



RESEARCH ARTICLE

Factors Affecting the Sound Quality of Pong LangPoowaniy Direksin^{1*}, Asst. Prof. Dr. Hirun, Jukarasen², Assoc. Prof. Dr. Pongpitthaya Sapaso³^{1,2,3} Faculty of Fine and Applied Arts, Khon Kaen University 40002**ARTICLE INFO****ABSTRACT**

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This research aims to study the factors affecting the sound quality of Pong Lang from Polang producers in Isaan to increase the overall knowledge of Pong Lang, an important musical instrument in Isaan worthy of preservation and further development. The research is qualitative using data collected from documents, field visits to the Pong Lang producers in Isaan, sound recordings, and interviews. The collected data was analyzed. From the study, it was found that the factors affecting the sound of Pong Lang consisted of the material, characteristics of the wood used in the production, wood sizes, notching of the Pong Lang, and other external factors, which are crucial to the development of Isaan musical instruments. If the forms and sound quality are consistently maintained and improved, the standards of the Pong Lang will increase, leading to sound improvements in other local musical instruments. The type of wood is interrelated with other factors. If the base materials are of low quality, the results are of lower quality. Therefore, careful selection of quality materials will affect current and future Isaan local musical instruments.

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1. INTRODUCTION

Pong Langs have been constantly being developed since the beginning of Isaan music culture from 1957 to 1980. It was assumed that the instruments were developed from the following four objects: (1) Kraw or Khaw Law, used to chase away animals. Khaw Laws were mostly hung in sheds built by the paddy fields; 2) Pong, used for giving signals in temples in the Isaan area; 3) Mak Khid, used by hanging on cattle necks to signal their whereabouts; and 4) Metal Mak Pong Lang, used to provide signals for trade caravans in the past, such as in cattle traders. During the adaptation period from 1995 to 2017, the instruments were further developed, adapted, and recreated by local musical experts in Isaan, allowing the pitch of the instruments to follow the sound of Kaen, an Isaan local instrument, following the Mor Lam melody and the melody inspired by nature. The instruments were later improved to allow for a greater variety of sounds, resulting in the shape of Pong Lang being made by connecting bars of wood. The number of Pong Lang bars varied from six to 18 bars, containing seven pitches. The pitches can be arranged with more than one octave. The shapes, sounds, and playing methods of the Pong Lang were developed to be played in full-band, solo, and contemporary music while producing a beautiful melody that fits in with modern times (Choatchamrat, 2018).

Currently, Pong Langs can be divided into two types based on their physical characteristics: wooden pong lang, such as monkey jack wood, Siamese Rosewood, Rosewood, and bamboo, and Pong Lang

made from metals, such as metal Pong Lang and Mak Ka Long. Wooden Pong Lang produces a more resonant sound and consists of a complex production process consisting of various steps, such as selecting the types of wood because each type of wood produces a different sound. The limitation of wooden Pong Langs is that sound can be distorted when exposed to changing weather conditions. Furthermore, wooden Pong Langs are larger and heavier than other types of instruments. Metal Pong Langs provide a clear, high-pitch, and resonant sound, both in the metal Pong Langs and Mak Ka Long. The production process of the metal Pong Lang is also more complicated than that of the wooden pong lang. The limitation of metal Pong Langs is that when coming into contact with hard objects, the body of the Pong Lang will have dents that might lead to the distortion of the sound, although compared to wooden Pong Langs, sound distortion in metal Pong Langs is rare comparing to wooden ones.

The current sound quality of Pong Lang has improved consistently. In the past, when technology for measuring sound frequencies did not exist, the producers relied only on memorization and word-of-mouth from local experts. Another method was comparing the pitch of the Pong Lang to the Kaens. The Current Pong Lang producers developed technology to help with production and use it as a means to adjust the instruments to the current social context. The integration of technology also led to the improved quality of other instruments and to innovation, adaptation, and creation based on the identity of the players by adding unique characteristics. Nevertheless, regardless of how the physical status of the instruments changed, they still maintained their unique sounds.

From the above statements, the researcher was interested in studying the factors affecting current Pong Lang from producers, experts, and knowledgeable people in Isaan local music to gain crucial information that can benefit the academic and Isaan local music fields. The findings can also be used as guidance for the further development of instruments for future generations.

2. OBJECTIVES

To study the factors affecting the sound quality of Pong Lang from the Pong Lang producers in Isaan.

3. RESEARCH METHODOLOGY

The research entitled Factors Affecting the Sound Quality of Pong Lang is qualitative research. The researcher compiled data to study the sound characteristics of the Pong Langs and the factors affecting sound quality. Data were collected from experts, academics, Pong Lang producers in Isaan, and Pong Lang players. The steps are as follows.

1. Data were collected through research documents, textbooks, academic articles, theses, books, and other sources of knowledge, such as the libraries at Kasetsart University, Khon Kaen University, and the Faculty of Music at Mahidol University.
2. The experts, Pong Lang producers in Isaan, and Pong Lang players were interviewed using structured and unstructured interviews to gain a variety of data.
3. Record the sound of Pong Lang from the target group, such as the Pong Lang producers in Isaan, to compare and find Pong Lang with good sound quality by scoping down to only wooden Pong Lang.
4. Analyze, synthesize, and evaluate the sound of the Pong Lang made by the producers in Isaan by the experts and draw the research conclusions.

4. RESULTS

From the analysis of the factors affecting the sound of Pong Lang, the researcher collected data from the producers in Isaan, experts, and Pong Lang players and drew the following conclusions.

4.1. Good characteristics of pong lang



Figure 1: Good characteristics of Pong Lang (own photo)

Good characteristics of Pong Lang require components that identify the instruments, that is, physical and sound components. The analysis results from interviews with experts, producers, and players are as follows.

The overall characteristics of Pong Lang must be beautiful. The size of each bar needs to be fully connected beautifully with the correct distance between each bar. The bars must be made from a woodbar without gnarls or incomplete parts. The bars should have large growth rings; in other words, the trees should be old enough before being used in production. Pong Lang bars need to have rounded edges and smooth surfaces and do not contain splinters. The wood was completely dry. The bars were arranged from largest to smallest. There was not much difference between the lengths of the bars. As for the sound component, the pitch needs to follow the scale, and the Pong Lang bars need to produce resonance. The tone of each bar was similar and not extremely sharp. The low tone is a clear characteristic of Pong Lang.

4.2. Factors contributing to the sound quality of Pong Lang

4.2.1. Material

The main material of Pong Langs is “wood”. The wood used in Pong Lang production is hardwood from trees with large and clear growth rings and condensed texture and is not too fine or loose. The wood must be completely dry with no moisture, such as Monkey Jack, Rosewood, or Siamese Rosewood. Currently, these trees are grown in crucial areas, most of which are prohibited. Some types of trees are prohibited from being cut. There are still trees that are allowed to be cut down and sold, such as Monkey Jack, leaving only a few types of wood for making Pong Lang. However, Pong Langs made from high-quality wood can still be found in institutions related to local Isaan music and the Isaan Arts and Culture Museum.

4.2.2. Siamese rosewood is considered a local Thai species originating in the tropical area of Asia in the Indochina region, which consists of Thailand, Myanmar, Laos, Cambodia, and Vietnam. In Thailand, trees are scattered in moist mixed deciduous forests, dry evergreen forests, and sparse forests, mostly in the East and Northeast regions. Wood from these trees is often used to make local instruments, such as Saw, Kluy, Rammanad, Ranat, and Pong Lang. Wood is a mix of red and purple, has a fine texture, and is durable. The oil in the wood was fully polished. The wood provides clear and resonant sound, good vibration, and is only slightly affected by weather changes.

4.2.3. Rosewood is a medium to large deciduous tree found in mixed forests. In Thailand, it is found scattered everywhere in moist mixed deciduous forests, dry evergreen forests, and sparse forests. However, the trees were mostly found in the eastern and northeastern regions. Wood was used to make Kluy, Tone, Ranat, and Pong Lang. The wood has a mix of brown and yellow colors, black lines, medium fine texture, and is very hard. The wood itself is very difficult to carve but polished very beautifully. This type of wood provides clear and resonant sound, good vibration, and is only slightly affected by weather changes.

4.2.4. Monkey jack trees originated in the tropical region of South Asia and spread throughout East Asia. Monkey Jack trees grow commonly in semi-open areas in rainforests, dry dipterocarp forests, mixed deciduous forests, and limestone forests. These trees are often found in the Northeast and Southern regions of Thailand and are often used to make Pin and Pong Lang. Wood has a mix of brown and light yellow colors, a hard and rough texture, is durable, has clear resin holes, provides good vibration, and is only slightly affected by weather changes.

4.3. Types of wood used for making Pong Lang

4.3.1. Perennial dead trees are trees that no longer produce flowers or leaves but do not fall to the ground. This type of tree can be caused by natural phenomena such as lightning. Perennially dead trees no longer receive any nutrients from the soil, causing them to become dry, which is a suitable characteristic for making Pong Lang.

4.3.2. Dried wood. In this case, the wood was cut from trees and left to dry naturally, allowing it to release water and resin. This is a natural method for eliminating moisture and color changes. Each type of wood requires a different length of time to dry, depending on its size, age, and local weather. The woods are brought in to make Pong Lang after they are completely dried.

4.4. Wood selecting

In selecting the wood to make Pong Lang, the wood needs to be completely dried. All Isaan wooden musical instruments require completely dry wood with no moisture to facilitate formation, cutting, lathing, and polishing processes. Woods that are not completely dry might end up distorted, bent, cracked, and broken, as well as attract insects or weevils, harming instruments. This case is often found in long drums and Toom drums made from large pieces of wood that were not completely dried, but rarely found in Pong Lang, except in cases in which the producers were not careful when selecting the wood and ended up using wood with defects, corrosion, and undried wood that greatly affected the sound. Undried wood is also easily affected by weather changes and causes distorted pitches such as extreme hot or cold temperatures.

4.4.1. Wood patterns in each type of wood used for making Pong Lang were similar. Their colors may differ depending on the type of wood used. In cutting wood, the Pong Lang producers cut the wood vertically and not horizontally. When cut into small bars, the patterns were visible. In the arrangement of the Pong Lang bars, it can be observed that the resin holes only face either the left or right direction of the bar, which shows a suitable wood selection for the Pong Lang. The wood bars vibrate based on the impact of the horizontal arrangement of the bars, allowing sound to travel through the horizontal holes.

4.4.2. Wood growth rings are crucial indicators for wood selection. The more growth rings there are the older the wood. Generally, the wood used for making Pong Lang must come from standing trees with large trunks and should be older than 20 years old. According to the concept of local experts, measurements are performed through the traditional wisdom method by placing them around the trees. If the trucks fit arm's length, the trees are considered large and are cut to check the growth rings. Afterward, the cut trees would be left to dry for six months to one year, which is considered an appropriate time to be used for making Pong Langs.

4.4.3. Wood defects are found in trees, such as gnarls, branch stems, or defects caused by people or animals, as well as other natural disasters. Defects can be observed on the surface of the trees, whether there are textures that are different from the rest of the trees or the lack of wood patterns and resin holes, which signifies that the wood cannot be used for making Pong Lang. These defects reduce the vibration of the sound and cause it to be dull. Therefore, producers would normally ignore trees with defects to maintain the sound quality of Pong Langs.

4.4.4. Pong lang sizes: Currently, Pong Langs come in many sizes based on consumers' needs. Different sizes affect the price of the instrument as well as the chosen material. For instance, a 60-centimeter Pong Lang made from Siamese Rosewood will have a higher price because of its larger size and the amount of wood used. Moreover, Siamese Rosewood has a higher market price. Currently, there are three sizes of Pong Lang: 60 cm, 50 cm, and 45 cm. These sizes were measured from the first bar on either side to the other end in centimeters. The size of the bars was reduced by 2 – 4 cm in each bar with a diameter of 6 cm or shorter in each bar. The diameter of the Pong Lang bar was measured in millimeters from the side of the bar, as shown in the following table.

Items	60-centimeter Pong Lang	50-centimeter Pong Lang	45-centimeter Pong Lang
1 st bar	60 centimeter	50 centimeter	45 centimeter
Diameter	60 millimeters	56 millimeters	50 millimeters
2 nd bar	58 centimeter	48 centimeter	43 centimeter
Diameter	58 millimeters	56 millimeters	50 millimeters
3 rd bar	56 centimeter	46 centimeter	41 centimeter
Diameter	56 millimeters	56 millimeters	50 millimeters

The three sizes of Pong Lang were reduced consecutively. For the 50 and 45-centimeter Pong Lang, the producers used a bar with the same diameter in a group of three. For example, the first three bars have the same diameter. This is to ensure that the Pong Lang has obvious discrepancies in size because the smaller bars of Pong Lang might decrease the aesthetics of the instrument based on the standard proportion. This is another technique for producers to maintain the good characteristics of Pong Lang.

The sounds created by the different sizes of the Pong Lang are different. However, the bars had the same pitch. Different sizes affect the sound frequencies, resonance, and loudness. It can be observed that the different sizes of the Pong Lang bar, as well as the diameters, mean that the mass of the wood is different and directly affects the sound. The following figures show the recording of Pong Langs made from the same type of wood but with different sizes.

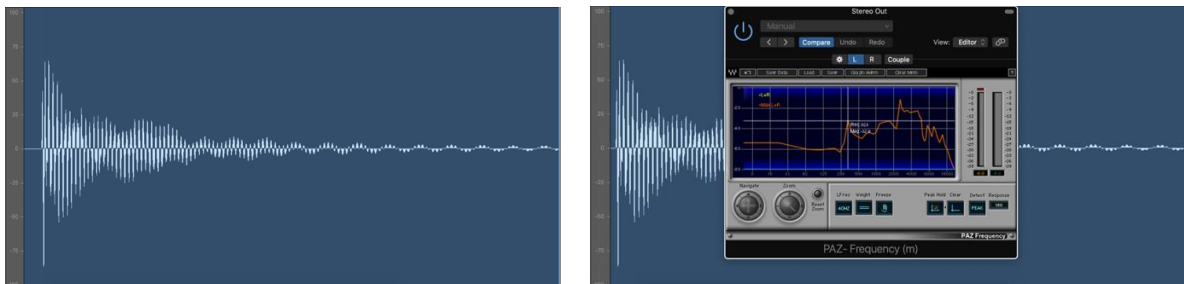


Figure 2: Low-frequency graphs of the first Pong Lang bar from the 60-centimeter Pong Lang (own photo)

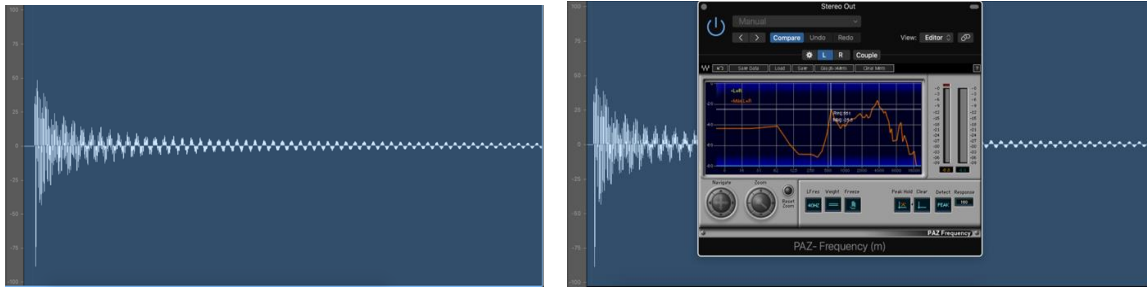


Figure 3: Low-frequency graphs of the first Pong Lang bar from the 50-centimeter Pong Lang (own photo)

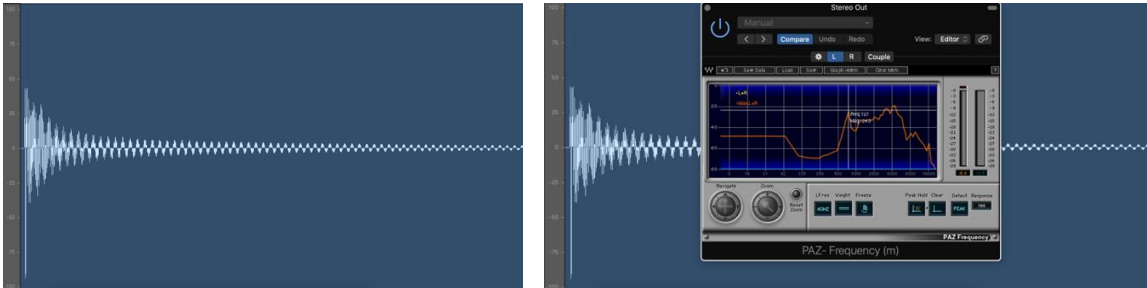


Figure 4: Low-frequency graphs of the first Pong Lang bar from the 45-centimeter Pong Lang (own photo)

The frequency graph shows the sound waves of the three Pong Lang and their clear differences. The 60-centimeter Pong Lang has wide wavelengths, amplitude, resonance, and vibration starting from the transient to the tail, with a thick mass at a longer length. The loudness of the 50 and 45-centimeter Pong Lang was similar, with less resonance. The vibration from the transient to the tail was narrower and decreased in amplitude at a shorter range. The frequencies of all three Pong Langs were also different. The sound of the 60-centimeter Pong Lang starts at 323 hertz, the 50-centimeter starts at 551 Hz, and the 40-centimeter starts at 727 Hz.

Therefore, the size of the Pong Langs is considered a crucial factor affecting the sound quality and characteristics of good Pong Langs. From the above figures, it can be observed that different sizes provide different results, such as loudness, resonance, and vibrations. In terms of sound frequencies, Pong Langs with good characteristics must produce low-frequency sounds that are not too sharp. The 60-centimeter Pong Lang, when played with the same note as the other two sizes, gives the lowest frequency, which aligns with the good characteristics of Pong Lang. In conclusion, a larger Pong Lang or Pong Lang with a denser mass will provide better sounds than smaller ones.

4.3.5. Notching the Pong Lang bar



Flat notches



Curved notches

Figure 5: Flat and curved notches (own photo)

The notches of the Pong Lang bars are another crucial factor affecting the sound of Pong Langs. Although the shapes of the notches were similar, the space for impact was different. It can be seen from the figure that flat notches have a larger impact area than curved notches, which affects the amount of vibration when played.

From the test, it can be observed that flat notches create a sound with equal amplitude at all points of impact, with no discrepancies in the vibration. In other words, no dead spots are observed. The curved notches have the lowest point at the center of the notch and are higher on the sides. It can be noticed that the center of the notch is thinner than the sides. The dead spot can be found 5-10 centimeters from the center of the notch to the holes where the bars are tied. The uneven thickness of the bars caused fewer vibrations.

Consequently, the notching of the Pong Lang bars is another important technique for both the players and producers and the consideration of their functions and the playing styles or techniques of the players. Some players might require quality touchpoints that benefit their playing styles to produce quality sounds, while others might need some prevention from inaccuracy while playing.

4.5.1. External factors: Pong Langs is primarily made of wood. These factors are the primary factors. However, there are external factors that negatively affect the sound of the instrument and are considered secondary factors, such as the playing stick, maintenance, or weather in which the Pong Langs were installed. Players must understand and strictly follow the following directions: Pong Lang sticks. Using sticks that are too heavy produces unwanted impact noise or amplitude as well as distortion in the pitches. Sticks that are too heavy can also affect Pong Lang bars, such as causing the bars to break or crack or the breaks and cracks in the sticks themselves. Using sticks that are too light will cause the sound to be too thin and sharp, and the sound of notes that are not full. However, lighter sticks did not deteriorate Pong Lang bars. The sticks should be of an appropriate size to maintain the quality of the bars and their duration. In other words, sticks from the same type of wood as Pong Lang increase the chance of the sticks being broken or cracked. The sticks should be made from softer wood, which can help preserve the Pong Lang bars and prevent sticks from being cracked or broken. Furthermore, softer sticks also prevent the sound from being too sharp, but allow the bars made from harder wood to produce lower frequencies.

5. DISCUSSION

The wood used in production needs to come from hardwood, **and** standing trees, and have large growth rings, clear patterns, fine texture, durability, and dryness, such as Monkey Jack wood, Siamese Rosewood, and Rosewood. This is in line with Choatchamrat (2022), who stated that the most popular wood for making Pong Lang is the Monkey Jack wood from the Monket Jack tree, which has died for over 20 years since this type of wood produces resonant and high-amplitude sounds. Current Pong Langs consists of three sizes: 60 cm, 50 cm, and 45 cm. These sizes were measured from the first Pong Lang bar, on either side, to the other end, in centimeters. The size of the bars was reduced from one end to another. This finding aligns with that of Rumsey et al. (2005) that the current Ranat Eks consists of 22 bars. The Tuan bar, the largest bar with the lowest pitch, is two inches in width and 16 inches long. The sizes of the following bars are reduced to the last bar, which is called "Look Yod." Good Pong Langs should have an overall aesthetic. The bars were arranged neatly with equal distances between them. The wood used for making Pong Lang must be a perfect piece of wood without gnarls or defects. Wood should have large growth rings. In other words, the wood should be old enough to be appropriate for making the Pong Langs. Pong Lang bars should have smooth curves and surfaces without any splintering. This finding aligns with Ruangyim (2020), who stated that the method for making the track of bars for the Ranat Thum requires the following characteristics: 1) selecting a Phai Tong with at least 8 inches in diameter, without defects, and having a beautiful surface. One observation found in the factors affecting the sound of Pong Lang was that

the material, or the type of wood, is the base factor that affects other aspects. If the core component is of low quality, the result will also be of low quality. Therefore, careful selection of the materials will provide good results for the instrument.

Technological and Process innovations are categorized as the more modern techniques which, in recent times, have helped shape both Pong Lang and music in the Isaan region. Currently, Pong Lang producers and experts have innovated technology to improve the quality and characteristics of the instrument. As for technical advancements, one of the significant improvements is the application of technology to production. Better ways of measuring sound frequency have made it easier for producers to achieve the best frequencies the Pong Lang uses. With information technology, producers are more able to fine-tune the instruments to today's social landscape yet retain the distinct sounds that have defined the existence of the Pong Lang. In addition, the technological growth in the creation of musical instruments has seen a boost in the quality of products produced in Pong Lang. Now, more materials and tools are available, which has opened a broad arena of detail possibilities and improved sound quality (Baayen et al., 2008). Another aspect is the quality of the materials used, especially the type of wood, which serves as the basis for enhancing the sound and the quality of Pong Langs. Apart from advanced technology, contemporary trends in music, such as the rise of electronic music or the fusion of traditional and modern styles, have also contributed to the evolution of Pong Lang. Another benefit of the instrument is that it has been developed to produce different music styles, expanding the capability and possibility of sounds (Coutinho & Cangelosi, 2011). This transformation has made the Pong Lang more portable by adding features that allow it to be played in full band performances, solo renditions, and modern music compositions while at the same time maintaining the cultural feel. The technological incorporation, advancement in craftsmanship, and the version of modern tunes are instrumental in the ongoing improvement of the Pong Lang. These improvements have not only improved the sound quality and construction of the instrument but also sealed its place in the modern music culture (Eerola et al., 2012).

A primary feature that needs mentioning is that the sound quality of the Pong Lang instruments depends on environmental factors. Relative humidity, temperature, and atmospheric conditions have shown that they affect the instrument's acoustic characteristics and, therefore, should be considered in providing a complete account of the sound quality of the Pong Lang (Filipic et al., 2010). Wooden Pong Lang instruments appear to be significantly sensitive to relative humidity standards in the environment. Wood works with moisture very well, and low or high humidity can easily make it expand or shrink. It could also affect the instrument's resonance and timbre (Gabrielsson & Lindström, 2010). The sound produced will be softer and warmer when used in high-humidity areas. When used in less humid areas, it produces a more transparent and vibrant sound. Thus, humidity must be constant, especially when storing the wooden Pong Langs, to retain their original shape and sound. Likewise, temperature changes affect the instrument's physical size, affecting the desired sound quality. Fluctuations in temperature likewise affect the materials of the Pong Lang, such that the instrument may change in pitch and timbre. The temperature condition while storing and transporting, as well as during performance, should be well regulated to maintain the instrument's sound stability. Additionally, conditions like air pressure and density can affect how the sound waves from the Pong Lang are conducted. These can influence the heterogeneity of sound distribution and how it is perceived, especially in outdoor or open-air conditions (Huron, 2008).

Considering these environmental factors in the context of Pong Lang production, storage, and performance is crucial for maintaining consistent sound quality and preserving the instrument's acoustic properties. By addressing the impact of humidity, temperature, and atmospheric conditions, Pong Lang producers can ensure that the instrument's sound remains true to its traditional characteristics while adapting to varying environmental circumstances (Juslin & Laukka, 2003). The Pong Lang holds immense socio-cultural significance within the Isaan community, playing a pivotal role in preserving and evolving the sound quality of this traditional musical instrument. Embedded

in the cultural fabric of Isaan, the Pong Lang is deeply intertwined with the region's heritage, communal traditions, and musical identity. As a symbol of local pride and heritage, the Pong Lang serves as a cultural emblem that embodies the rich musical heritage of Isaan. Its distinct sound and unique playing techniques are deeply rooted in the region's folk traditions, reflecting the everyday lives and experiences of the local community. Through its melodic resonance and rhythmic patterns, the Pong Lang encapsulates the oral traditions, rituals, and festivities that define Isaan's socio-cultural landscape (Kim et al., 2010). Additionally, the Pong Lang acts as a catalyst for social cohesion and community bonding. Its presence during communal gatherings, celebratory events, and traditional ceremonies fosters a sense of shared identity and collective belonging among the people of Isaan. As a result, the instrument serves as a cultural bridge that connects individuals across generations and reaffirms the community's cultural heritage (Marozeau et al., 2003). Moreover, the acoustic characteristics of the Pong Lang instruments and their ability to develop and maintain good sound quality are somewhat linked to the community's concern for the posterity of savoring traditional music. Despite the idea that culture bearers are essential in the preservation of an instrument and its sound, the Isaan community is significant in the transmission of domain-specific knowledge, playing techniques, and instrument-making skills over the generations helps in the maintenance of the purity and consistency of the Pong Lang's sound. This holds especially when the instrument changes with the times and modern musical forms and embraces technological improvement; its place in the Isaan social-cultural life is not in doubt (Peeters et al., 2011). Thus, the Pong Lang is innovated, adhering to the traditional manifestations and maintaining the peculiarities of the sound, which proves the cultural and artistic adaptability of the Isaan people. Therefore, it is implied that the Pong Lang's socio-cultural function concerning the Isaan people's society is inextricably tied to its role in influencing the maintenance and development of the Pong Lang body and sound. Being one of the pride and joy of Isaan, the Pong Lang continues to be a strong standing as a symbol of music making of the community that upholds the heritage of making music with the transitioning of the culture in the modern world.

6. CONCLUSION

The research on the factors affecting the sound quality of Pong Lang instruments reflects the value and quality of production, serving as a guideline for enhancing Isaan instruments. The findings can be utilized as observations and directions for Pong Lang producers and players seeking a deeper understanding to continually enhance the sound quality of their instruments. Currently, the wood used in crafting Pong Lang instruments includes Siamese Rosewood, Rosewood, and Monkey Jack wood. Each type of wood varies in texture, color, and density. However, the key components considered in the quality of the wood used for making Pong Langs are strength, beauty, resonance, resin holes, and resistance to changing climates. One important consideration when selecting wood for Pong Lang instruments is that the trees should be dead standing or completely dried, and over ten years old. Freshly cut trees are left to dry for six months to one year. The arrangement of the Pong Lang bars should be horizontal, taking into account the patterns of the wood and resin holes. The bars should be free of defects such as gnarls or branch stems, which can impact both aesthetics and sound quality by reducing vibrations and creating dead spots. The current sizes of Pong Lang instruments are 60 cm, 50 cm, and 45 cm, measured from one end of the bar to the other. Each bar is reduced by 2 cm in each size. From the testing, it is evident that the 60-centimeter Pong Lang instruments produce wider sound waves, amplitudes, resonances, and vibrations compared to the other two sizes, indicating that size affects sound quality. Notching of the bars is a technique employed by different producers, with flat notches producing an equal amount of sound at every impact point without reducing vibration. External factors affecting the sound of Pong Lang instruments include the weight of the sticks, with lighter sticks producing a sharper sound. Sticks made from the same type of wood can lead to bars breaking or cracking. Maintenance and consideration of weather conditions are crucial, as improper temperature control or frequent

temperature changes can result in distorted pitch and potential cracking of the Pong Lang instruments, ultimately affecting sound quality. In conclusion, all identified factors directly impact the sound quality of Pong Lang instruments. Producers, players, and stakeholders should adhere to these guidelines to enhance and preserve the sound quality of the Pong Lang instruments. Additional improvements may be necessary to further enhance the overall quality of the instruments.

7. SUGGESTIONS

Based on the study of the factors affecting the sound of Pong Lang, the production and performance of Pong Lang by the producers, players, or stakeholders should consider the sound quality of Pong Lang, which can be applied to the improvement of other instruments. If the form and sound quality are consistently maintained and improved, Pong Langs will gain a higher standard. Additionally, this will lead to improvements in the sound quality of other Isaan local musical instruments.

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