environmental, cultural,



technological, economic, and historical context in which it exists. While often difficult to reconcile with regulatory and popular demands of the five factors mentioned, this kind of architecture still plays a role in architecture and design, especially in local branches. (Scott, 1996)

The Filipino house is much the same among civilized and uncivilized tribes, and has changed but little since the islands was first visited by Europeans. There is nothing very distinctive about the Filipino house. Its general type occurs through the forested tropical parts of the earth, at any rate wherever the population does not live clustered in cities. The main essential is a steep roof to provide a dense shade from the sun and shed the torrential rains. The second requisite is a floor that shall be raised above the dampness of the ground and the snakes and vermin that infest its surface. The Filipino floor is always a few feet above the soil, often eight or ten and sometimes, when houses are set in the forked branches of trees, twenty, forty, or even sixty feet. (Scruton, 2003)

Kalinga as one of the major tribes in the Cordillera settled on leveled or terraced areas on the slopes of steep mountains situated near waterways, because of the prevalence of tribal wars in the past, the *ili* or village were located in the strategic areas surrounded by difficult terrain where villagers can easily be forewarned against invaders or intruders (Delos Reyes). Kalinga traditional house building is one of the most admired ethnic structural designs for having employed an indigenous system of construction that is more complex than its seeming simplicity. This old or ethnic architecture were all inspired by the environment like the climate, vegetation, and fauna. (Perez, 2000)

As observe in the modern/polite architecture, Vernacular is becoming a basis for our new structure, getting its feature of being multifunctional, having a big room with many different uses, is an example of copying a traditional house functions. As well as passive ventilation, that saves everything from being used on air cons and electric fans. Also we are again using more organic material that will not pollute and destroy our nature. With all that we can see that the shadow of the traditional house still lingers in our structures of today, its functions being used, it may be different in materials but its uses are still the same in its use. (Architeacher)

As a design concept for a structure that is inspired by native a house, a design that goes with the time, it basically means that the folks were able to construct with the available materials



and tools. It would make use of the functions of the Kalinga traditional house that has presented a kind of structure that is both functional and efficient need the use of the technologies today to make a structure that both respects the past and the present. The account of the Kalinga vernacular architecture is knotted with that of the people, their socio-cultural beliefs and traditions and practices, as well as their indigenous knowledge systems and practices. But while Kalinga architecture is reckoned important part of the people's really rich tangible heritage that allows present day generation to understand and appreciate their past, barely is there an effort undertaken to conserve it. At present, vernacular Kalinga house builders are decreasing and native construction materials are at the edge of extinction, a disturbing reality which practically threatens the survival of the people's already vanishing heritage. (Sugguiyao, 1990)

Thus, Imperative to the conservation of the traditional Kalinga house is the understanding of its intrinsic cultural values in union with acquiring the knowledge and skill of its construction. This way, we come to appreciate our past, enhance our present lives, and outline the structure of our future. As stated by Noche (2009), the history and culture of a nation can be reflected in its architectural heritage

## **CONCEPTUAL FRAMEWORK**

The term vernacular is derived from the Latin *vernaculus*, meaning "domestic, native, indigenous"; from *verna*, meaning "native slave" or "home-born slave". The word probably derives from an older Etruscan word. In linguistics, vernacular refers to language use particular to a time, place or group. In architecture, it refers to that type of architecture which is indigenous to a specific time or place (not imported or copied from elsewhere). It is most often applied to residential buildings.

Thus, everything has a beginning; everything would have started from something, some say that there is nothing that is original, because everything is based on something else; some say that things are created because of it being needed. We transport ourselves to the past, and look at what was there before us. The traditional Kalinga house is a structure that is created with the use of very organic and all natural building materials that are the only things where available at that time, no use of technology being made and build by the hands of the people before us.



The house shows sub-phonemic differences which produces quite a colorful list of local variants that is bale (Kiangan), faze (Banaue), pwale (Mayoyao), baley (Bakod), ba-ey (Bakun), bo-oy (Kayan), booy (Asiga), be-ey (Tiempo) , boroy (Bonot), foruy (Bangad), buloy (Mabaca), fuloy (Bugnay), pfoloy (Talalang), furuy (Maducayan), fyarey (Natonin) and fo'loy (Pasil). The same root word is found among neighboring dialects (e.g., Ilocano balay, Cagayan Negrito bali', Ibanag bale) and pretty generally throughout the Philippines (e.g., Mandayan baey, Tagalog bahay)-to say no- thing of far Polynesia (e.g., Hawaiian hale, Samoan fali). The Bontocs, however, call their houses afong. that Kalinga houses-furoy (Bangad), fuloy (Bugnay), phoyoy (Balbalasang), *bey'oy (Lubuagan)*.

## OBJECTIVES OF THE STUDY

Specifically, the study aims to:

1. visit and document the details on traditional Kalinga houses for comparison as to the following areas:
  - A. folk structural framework that make the various parts of the house,
  - B. manifestation of mathematical concepts in planning and assembly of the pre-fabricated and nail-free individual parts traditional Kalinga house;
  - C. types and quality of materials used.
2. describe the layered structure and the functionality of space of the folk architectural design of the Kalinga house ; and
3. identify the socio-cultural values attached to the folk architectural design of the Kalinga house.

## METHODOLOGY

As this research relies on existing data that are largely visual in nature, insight observation took the forefront among the methodological options. Documentation plays a considerable role in recording data needed while also taking into accounts the folk wisdom courtesy of the descriptive narration of the village elders during interviews scheduled with the village craftsmen who still maintain the tradition in some areas of Kalinga Province. Also to lend legitimacy to the wealth of data gathered a consultation was scheduled with Mr. Alonzo Saclag, a National Living Treasure Awardee in culture and the art.



## RESULTS AND DISCUSSION

### 1. The Traditional Kalinga House (Foy'oy)

#### A. The Folk Structural Framework and Parts of the House

Even before Christian lowlanders encroached on their lands, the Kalinga people were already divided by class. Some families had plenty of Riceland, enjoyed full granaries, and hosted feasts where their many guests ate and drank for several days at their expense. Other families had limited land, had little to store, and never knew where their next meal would come from. In between these two extremes were those who, though not wealthy, were not destitute either. These extremes in social class are reflected in their traditional house types.

Kalinga houses are of two shapes, the octagonal house and the square house. The Kalinga house gives the impression to be nothing but a square and octagonal mesokurtic structure resting on four and twelve posts. A meticulous examination of the structure, however, reveals a multipart structure that renders tensile strength capable of hold out to a destructive typhoons, heavy rain, and fierce earthquakes. It is constructed out of carefully selected indigenous timbers that are strongly mortised, attached, and handled to hold the house together. In its entirety, no nails are used for all connections. Below is the comparison between the two types of house.

Square House ( <i>Vinulinaw or Pinaltong</i> )	Octagonal House( <i>Gilitod/Finaryon</i> )
The poor man's dwelling among the Kalinga with four main posts erected directly at the corner. Square house is compact, sophisticated and deceptive in its simplicity. These square houses might on statistical grounds alone be	It is the dwelling of wealthy families or the aristocratic class and this type of traditional house could only be found in some part of Tanudan, Tinglayan and Lubuagan. The octagonal house which is larger and older than the square house is made possible by 12 short



called the "typical" Kalinga house, it is elevated to about shoulder height by four posts (*tu'ud*), around which are fitted cylindrical or square stone rat-guards.

Four posts are mortised on to intersections of the beams and joists. They carry crossbeams, each of which supports a pair of queen posts. The crossbeams that connect the tops of the queen posts allow rafters to rise in a slight curve over the roof beams to end the three ridgepoles. The *sawali* walls which are considered by other Kalingas "hardly houses at all" and which are frequently destroyed by fire when their builders move on to new swidden sites. These *sawali* walls are lashed to the outside of the roof-supporting posts (frequently made of the fern-tree trunk which is resistant to rot), and the floor is so independent of them that an opening of several inches appears between them on all sides through which betelnut juice can be spit. Such square houses are often made of wood, and by the time the Kalinga logs are piled up around outside and the grass roofing laid on like a farmer's old straw hat, it is difficult to distinguish them from octagonal houses at a distance. In these wooden houses, of course, the wall-boards are mortised into sills, not lashed to the outside post.

posts: four inner posts marking a square at the center and eight outer ones forming octagon. Girder and joists passing over the posts to support the floor laths, while rabbeted beams on the eight outer posts receive the wall boards. the three floor joists, two girders and four posts which form the foundation of the house are called *fat-ang*, *'oling* and *tu-od* respectively, and riding on top of the joists are two beams or stringers that run from front back called *anisil* or *fuchis*. Just beyond each end of these stringers, but not mortised into them, is another post set in the ground, and at equivalent distance from the center of the house four more off to each side of the central four, giving a total of eight for the support of the wall. Across the top of these eight outer (and lighter) posts, and connecting them, are eight short sills (*pisipis*) grooved to receive the wallboards (*okong*), the front and back ones being parallel, the two side ones being parallel, and the four corner ones joining them at a 45' angle -producing that eight-sided plan for which the house is famous. The logs piled outside below the level of the floor are backed up against a sawali matting (*chingching*) which encloses the area beneath the house. The thatched, hipped roof is not high and steep, and the eaves form a rough edged circle. The octagonal form is not clearly pronounced in the wooden and bamboo walls. The octagonal house is about 6 meters long and 5 meters wide. The floor of the living area is 1 to 2 meters above the ground. The height from the ground to the roof ridge is about 4 to 5 meters.

### **Similarities of the types of the Kalinga House**

Both types of house are elevated by posts, and have a single room and split bamboo flooring that can be detached, rolled up and taken to the river for washing. In other houses, the floors are made of pinewood. Traditional houses of the Lubo, Fangad, ethnic groups in



Tanudan, and Tinglayan share similar architectural designs. This could be attributed to the relatively temperate climate these municipalities experience.

Generally, posts are either with or without roots. However, distinctive of the Lubo and Fangad houses are the posts with truncated roots while the remaining four posts is a plain round or square log, these provides added stability and resilience against intense earthquake. Meanwhile, the height of the wallboards reaches up to chest level necessitating the shelves to be at a higher elevation.

The reed-mat floor (*chatagon*) is laid down in the center section on laths (*chosar*) set into the top of the three joists parallel to the stringers, and in the two side sections on laths which run transversely from the outer edges of the stringers to the inner edges of the sills. Mortised into the upper faces of the stringers are four sturdy posts (*paratok*), each two of which carry a cross- beam (*fatangan*) which, in turn, carries two light queenposts (*ta'ray*) supporting four crossbeams or purlins (*ati-atig*) in the form of a square. The rafters (*pongo*), fastened below to the upper beam (*pisipis*) of the outside wall, are bowed over these purlins and drawn together over three small ridgepoles which carry little actual weight but form the ridging (*panabfongan*). Despite the central square foundations and the octagonal floor plan, however, the roof with its ridgepole presents a different profile from the side than from the front. The bowed *pongo*- rafters are not duplicated on the front or back of the house; instead, straight rafters (*pakantod*) run up only as far as the crossbeams (*ati-atig*), except for the central one which continues on up to give some stability to the ridgepole formation. The thickness of the grass thatching and the extent of the smoke hole overhang, however, disguise these details from the observer on the outside, the whole roof appearing as rounded as would be appropriate to an octagonal building.

The front, back, and two sides of the Kalinga house are a bit longer than the diagonal corners, and the sills on the front and back which support the openings which serve as both doorway and window actually have a different name (*pang-sawaan*) from the others (*pisipis*), and are supported by being mortised into the stringers. In some floor area, one corner is always missing where the ground-level door enters into the rice-pounding area to be considered the true entranceway, a short ladder often being provided therein up to the floor level. To support the resulting exposed edge of lathing and flooring, as well as to



provide additional support for areas like the fireplace, extensions are mortised into the end of one or more of the joists and carried to the outer posts.



Figure 1: Square House  
(*vinulinaw/pinaltong*)



Figure 2: Square House  
(*finaryon/kinipas/sinagi/gilitod*)

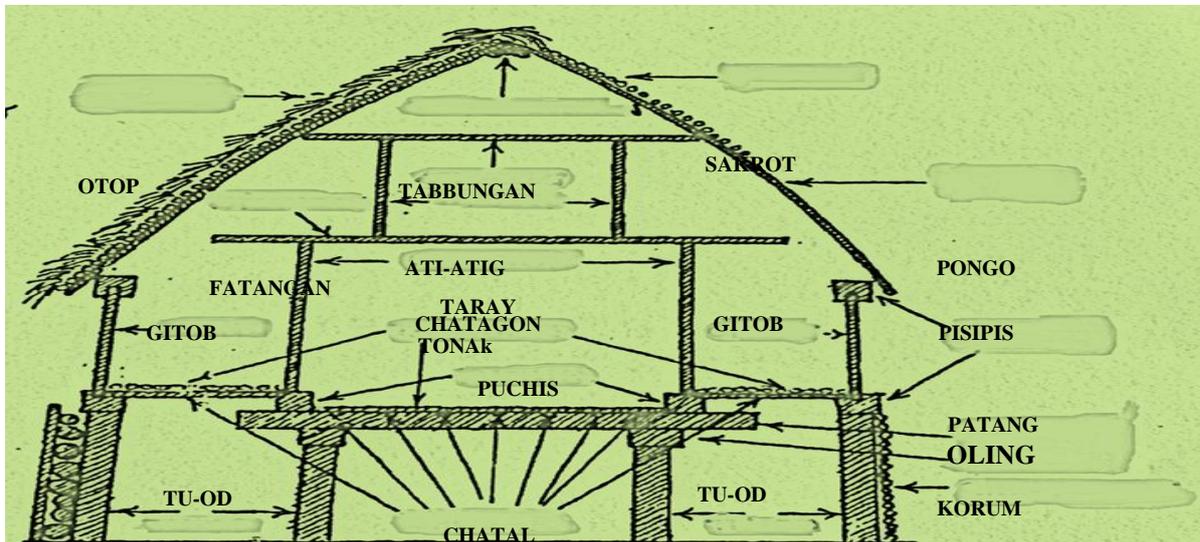


Figure 3: Octagonal House

### **Parts of the Traditional Kalinga House**

- a) *Posts (tu-od)*- These are simply set on the ground with the truncated roots acting as footing, and this is the one support the whole house. The house is erected on 12 short strong posts: four inner posts marking a square at the center and eight outer ones forming octagon. which are usually made of large round logs having an approximate size of 8-12 inches wide by 6-10 feet in length. These are buried about 2-3 feet below the ground and locked in with stones as foundation. Some posts have intact roots. These are simply set on the ground with the truncated roots acting as footing.
- b) *Laths (Chatal)*- The wooden planks of the floor are about 2 inches thick and 7 feet 7 inches long. The width varies from 12 or 16 to 30 inches wide that covers the whole floor area. The center section where the reed-mat floor(*datagon*) is laid down.
- c) *Pilling of Logs & lumber (korum)* - the pilling up of logs and lumber along the outside of the house as if to prevent any enemy from slipping underneath to drive a sudden spear up through the bamboo flooring. It may be 12-14 inches thick with 14-16 inches depth and 12-14 feet long. The top surface of each girder is flat while the base is rounded.
- d) *Wall Header (patang)* – This chest level transverse beam is where the wall boards are rabbetted.
- e) *Transverse Girders (oling)* – It supports the two floor beams and center floor joist
- f) *Sills (pisipis)* – A short groove that received the wallboards.

- g) *Beams or stringers (Puchis)* – It is the center floor beam upon which the floorboards are fastened. Both sides of the center floor beam have right angled grooves for attaching the floorboards. It used as a pillow.



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- k) *Beams or stringers (Puchis)* – It is the center floor beam upon which the floorboards are fastened. Both sides of the center floor beam have right angled grooves for attaching the floorboards. It used as a pillow.
- l) *Reed-mat floor (chatagon)* – It is made of bamboo or wood, used to cover the whole floor area.
- m) *Wall boards (gitob/chavvi)* – These measure about one and one-half inches thick , with varying width and height.
- n) *Intermediate post (tonak)* –These support the ceiling beam and the lintel beam or purlin.
- o) *Attic Central Beam (fatangan)* – It is upon this attic central beam where one or two king posts are positioned.
- p) *King post (taray)* – It holds the roof from collapsing. It stands at the attic central



- q) *Purlin (ati-atig)* – It is a horizontal timber supporting the rafters of the roof. It also carries the central cross-beam.
- r) *Apex Frame (taffungan)* – It supports the upper ends of the rafters , the roof a pyramid shape. It also serves as the smoke exhaust of the house.
- s) *Rafters (pongo)* – It is fastened below to the upper pisipis –beam of the outside wall, are bowed over the purlins and drawn together over three small ridgepoles which carry little actual weight. This is also the first layer of roof (otop).
- t) *Stick Mat (Sakrot/Pa'ol)*. These are long, runo sticks that tied by rattan vine in the rafters ((pongo)or chopped flat boards held by the square roof apex frame. Small tree branches are chiseled and pegged into the apex frame to hold the top rafters in place. The lower ends of the rafters are also pegged to the purlins. They are equally spaced and cantilevered to the level of the floor area.
- u) *Roof (otop)* It made of cogon grass, a bundled of cogon grass roofing are laid beginning from the base to the top and these are tied over a slit bamboos.
- v) *Shelves (tap-yay)*. These are built at the sides of the walls. From the wall header to the roof, boards are fitted horizontally to form a shelf. The space is wide enough to accommodate many clothes, mats, blankets and other household belongings. The shelf above the wall header serves as a cupboard.
- w) *Fireplace (uutuwan)*. It is composed of a hearth (*chalpong*), fire wood shelf (*suugan*), and rice stacking shelf (*salpa-an*). Except for houses used as rice granaries, the Kalinga house is equipped with an earthen fireplace about 3 to 4 square feet. Above it are layers of open shelves. The lower shelf is used for drying firewood. A shelf above it is used to dry stacks of rice and other food staples to be dried and preserved.
- x) *Door (sawang)*. A 2-3 pieces Sliding door depending on the width board up horizontally to the end of the wallboards of to the intermediate posts and door jambs. It is locked in place by a wooden hook-shaped wood.
- y) *Porch (Vangsal)*- the terrace that opens to the living room.
- z) *Ladder (alchan)*. It is a meter wooden ladder with wooden rungs. It provides access to the house.



## **B. Mathematical Concepts in Planning in Construction of the Pre-Fabricated and Nail-Free Traditional Kalinga House;**

### **System of measurement**

For the Kalinga, the body parts, ruled when it comes to linear measurement. The length of a foot, the width of a finger, and the distance are prevalent measurements among the folk builders. Length and width of timber are estimated by means of arms length (*chopa*), the distance between an adult's fully outstretched hands, and is measured from fingertip to fingertip. *One chop* may have an equivalent of about five to six feet depending on how long are the arms of the person estimating the measurement (Tuguic, L, 2014).. On the average, the floor area of a regular house measures about two square *dopah* or about eight to ten square feet. The indigenous measurement *Changan* is also used. It makes use of the span of the thumb and middle fingers' tip when stretched. This system of measurement is frequently employed when calculating width of boards. Correspondingly, on the average, the length of *sin changan* is about eight to nine inches.

### **Nail-Free Traditional Kalinga House**



### **Traditional Kalinga House Construction Method (Octagonal House)**

1. Lay the foundation of the house by digging the holes and put the four posts. Position the four floor joists, four inner posts marking a square at the center . Put also the eight short sills (*pisipis*) to the outer ones forming octagon.
2. Just beyond each and these stringers but not mortised into them, is another post set in the ground, and at equivalent distance from the center of the house four more off to each side of the central four, giving total of eight for the support of the wall, across the tops the tops of these outer( and lighter post), and connecting them which is grooved to receive the wall-boards
3. Affix the transverse girders into the posts and attached the floor beams on the top of the girders. Mortise the secondary post to the side floor beams then connect the front floor joist to both ends of the side floor beams. Girders and joists passing over



the posts to support the floor laths, while rabbeted beams on the eight outer posts receive the wall boards. Four posts are mortised on to intersections of the beams and joists. They carry crossbeams, each of which supports a pair of queen posts. The crossbeams that connect the tops of the queen posts allow rafters to rise in a slight curve over the roof beams to end the three ridgepoles.

4. The wall-boards (*cha'vi*), the front and back ones being parallel to the two side ones being parallel, and the four corner ones joining them at 45 angles producing that eight-sided plan for which the house is famous. The logs outside below the level of the floor are backed up against
5. The laths (*chattal*) are set into the top of the three joists parallel to the stringers, and in the two side sections on laths which run transversely from the outer edges of the stringers to the inner edges of the sills;
6. The reed mat floor (*chatagon*) is laid down in the center section on laths (*chosar*). rolled reed mats which are sometimes put down for domestic chores
7. Lock in the wall header to the wall boards and mount horizontally the attic center beam and two other supporting beams to the purlins.
8. Drive wooden pegs to the bore holes at the joints to secure them and mortise the king post to the attic center beam. Also, mortise its top tenon to the apex square beam.
9. Bore holes at the rafters and at the apex frame then after which, tie the upper ends of the rafters to the apex frame.
10. Structure the rafters with runo stick and lay them horizontally over the roof and tie securely.
11. Roof the house with cogon starting at the bottom progressing upwards with four to five bundles are tied together one at the time on the rafters.
12. Tie the cogon at the protruding king post and mount the door cover it a pot so as to keep the knot intact as well as to prevent leakage during rainfall. Afterwards, trim the edges of the cogon roofing; mount door jamb on the front floor joist; firmly fit the floor boards to the floor beams and joists; place the wall header over the door jamb; refine and fit the wall boards in place.



13. Put in the supporting beams of the shelves. Next, create the shelves at the front, sides, and rear of the house starting the wall header to the rafters.
14. Construct the sliding door by rabbeting the wood planks and make a stick mat for the floor of the attic by twining each stick with thinly stripped rattan vine.
15. Make the movable ladder out of bamboo and build the fireplace by filling the three square fit box with soil.
16. Subsequently, install three stones at the middle to serve as fire stove.

### **C. The Traditional Kalinga House Construction Tools Materials**

The local environment and the construction materials it can provide, govern many aspects of vernacular architecture in Kalinga . Areas rich in trees will develop a wooden vernacular, while areas without much wood may pinewood (*fanglan*) or it is common to use bamboo, as it is both plentiful and versatile. Vernacular house, almost by definition, is sustainable, and will not exhaust the local resources. If it is not sustainable, it is not suitable for its local context, and cannot be vernacular.

The use of modern equipments and technologies are inaccessible to the Kalinga of ancient times, yet their resourcefulness enabled them to devise ways to measure, cut, shape, and connect each part of the house with incredible precision, constructed with native tools by local techniques purely local materials by traditional techniques but rendered variations in size, shape or number of component parts, usually to the increase of convenience and often with real ingenuity.

To cut and chop lumber, a native ax (*wasay*) is used for chopping timber. Then, a coil of string (*pey'tik*) soaked in a staining liquid is employed to mark straight lines on logs, thus serving as guide when cutting or sawing. For making mortise and tenon, chipping extra segments, as well as shaping lumber into its desired form, a large and heavy single bladed bolo is utilized. A chisel is also used in boring holes. Rattan vines, on the other hand, are split thinly by means of a small but sharp knife. Meanwhile, coarse leaves of the *Liha* tree are used as sand paper to refine the surfaces of the board.

The local and environmentally friendly materials used in construction are Giant fern/pine tree or any hard woods, these are utilized for posts, beams, and wallboards, different species of bamboo are use to set the walls, floors and roof, and for tying and pegging the mortise and tenon folk builders make use of rattan and dries cogon grass are bundled with



rattan strips and carefully clipped onto the rafters as roofing Runo sticks – used for making a floor and it used for the second layer of roof.

### C.1. Construction Materials

#### Major Parts of the House

1. Post

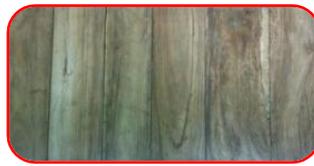


Timber



Giant Fern (*banglan*)

2. Wall Boards



Wood(*ja'vi*)



Bamboo

3. Roof



Runo Stick (*pa'ol*)



Runo Stick(*pa'ol*)



Dried Cogon Grass(*go'lon*)



Dried Cogon Grass(*go'lon*)



Rattan(*iwoy*)



Rattan (*iwoy*)

### C.2. Common Construction Tools



Ax (*Wasay*)



coil of string (*pey'tik*)



(*Katam*)



*Taga*



*Kabra*



*Lusok*



Ribir



Paso'

## 2. The layered structure and the functionality of space

Despite its being a one-room house, the space of the Kalinga house is multi-functional. It does not only serve as a shelter from environmental elements but for multifunctional purposes.

### A. Traditional Kalinga House First/Ground Level

The first level is a space under/below the house. It serves as storage area for farm tools and equipments, log for firewood, for pounding rice during rainy seasons and often times as animals den during night time. Below the house, it serves as midday rest, entertaining visitors, weaving, carving, and accomplishing other household tasks.



### B. Traditional Kalinga House Middle/Main Level

The second and main level is the family's living room, kitchen, and bedroom. It is accessible through a removable ladder. Within the sides of the main level are shelves, which serve as storage area for clothes and blankets as well as kitchen utensils.

The main level is accessible through a removable ladder (*alchan*) leading to a porch (*vangsal*), entering the house is made possible by a 2-3 vertically mortised sliding door opens to the living room or the platform (*chattagon*), it is lower than the other sides, it is the area for eating, recreation, and performance of rituals and other family life cycles. To the left and right, as one enters the house is the sleeping area called *sipi*, it is elevated 2-3 inches from the *chattagon*, each about 1.20 m. wide. It is basically a bamboo mat woven with rattan strips and laid on laths. At the middle section the bamboo strips of the mat run crosswise; at the side sections, lengthwise, thus further defining the levels and spaces. and water jars on the *sipi* opposite it. Clothes are kept in rattan boxes on the side floors. towards the rear, is the fireplace slightly raised above floor level, one senses the protective feeling of the dome and the warmth emanating from the fireplace towards the rear, Over



this fireplace is the storage rack called *sarpaan and suugan*.; the hearth consists of three similar in size stone called *chalpong*, above the hearth is a storage for firewood (*su'ugan*) above the *su'ugan* is for drying purposes such as palay during rainy seasons and or domestic/wild meat. Opposite the front door, on the back wall is another door; this serve as exit passage during tribal wars or a way to do other household chores. The walls from floor level to eaves are of wooden boards placed vertically. From ground level to floor level, the walls are of plaited bamboo or sawali. Logs are piled against the lower section of the wall.

The interior of the house is remarkable for its spatial concept and organization. The floor is divided into three parallel sections running front to back, the central portion being lower than the sides. The eight sides are more clearly defined inside the house than outside because of the exposed structural frame of walls and roof. The roof's inner configuration dominates the interior space. The Kalinga roofs vault and octagonal plan create a sense of expansion within the interior. The floor, consisting of reed mats that can be rolled up, gives the interior a play of textures.

Kalinga houses have no furniture as such, and other house- hold fittings are very simple. Cooking is invariably done in a square ashbox fireplace with no chimney and with three stones, above the fireplace there are always two or more shelves suspended from beams or crosspieces, a heavier one for drying firewood (*su-ugan*) and lighter one for grain or legumes(*salpaan*). Such food as salt which requires dry storage is kept in bamboo, wooden or woven containers tucked in someplace over the fire or in the roof structure, and a number of bars or protruding ends of beams, sometimes carved into hook shapes, serve for hanging clothes or other things likely to be chewed up by rats. Although both eating and sleeping are done on the floor, common in the southern part of the Province are blocks of wood about four inches high used as stools or pillows or as supports to raise the head end of a sleeping board, while in Kalinga people sleep with their heads resting on the higher side sections of the floor. In Kalinga, too, where heirloom Chinese plates are made much of, most houses are fitted with a kind of plate rack for preserving and displaying them. The following are some of the parts of the middle layer of the Kalinga house.



*alchan (ladder)*



*Vangsal (porch)*



*Sawang (door)*



*chattagon (reed mat)*



*sipi (bedspace)*



*chalpong (fireplace)*



### ***C. The Traditional Kalinga House Upper Level (roof)***

Above the main level is the attic, commonly known as the *otop*. It is made by lining the attic beams with a stick mat. Basically, this space is utilized for storing rice and ritual paraphernalia. In addition, it acts as a structural support to the roof.

The roofing material, with the exception of the solid bamboo roofs already noted, is invariably a kind of coarse grass bound to a flat covering of parallel reeds; in a few places at lower altitude the leaves of these same reeds are used instead, and at a few places the roofs are mainly grass but have reed-leaves at the eave ends. The four-trapezoid roof common, in varying proportions, to the rest of the Cordillera has the double advantage of giving eaves and protection to all sides of the house at the point where rain is most likely to beat in, yet having what amounts to tiny open gables under the ridgepole as smokeholes. This is the general shape of the tile roofs of Japanese and Chinese temple architecture, and may well serve as a clue to the origin of the same.



*Suugan (Storage rack)*



*salpaan (Storage rack)*

### **3. Socio-Cultural Values**

The house is one of most valuable possessions among the Kalingas. Attitudes toward houses are integral part of peoples' world-views and need to be understood in a wider perspective. It holds family life where the folk procreates and children are raised and shaped until they are grown and prepared to have families and homes of their own. Hence, its construction is treated with strict adherence to certain traditions and practices from the beginning until it is finished.

#### ***The Kalinga Bayanihan system (gah'gah)***

Building a house for the Ikalanga is a group effort, a practice is known as *gaga*. The workers do not expect any pay for the labor they voluntarily rendered. The mere thought of having been able to extend assistance when one is in great need is deemed a valuable compensation. On the other hand, one is assured that willing hands are readily available when needed in the future. There are instances whereby the *gah'gah* is carried out. Primary is during the transport of bamboo and lumber from the forest to the community. Then, the collection of cogon grass and *runo (pa'ol)* shoots for roofing. After that, the construction of the Kalinga traditional house. As soon as one plans to construct a house, he informs his kinsmen and neighbors, inviting them to help one or two days before the *gah'gah* is scheduled. For the Ikalanga to show profound gratitude, the house builder's family prepares plenty of food and drinks for the workforce. A pig is butchered for their lunch, and rice cake (*pinantalok or inanchila*) is to be served for their snack time. In the afternoon relaxation, ample sugarcane wine (*fayas*) is brewed for their pleasure.

#### ***The Kalinga Paniyaw and Ngilin (Prohibition and Taboos)***

Traditional house construction requires strict observance of prohibition and taboos as well as performance of several rituals. From the entire duration of the construction, the owner should be vigilant for negative omens that might bring bad luck to the workforce or to the family who will soon occupy the house. For instance, a snake or a red bird (*ichaw*) crossing the path while going to the work imply a negative sign necessitate the postponement of any



activity related to the construction of the house. On the other hand, work is also set in abeyance if a death vigil is being held within the village. To make certain that the house would endure the tough environment, workers are usually required to adhere to certain ritual prohibitions known as *ngilin*. To ensure that the prohibitions are religiously observed, some would ask their workers to stay with the family while major work is going on.

### ***The Kalinga Gender Roles and Ownership***

Conventionally, the male members of the family prepare the lumber, runo sticks, and rattan vines. They are also responsible for erecting the structure. On the other hand, the females prepare the meal of the workforce. The family house is usually vacated and given to the eldest daughter upon marriage. Parent believes that the oldest son had a potential to build his own house when he get married, but if there's no girl in the family the house will give to the oldest son of the family. Custom prescribes for parents to build a new house soon as they receive information of their daughter's plan of getting married. This way, the couple will have a shelter of their own. In other tribes of Kalinga, the family house is reserved for the youngest child of the family. In so far as the youngest is deemed to be the last to marry and leave the house, he or she would at least have a place to stay. Besides the youngest child has the responsibility of caring for the parents in their old age. Hence, the house stays with him or her. Among the Tawali, the house is reserved for the youngest child of the family. In so far as the youngest is deemed to be the last to marry and leave the house, he or she would at least have a place to stay. Besides, the youngest child has the responsibility of caring for the parents in their old age. Hence, the house stays with him or her.

### ***The Kalinga Traditional House Adornment & Symbols***

The Kalinga decorations are aesthetics as well as socio-politico-religious emblems. Common embellishment are the (*say-ang and kalasag*), (*panay*), (*gusi*), (*baag and kain*), the rich (*baknang*) display skulls of butchered pigs and horns of carabaos and deer on the walls or front post of their houses as ornaments to show off their wealth and social status. Inside the wealthy Kalinga Houses are shelves or racks (*sakaw*) where heirloom pieces like Chinese plates (*panay*) and jars are displayed. Such display of the family heirlooms is a status symbol among the Kalinga. Other Kalinga structures are the *alang* or granary and the *sigay* or resting shed in the fields. Other emblems are the *alot* placed at the top side of the roof main house post to protect the house.



### ***The Kalinga House Construction Rituals***

In the cutting of lumber for construction materials, Kalinga believe that every tree has a soul, thus a ritual is being performed to ensure that the main parts of the house such as the posts, side floor beams, center floor beam, transverse girders, and secondary posts are intact. By doing this, they are convinced that the bonding of the trees' souls will keep the house strong against calamities. During the construction of a house, especially the foundation of the house, another ritual is to be performed to seek permission from the deities as well as to beg them to protect the workers and the structure so that no harm may beset them. When a new house is constructed, the Kalinga perform another ritual called *Chumchumog* to acknowledge and praise the deities for blessings of prosperity and good health for the occupants of the house. In case a bad omen is observed from the bile sac of the sacrificial animal, habitation of the house is postponed or called off. Through experience, bad omen usually signifies an impending doom for the family. It is, therefore, interpreted as forewarning from the deities. The traditional priest blesses every part, corner, and level of the house so it may last long and bring peace, harmony, and fortune to the occupants. At the same time, a family welfare ritual may also be performed for the occupants.

Sample of ritual in Chumog that the old woman chants in dialect:

*“Adi pay martu de tagu sia martu de kau.”* This means that *“blessed this house and so with the family so that they will be happily ever after. The woods will be the one to be ruined not any member of the family.”*

### **CONCLUSION**

1. The way of life of occupants is of great influence on vernacular house forms. The size of family units, who shares which spaces, how people interact and many other cultural considerations will affect the layout and size of the Kalinga traditional house and most vital feature that evokes artistic expression in construction is its suitability to the ecology of the place.
2. Despite its being a one-room house, the spaces of the Kalinga house is multi-functional. It does not only serve as a shelter from environmental elements and a place to procreate and raise a family but for other purposes as well,



3. Kalinga Culture has a great influence on vernacular dwellings, the built environment, spaces, and the activities of people are inter-related and inseparable. The value of sharing, observance of prohibitions and taboos and performance of rituals, and display of symbols and ornaments, as occupants often decorate buildings in accordance with local customs and beliefs serve as an expression of the people's creativeness, feelings, thought processes, values, experiences, fears, and aspiration.

## RECOMMENDATION

1. Kalinga architects should study vernacular dwellings including aspects of the vernacular in their designs and draw inspiration from them, for innovations in environmental and socio-economically sustainable design and planning.
2. On mathematics Education, engage the students to learning experiences with real life situation or materials observable in their environment and culture, allow students to see connection of modern mathematics and the indigenous mathematics from their heritage. These concepts are very relevant to mathematics education especially in learning process that focuses on understanding and analytical thinking.

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