Conventional Methods Meet the Contemporary Scientific Adaptations in Vernacular Architecture: A Curious Comparability

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Abstract: **Vernacular architecture has evolved into appropriate building methods for each type of culture and climate owing to over hundreds of years of experience. Because of the proper use of environmental design strategies and compatibility with social and cultural norms vernacular architecture has successfully created a desirable indoor environment with minimal energy consumption. Modern technology is all about efficiency in science and velocity in implementation. Socio-cultural consciousness or indigenous knowledge systems nourished with beliefs and practices in the vernacular building traditions are less acknowledged by modern science as imperative. In this context, the present study has shown the direction, i.e. how and the way, in which, vernacular architecture is crucial in representing modern scientific knowledge in constructing buildings. Remarkably, rich repository of traditional knowledge systems, especially techniques and practices involved in creating living- friendly interiors in the abodes of pre-modern Sri Lanka, are analogous with modern technical applications. The body of the article defines and analyses how traditional building techniques illustrate modern technological adaptations and the symmetry between traditional practices and modern technology as appeared in vernacular architecture, particularly, in heat transfer and damp prevention mechanisms used in dwellings in the sixteenth and nineteenth century Sri Lanka. The findings achieved in the research illustrate that the vernacular architecture which represents an eco-friendly organic constructing system mirrored modern building techniques to fit with the natural environment and cause less harm to the built environment.**

***Key Words*: damp prevention, heat transfer, Kandyan Kingdom, vernacular architecture, śhilpa texts**

I. INTRODUCTION

Several scientific realities which are defined by the West through knowledge of modern technology could be seen in traditional folk societies as well. Methods and strategies that have been used in constructing vernacular houses illustrate asymmetries with modern technological identifications which in turn facilitated the merging of the perceptual difference between the East and the West along the lines of advanced technological adaptations. Although internationalization and mechanization as well as changes in people's life - styles have led to despising and repudiating traditional architecture (Michiani & Asano, 2016), it is important to acknowledge its high level of ethical commitment to the local people, their locations, cultures and traditions. The coexistence between traditional knowledge systems and modern scientific acquaintance can be best explained through vernacular architecture because it is based on text, methods, beliefs and practices, whereas modern building practices are based on techniques, laboratory-based innovations, established text and advanced construction materials. Therefore, this paper will focus on vernacular architecture to understand and gain insights on how traditional building practices are crucial in representing modern scientific knowledge and technological applications.

The term vernacular architecture is being used by various scholars to denote diverse yet recurrent meanings and connotations such as indigenous, folk, primitive, popular etc. According to Amos Rapoport, vernacular architecture denotes a set of localized buildings (Rapoport, 1969:1). Derived from the Latin word *vernaculus* (native), this style of architecture is modest in terms of construction which utilizes materials and resources available in the vicinity and reflect indigenous traditions, but is nourished with a higher degree of scientific acquaintance (Oliver, 1997: xxi). As spelt out by Oliver, vernacular architecture is "the local or regional dialect, the common language of the building and as such, it encompasses a spectrum of building traditions as diverse as that of linguistic traditions" (Oliver, 1997: xx-xxi). At times, traditional architectural heritage or vernacular architecture, which stems from many historical influences, often represents diversity in Eastern and Western cultures. The Western science and knowledge system is based on an academic and literate transmission, whereas Eastern knowledge is often passed on orally from one generation to the next by the elders or by method(s) and application. In terms of vernacular constructions, the belief of having a channel between traditional practices and modern science becomes erroneous because in practice and in technique vernacular architecture elaborates modern scientific adaptations. Building technology as a paramount part of the culture, either in the East or in the West, clearly represents or strongly explains the unavailability of such differences or variations. Traditional methods in building construction and affiliated practices synonymously represent modern building techniques and recipes. The discussion presented in this paper elaborates along with sufficient evidence to prove this statement.

Buildings in general, represent a broad category of architectonic structures ranging from secular to monastic edifices (Rapoport, 1969: 1-3). This paper primarily focuses on secular architecture, especially housing construction and its representative quality in modern scientific adaptations. Therefore, while carefully analyzing the interrelations among memory, tradition and folk knowledge, the study attempts to describe how and in what ways the vernacular architectural traditions successfully demonstrate modern scientific interpretations and identifications through the building culture. To this extent, the paper focuses on two aspects: heat transfer and damp prevention. Thus, it attempts to reveal (i) how and in what ways the passive constructional techniques are used to control the heat and cold inside the building, as well as (ii) how to reduce the internal and external dampness of a traditional house. Passive constructional techniques are known as the methods that take full advantage of natural ventilation and nature-oriented aspects such as the location of the building, the orientation of the building, properties of building materials, and the general approaches that are innovated and developed for buildings focusing on thermal energy control, natural ventilation and moisture resistant (O'Connor, 2015:17; Agboola, 2017: 18-20).

The heat transfer and damp prevention systems in traditional Sri Lankan houses belonging to the sixteenth and nineteenth centuries, known in Sri Lanka as the Kandyan era (1592-1815), will be explained in this study to clarify the interconnection between traditional knowledge and its asymmetry with modern technological practices regarding building construction. Building methods and systems followed in constructing the floor, roof and walls of a 'Kandyan' house will then be illustrated on how far such conventional knowledge and efficient usage of folk experiences are similar to modern scientific interpretations.

The geographical area of the Kandyan kingdom covers a vast extent of natural boundaries such as mountain terraces, tropical rain forests and the longest river of the island nation of Sri Lanka. Hence, the Kandyan kingdom was a geographically 'isolated' political entity from the coastal dominated by the Europeans, i.e. the Portuguese and later by the Dutch. After becoming masters of the maritime province in 1796, the British entertained ambitions of annexing the Kandyan Kingdom and was able to achieve their desired aim. As a result of signing the Kandyan Convention (1815), the treaty between the British and the chiefs of the polity, marked the cession of the Kandyan Kingdom and Britain received complete control over the island in 1815. The British administration of the island lasted until gaining independence in 1948. However, the inter-relations through internal trade networks between the coastal areas and the hill country kingdom not only brought commodities but also cultural influences.

II. TRADITIONAL WISDOM IN ŚHILPA TEXTS

Several ancient śhilpa texts, literally mean the science of śhilpa (arts and crafts) known as either vāsthu śāstra or śilpa śāstra that describe some aspects of residential buildings. Vāstu śāstras deal with architecture including building houses, forts, temples, apartments, villages, towns and layouts etc. The large collection of śhilpa texts in the form of palm-leaf manuscripts in Sri Lanka, which are enriched with information on architecture illustrates how the indigenous knowledge tacitly represents the scientific knowledge on present-day technological identifications of building constructions. The śhilpa texts are recognized as one of the most pivotal sources that could be utilized for understanding the traditional dwelling technology of Sri Lankans. The teachings in the śhilpa texts written by experts who possessed general knowledge and pragmatic exposures that were passed on from generation to generation through the ages, are bound with human experiences of constructing dwellings. One of the significant works in this category is *Maimataya* an ancient treatise on architecture and design. (Appuhamy, 1892). The entire work contains 283 verses on different aspects of construction, ranging from selecting a suitable land, constructing a building and building strategies. Apart from that, it also demonstrates how construction should take place in an eco-sensitive manner (Appuhamy, 1892: verses 269-275) and how natural environmental conditions are taken into consideration in construction (Appuhamy, 1892: verses 270-272). The manuscripts of *Gebim Shastra* and *Bhumi Shastra* (both means in literally the study of land) too mention important facts which are directly connected with 'ideas to be concerned' in building constructions. Apart from these, is another important manuscript for housing construction named *Gebim belima* (literally inspecting the land) which contains auspicious symbols related to the land. It provides a several pieces of advice to the builder on how to select a land which is embodied with 'good omens' (Appuhamy, 1892: verses 271-273). All these manuscripts elaborate the aesthetic sensibility and traditional knowledge, as well as their scientific validity in the modern sense.

Not only one of the prime concerns in modern building science, but the notion of heat transfer and prevention of dampness in buildings and its adverse effects on humans had been discussed even in those ancient Silpa texts. For example, *Maimathaya* explains the dampness in houses as "land that is wet at the time when there is no rain, is bad. O' sir! If a house is built then, it will be involved in sickness night and day"(Appuhamy, 1892: verse 243). Some of the verses in *Maimathaya* devoted to practical advice are shrewd and even obvious, such as the warning not to build on a site which is wet even in dry weather (Appuhamy, 1892: verse 244). Similarly, it has been explained in *Maimataya* that establishing more open spaces or open to sky areas within the confined dwellings will facilitate releasing the sending away the heat that generates during the day time (Appuhamy, 1892: verse 280). Here, it emphasizes the locating of internal courtyards and spacious internally established corridors around the courtyard. In a discussion where attempts to understand the amalgamation of modern building technologies and the traditional construction practices in vernacular architecture, an extensive study through the examination of textual evidence belonging to the ancient period is indeed a vital. Ancient *shlpa shastra* texts are the golden repositories of indigenous knowledge and practices and have withstood the test of time.

III. HEAT TRANSFER

One of the conspicuous concepts in constructions in the Kandyan period was the occupant's comfort. It is noticeable that certain innovations had been implemented towards achieving the said goal. The occupant's comfort was mainly ensured by reducing the excess heat and the unbearable breeze that was usually generated by the tropical climate in the good old days. In modern times, heat transfer is identified by scientists as the transition of thermal energy from a hotter mass to a cooler mass. In general, architectonic perception is a mechanical process which manages the overdriving of excess heat and encourages cooling of the atmosphere in an enclosed device. This modern scientific identification is demonstrated in traditional Sri Lankan houses belonging to the sixteenth and nineteenth centuries, especially in houses belonging to the Kandyan period. This can be manifested under three factors: material utilization, architectural elements, and technology. This section will expand on these three factors.

Kandyan architecture is known as a folk tradition. The construction of secular and monastic buildings was done by 'well trained architects' through following and adhering to age-old building practices passed down from person to person, generation to generation, particularly orally. They considered cultural expressions, social norms and eco-sensitiveness as prime elements in building construction. The architects of the Kandyan period experimented with annexing various architectural elements to dwellings to minimize the internal temperature of the abode. Demonstrating their concerns in this feature, they were particular about averting cold air that could come from the outside. To maintain the exterior-interior heat balance, some architectural elements and devices were used. One such element was the central courtyard. Most of the buildings belonging to the Kandyan period consisted of interior courtyards. Two types of courtyards were popularly seen in dwellings by residents of this region: the interior courtyards and the exterior courtyards. These open spaces played a significant role in providing fresh air and sunlight, and ensuring natural ventilation. The topography of the central highland of the island is basically tropical, but during the day the temperature is a little higher than that of the night (Percival, 1975: 38; Davy, 1983: 49). Therefore, the courtyard was the paramount element that had been deployed to achieve the climatic responsiveness of the Kandyan built form. It displayed excellent characteristics in terms of responding to climatic conditions and was well-protected from excessive heat. During the daytime when the sunrays came into the interior courtyard, the heated air rose up as convection currents and set up an air flow that ventilated the house, and kept it cool. At night, when the density of cool night air came into the courtyard, the gaps between the wall plate and the roof sufficiently poured fresh air into the enclosed rooms that surrounded the courtyard. In fact, as mentioned under the constructional materials, the heated air escaped through the roofing materials which consisted of heat insulating quality, especially through the thatched and tiled roof. Under the dual function of the air, the internal heat was emitted while creating a comfortable heat-free atmosphere inside the house. In the dual function, the airflow brings cool air into the interior and releases the heated air from the open space of the central courtyard and through the roofing materials. This process is displayed in the following diagram (Fig. 1).

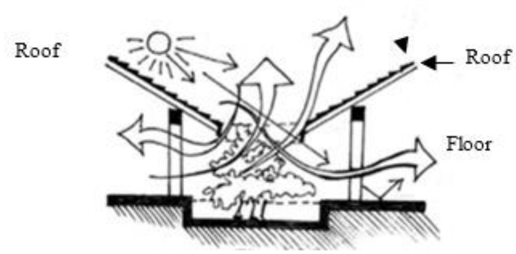

Fig 1 The pattern of air movement through the central courtyard

It is evident that one of the prime aims of including central courtyards within the building was to supply a cooling breeze into the house and provide maximum internal comfort. The courtyards in Kandyan houses functioned as cooling tunnels, and in turn, its heat transfer mechanism provided a soothing effect to the inhabitants. Courtyards have become one of the most significant architectural elements in modern dwelling constructions. When the underlying importance of its establishment and ancient usage value act as a positive regulator for resistance to internal warmth, courtyards demonstrate the hybridity of traditional and modern knowledge.

The verandah was another element that was used as a transitional technique for transferring heat. It functioned as a thermal buffer to the internal space. Verandahs were used not only as a calorific barricade which cut down solar radiation, but as outdoor living spaces. Due to this thermal barrier, the heat did not transfer through the verandah into the house and did not affect the indoor temperature, but maintained a cooler environment inside the 'Kandyan' dwelling. As an outdoor living space, dwellers in these regions used to spend most of their time in the verandah. The relatively high amount of heat that was produced due to these congregations had been eased by the cross ventilation system of the verandah, as explained above. Dutch officials who were the 'rulers' of the coastal region during the period from 1640 to 1796 too used the verandah called *isthoppuwa* in their language to reduce ease the heat coming from the exterior. In the elite houses of the Kandyan era the outdoor porch with a roof was called as verandah; opposed to that, in dwellings of common people, it was *pila* that functioned as the thermal barricade. Apart from its technical attribution *pila* was a semi-private area of the abode where it served as a space for welcoming outsiders as well as the sleeping area of the male family members. Further, the *pila* in general houses had usually constructed with recyclable materials such as clay, cow-dung (Percival, 1975: 125) and mud mortar. Those materials contained a higher degree of insulation and high level of heat absorption quality. Therefore, it prevented the conductivity of heat and provided a cool environment inside the house.

Further, in hot and humid climatic conditions, the *pila* and the verandah functioned against the dampness of the earth that would seep into the building and as a thermal barrier too. This way, both elements prevented conduction or transference of heat coming into the building and reduced the internal temperature level, so that any extra mechanical energy was not needed for cooling the internal environment (Fig. 2). Thus, it is clear through the above discussion that the *pila* or verandah in Kandyan houses provided a relaxing effect by its capacity to reduce the internal temperature and directly influenced creation of a comfortable living environment within the abode by interacting with four main heat transfer mechanisms; conduction, radiation, convection and evaporation.

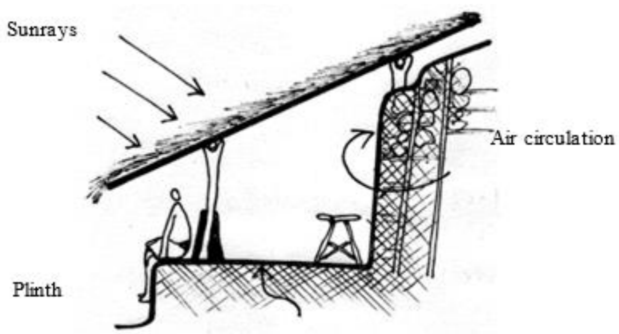

Fig. 2 The Verandah or / and *Pila* of a Traditional Kandyan house

Another interesting feature of these 'Kandyan' homes is the small windows and narrow doors. Because the inner rooms are usually used only for sleeping, it is not considered necessary to have much light here. It is also believed that larger openings intensified the heat and glare. Therefore, small openings and narrow doorways played a vital role in maintaining interior warmth. Windows helped to perpetuate equilibrium between the high temperature during the cold rainy seasons and the low temperature during the daytime. Sunlight is a stronger source of radiant heat and window glazing prevents generating high heat in the interior through the open spaces which helps for cross ventilation.

Materials too played a significant role in heat transfer which in turn emphasizes the modern applicability of certain building materials. It has been confirmed that materials used in Kandyan dwellings, mostly short-lived perishable materials had high heat absorbent quality and these are being tested by modern scientific technologies**.** Usually, houses belonging to the sixteenth and the nineteenth centuries located in the central area of the Island nation are constructed with recyclable materials such as clay, cow-dung (Percival, 1975: 125) and mud mortar. Those materials contained a higher degree of insulation and a high level of heat absorption quality. Therefore, it prevented the conductivity of heat and cooled the interior of the house. In fact, the use of natural clay and thatched roof preferably suited to the tropical climate, popularly known as the balmy weather in Sri Lanka. When the weather is cool and humid, especially at night, the porosity of the clay absorbs moisture, and during the day, when it is warm, the moisture is expelled. The architectural elements such as roof, walls and floor of the Kandyan house can be employed to illustrate how heat transfer mechanism used in dwellings in the sixteenth and nineteenth century Sri Lanka.

As established previously, the heat transferring and heat absorption qualities of the roof, as a whole, resulting in providing a convenient indoor setting to the house. The traditional roof style that was popular in the Kandyan provinces was usually constructed with porous materials that are breathable. The utilization of eco-sensitive materials of relative thickness too provided a sound insulating effect with high heat regaining capacity. Its 'stack effect' is due to raw materials like cadjan or straw functioned as a hot air outlet. Because of its orientation and comparatively large exposed area, the typical Kandyan roof generated considerable heat during the daytime. The low temperature radiation from a heated ceiling not only heats the other surfaces, but indirectly adds to body discomforts (Richards, 1957:84). The shape of the roof is also of utmost importance in sunny climates. A flat roof, for instance, receives solar radiation continuously throughout the day, at a rate that increases in the early morning and decreases in the late afternoon due to changes in both solar intensity and the angle of the sun (Richards, 1957: 84). The roof surface will then act as a means for heat to be transmitted from inside the building to the ambient air. The process cools the air without increasing the humidity inside the room, and thus improves the thermal comfort level of the room.

The weather conditions of the Kandyan provinces varied according to divergent climatic regions (Heydt, 1952: 112; Percival, 1975: 168-169; Davy, 1983: 44-57). In the upper part of the Kingdom, especially in Vanni, Nuwarakalaviya and Thamankaduwa, a high degree of warm climate was evident during the daytime. In contrast, the central hill area of the Kingdom experienced medium hot weather during the daytime. Both areas were comparatively cold during the night or chillier than any other part of the country (Davy, 1983: 50). While considering the prevailing topographic and climatic conditions in the Kandyan provinces, along with the provision of maximum indoor comfort to the occupant, Kandyans favoured the high pitched roof which more suitably adapted to the above-mentioned climatic conditions (Karunaratne, 1993: 28-30). In comparison to the flat roof, the high pitched roof, where the total surface area of the roof had been spread limitedly and received less solar radiation than that of a flat roof. (Esfahania, et al. 2021: 407-410). When the height of a part of the interior increases, the warm air that comes into the building, will be transmitted within the roof and the wall. The high ceiling encouraged the free flow of air through the building. Although the Kandyan roof did not deliberately consist of a specific element like a ceiling (Widyalankara, 2006), the rafters located in certain spaces functioned, as air circulating particles, which enabled the outward circulation of hot air that came into the house through the roof.

The roof covering was usually cadjan (woven coconut palms), palmyrah (*Borassus flabellifer*), straw, grass mostly, Illuk (*Imperata cylindrica*) and Maana (*Glyceria maxima*) or sometimes a combination of these materials. A wide overhang is created, projecting about three feet from the wall, ensuring that the mud walls do not get wet, thereby avoiding catching moisture during the rainy season. In the North Central region, the overhang had another reason, writes Architect De Vos. He affirms that the low hanging roof protected the house from strong winds, and it had only one entrance, reached by crouching under the eaves (De Vos, 1977: 42-43).

The thick mud wall construction of Kandyan dwellings with its higher heat absorbent quality was an effective method for heat transfer. The mud wall construction could retain heat and, store in it during the cold weather, thereby delaying the heat from entering the building during the day time. That made the interior of the abode comfortable to live in, even in a hostile climate. Johann Wolfgang Heydt, a German cartographer who was an employee in the Dutch East India Company (VOC) during the Dutch occupation in Sri Lanka in eighteenth century, observed that, ‘water in clay vessels was also cool, that one must wonder at it, and it does not happen with other vessels, therefore the cause of it must come from the clay’ (Heydt, 1952: 104). This fact is palpable even today. Hence, it is evident that the walls of these houses literally breathe, acting as a natural “air conditioner”, which prevents heat from crossing the walls, thus reducing the possibility of the inner temperature rising.

The floor construction of Kandyan houses is as well vital to be examined when discussing about the thermal comfort of sixteenth and nineteenth century dwellings. Using cow-dung for flooring was the common yet popular practice among the folk in pre-modern Sri Lanka. Knowing the fact that cow-dung has multiple benefits, and acts as a cheap thermal insulator as well as an insect repellent, people used it for flooring their houses (Mukherjee & Ghosh, 2020: 61-62). According to Ayurveda, cow-dung too can function as a purifier for all the wastes in nature. As shown in recent experiments, it consists of bacteria that are harmless to human beings (Randhwa & Khullar, 2011) and nourished with properties which provide both warmth and coolness together. It perfectly suited the central hill region and peripheral provinces of the Kandyan kingdom since those areas were hot during the day time and cold at night. The peripheral areas of the Kandyan Kingdom were located at the boundary of the Kingdom and included mainly Nuwarakalaviya, Thamankaduwa and Vanni areas (Percival, 1975: 167). Yet, cow-dung has a high moisture content and evaporation level that help make the indoors cool. During the night when the temperature dropped considerably, the surface of the floor becomes warm and comfortable for dwellers who sleep on the floor. Because of its porous nature, the thermal conductivity of cow-dung is usually less. Thus, the heat is retained in the area where the body had been in contact with the floor. The cow-dung floor finish was not restricted to any particular building type, but adapted to all kinds of buildings: religious, royal, noble and peasant. “Every Buddhist temple and Hindu pagoda had its flooring covered with this cooling composition, which was regarded as anti-contagious and wholesome to the human frame” (Bennett, 1984: 213). Based on the above discussion, it is clear that the determining factor behind the design of the roof, walls and courtyard of Kandyan houses was the comfort of the occupants in terms of managing temperature.

IV. DAMP PREVENTION

What is meant here by dampness is water in its free liquid form or its presence as vapour in the air, or as moisture content of building materials (Oxley & Gobert, 2011: 11). Among many reasons, moisture too could be taken as a cause for dampness (Oliver, Douglas & Stirling, 1997: 6). Dampness in the elements of a building structure can rise due to rain water penetration from the ground and condensation. The performance of the external fabric, roofs, walls and floors in resisting or tolerating dampness was the major factor which determined the damp condition in a building (Trotman, Sanders & Harrison, 2004: 12-14). It has been observed that moisture played two different roles in Kandyan buildings (Widyalankara, 2006). Moisture and humidity were unavoidable factors affecting building construction in the Kandyan provinces, especially in the central hills. The moisture problem was relatively significant in the 'wet zone', although the area coverage of the Kandyan kingdom was wide in range and varied locality (Widyalankara, 2006).

The location of courtyards within the Kandyan houses helped in minimizing the internal moisture. Since it opened to the sky, the solar radiation reflected upwards and moisture of the area did not remain, but evaporated gradually. The entire courtyard was usually covered with eaves on all four sides that projected outward from the walls to protect the walls from heavy rain. Nevertheless, these eave roofs that surrounded the courtyard did not consist of down pipes or gutters like that of the present day, but the traditional Kandyan architect created a method of disposing excess rain water that came into the courtyard. The rain water which fell on to the roof directly drained to the courtyard, and a mud pipe which ran underneath the building drained out the collected water from the courtyard (Fig. 3).

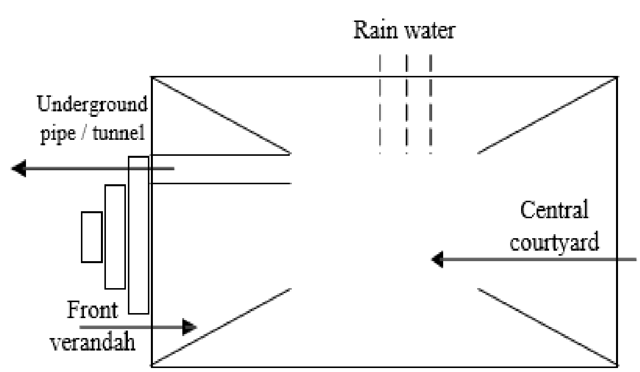

Fig. 3 The Traditional System of Disposing Rain Water in the Courtyard

The excavations conducted in the Palace Complex in Kandy have made some interesting revealings (Second AER, 1985: 8) on this kind of draining out of water accumulated in the courtyard. The courtyard or the open area to the west of the Audience Hall consisted of a drainage system as mentioned above, and it has been a prominent feature in other domestic buildings during the period under review. It was a stone-covered drain which could well be that of the gutter letting out rain water around the Audience Hall (Second AER, 1985: 6). Yet, through the excavations an opening was found at the North – Western corner of the central courtyard in the Queen's Chamber, or as traditionally known, in the *mëda wāsala,* which indicated the existence of a gutter to let out rain water as the court was open to the sky (Fourth AER, 1989: 10). Further, excavations revealed that the stone gutter is 250 cm wide, and is 78 m long (Fourth AER, 1989: 10). However, it could be surmised that this water disposal system had been promoted to prevent internal dampness together with moisture.

Furthermore, in hot and humid climatic conditions the *pila* and the verandah functioned against the dampness of the earth that would seep into the building, and also as a thermal barrier. In this manner, both elements prevented the conduction or transfer of heat coming into the building and decreased the internal temperature level, so that any extra mechanical energy was not needed for cooling the internal environment. Therefore, the *pila* and the verandah directly influenced the occupants' comfort by interacting with four main heat transfer mechanisms; conduction, radiation, convection and evaporation.

The traditional Kandyan architect created a method of disposing of excess rainwater that came into the courtyard by establishing a drainage system that connected the courtyard to the outside. This method of ejecting rainwater helped to maintain a damp-free interior within the house. Underground clay pipes had been set-up from the courtyards to the verandah to drain rainwater that accumulated in the courtyards. These pipes were made from clay by placing one half-round tile on another. The following picture shows the traditional Kandyan system of disposing of rain water collected in the courtyard.

Marinating a sandy compound which is popularly known as *veli midula* (sand compound) in front of the buildings was another feature that was used to maintain a damp-free environment around the house. In some instances, this immediate open area was known as '*veli maluwa'* (D'Oyly, 1995: 142) or the sand court. The *veli midula* extended to a distance of about ten feet around the house and was an open area filled with sand where no trees were planted. This area around the house was normally composed of pebbles and sand but these were quite different from the capillaries of the original soil of the area. In reality, this type of treated ground is extremely permeable. Therefore, rainwater absorbed very quickly and was capable of preventing dampness rising from the ground. It can be assumed that the traditional Kandyan architect was enriched with such scientific knowledge due to the time honoured experiences. Consequently, the *veli midula* or the front sandy compound functioned as an 'absorber' of water, especially the rain water, which in turn, resulted in creating a dry effect around the building.

Modern science has proved that water in the soil is attractive to termites. Heavy rainfalls or flooding combined with elevated temperatures promote termite activity. Yet, the role of moisture in clay and its relation to Kandyan dwellings is more or less interconnected. Preventing buildings from being affected by dampness and controlling moisture was needed because of this scenario. In modern architectural practice, controlling termite attacks by injecting specified chemicals into the ground before and after constructing the house, imposing housing regulations where draining out rain water and other domestic waste emphasizes how modern technological involvement is on par with ancient practices in vernacular architecture. Simple yet attractive traditional mud houses of the Kandyan era may rapidly become a thing of the past.

However, the simple techniques used, the community bonding it created, and the minimal environmental impact of its construction are qualities to be valued and remembered even in the present-day albeit these are seen as 'less important' in modern science. Heat transferring and damp preventing methods practiced by traditional folk thereby cannot be disposed of as non-scientific or primitive, simply because these belong to primitive Asian cultures. Instead, it carries great value in terms of inherent high technological and scientific value because these are results of human experiments carried out in 'social labs' for centuries. Moreover, these are essential absorptions of changing climates and typologies.

V. CONCLUSION

The architectural practice of a community is portrayed through diverse manners, sometimes through their practices, folklore and to a certain extent through their literature. Such indigenous knowledge is constantly changing in corresponds to the diversifying needs of its producers, life experiences and negative – positive social establishments, either in the form of social privileges or taboos. Despite their overt valorization of indigenous knowledge Western scientific archivists sometimes are reluctant to accept the worthiness of 'raw' indigenous knowledge and - upon a collective of collection Western scientists insist on testing its validity via modern scientific experiments. The scientific validation of traditional knowledge is rather challenging and could be a tiresome and exhaustive exercise since those are accompanied by individual experiences of dynamic cultural systems. It cannot be suppressed reality that the vernacular architecture is embodied with the representative quality of modern technological knowledge and the traditional building science and methods of the East are indeed identical to Western scientific achievements in the pre-colonial global context. Remarkably, it is evident that the construction knowledge of our ancestors, in most instances resembled the symmetrical relations with contemporary technological innovations. In an era where facing various devastative global environmental issues, it is appropriate and well in time to reconsider combined solutions or rather known as ‘hybrid’ developed by the ancestors concerning the building industry. It is yet to be considered to amalgamate traditional knowledge with modern practices to achieve significant results in sustainable architecture, as it is apparent that vernacular architectural practices are identical to modern building techniques. In some cases, this can lead to a higher efficiency than what can be achieved if only modern technology is applied.

REFERENCES

[1] Appuhamy, D.P. de Silva (ed.), The original manuscript of the Maimataya, was printed as a monograph, Colombo, 1892.

[2] Bennett, J.W. Ceylon and its Capabilities, Rajagiriya: Trumpet Publishers (Pvt.) Ltd., 1984

[3] Davy, J. An Account of the Interior of Ceylon and of its Inhabitants with Travels in that Island, Dehiwala: Tisara Prakasakayo, Reprint 1983.

[4] De Vos, Ashley. "Some Aspects of Traditional Rural Housing and Domestic Technology" in Proceedings of the National Symposium on Traditional Rural Culture of Sri Lanka, Colombo: The Department of National Museum, 39-61, 1977.

[5] D’Oyly, Sir J, Diary of Mr. John D'Oyly, New Delhi: Navrang, 1995.

[6] Encyclopedia of Vernacular Architecture of the World, Edited by Paul Oliver, P. Cambridge: Cambridge University Press, 1997.

[7] Esfahania, S.K., Karrech, A., Cameron, R., Elchalakani, M., Tenorioa, R., Fernando, J, ‘Optimizing the solar energy capture of residential roof design in the southern hemisphere through Evolutionary Algorithm’, Energy and Built Environment, Volume 2, Issue 4, October 2021, Pp. 406-424.

[8] Fourth Archaeological Excavation Report, Colombo: Department of Archaeology, 1989

[9] Gebim belima, The Collection of Historical Manuscripts, Colombo, collection number 21511.

[10] Gobert, E. G. & Oxley, T.A. Dampness in Buildings, NY: Taylor & Francis Ltd, 2011.

[11] Heydt, J.W. Heydt's Ceylon: being the Relevant Sections of the Allerneuester Geographisch- und Topographischer schan-platz von Africa and Ost-Idien etc (1744), R. Raven-Hart. (Tr.), Colombo: Ceylon Government Information Department, 1952.

[12] Karunaratne, L.K. ‘The timber framed building tradition in Sri Lanka, Wood, International Scientific Committee 10th General Assembly, Colombo, Sri Lanka, pp. 26-32, 1993.

[13] Michiani, M.V. & Asano, J. Influence of inhabitant background on the physical changes of Banjarese house: a case study in Kuin Utara settlement, Banjarmasin, Indonesia, Front. Archit. Res., 5, pp. 412-424, 2016.

[14] Mukherjee, G and Ghosh, S. “Use of Cow Dung as Mosquito Repellant,” International Research Journal of Pharmacy and Medical Sciences (IRJPMS), Volume 3, Issue 1, pp. 61-62, 2020.

[15] O’connor, J.M. Architecture & Passive Design, London: Design Media Publishing (UK) Ltd., 2015.

[16] Oliver, A., Douglas, J. & Stirling, S. Dampness in Buildings, New York: Wiley Publishers, 1997.

[17] Percival, R. An Account of the Island of Ceylon, Reprint of Second edition, Dehiwala: Tisara Prakasakayo, 1975.

[18] Randhawa, G.K. & Kullar, J.S. ‘Bioremediation of pharmaceuticals, pesticides, and petrochemicals with gomeya/cow dung’. International Scholarly Research Network, Pharmacology, Volume 2011.

[19] Rapoport, A. 1969. House Form and Culture (Foundations of Cultural Geography Series), Englewood Cliffs, N.J.: Prentice Hall, 1969.

[20] Samuel, D.G.L., Dharmasastha, K., Nagendra, S.M.S, Maiya, M.P., ‘Thermal comfort in traditional buildings composed of local and modern construction materials’, International Journal of Sustainable Built Environment, Volume 6, Issue 2, pp. 463-475, 2017.

[21] Second Archaeological Excavation Report, Colombo: Department of Archaeology, 1985.

[22] Trotman, P., Harrison, H. and Sanders, C. Understanding Dampness, United Kingdom: Building Research Establishment, 2004.

[23] Widyalankara,Y.A. Unpublished PhD Thesis submitted to the university of Kelaniya, Sri Lanka, 2006.