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Filipino Vernacular Scales and Their Use in Construction

Introduction

Scale has been defined as: ‘The size of a building in relation to its surroundings, or the size of parts or details of the building, particularly in relation to the scale of a person. Scale refers to the apparent size, not the actual size.’ (State of Victoria (Department of Environment, Land, Water and Planning 2016)) Divya Khotari in her discourse on “The Psychology Behind Scale In Architecture” mentions that scale in architecture is a ratio based on the architectural elements with each other and their surroundings being in harmony with the human body. The measurements of architectural elements in a building are based on the measurements of a human body (Khotari 2022).

But what if the human body itself, and its parts, are used to measure the building elements? Then they become the units of measurements in creating a space. We also know that there are variations in the sizes of humans which are dependent on their locations, nutrition and economy.

The Filipinos would have different body measurements from other races which have been shaped not only through genetics but by their experiences. But it is also interesting to note that the Filipinos are explorers, and since the start of Filipino history have been finding ways and means of survival and inventive processes, even in the field of architecture and construction. It can therefore be theorized that they must have also used the parts of the human body as vernacular scales in the course of construction.

The term “vernacular scale” was coined from its association to “vernacular architecture”. The phrase “vernacular architecture” was used by Sir George Gilbert Scott in 1857, in the first chapter of his book “Remarks on Secular & Domestic Architecture, Present & Future.” He wrote:

“Vernacular architecture usually serves immediate, local needs; is constrained by the materials available in its particular region; and reflects local traditions and cultural practices. Traditionally, the study of vernacular architecture did not examine formally schooled architects, but instead that of the design skills and tradition of local builders, who were rarely given any attribution for the work.”

In a children’s story book written by Mimi Navales entitled “*Ang Panukat ni Kat*” (Kat’s Measuring Tool) and published by the Department of Science and Technology of the Philippines in 2022 and geared for children 3 years of age and above, four common scales based on the Filipino anthropometrics were identified: *piranggot* (length of the pointer finger, about 4”), *dangkal* (length of the extended pointed finger and thumb, about a span of 7-8”), *talampakan* (one foot), and *dipa* (length of the arms or fathom which is about 5-6 ft.). In the book, the author suggests that measurements of rooms can be done even without the use of a measuring tape through the parts of the body. (Navales 2022)

Statement of the Problem

This paper will explore Philippine vernacular scales (the four common scales that have been mentioned by Ms. Navales in her book) and their use in the Philippine construction industry at the present time.

The research questions that will be tackled will include the following:

- Are the vernacular scales still being used for construction in the cities, particularly in the vicinity of Metro Manila?
- Are there other vernacular scales that are used aside from these four common scales?
- How are the scales used by construction workers?
- Do they consider using the scales as efficient or not?
- Will the body measurements of these construction workers be close to the standard sizes defined by Ms. Navales?

Significance of the Problem

The paper can contribute to the understanding of scales and its association with the construction industry. It can also give credence to the move by the Philippine Department of Science and Technology to teach the children about vernacular scales and its practical uses which the children can later on adopt even in adulthood.

Scope and Limitations of the Study

The paper discusses a short history of the Filipino vernacular architecture and the possibility of the use of vernacular scales in traditional building, provides a glimpse of the current Philippine industry, particularly in Metro Manila, and includes the results of surveys made among construction workers. Due to lack of time and availability of the construction workers during the study period, only a total of 51 construction workers were surveyed and limited to a construction project within the city of Paranaque in Metro Manila

Review of Related Literature

Filipino Vernacular Architecture

There are five principal features that pertain to the vernacular mode of building according to the book chapter “Philippine Vernacular Architecture and its Austronesian Ancestry” of *Arkitekturang Filipino* by Dr. Gerard Lico. These are: (1) the builders, whether artisans or those planning to live in the buildings, are non-professional architects or engineers; (2) there is consonant adaptation, using natural materials, to the geographical environment; (3) the actual process of construction involves intuitive thinking, without blueprints, and is open to later modifications; (4) There is a balance between social/economic functionality and aesthetic features; and, (5) architectural patterns and styles are subject to a protracted evolution of traditional styles specific to an ethnic domain. (Lico 2008)



Fig. 1 Bahay Kubo

Source: 3D Warehouse

In the Philippines, vernacular architecture has been identified with the bahay kubo, the traditional Filipino house, and the bahay na bato, which is an amalgamation of Spanish and traditional architecture. The pre-Hispanic bahay kubo utilizes building materials that are abundant and immediately available, is of simple construction, and may also be easily reconstructed, according to Senen Antonio in his discussion in “Lean Interpretations from Philippine Vernacular Architecture”. He also mentioned that the bahay kubo by nature is an impermanent structure with light and simple structure that may be constructed by less-than-skilled labor. (Antonio 2014) We can also surmise that the construction of the bahay kubo and similar indigenous structures would also have been with the use of what we may call as vernacular scales.

The *bahay na bato* was introduced during the Spanish Colonial Period in the Philippines. In 1521, Ferdinand Magellan discovered the Philippine islands but it was not until 1565 when the first colony was established by Miguel Lopez de Legazpi. Although the first colonies were made of clusters of *bahay kubo* and structures of similar characteristics, the *bahay na bato* was later introduced in 1587 with the desire for structures which will last with more durable materials like stone or bricks. and upon the edict of the Governor General Santiago de Vera who commanded that all buildings in Manila were to be made of stone. (Lico 2008). Earthquakes though, called for structures that would be more resilient so that the *bahay na bato* was characterized with materials that would be light on the second floor and heavier on the ground floor. Even though skills on making the *bahay na bato* would also evolve, it still can be argued that the scales they used in the construction would still be vernacular scales since the measuring tape or meter tape was not invented by British metal-worker James Chesterman until 1829. (Zibell 2020)



Fig. 2 Bahay na Bato

Source: Pinterest – Oil on Canvas by JBulaong 2014

Philippine Construction Industry

The Philippine construction industry was the fastest growing industry in the Asia-Pacific region before the Coronavirus (COVID-19) pandemic. It diminished the growth of the industry from positive 14.9% in 2018 to a negative growth 27.2% in the first quarter of 2020 because of the containment measures of the government. However, the government continued its programs of "Build, Build, Build" under the Duterte administration, which was centered on major infrastructure projects, so that the construction industry reached a record high growth by the end of 2021. In 2022, the industry was projected to grow by 14.9% and expand by an annual average rate of 7.8% up to 2025 according to a report by an analyst entitled "Construction in Philippines - Key Trends and Opportunities to 2025 (Q2 2021)". (Reportlinker 2021)

The Philippine Statistics Authority has also reported that in the first quarter of 2022, the number of constructions from approved building permits was posted at 37,270. By type of construction, residential buildings reported the highest number of constructions of 26,546 or 71.2 percent of the total number of constructions during the quarter. (PSA 2022) Residential buildings include: single-attached homes, single-detached homes, condominiums, apartments and townhouses. (Property Source 2021)

This type of construction expanded at a rate of 4.0 percent, which was slower compared with the annual increment of 10.0 percent in the same quarter of 2021. Although majority (85.9%) of the total residential constructions were single-type houses, residential condominiums posted the highest average cost of Php 18,347 per square meter during the quarter, while residential duplex/quadruplex recorded the lowest at Php 8,798 per square meter. (PSA 2022)

The regions that posted the highest spending in the construction industry were the following:

- Region IVA - CALABARZON, Php 20.22 billion (23.3%);
- National Capital Region or Metro Manila, Php 14.79 billion (17.0%); and
- Region III - Central Luzon, Php 10.26 billion (11.8%). (PSA 2022)

The government promotes the development of affordable housing, medical facilities, transport and renewable energy infrastructures which will support the expansion of the construction industry for the years to come.

Philippine Construction Workers

The top five sub-sectors in the Philippines with the highest increase on the number of employed persons from October 2021 to October 2022 according to the article "Employment Rate in October 2022 is Estimated at 95.5 Percent – Philippine Statistics Authority" are:

- a. Wholesale and retail trade; repair of motor vehicles and motorcycles (672 thousand);
- b. Transportation and storage (553 thousand);
- c. Construction (426 thousand);
- d. Accommodation and food service activities (407 thousand); and
- e. Administrative and support service activities (366 thousand).

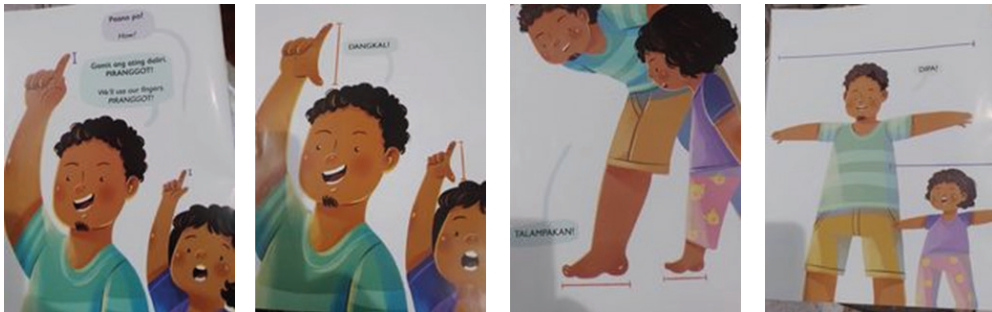
In the study "Real-time Simulation of Construction Workers Using Combined Human Body and Hand Tracking for Robotic Construction Worker Systems", the authors stated that construction is an inherently less safe sector than other sectors because it exposes workers to harsh and dangerous working environments, and that the nature of the construction industry results in a comparatively high incidence of serious injuries and death caused by falls from a height, musculoskeletal disorders and being struck by objects, which is why they have proposed the use of robotic systems to help construction workers from being exposed to these dangers. (Kurien, et al. 2018).

The study "How Adoption of Coping Behaviors Determines Construction Workers' Safety: A Quantitative and Qualitative Investigation" also states that safety problems have long been prominent in the construction industry, with huge numbers of injuries and fatal incidents annually among construction workers. Construction workers also suffer high levels of stress, and unmanageable stress can lead to problems of reduced safety. Practical recommendations are made to facilitate the adoption of effective coping behaviors by construction workers, including team-building exercises, safety empowerment and stress management programs. (Liang, et al. 2021). Since the construction workers should be taking precautions, usage of vernacular scales might in some way be useful to them in their work.

A study conducted on Filipino workers in export zones by Jinky Leilanie Del Prado-Lua entitled "Anthropometric measurement of Filipino manufacturing workers" among 1805 individuals, composed of 53.3% females and 46.7% males, majority of the subjects were between 150 and 174 cm in height. Anthropometric measurements of workers show that the mean standing height for males is higher than that for females at 167.0 cm and 153.9 cm, respectively. Meanwhile, the mean sitting height is 84.8 cm for males and 79.9 cm for females. Other anthropometric

measurements of the workers taken were body circumferences, grip strength, depth (forward reach), breadth (elbow to elbow span), all of which are essential in the work place, the export zones in this case, so that they can be designed efficiently. (Lua 2007)

For this study, a proposed survey of construction workers on their anthropometric measurements will be done similar to that of Lua's study, but the measurements will be centered on the vernacular scales that was pointed out by Navales in her book. These are *piranggot* (length of the pointer finger, about 4"), *dangkal* (length of the extended pointed finger and thumb, about a span of 7-8"), *talampakan* (one foot), and *dipa* (length of the arms or fathom which is about 5-6 ft.)



Figs. 3-6 Illustrations of 1) *piranggot* 2) *dangkal* 3) *talampakan* 4) *dipa*

Source: Mimi Navales book

Research Methodology

The study was done in the National Capital Region (Metro Manila). A descriptive survey method was used to determine construction workers perception of the vernacular scales. Probabilistic stratified random sampling was used.

The respondents chosen based on their availability were 51 construction workers of Prompt Managers and Construction Services, Inc. (PMCSI) working on a residential and commercial condominium project in Paranaque City called the Central Link. The Filipino-owned company is known to offer and provide the highest quality of construction management services. Their main policy as an organization is to "recognize that people are the essence of any good business". (PCSMI Company Profile, January 2023).

The respondents were informed about the study's purpose. Informed consent was asked from each respondent before answering the survey questionnaire. The office of the construction engineer of the project assisted in the process. Before the respondents left, tokens of food were distributed to them.

The survey questionnaire consisted of demographic questions like age, province of origin and years of work with the construction industry. Since all of the interviewees and construction workers were men, gender was not part of the questionnaire.

Questions related to the vernacular scales, their use, or observed use were included. The vernacular scales were demonstrated by the researcher to the respondents to explain them visually. The respondent's knowledge and identification of other vernacular scales not mentioned in Navales' book, as well as the usefulness

and practicality of use were also investigated. Measurements of the body parts of the construction workers related to the four vernacular scales were made. These will be compared to the measurements that Navales mentioned.

Results and Analysis of the Survey

The ages of all male respondents ranged from 24 years – 54 years old. As to the provinces where they came from, 25 provinces of the Philippines were mentioned (Figure 7). One respondent each came from the provinces of Aurora, Bulacan, Camarines Sur, Laguna, Mindoro, Pangasinan, and Quezon, which are all found in Luzon; from the provinces of Antique, Northern Samar and Western Samar, which are found in the Visayas; and from the provinces of Agusan del Norte, Lanao del Norte, and Misamis Occidental, which are found in Mindanao; two respondents each came from the provinces of Isabela and Marinduque (Luzon), Leyte and Negros Oriental (Visayas), and the Bicol region; three respondents each came from Albay, Metro Manila, and Sorsogon (Luzon); four respondents each came from Cavite and Rizal (Luzon), which are provinces adjacent to Metro Manila; five respondents came from Zamboanga del Sur (Mindanao) and six respondents came from Nueva Ecija (Luzon). The data shows that construction workers hail from the three biggest island groups of the Philippines.

They were asked to indicate the years of their experience in the construction industry as follows:

- a. 1-5 years (17 construction workers)
- b. 6-10 years (4 construction workers)
- c. 11-15 years (20 construction workers)
- d. 16-20 years (7 construction workers)
- e. more than 20 years (3 construction workers)

Table 01. Frequencies for Years in the Construction Industry

Years	Frequency	Percent	Valid Percent	Cumulative Percent
1-5 years	17	33.333	33.333	33.333
6-10 years	20	39.216	39.216	39.216
11-15 years	7	13.725	13.725	13.725
16-20 years	4	7.843	7.843	7.843
More than 20 years	3	5.882	5.882	5.882
Missing	0	0.000		
Total	51	100.000		

Source: generated through the use of JASP program

Aside from Metro Manila, they have worked in 18 other provinces. These are in Agusan del Norte, Albay, Batangas, Cavite, Davao, General Santos City, Ilocos Norte, Isabela, Laguna, Marinduque, Negros Oriental, Nueva Ecija, Pampanga, Pangasinan, Quezon, Rizal, Sorsogon and Zamboanga del Sur. This question was asked in order to identify whether the construction skills of workers were honed while they worked in their provinces.

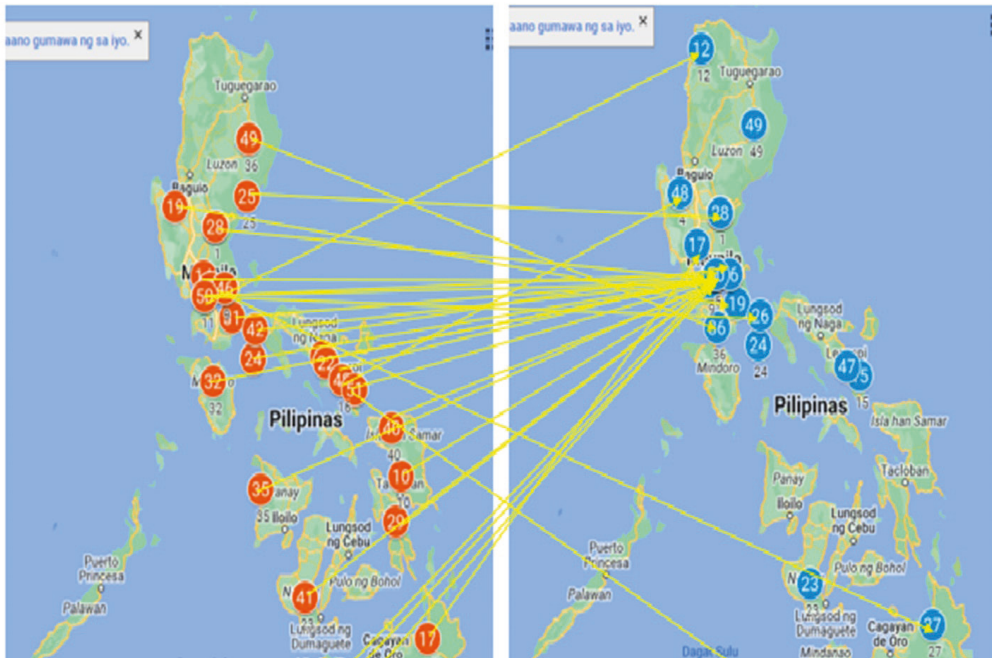


Fig. 7 Correlation of workers places of residence to their places of work

Source: Power Point by John Mark Mercado

When asked about their familiarities with the vernacular scales: piranggot (length of the pointer finger, about 4”), dangkal (length of the extended pointed finger and thumb, about a span of 7-8”), talampakan (one foot), and dipa (length of the arms or fathom which is about 5-6 ft.) and if they have used it in their construction work, the following data were generated:

Table 02. Frequencies for Familiarity and Use of Vernacular Scales

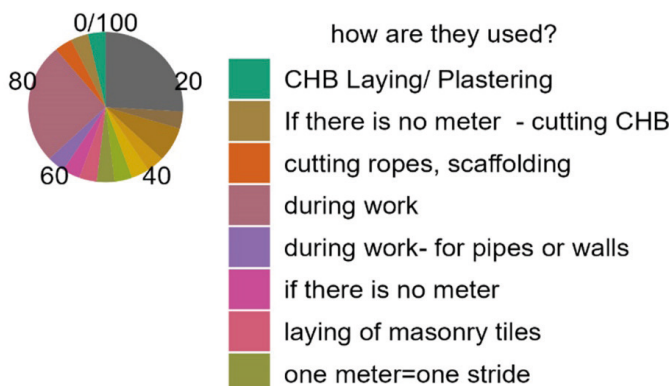
Familiarity and Use	Piranggot	Dangkal	Talampakan	Dipa
Frequency				
Minimum 0 – No	32	22	31	22
Maximum 1-Yes	19	29	20	29
Percent – No	62.745	43.137	60.784	43.137
Valid Percent – No	62.745	43.137	60.784	43.137
Cumulative Percent – No	62.745	43.137	60.784	43.137
Percent – Yes	37.255	56.863	39.216	56.863
Valid Percent – Yes	37.255	56.863	39.216	56.863
Cumulative Percent – No	100.000	100.000	100.000	100.000
Missing	0.000	0.000	0.000	0.000
Total	51	51	51	51

Source: formulated through the help of JASP program

The above data would show that most construction workers were familiar and would actually use two vernacular scales – dangkal and dipa – with similar percentages of 56.863 among the Yes answers (29 out of 51 respondents). The scale which they are least familiar with and thus would not commonly use would be piranggot which has a percentage of 62.745 with No answers (32 out of 51 respondents). Talampakan has almost the same percentage as piranggot with 60.784 of No answers (31 out of 51 respondents).

In terms of how they are used, only 27 construction workers gave their answers. They answered from the very general topic – during work – to the more specific tasks as follows: for concrete hollow blocks (CHB) laying and plastering, for cutting concrete hollow blocks (CHB), for cutting ropes and scaffolding work, for pipes and walls, for laying of masonry tiles, and for ground surveying. Some have been candid to say that they use the scales when they forget to bring their meter to the 12th floor (highest part of the construction). Knowing that there are many dangers involving construction work, it could be a safety measure. Some identified the carpenters and masons to be the users of the vernacular scales. There are also those who surmised that they may be only used in small constructions because rules in the construction company prohibits the use of inaccurate measurements.

Table 03. Distribution of the Use of Vernacular Scales in Construction



Source: formulated through the help of JASP program

As to the question of whether or not they can identify other vernacular scales used in construction, only 17 out of the 51 respondents gave their answers and the most common were the *kalahating dipa* (from one shoulder to the tip of the fingers of the other arm) and *taas* or their height.

Table 04. Descriptive Statistics for Identification of Other Vernacular Scales and Observed Use

Identification and Observation	Other vernacular scales	Identification	Observation
Valid	51	17	51
Missing	0	34	0
Mean	0.431		0.471
Std. Deviation	0.500		0.504
Minimum (No)	0.000		0.000
Maximum (Yes)	1.000		1.000

Note. Not all values are available for Nominal Text variables

Source: generated through the help of JASP program

When asked about the convenience of using vernacular scales, majority answered No (39 out of 51 respondents). Here are the frequencies for convenience:

Table 05. Frequencies for Convenience of Vernacular Scales

Convenience	Frequency	Percent	Valid Percent	Cumulative Percent
No	39	76.471	76.471	76.471
Yes	12	23.529	23.529	100.00
Missing	0	0.000		
Total	51	100.000		

Source: generated through the use of JASP program

Finally, the anthropometric measurements of the surveyed construction workers were measured and the following table gives us a glimpse of the results.

Table 06. Descriptive Statistics for Vernacular Scale Measurements among the Construction Workers

Anthropometric Measurements in Inches	Piranggot	Dangkal	Talampakan	Dipa
Valid	51	51	50	51
Missing	0	0	1	0
Mean	3.336	6.815	10.320	65.526
Std. Deviation	0.275	0.626	0.566	3.180
Minimum	3.000	5.000	9.000	57.000
Maximum	4.000	8.000	12.000	73.000
Navales	4.000	7.000-8.000	12.000	60.000-72.000

Source: generated through the help of JASP program with one modification

Comparing the results with the measurements given by Navales in her book, we can see that the maximum results are very close to her stated measurements. There are also results below the minimum measurements which she has stated. It is worthy to note that there is a high standard deviation for *dipa*, pointing to the inaccuracy of this particular vernacular scale.

Conclusions and Recommendations

Based on the results of the investigation, the following conclusions were drawn:

- Vernacular scales are still being used for construction in the cities, particularly in the vicinity of Metro Manila. Half of the number of construction workers surveyed were familiar with all vernacular scales mentioned. Other vernacular scales mentioned by the workers that were not included in the survey form were *kalahating dipa* and *taas*.
- Most of the users of the vernacular scales are carpenters and masons, and the usual application includes masonry work and ground surveying.
- Majority think that the use of vernacular scales is not as efficient as the meter tape, and would use the latter for efficiency and accuracy in the construction.
- The high standard deviation for the measurement of *dipa* points to the inaccuracy of this measurement.

As a recommendation, introducing vernacular scales to children would be a means for them to develop practical skills which they could find useful in adulthood. This art could be neglected if they get used to more accurate measures, however, their use in the history of vernacular architecture can always be acknowledged. The move of the Philippine Department of Science and Technology (DOST) to teach them to children through books and school lessons is a commendable step towards this end.

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